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Biodiversity Support Program

Bulgaria's Biological Diversity: Conservation Status and Needs Asses

Volumes I and II

Scientific papers prepared as a foundation for *Conserving Biological Diversity in Bulgaria The National Biological Diversity Conservation Strategy* developed through the joint efforts of the Government and the People of the Republic of Bulgaria, the U S Agency for International Development, and the Biodiversity Support Program

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Bulgaria's Biological Diversity: Conservation Status and Needs Assessment

Volumes I and II

Edited by Curt Meine, Ph D

Bulgarian version edited by Marieta Sakalian, Ph D

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Introduction

Since 1989 Bulgaria has experienced profound social economic and political changes that continue to have farreaching implications for the protection and sustainable use of the country's rich flora and fauna Bulgarian officials, scientists and conservationists working to respond to these changes were assisted in the period 1991 1994 to develop a set of recommen dations for conserving Bulgaria's biota through the National Biological Diversity Conservation Strategy (NBDCS) project A 3 year process, spanning from 1992 to 1995 was funded by the Bureau for Europe and the New Independent States of the U S Agency for International Development (USAID/ENI) and was carried out as technical assistance to the Government of Bulgaria's Ministry of Environment (MOE) by the U S based Biodiversity Support Program a consor tium of World Wildlife Fund The Nature Conser vancy and World Resources Institute

Central to the development of the Strategy which included a summary review of the current status of biological resources in Bulgaria, was a planning pro cess in which a series of papers on key aspects of the country's biodiversity were prepared Teams of top Bulgarian scientists were recruited to prepare these papers as were representatives of national and re gional nongovernmental organizations and govern ment agencies, and professionals in the fields of pro tected area management environmental economics law tourism regional planning and private/park part nerships

The papers were presented at the National Bio logical Diversity Conservation Strategy workshop held at Sveti Vrach outside Sandanski, Bulgaria on March 12 20, 1993 The workshop and the background documents were designed to develop consensus on a national strategy for the conservation and sustainable use of Bulgarian natural resources and to provide a framework for future foreign assistance to conserva tion and development projects

In preparation for the workshop the teams of sci entists and agency and organizational representatives were enlisted to assemble and evaluate information on the biological basis for conservation planning in Bul garia They were charged with the task of exploring and forming recommendations within the fields of *biological diversity applied biology social and economic sciences*, including law and policy *nongovernmental actions* and opportunities, and information as a man agement and policy tool (particularly in the form of *geographical information systems (GIS)*) For each re spective taxonomic group or resource, the biological and applied biology teams were asked to summarize the current state of knowledge about their topic, with particular attention to the following categories

1 poorly known geographic areas requiring fur ther study,
2 best available estimates of populations for spe cies or subspecies, or at minimum a general statement of species richness,
3 species rarity,
4 levels of endemism,
5 geographic distribution of ecosystems, habitats and/or unique communities,
6 indication of the ecological services provided by the resource
7 fragility under specific human activities,
8 known threats,
9 location of sites containing the most represen tative sample of Bulgaria's biodiversity and
10 inventory of species with proven or potential economic importance

This preparation resulted in the most comprehen sive assembly of knowledge about Bulgaria's biological resources and their status to be gathered in one place The publication of these papers in Bulgarian and English represents the compilation of this accumulated knowledge in a physical form that may be accessed by anyone in search of information

The English versions of these papers are collected into a single book, which parallels the structure and order of the two volumes published in Bulgarian Topics in both publications range from macromycetes to large mammals from wild medicinal plants and plant genetic resources to domestic endemics and relatives of wild species The policy components of the papers include current and recommended man agement practices suggested law and policy frame works, and attitudes among the public toward pro tected areas and biodiversity In total there are 41 in dividual papers In addition 21 of the 52 original and

15 composite maps developed for this project are included in Section 5

These maps rendered for publication on Arc/View are the culmination of a process in which each of the five teams produced drawings on scale maps that were subsequently digitized and coded as data sets in the geographical information system The data was then synthesized and used to produce composite maps such as the gap analysis map that appeared in *Conserving Biological Diversity in Bulgaria The National Biological Diversity Conservation Strategy* published in June 1994 These maps were created using multiple data sets which were scored and combined to produce a compound image Though the maps in this publication were produced at Environmental Systems Research Institute Inc (ESRI), in Redlands, California they are derived from the same data base that resides on the GIS system at the Institute of Zoology in Sofia Bulgaria

The audiences for this publication are the participants of the NBDCS workshop and other scientists who will find the taxonomic information and recommendations within their own disciplines interesting However we hope that the citizens scientists NGOs and government officials of Bulgaria and other countries especially in Central and Eastern Europe on whom depends the successful creation and implementation of sustainable development practices will find these papers to be helpful in assessing their resources and developing their longterm strategies The impetus for this work has been the hope that it will be useful in safeguarding and sustaining Bulgaria's biological diversity while generating social and economic benefits for current and future generations

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The Biodiversity Support Program would like to reprise briefly our thanks to the many institutions and individuals who made this publication possible

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Christie Feral who acted as managing editor and gave considerable time and energy to rendering the many pages into a completed volume

Section One
Bulgaria's Biological Diversity

The Macromycetes Fungi of Bulgaria

Maria Drumeva-Dimcheva and Melania Gyosheva-Bogoeva

SUMMARY

The macromycetes constitute a large part of Bulgaria's fungal resources and are important components in its natural ecosystems This widespread group of fungi includes a majority of the species in the class Basidiomycetes as well as a large number of the representatives of the classes Ascomycetes (in the orders Pezizales Helotiales Tuberales and Sphaeriales) and Myxomycetes

Initial studies of the macromycetes of Bulgaria were undertaken at the beginning of the 1900s The few mycologists who have worked (and those who are still working) in Bulgaria have studied mainly the species composition and chorology of the macromycetes in various regions of the country Relatively little research has been done on the taxonomy and ecology of these fungi

At present about 2100 macromycetes taxa have been identified for Bulgaria in the scientific literature 76% from the class Basidiomycetes 20% from the class Ascomycetes and 4% from the class Myxomycetes The distribution of the macromycetes within the country has not been studied so thoroughly The mycological literature provides relatively good data on the macromycetes species composition of Vitosha Mountain the eastern Rila Mountains the Rhodope Mountains Golo Bardo Mountain Lozenska Mountain and the Pirin Mountains The remainder of Bulgaria's territory (which is a considerable) has been poorly studied with respect to the macromycetes

The data in the mycological literature are insufficient to allow an objective and comprehensive evaluation of the species composition distribution and ecology of the macromycetes in the main ecosystems of Bulgaria Most of the macromycetes described in the published literature occur in forest ecosystems (both coniferous and deciduous) in the mountain regions 25% of the species occur in the spruce and pine communities 26% in the mixed deciduous forests 21% in oak forests and 20% in the beech forests

Scientific information about the macromycetes in the protected areas of Bulgaria is very scarce Inventories of macromycetes species have been published for only for 11 reserves Longterm mycoecological studies and mapping of rare macromycetes species have been carried out only for the Ostritsa Reserve on Golo Bardo Mountain

At present the identification of rare and threatened fungi species in Bulgaria is exceedingly difficult This is due in large part to the fact that no national plan for the protection of fungi has been developed and no criteria for determining the status of species has been established On the basis of longstanding investigations and Red Lists and Red Data Books prepared in other European countries, this paper advances a list of 65 macromycetes species that are rare for Bulgaria

About 200 species of edible fungi grow in Bulgaria Regretfully efforts to explore and protect these important resources are not yet adequate

The most significant threats to the survival of the macromycetes in Bulgaria are the uncontrolled rapacious collecting of edible fungi, the destruction of the forest communities industrial pollution and the intensive development of motortourism and tourist facilities It is safe to predict that unless urgent measures are undertaken the influence of these anthropogenic activities will result in considerable decreases in and even the extinction of the populations of many fungi species

Based on analysis of the status of the macromycetes in Bulgaria and the state of our knowledge about them, this report offers a number of proposals for the Ministry of Environment to consider in developing an urgent program to protect the fungi of the country

INTRODUCTION

The fungi are a large group of organisms comprising about 100,000 species worldwide Due to the peculiarities of their vegetative bodies (the mycelia) nutritional requirements and reproductive strategies the fungi occupy an unusual place within the world of organisms According to modern thinking they constitute a separate kingdom – Mycetalia – alongside the plant and animal kingdoms (the Vegetabilia and Animalia)

Fungi are widespread in nature They are a constituent part of practically all natural ecosystems being especially numerous in forest ecosystems Fungi from all trophic groups (saprotrophs, parasites and mycorrhizal fungi) play an important role in the functioning of ecosystems Because many fungi have im

portant bioindicative properties they are extremely useful in monitoring programs and can be used successfully in longterm studies of environmental conditions in regions burdened by anthropogenic impacts

The modern classification of fungi is as follows

Kingdom Mycetalia
- Division Myxomycota
  - Class Acrasiomycetes
  - Class Myxomycotes
  - Class Plasmodiophoromycetes
- Division Eumycota
  - Class Chytridiomycetes
  - Class Oomycetes
  - Class Zygomycetes
  - Class Ascomycetes
  - Class Basidiomycetes
  - Class Deuteromycetes

Our paper focuses on the macromycetes fungi This large group includes a majority of the species of the class Basidiomycetes and a substantial number of representatives of the classes Ascomycetes (orders Pezizales Helotiales and Tuberales, and a part of Sphaeriales) and Myxomycetes of the division Myxomycota

Macromycetes constitute a large part of Bulgaria's fungal reserves and are important components of its natural ecosystems They create a secondary product beneficial to both animals and people in the form of fruiting bodies the yields of which in the forests may reach over a ton of fresh weight per hectare In Bulgaria as in most countries macromycetes are a tremendously valuable food product This in turn makes them extremely vulnerable In Bulgaria the edible fungi are subject to uncontrolled rapacious gathering and commercial trade As a result, the populations of a number of species can be considered threatened In addition to the edible fungi, other very rare and interesting macromycetes species are gathered Many species are striking and even whimsical in appearance These fungi, together with the poisonous species (whose fruiting bodies are for obvious reasons destroyed by people) are also threatened with declines in their populations

When considered in the context of activities in defense of fungal biodiversity both in Europe and in the world Bulgaria's conservation efforts are seen to be lagging considerably This is exceptionally alarming It is absolutely essential that Bulgarians initiate a series of scientific institutional and technical activities especially directed toward the protection of fungal resources and toward their wise use For that reason we have in this report summarized the information available in the Bulgarian mycological literature on the species composition distribution and ecology of the macromycetes – the most seriously threatened among our fungal reserves We have placed special emphasis on the economically important edible and poisonous fungi as well as the rare and interesting macromycetes species in our country In considering more comprehensively the attributes of the macromycetes in Bulgaria we have referred also to fungi species that are important for the functioning of the forest and other ecosystems

THE BACKGROUND OF MYCOLOGICAL INVESTIGATIONS IN BULGARIA

The study of Bulgarian fungi began in the early twentieth century and involved mainly the investigation and elimination of fungal diseases of cultivated plants Much of this phytopathological research was performed at the experimental agricultural stations near Sadovo Obraztsov Chiflik, and in Sofia at the Faculty of Agronomy Although the investigations carried out in these centers focused mainly on phytopathology the published materials included data on parasitic fungi species that were either new to science or identified for the first time in Bulgaria New information was also reported on the morphology and biology of fungi

Early Investigations

The founder of mycological science in Bulgaria is considered to be Konstantin Malkov who laid the foundations for an inventory of fungi parasitic on the wild and cultivated plants in the country Significant contributions to the study of parasitic fungi in Bulgaria can be found in the work of P Kozarov B Ivanov H Savov D Atanasov I Kovachevsky A Hristov A Radoslavov T Dimitrov and more recently M Markov Ts Hinkova P Mihailova S Vanev V Fakirova and B Rosnev (Stanev 1987 Fekirova 1991)

Purely fundamental mycological research has been carried out by botanists at the Faculty of Physics and Mathematics at the University of Sofia The first theoretical investigations of macromycetes fungi in Bulgaria are associated with the name of the first Professor in Botany at the University of Sofia – Stephan Georgiev He collected and identified a number of fungal species previously unknown in the country mainly from coniferous forests in the Rila Mountains near Borovets His findings were posthumously published by S Petkov (Petkov 1905 1906)

Another of the early macromycetes investigators was Kium Vlaev He collected materials from Vitosha Liulin and the outskirts of Sofia As a participant in the Balkan War he gathered materials from Turkish Thrace later publishing the results (Vlaev 1915) Vlaev's untimely death hindered the publication of further results from his research This information later appeared in papers by Boyan Barsakov (Barsakov 1926a 1926b 1929)

Todor Dimitrov's research involved forest phytopathology In his publications he referred to some parasitic macromycetes from the family Polyporaceae

(Dimitrov 1922 1923 1926)

Floristic Studies

Among these early mycologists Boyan Barsakov made the greatest contributions to the study of the macromycetes fungi In a total of 12 publications he reported 614 species and varieties of macromycetes new for Bulgaria from the classes Basidiomycetes and Ascomycetes and several hundred other species with new habitats for various parts of the country (Barsakov 1926c 1928 1930 1931 1932 1933 1936 1939a and 1939b) He collected materials from Vitosha Liulin the Rila and Pirin Mountains the Western Rhodopes the Stara Planina Mountains and Sredna Gora Barsakov's work on Vitosha Mountain (Barsakov 1933) was the first attempt at a more systematic regional study of macromycetes in Bulgaria (Stanev 1987)

During the first half of the century a number of European (particularly Czech) mycologists visited Bulgaria and made substantial contributions to the study of its fungi Macromycetes were collected and results published by Klika (1926b) Piebauer (1937) Pilat (1926 1927) Hruby (1931) and others (Stanev 1987)

As is clear from the previous discussion, the first data with respect to the diversity and distribution of the macromycetes of Bulgaria were chiefly the result of incidental investigations Regretfully almost none of the materials of the first Bulgarian mycologist are preserved Specimens collected in Bulgaria in the first half of this century are housed in the Botanical Institute in Prague It is likely that individual small collections can also be found at other places abroad

The foundations for the systematic study of the fungi in Bulgaria were laid by Tsvetana Hinkova In a series of papers she published the results of longterm investigations on the macromycetes in coniferous and deciduous communities on Vitosha in the eastern Rila and at Loudogorie (Hinkova 1950 1951 1953 1954 1955a 1955b 1958a 1958b 1961 1962 1963) Together with other mycologists Hinkova published data on the species composition and chorology of the macromycetes in various regions of Bulgaria Hinkova and Alexandrov (1971) and Hinkova and Fakirova (1970) reported the results of their studies of the species composition of the macromycetes on Lozenska Mountain

Hinkova and Drumeva (1978) published data obtained as a result of several years of study of the macromycetes in pine plantations of varying age in the western and eastern Stara Planina Mountains and in the eastern Rhodopes Hinkova et al (1979 1981) published results of longterm investigations of the macromycetes in different plant communities in the Rhodopes The same authors have carried out stationary mycological investigations in the forest communities of the Pirin Mountains (Hinkova et al 1990 Stoychev and Drumeva 1987)

Data on the species composition and chorology of the macromycetes in various regions of Bulgaria can also be found in the publications of other Bulgarian and foreign mycologists Kreisel (1962) Stoychev (1979) Kuthan and Kotlaba (1981 1988) Vanev and Reid (1986), Dorfelt (1987) Gyosheva (1991a) Gyosheva and Drumeva (1991) Drumeva et al (1992) and others

Taxonomy

In contrast to these floristic studies only a few mycologists have worked in the field of macromycetes taxonomy in Bulgaria The papers of Alexandrov (1968 1969 1970 1971) provide information on the systematics of the macromycetes from the Discomycetes of the class Ascomycetes gathered on Vitosha and in the Stara Planina Mountains Fakirova has contributed studies of the taxonomy of the macromycetes from the Pyronomycetes and Discomycetes of the class Ascomycetes and especially of the coprophilous fungi in this class (Fakirova 1967, 1968 1969 1970 1978 1982 1985 and others) Chilakov develops taxonomically the genera *Bovista* *Lycoperdon* and *Phallus* from the Gasteromycetes (Calakov 1978 1982 1985) Reid and Vanev (1984) present taxonomic descriptions of macromycetes species new and interesting for Bulgaria Stoychev (1979 1981a 1981b 1982 1987a 1987b) worked on the taxonomy of the fungi of the family *Polyporaceae*

These have been the most significant taxonomic investigations of macromycetes in Bulgaria so far In 1991 work began on the publication of the multivolume *Fungi in Bulgaria* (Fakirova 1991) As this publication develops it will present new taxonomic information on different macromycetes groups

Mycoecology

The beginnings of mycoecological investigations in Bulgaria can be traced to Tsvetana Hinkova's article (1954) "The Higher Fungi on Vitosha" Certain aspects of macromycetes ecology can also be found in her other works (Hinkova 1958a 1961b) The mycological studies of Drumeva in pine plantations (Drumeva 1981 1983) and in the forest communities of the Pirin Mountains (Stoychev and Drumeva 1987) were also ecologically oriented Gyosheva has studied the macromycetes as components of the major ecological communities of Golo Bardo Mountain (Gyosheva 1984 1991b) and of the Balkan pine communities on Vitosha (Gyosheva and Bogoev 1985) Her work has also focused on the role of the saprotrophic macromycetes in the cycling of forest materials (Gyosheva and Matakieva 1985 Bogoev and Gyosheva 1987) Data from studies of wooddestroying macromycetes in various forest communities in Bulgaria are found in the works of Videlov et al

(1987) and Rosnev and Stoychev (1985)

From this brief historical review of Bulgarian mycology it is plain that the few mycologists who worked and who are still working in Bulgaria have focused mainly on studies of macromycetes species composition and chorology in various regions of the country The macromycetes materials collected by the younger generation of mycologists (Hinkova Drumeva Fakirova Stoychev Gyosheva) are housed in the mycological herbaria of the Institute of Botany in Sofia and in the Higher Agrarian Institute in Plovdiv

GAPS IN KNOWLEDGE OF THE MACROMYCETES

Thorough review and analysis of the mycological literature in Bulgaria leads to the conclusion that the available scientific information about macromycetes is rather scanty Based on this information, it is not yet possible to characterize comprehensively the status of the macromycetes as a basic part of the fungal reserves of Bulgaria

The are five main areas in which further research on the macromycetes of Bulgaria is needed

1 *Taxonomy and ecology* As mycological science developed in Bulgaria, the few mycologists who worked here failed to lay solid foundations for purposeful taxonomic and ecological investigations on the macromycetes These basic areas of mycology are still poorly developed in Bulgaria with respect to the macromycetes Our mycological literature is deficient in data about the taxonomy and ecology of these fungi

2 *Species composition and distribution* Macromycetes species composition has not been studied adequately in Bulgaria Systematic investigations of these fungi have been carried out for many years in just a few regions Many of the publications include data about macromycetes collected during short field trips As a result, different parts of the country have been explored to varying extent the number of the poorly studied regions being exceedingly large

3 *Sitespecific research* The majority of mycological investigations have been carried out using methods that have hindered qualitative and quantitative evaluation of specific sites and that have not allowed for the elucidation of the structure of mycocenoses in the major ecosystems of Bulgaria Mycological studies using the stationary method have been carried out only in recent years These latter studies have begun to provide more information on the species composition phenology ecotrophic structure, and productivity (the number and biomass of fruiting bodies) of the macromycetes (Drumeva 1981 1983 Gyosheva and Bogoev 1985 Gyosheva and Matakieva 1985)

4 *Longterm research in reserves* A very significant gap in the exploration of the macromycetes in Bulgaria is the lack of systematic longterm studies of species composition and the mapping of these fungi in the nation's reserves The macromycetes have been well studied and mapped only at the Ostritsa Reserve in the Golo Bardo Mountains (Gyosheva 1991b)

5 *Edible fungi* Too little is known about the species composition and productivity of the edible fungi in the various regions of Bulgaria There is practically no scientific information on the reserves of edible fungi in the country

These major gaps in knowledge present great obstacles to the creation of a sciencebased program for the protection of the fungal diversity of the country In order to overcome these obstacles mycological investigations in Bulgaria must be intensified and the facts about species composition and distribution of the macromycetes ascertained The macromycetes in the reserves must be studied and mapped as fully as possible

A special program should be created to stimulate exploration of the edible fungi in all parts of the country The major gaps in our knowledge of the macromycetes in Bulgaria can be filled only with the help of such urgent measures Regretfully the small number of Bulgarian mycologists are unable to solve these important tasks without the assistance of the Ministry of Environment

GEOGRAPHIC AREAS REQUIRING FURTHER STUDY

The distribution of the macromycetes in Bulgaria has not been adequately studied Of the 20 floristic regions of the country (Map 2) only in the Rhodope Mountains has the species composition of the macromycetes been well studied This work includes longterm systematic investigations on the macromycetes (Hinkova et al 1979 1981)

Studies of macromycetes species composition and longerterm mycological investigations have been carried out in other mountain regions and in territories in other floristic regions the eastern Rila Mountains (Hinkova 1955 1958a 1958b) Vitosha Mountain in the Vitosha floristic region (Barsakov 1933 Hinkova 1954 1955 Alexandrov 1968 1970 1971 Gyosheva and Bogoev, 1985) the Pirin Mountains (Hinkova et al 1990) Golo Bardo Mountain in the Znepole floristic region (Gyosheva 1984 1991a 1991b) Lozenska Mountain in the Sredna Gora floristic region (Hinkova and Fakirova 1970 Hinkova and Alexandrov 1971) the southern Black sea coast (Kuthan and Kotlaba 1981 1988) the forests of Karakuz and

Palamara (Loudogorie) in the northeastern Bulgaria floristic region (Hinkova 1962) and the pine plantations in the eastern and western Stara Planina Mountains (Hinkova and Drumeva 1978, Drumeva and Stovchev 1984 1987) (See Map 2, p 808)

All the other floristic regions of Bulgaria have been inadequately studied with respect to macromycetes Published data is extremely scanty for the macromycetes of the Danube River plain the western border mountains Slavyanka Mountain and the Mesta River valley All poorly studied and unexplored floristic regions in Bulgaria are of interest from a mycological point of view The unique vegetation and relatively insignificant anthropogenic influence at Strandzha Mountain Belasitsa Slavyanka Mountain the western border mountains and the mountains of the Znepole region (Kraishte) suggest a rich diversity of macromycetes including species that are new rare and interesting for the country At the same time, however little species variety or richness can be expected in unstudied areas near large cities, in industrial regions in forest communities strongly influenced by human activities or under ecological conditions unfavorable for the development of fungi

Appendix 3 provides the number of macromycetes species published for each floristic region of Bulgaria along with the principal published sources

STATUS OF THE MACROMYCETES IN BULGARIA

So far about 2100 taxa of macromycetes – species subspecies varieties and forms – have been described for Bulgaria divided among the following systematic groups (figures should be considered approximate)

Division Myxomycota – 57 taxa
- Class Myxomycetes – 57 taxa

Division Eumycota – 2002 taxa
- Class Ascomycetes – 415 taxa
  - Order Sphaeriales – 37 taxa
  - Orders Discomycetes (Helotiales Pezizales Tuberales) – 378 taxa
- Class Basidiomycetes – 1607 taxa
  - Subclass Homobasidiomycetidae – 1574 taxa
    - Order Aphillophorales – 468 taxa
    - Order Boletales – 76 taxa
    - Order Agaricales – 804 taxa
    - Order Russulales – 142 taxa
    - Order Gasteromycetes – 84 taxa
    - Order Melanogastrales – 1 taxon
    - Order Hymenogastrales – 4 taxa
    - Order Sclerodermatales – 7 taxa
    - Order Lycoperdales – 57 taxa
    - Order Nidulariales – 10 taxa
    - Order Phallales – 5 taxa
    - Order Podaxales – 2 taxa
  - Subclass Heterobasidiomycetidae – 33 taxa
    - Order Auriculariales – 3 taxa
    - Order Tremellales – 19 taxa
    - Order Tulasnellales – 1 taxon
    - Order Dactymicetales – 10 taxa

At present about 5500 species of macromycetes are known for the world mainly from the classes Basidiomycetes and Ascomycetes In view of the fact that the macromycetes of Bulgaria have not yet been adequately studied the number of published taxa is evidence of a considerable degree of species diversity

The extent of poorly studied or almost unexplored regions in Bulgaria suggests that a great reserve of unknown species of fungi exists here As proof of this new and rare taxa of macromycetes from all systematic groups are still emerging with each successive comprehensive study of the macromycetes, and even during mycological field trips

RARE SPECIES

For a number of reasons it is very difficult at present to distinguish rare fungi species First and foremost a program for the protection of the fungi of Bulgaria has not yet been developed, and so criteria for determining the status of rare and threatened species have not been established

The biological characteristics of fungi present additional difficulties for determining rarity Fungi are strongly affected by climatic conditions, especially as regards the sporadic character of their fruiting bodies This demands that long (i e not less than tenyear) stationary investigations be conducted in order to distinguish species composition in a given community Only in this way will it be possible to establish the longterm cyclic recurrence characteristic of many fungi species The ephemerality of the fruiting bodies of the fungi also greatly hampers exploration of their populations

These peculiarities of fungal biology combined with the poor amount of research on macromycetes at the national and regional levels hinder efforts to prepare a definitive list of rare and threatened species It is quite probable that macromycetes species that have been collected just once or twice and whose distribution throughout the country has not been well studied would be included in the category of rare species Such are many species from the genera *Helotium Helvella Leptoglossum Mitrula Entoloma Hygrocybe Hygrophorus Inocybe Lactarius Russula Tricholoma* and others from the classes Ascomycetes and Basidiomycetes

In determining rarity consideration should be given to the varying degree of intensive exploitation and other negative anthropogenic influences upon the ecosystems in the different parts of Bulgaria It is quite possible for any given species to be considered rare or threatened only in some regions For this reason longterm regional investigations of the macromy

cetes are absolutely indispensable Unfortunately studies of this sort are almost nonexistent in Bulgaria

Due to these difficulties in determining the rarity of macromycetes species in Bulgaria we in our efforts have employed mainly our own longterm regional investigations those of other authors and also the Red Lists of a number of European countries especially Bulgaria s neighbors Our proposed list of rare species comprises 65 species (Appendix 4) Since this is the first attempt of its kind for Bulgaria this list cannot be considered exhaustive and should be regarded as preliminary Regions with rare macromycetes species for Bulgaria and Europe are presented in Map 3

MACROMYCETES IN THE ECOSYSTEMS OF BULGARIA

The macromycetes have not been well studied as components of the main ecosystems of Bulgaria Until recently ecological investigations of the macromycetes were largely ignored As a result the data in the mycological literature are insufficient to allow objective and comprehensive evaluations of the species composition distribution and ecology of macromycetes in the various types of ecosystems of Bulgaria The published taxa of macromycetes for the most extensive ecosystems in the country are as follows (figures are approximate)

Coniferous forest ecosystems
- Communities of *Picea abies* 525 taxa
- Communities of *Pinus sylvestris and P nigra* 523 taxa
- Communities of *Pinus peuce* 98 taxa

Deciduous forest ecosystems
- Communities of *Fagus sylvatica* 424 taxa
- Oak communities (*Quercus cerris Q frainetto Q robur*) 468 taxa

Mixed deciduous communities
- (*Carpinus betulus Acer campestre A pseudoplatanus Betula pendula Fraxinus excelsior Corylus avellana*, and others) 549 taxa

Herbaceous ecosystems 260 taxa
Plant communities in the subalpine zone 27 taxa
Plant communities in the alpine zone 43 taxa

Analysis of data from the literature reveals that the greatest number of macromycetes species has been published for forest ecosystems (deciduous and coniferous) in the mountainous regions of Bulgaria Vitosha Mountain the Rila Mountains the Rhodope Mountains the Pirin Mountains and the Stara Planina Mountains

Judging from the literature and from our own investigations we consider the following plant communities to be particularly interesting and unique in terms of the species composition and ecology of macromycetes oak and beech forests on calcareous substrates dense forests (e g of Ropotamo National Park and the Gorna and Dolna Topchia Reserves along the Kamchia River) plant communities in the alpine and subalpine zones especially the alpine peats communities of *Juniperus excelsa Phillyrea media* and *Castanea sativa* (e g on Belasitsa Mountain and in the Pirins) These communities should be given special attention with respect to their fungi

Mycoecological investigations in different types of ecosystems (Hinkova 1954 1958 Drumeva 1981 1983 Gyosheva 1984 1991b Gyosheva and Bogoev 1985) have allowed researchers to identify a number of widespread macromycetes species that play important roles in the functioning of the forest and herbaceous ecosystems of Bulgaria (see Appendix 5) The most widespread and characteristic edible fungi in the main types of ecosystems of Bulgaria are listed in Appendix 6

FRAGILITY

The macromycetes are highly susceptible to anthropogenic disturbances Investigations throughout the world have given evidence of the significant bioindicative properties of the fungi In this respect they are as effective as lichens as bioindicators In Bulgaria no research results have yet been published in which fungi were used in biomonitoring Since 1992 however specialists from the Taxonomy and Ecology of the Fungi Department of the Institute of Botany at the Bulgarian Academy of Sciences have been studying the accumulation of heavy metals in the fruiting bodies of the macromycetes in certain industrial regions of the country

Observations in seriously disturbed ecosystems – near large cities in industrial regions in tourist complexes along roads and so forth – have revealed a number of correlations verified in many European countries testifying to the high fragility of the macromycetes with respect to human activities In these ecosystems the species composition and trophic structure of the fungi communities are considerably altered and a number of ruderal and nitrophilic species become dominant In Bulgaria these include members of the genera *Coprinus Psathyrella Panaeolus Stropharia* and *Russula* (*R delica*) These species stand out against the background of the considerably reduced species composition of the macromycetes

The macromycetes are susceptible to other anthropogenic influences For example the clearing and burning of forests rapidly alters macromycetes species composition Some fungi groups are replaced by others in the process of secondary succession The publications of Drumeva (1981) document such changes Additional anthropogenic activities that threaten the survival of the macromycetes and the structure of fungi in the ecosystems of Bulgaria include the intensive collection of edible fungi (see below) industrial pollutants (especially acid precipitation) and the destruc

tion of forest communities Most vulnerable to these pressures are the edible fungi the mycorrhizal fungi the litter saprotrophs and species that are strictly acidophilic or calciphilic

MACROMYCETES IN THE RESERVES OF BULGARIA

The mycobiota of the reserves in Bulgaria has been poorly studied Data are available for only 11 reserves or about 17% of the protected areas of the country Data on the macromycetes are published for the following reserves

Aidashlak – 2 species (Stoychev and Drumeva 1987)
Arkutino – 1 species (Stoychev and Drumeva 1979)
Bavuvi Doupki – 39 species (Hinkova et al 1990)
Beglika – 64 species (Barsakov 1931 Hinkova et al 1979 Stoyhev 1982 Reid and Vanev 1983 1986 Bogoev and Gyosheva 1987 Stoychev and Drumeva 1987)
Bistrishko Branishte – 7 species (Barsakov, 1926 Hinkova 1955 Alexandrov 1971)
Karakouz – 77 species (Hinkova 1962)
Ostritsa – 88 species (Gyosheva 1984 1991a 1991b)
Parangalitsa – 58 species (Rosnev and Stoychev 1985 Drumeva and Stoychev 1986 Kuthan and Kotlaba 1988)
Silkosiya – 4 species (Kuthan and Kotlaba 1988)
Shabanitsa – 43 species (Hinkova et al 1979)
Sherba – 1 species (Stoychev and Drumeva 1987)

Longterm mycological investigations and mapping of rare macromycetes species have been carried out only at the Ostritsa Reserve on Golo Bardo Mountain (Gyosheva 1991b) Appendix 7 lists the macromycetes species that have been found in the Bulgarian reserves Rare species are marked with an asterisk

SPECIES COLLECTED IN THE WILD

About 200 species of edible fungi grow in Bulgaria comprising an important part of the country's biological resources In recent years the interest in certain fungi species as a source of economic return has greatly increased Considerable amounts of fungi are being collected in the forests and sold for export to western Europe without any control The species with the greatest demand and highest prices on the Bulgarian fungi market" are all edible boleti especially *Boletus edulis* and *B pinophilus* *Cantharellus cibarius* and species from the genera *Gyromitra* *Morchella* and *Vepra* of the class Ascomycetes Well financed expeditions are also organized by foreign companies to search for truffles as well as less popular fungi such as a large number of species from the genus *Hygrophorus* Some of these species are rare in Bulgaria All of these facts are indicative of the currently unscrupulous conditions under which fungal reserve are exploited within the country

Appendix 1 lists the most valuable edible fungi in Bulgaria (139 species) In order to facilitate the eventual preparation of a program for the management and preservation of these species, they are grouped into four categories

Category 1 Edible fungi bearing fruiting bodies annually and frequently and collected on a large scale 35 species listed

Category 2 Relatively rare edible fungi bearing fruiting bodies frequently and collected on a large scale 36 species listed

Category 3 Rare species of edible fungi bearing fruiting bodies rarely but being collected 29 species listed

Category 4 Edible fungi bearing fruiting bodies annually and frequently but not being collected on a large scale (i e unfamiliar or notsopalatable fungi) 39 species listed

Appendix 2 lists the most well known poisonous fungi in Bulgaria (28 species) Most of these are widespread and fructify frequently Rarer and more interesting species of poisonous fungi for Bulgaria and Europe are *Agaricus placomyces* *Amanita vittadini* *Boletus rhodopurpureus* *B rhodoxanthus* and *Cortinarius orellanus*

Impact of Collecting

The collecting of edible fungi in Bulgaria is done in a most rapacious way The fruiting bodies are uprooted damaging the mycelium Vast areas in the forests are trampled No ripe fruiting bodies are being left for reproduction In most cases the fungi collectors possess inadequate knowledge about the mode of fungi growth and picking techniques and destroy all other fungi that they encounter but do not know

The uncontrolled gathering of fungi has continued in Bulgaria for a number of years now and will continue to expand unless urgent legislative measures are taken If no actions are taken populations of these fungi will certainly diminish and may even disappear in the most devastated regions The most vulnerable fungi populations are those in the Categories 1 2 and especially 3 above

Two years ago the Fungi Department of the Institute of Botany of the Bulgarian Academy of Sciences developed a program to study the populations of edible fungi in the most heavily exploited parts of Bulgaria Regrettfully this program has not yet been financed

Managing the Collecting of Fungi

A program of legislative measures is urgently needed to gain control over the collecting of edible fungi and to preserve the fungal reserves of the country with special emphasis on the edible fungi in the most seriously threatened regions (see recommendations below and Map 4) If legislative measures are not undertaken soon the populations of many edible fungi will be dangerously reduced or even driven to extinction within the next ten years This scenario should be considered conservative, since it assumes no alternation of highyield and loweryield years for the fungi

In order to facilitate the creation of a science based program of legislative measures, mycologists and other experts from the Ministry of Environment have prepared a descriptive document "Characteristics of the Macromycetes Fungi in the Main Types of Ecosystems of Bulgaria" (Gyosheva and Drumeva 1992) This document was adopted by the Committee of Specialists of the Ministry of Environment on 15 December 1992

THREATS TO THE MACROMYCETES OF BULGARIA

Historically the main threats to the survival of the macromycetes have been

1 The clearing (and burning) of forests to provide arable land and the exploitation of forests for the wood industry

2 Destruction of forests for the construction of roads industrial enterprises tourist complexes and athletic facilities and

3 Heavy grazing in the herbaceous and forest communities which diminishes macromycetes species diversity and encourages the proliferation of many ruderal and nitrophilic species

At present the most dangerous threats to the survival of the macromycetes are

1 As noted above the uncontrolled collection of fruiting bodies for commercial purposes especially the unrestricted export of large amounts of fungi by foreign companies This can lead to the destruction of whole populations in certain habitats while reducing considerably the possibilities for restoration

2 The impacts of intensive forestry and agricultural techniques (e g the clearing of forests, plowing of glades and meadows and overgrazing) These techniques tend to alter species composition reduce species diversity and lower the productivity of the macromycetes

3 Largescale emission of industrial wastes (including transboundary pollution) Industrial wastes cause extinction among the more fragile species of fungi in areas near the source of pollution as well as alterations and reductions in species composition across a broader area Acid precipitation disturbs the trophic processes of mycorrhizae and diminishes the quantity of fruiting bodies of the macromycetes Acid precipitation also has significant impacts on the litter saprotrophs and leads to extinctions in populations of basophilic species Open pit mines present a direct threat to fungi Although limited in territory such mines cause direct destruction of the vegetation cover including the macromycetes

4 Intensive development of motortourism and tourist facilities This is very dangerous to the macromycetes The building of roads in the mountains gives people easy access to forest communities situated in the highest altitudes and in regions far removed from large cities Commercial fungi collectors can thus easily and quickly collect and transport large amounts of edible fungi

Looking toward the future the most important potential threats to the survival of the macromycetes in Bulgaria are the overcollecting of edible fungi industrial pollution the clearing of forests and overgrazing

RECOMMENDATIONS

Based on the foregoing analysis we recommend the following measures to protect and restore the fungal reserves in Bulgaria

1 Create as soon as possible a preliminary list of rare and threatened macromycetes in Bulgaria drawing upon existing longterm investigations scientific literature and herbarium materials and using mycology specialists under the guidance of the Ministry of Environment On the basis of this list mycological investigations should be carried out for a number of years in all regions of the country with the aim of preparing regional red data lists and a Red Data Book for the fungi in Bulgaria

2 Do everything practically possible to include Bulgaria in the European program for mapping and protecting fungi and to encourage the creation of a Balkan Red Data Book for fungi

3 Search for opportunities to finance joint projects with leading mycological centers in Europe to study the mycobiota of Bulgaria and to create a

red data list for the country This is important given the low number of the mycologists in Bulgaria

4 Since reserves are the only places where the protection of fungi is really attainable at the present moment the Ministry of Environment should explore the possibility of establishing a program for studying and mapping the mycobiota within them

5 Consolidate efforts to protect the fungi within the reserves

6 Increase efforts to protect the fungi within the national parks and in certain interesting ecosystems near tourist complexes and along the Black Sea coast

7 Create microreserves in certain characteristic ecosystems of Bulgaria notable for their high fungal biodiversity and the presence of rare and interesting species

8 Under the guidance of the Ministry of Environment prepare a program to survey the reserves of edible fungi in the country and to map the most valuable and highyield species by region

9 Initiate strict controls on fungi collecting particularly for species subject to trade in the most seriously threatened regions of the country the Rhodopes the Rila Mountains the Stara Planina Mountains Sredna Gora and the Vitosha region

10 Revise the list of edible fungi permitted for trade according to the national standard of 1960 removing the names of threatened species *Amanita caesarea Boletus aereus B fechtneri B regius Morchella conica M esculenta* and others In addition the national standard for fungi trading should be corrected and the list of permitted species updated

11 To attain effective legislative measures for the protection of the fungal reserves in Bulgaria the Ministry of Environment should at the end of each year be presented with information about the species composition and the amount of fungi purchased and exported Based on this information the Ministry should evaluate the need to initiate more restrictive management regimes for certain fungi species in specific regions

12 A program to record and report annual data on the edible fungi of managed forests and in the reserves should also be initiated

13 In order to restore fungal reserves develop and implement in the managed forests a program of artificial mycorrhization of the woody plants The aim of the program should be to maintain stable populations of valuable edible fungi especially in the anthropogenically damaged forests, as well as to create fungal plantations of these species Artificial mycorrhization would also have a positive influence also on the ecological status of the forests in Bulgaria

14 Study the distribution of the truffles in Bulgaria with special attention to *Tuber aestivum* and its inclusion in the red data list for the country

15 Carry out of a largescale program to popularize scientific knowledge about the fungi and to communicate the need to protect fungi as an element of nature Activities should be organized so as to take in all parts of the population (e g , through the electronic media and special educational courses on fungi) These activities should pursue one single aim to develop the conservation ethic of the population

16 Prepare regional brochures folders and posters illustrating rare and threatened fungi, especially edible species These visual materials should be placed at hotels tourist huts lift stations schools and other sites

17 Popularize through fungi courses books, and other means the collecting of delicious edible fungi that are unfamiliar to the public, and the populations of which are abundant (Category 4)

18 Look for opportunities especially in the near future (i e 1994 95) to create in Bulgaria a collection of cultures of rare and threatened fungal species with the ultimate aim of reintroducing them to natural habitats

19 The following species of edible fungi are recommended for special attention They are the most intensively collected and their populations should be more carefully managed on an annual basis, with the ultimate aim of initiating stricter management regimes where and when necessary

1 *Amanita caesarea* – Category 2
2 *Boletus aereus* – Category 2
3 *Boletus fechtneri* – Category 2
4 *Boletus regius* – Category 3
5 *Boletus edulis* – Category 1
6 *Cantharellus cibarius* – Category 1
7 *Cantharellus cornucopioides* – Category 2
8 *Morchella conica* – Category 2
9 *Morchella esculenta* – Category 2
10 *Verpa bohemica* – Category 3
11 *Verpa conica* – Category 3

Appendix 1 Valuable Edible Fungi in Bulgaria

Category 1 Edible fungi bearing fruiting bodies annually and frequently and collected on a large scale

1 *Agaricus arvensis* Schaeff
2 *A campestris* L
3 *Amanita rubescens* Pers (Fr)
4 *Armillaria mellea* (Vahl Fr) Kumm
5 *A tabescens* (Scop Fr) Emel
6 *Boletus edulis* Bull Fr
7 *B pinophilus* Pil Fr Derck
8 *Calocybe gambosa* (Fr) Sing
9 *Camarophyllus pratensis* (Pers Fr) Kumm
10 *Cantharellus cibarius* Fr
11 *Chtopilus prunulus* (Scop Fr) Kumm
12 *Entoloma clypeatum* (L) Kumm
13 *Flammulina velutipes* (Curt Fr) Karst
14 *Gyroporus castaneus* (Bull Fr) Quel
15 *Hydnum repandum* L
16 *Lactarius piperatus* (L F) Pers
17 *L deliciosus* (L) S F Gray
18 *Leccinum rufum* (Schaeff) Kriesel = *L aurantiacum* (Bull) S F Gray
19 *L scabrum* (Bull Fr) S F Gray
20 *Lepista nebularis* (Batsch Fr) Harmaja
21 *L nuda* (Bull Fr) Cke
22 *Macrolepiota excoriata* (Schaeff Fr) S F Wasser
23 *M procera* (Scop Fr) Sing
24 *M rhacodes* (Vitt) Sing
25 *Marasmius oreades* (Bolt Fr) Fr
26 *Pleurotus ostreatus* (Jacq Fr) Kumm
27 *Ramaria aurea* (Schaeff) Quel
28 *R flava* (Schaeff Fr) Quel
29 *Russula vesca* (Schaeff) Fr
30 *Sarcodon imbricatus* (L) Karst
31 *Suillus bovinus* (L) O K
32 *S granulatus* (L) O K
33 *S luteus* (L) S F Gray
34 *Tricholoma portentosum* (Fr) Quel
35 *T terreum* (Schaeff Fr) Kumm

Category 2 Relatively rare edible fungi bearing fruiting bodies frequently and collected on a large scale

1 *Agaricus augustus* Fr
2 *A comptulus* Fr
3 *A haemorrhoidarius* Kalchbr et Schulz
4 *A silvaticus* Schaeff
5 *Albatrellus confluens* (Alb et Schw Fr) Kotl et Pouz
6 *A ovinus* (Schaeff Fr) Kotl et Pouz
7 *Amanita caesarea* (Scop Fr) Pers
8 *Boletus aereus* Bull Fr
9 *B erythropus* (Fr Fr) Krbh
10 *B fechtneri* Vel
11 *B impolitus* Fr
12 *Craterellus cornucopoides* (L) Pers
13 *Fistulina hepatica* (Schaeff) Fr
14 *Gyroporus cyanescens* (Bull Fr) Quel
15 *Hygrophorus russula* (Schaeff Fr) Quel
16 *Kuehneromyces mutabilis* (Schaeff Fr) Sing fr A H Smith
17 *Lactarius sanguifluus* Fr
18 *L semisanguifluus* Heim fr Leclair
19 *L volemus* (Fr) Fr
20 *Laetiporus sulphureus* (Bull Fr) Murrill
21 *Langermannia gigantea* (Batsch Pers) RostK
22 *Lepiota clypeolaria* (Bull Fr) Kumm
23 *L subalba* Kuhn Orton
24 *Macrolepiota mastoidea* (Fr) Sing
25 *Morchella conica* Pers Fr
26 *M esculenta* Pers Fr
27 *Paxillus involutus* (Batsch Fr) Fr
28 *Polyporus squamosus* (Huds) Fr
29 *Ramaria botrytis* (Pers Fr) Ricken
30 *Russula vesca* Fr
31 *R virescens* (Schaeff emend Pers) Fr
32 *Tricholoma flavovirens* (Pers Fr) Lundell
33 *T imbricatum* (Fr Fr) Kumm
34 *T populinum* Lge
35 *Xerocomus badius* (Fr) Kuhner Gilb
36 *X subtomentosus* (L) Quel

Category 3 Rare species of edible fungi bearing fruiting bodies rarely collected

1 *Agaricus bernardii* Quel
2 *A bitorquis* (Quel) Sacc
3 *A excellens* (Moell) Moell
4 *A macrosporus* (Moell ex Schff) Pil
5 *Boletus queletii* S Schulzer
6 *B regius* Krbh
7 *B speciosus* Frost
8 *Clavariadelphus pistillaris* (L) Donk
9 *Cortinarius praestans* (Cord) Gill
10 *Gomphus clavatus* (Pers Fr) S F Gray
11 *Hericium coralloides* (Scop Fr) S F Gray
12 *Leccinum quercinum* Pil
13 *Lepista personata* (Fr Fr) Cke
14 *Leucopaxillus giganteus* (Fr) Sing
15 *L lepistoides* (R Mre) Sing
16 *Pleurotus eryngii* (DC Fr) Quel
17 *Pseudohydnum gelatinosum* (Scop Fr) Karst
18 *Rozites caperatus* (Pers Fr) Karst
19 *Sparassis crispa* (Wulf in Jacq) Fr
20 *Russula aurea* Pers = *R aurata* Fr

Appendix 1 Valuable Edible Fungi in Bulgaria (continued)

Category 3 Rare species of edible fungi bearing fruiting bodies rarely collected (continued)

21 *R lutea* (Huds Fr) S F Gray
22 *Suillus gravillei* (Klotzch Fr) Sing
23 *S sibiricus* Sing
24 *S variegatus* (Sw Fr) O K
25 *Tricholoma columbetta* (Fr) Kumm
26 *T focale* (Fr) Ricken
27 *Verpa bohemica* (Krombh) Boud
28 *V conica* Swartz Pers
29 *Volvariella bombycina* (Schaeff Fr) Sing

Category 4 Edible fungi bearing fruiting bodies unusually and frequently but not being collected on a large scale (unfamiliar or not so delicious)

1 *Agrocybe cylindracea* (DC Fr) Mic = *A aegerita* (Brigantii) Sing
2 *A praecox* (Pers Fr) Kumm
3 *Amanita vaginata* (Bull Fr) Roze
4 *Boletus luridus* Schaeff Fr
5 *B piperatus* Bull Fr
6 *Boletus nigrescens* Pers Pers
7 *B plumbea* Pers
8 *Calvatia excipuliformis* (Scop Pers) Perdeck
9 *C utriformis* (Bull Pers) Jaap
10 *Cantharellus tubaeformis* (Bull) Fr
11 *Chroogomphus rutilus* (Schaeff Fr) O K Miller
12 *Clitocybe gibba* (Pers Fr) Kumm
13 *C clavipes* (Pers Fr) Kumm
14 *C geotropa* (Quel) Quel
15 *C odora* (Bull Fr) Kumm
16 *Collybia butyracea* (Bull Fr) Kumm
17 *C dryophila* (Bull Fr) Kumm
18 *Coprinus atramentarius* (Bull Fr) Fr
19 *C comatus* (Mtll Pers) Pers
20 *Gomphidius glutinosus* (Schaeff Fr) Fr
21 *Helvella crispa* Fr
22 *H lacunosa* Afzelius Fr
23 *Laccaria laccata* (Scop Fr) Beck &r Br
24 *L amethystea* (Bull) Murr (*L amethystina* Cke)
25 *Lactarius mitissimus* (Fr) Fr
26 *Lepista flaccida* (Sow Fr) Pat
27 *L sordida* (Schum Fr) Sing
28 *Lycoperdon perlatum* Pers Pers
29 *Marasmius alliaceus* (Jacq Fr) Fr
30 *Megacollybia platyphylla* (Pers Fr) Kotl & Pouz
31 *Pluteus atricapillus* (Batsch) Fayod
32 *Russula aeruginea* Lindbl in Fr
33 *R cyanoxantha* (Schaeff) Fr
34 *R grisea* Fr
35 *R olivacea* (Schaeff) Pers
36 *Tricolomopsis rutilans* (Schaeff Fr) Sing
37 *Vascellus pratense* (Pers Pers) Kreisel
38 *Xerocomus chrysenteron* (Bull) Quel
39 *X rubellus* (Krbh) Mos

Appendix 2 Best Known Poisonous Fungi in Bulgaria

1 *Agaricus placomyces* Peck = *A melleagris* J Schff
2 *A xanthodermus* Genevier
3 *Amanita muscaria* (L) Pers
4 *A pantherina* (DC Fr) Krombh
5 *A phalloides* (Fr) Link
6 *A virosa* (Fr) Bertillon
7 *A vittadinii* (Mor) Vitt
8 *Boletus rhodopurpureus* Smotl
9 *B rhodoxanthus* (Krbh) Kallenb
10 *B satanas* Lenz
11 *Clitocybe phyllophila* (Fr) Kumm = *C cerrusata* (Fr) Kumm
12 *C dealbata* (Sow Fr) Kumm
13 *Cortinarius orellanus* Fr
14 *Entoloma sinuatum* (Bull Fr) Kumm
15 *Galerina marginata* (Batsch) Kuhner
16 *Gyromitra esculenta* (Pers) Fr
17 *Hebeloma sinapizans* (Paulet Fr) Gill
18 *Hypholoma fasciculare* (Huds Fr) Kumm
19 *Inocybe patouillardii* Bres
20 *Lactarius torminosus* (Schaeff Fr) Pers
21 *Lepiota cristata* (Bolt Fr) Kumm
22 *Omphalotus olearius* (DC Fr) Sing
23 *Ramaria formosa* (Pers Fr) Quel
24 *R pallida* (Schaeff em Bres) Ricken = *R mairei* Donk
25 *Russula emetica* (Schaeff) Pers Fr
26 *Scleroderma citrinum* Pers = *S aurantium* (L) Pers
27 *Tricholoma pardalotum* Herink fr Kotl = *T pardinum* (Pers) Quel
28 *T virgatum* (Fr Fr) Kumm

Appendix 3 Numbers of Macromycetes Published for the Floristic Regions of Bulgaria and the Main Publications (figures are approximate)

1 Black Sea coast (northern southern) 548 taxa (Barsakov, 1929 1930 Kreisel 1959, Hinkova 1961, 1963 1964, Kuthan and Kotlaba 1981 1988)
2 Northeastern Bulgaria 291 taxa (Hinkova 1962 Kuthan and Kotlaba 1988)
3 Danube River plain 5 taxa (Barsakov 1929 Hinkova 1968 Stoychev and Drumeva 1984)
4 Balkan (Stara Planina) foothill region 26 taxa (Barsakov, 1926a, 1926b, Kreisel, 1959, Drumeva, 1981, Kuthan and Kotlaba 1988)
5 Stara Planina Mountains (eastern, central, western) 501 taxa (Hinkova and Drumeva, 1978 Stoychev and Drumeva, 1984, 1987)
6 Sofia region 226 taxa (Petkov 1905 1906 Barsakov 1926a 1928 1929 1932 1933, Hinkova 1950 1960, Hinkova and Draganov, 1963/1964 Drumeva et al , 1992)
7 Znepole region 272 taxa 254 taxa from Golo Bardo Mountain (Barsakov 1929 1930 1932 1936, Hinkova 1955b, 1955c, Gyosheva, 1984 1991a, 1991b)
8 Vitosha region 887 taxa, 805 taxa from Vitosha Mountain (Barsakov 1933 Hinkova 1954 1955a Alexandrov 1968 1970 1971 Gyosheva and Bogoev 1985), 69 taxa from Lyulin mountain (Barsakov, 1926a 1928 1929 Hinkova 1955b Hinkova and Draganov 1963 1964) 47 taxa from Plana Mountain (Alexandrov, 1969 Hinkova 1961 1963 1964 Hinkova and Stoychev, 1983, Drumeva et al 1992)
9 Western border mountains 4 taxa from Ograzden mountain (Hinkova and Stoychev 1983)
10 Strouma River valley 22 taxa (Hinkova 1961 Hinkova and Stoychev 1983 Drumeva et al 1992)
11 Belasitsa Mountain 16 taxa (Chalakov 1982 Drumeva et al 1992, Fakirova 1967 1968 1969 1970a 1970b)
12 Slavyanka mountain 4 taxa (Fakirova 1970 Chalakov 1978 1982)
13 Mesta River valley 1 species (Hinkova and Stoychev 1983)
14 Pirin Mountains 360 taxa (Stoychev and Dimcheva 1987 Dorfelt 1987 Hinkova et al 1990)
15 Rila Mountains 580 taxa (Barsakov, 1926a 1926c 1928, 1929, 1930 1931 Hinkova, 1955 1958a 1958b Rosnev and Stoychev, 1985 Dorfelf, 1987)
16 Stredna Gora Mountains 334 taxa (Barsakov 1926a 1928 1929 Hinkova, 1961 1963 1964 Hinkova and Draganov 1963 1964 Hinkova and Stoychev 1983 Drumeva et al 1992) 310 taxa from Lozenska Mountain in western Stredna Gora (Hinkova and Fakirova 1970 Hinkova and Alexandrov 1971)
17 Rhodope Mountains 674 taxa (Barsakov 1926a, 1926c, 1928, 1929 1930 1931, 1936 1939a Hinkova et all 1979 1981 Drumeva and Stoychev 1980 Pilat 1926 1937 Reid and Vanev 1984 Vanev and Reid, 1986)
18 Thracian Plain 135 taxa (Klila 1925 1926 Pilat 1937 Stoychev 1982 Stoychev and Drumeva 1984 1987)
19 Tundzha hilly region 43 taxa (Drumeva and Stoychev 1988 Kuthan and Kotlaba 1988 Gyosheva and Drumeva 1992)
20 Strandzha Mountain 63 taxa (Barsakov 1936 Hinkova 1963 1964 Hinkova and Draganov 1963 1964 Stoychev, 1979 Kuthan and Kotlaba 1988, Gyosheva and Drumeva 1991)

Appendix 4 Rare Macromycetes Species of Bulgaria and Some Rare and Protected Species in Europe

1 *Agaricus abruptibulbus* Peck Protected in Europe Vitosha Mountain, Strandzha Mountain, Southern Black Sea coast
2 *A altipes* (Moell) Moell Rare species for Europe Strandzha Mountain
3 *A squamulifer* (Moell) Pil Southern Black Sea coast Thracian plain
4 *Albatrelluus cristatus* (Schaeff Fr) Kotl fr Pouz Protected in Europe Rila Mountains
5 *A pescaipae* (Pers Fr) Pouz Rhodope Mountains
6 *Amanita battarae* Boud Pirin Mountains
7 *A porhyria* Alb fi Schw Fr Vitosha Mountain
8 *A strobiliformis* (Paulet Vitt) Bertillon Protected in Europe Rila Mountains Rhodope Mountains, Golo Bardo Mountain reserve "Ostritsa"
9 *A vittadinii* (Mor) Vitt Rare species for Europe Thracian plain
10 *Boletus lupinus* Fr Rare species for Europe Golo Bardo Mountain
11 *B rubinus* W G Smith Tundzha Hilly Region
12 *B torosus* Fr in Fr Hok Rhodope Mountains, northeastern Bulgaria
13 *Cantharellus friesii* Quel Vitosha Mountain
14 *Catathelasma imperiale* (Quel) Sing Rare species for Europe Protected Vitosha Mountain Rhodope Mountains
15 *Clathrus archeri* (Berk) During Rare species for Europe Protected Southern Black Sea coast

Appendix 4 Rare Macromycetes Species of Bulgaria and Some Rare and Protected Species in Europe (continued)

16 *C. ruber* Pers. Protected. Black Sea coast, Strandzha Mountain.
17 *Clavariadelphus pistillaris* (L.) Donk. Protected. Vitosha Mountain, Rila Mountains, Loudogorie, Lozanska Mountain, Rhodope Mountains, Konyavska Mountain.
18 *Clitopilus giovanellae* (Bres.) Sing. Rare species for Europe. Ograzden and Strouma River valley.
19 *Cortinarius praestans* Cord. Gill. Rare species for Europe. Protected. Vitosha Mountain, Lozenska Mountain.
20 *C. violaceus* (L.) S.F. Gray. Protected. Vitosha Mountain.
21 *Creolophus cirratus* Pers. Fr. Karst. Vitosha Mountain, Rila Mountains, Rhodope Mountains, Black Sea coast, Eastern Stara Planina Mountains, Strandzha Mountain, northeastern Bulgaria, Danube River plain.
22 *Crinipellis mauretanicus* R. Rare Mediterranean species. Thracian plain.
23 *Cyathus striureus* (Schw.) de Toni. Rare species for Europe. Slavyanka Mountain.
24 *Elaphomyces granulatus* Fr. Black Sea coast, Ropotamo National Park.
25 *Elasmomyces mattirolianus* Cav. Rare species for Europe. Rila Mountains.
26 *Endoptychum agaricoides* Czern. Rare species for Europe. Thracian plain.
27 *Gestrum quadrifidum* Pers. Pers. Protected. Rila Mountains.
28 *G. triplex* Jungh. Vitosha Mountain, Black Sea coast, Ropotamo National Park.
29 *Gomphus clavatus* Pers. Fr. S.F. Gray. Vitosha Mountain, Rila Mountains.
30 *Grifola frondosa* Deck. Fr. S.F. Gray. Protected. Western Rhodope Mountains, Golo Bardo Mountain, Ostritsa Reserve.
31 *Gyrodon lividus* Bull. Fr. Sacc. Northern Black Sea coast, Pirin Mountains.
32 *Hericium coralloides* Scop. Fr. S.F. Gray. Protected. Thracian plain, northern Black Sea coast, Sredna Gora Mountains, Rila Mountain, eastern Stara Planina Mountains.
33 *H. erinaceum* Bull. Fr. Pers. Western Stara Planina Mountains, Rhodope Mountains.
34 *Hygrocybe murinacea* Bull. Fr. Mos. Rare species for Europe. Vitosha Mountain.
35 *Hygrophorus arbustivus* Fr. Fr. Black Sea coast, Rhodope Mountains.
36 *Lactarius acerrimus* Britz. Tundza Hilly Region, Strandzha Mountain.
37 *L. spinosulus* Quel. Rare species for Europe. Vitosha Mountain.
38 *Lepista luscina* Fr. Fr. Sing. Rare species for Europe. Thracian plain.
39 *Leucoagaricus macrorhizus* (Loquin) Horak. Protected. Thracian plain.
40 *Leucopaxillus compactus* (Fr.) Neuhoff. Rare species for Europe. Rhodope Mountains, Strouma River valley.
41 *Macrotyphula filiformis* (Bull. Fr.) Pacchnatz. Protected. Vitosha Mountain, Pirin Mountains, northeastern Bulgaria, Sofia region.
42 *M. fistulosa* (Holmsk. Fr.) R.H. Petersen. Protected. Rila Mountain, Lozenska Mountain, Rhodope Mountains, Stara Planina Mountains.
43 *Melanogaster variegatus* (Vitt.) Tul. Strandzha Mountain, Lozanska Mountain.
44 *Melastiza chateri* Boud. Rhodopes Mountains, Beglica Reserve.
45 *Meripilus giganteus* (Pers. Fr.) Karst. Protected. Vitosha Mountain, Rila Mountains, Loudogorie, Thracian plain, Golo Bardo Mountain.
46 *Mutinus caninus* (Huds. Pers.) Fr. Protected. Vitosha Mountain, Rila Mountains, Black Sea coast, Ropotamo National Park, Rhodope Mountains, Thracian plain.
47 *Mycenastrum corium* (Guersent in DC) Desv. Belasitsa Mountain, Sredna Gora Mountains, Lozenska Mountain, Thracian plain, Golo Bardo Mountain.
48 *Otidea alutacea* (Pers.) Mass. Rare species for Europe. Danube River plain.
49 *Phallus habriani* Vent. Pers. Protected. Rila Mountains, Black Sea coast, Ropotamo National Park, Thracian plain, Stara Planina Mountains.
50 *Phylloporus pelletieri* (Lev.) Quel. Pirin Mountain, Konyavska Mountain.
51 *Pisolithus arhizos* (Scop. Pers.) S. Rauschert. Strouma River valley, Strandzha Mountain, Black Sea coast, Konyavska Mountain.
52 *P. tinctorius* (Mich. Pers.) Cooker. Conch. Protected. Western Stara Planina Mountains, Thracian plain.
53 *Pluteus phlebophorus* (Ditmar. Fr.) Kumm. Rare species for Europe. Lozenska Mountain, central Stara Planina Mountains, Thracianplain.
54 *Porphyrellus porphyrosporus* (Fr.) Gilbert. Central Stara Planina Mountains, Pirin Mountains, Rila Mountains.
55 *Pulveroboletus gentilis* (Quel.) Sing. Protected. Black Sea coast, Ropotamo National Park, Lozenska Mountain.
56 *P. lignicola* (Kallenb.) Pil. Protected. Central Rhodope Mountains.
57 *Russula solaris* Ferdinandsen & Winge. Western Rhodope Mountains.
58 *R. veternosa* Fr. Vitosha Mountain, Stara Planina Mountains.

Appendix 4 Rare Macromycetes Species of Bulgaria and Some Rare and Protected Species in Europe (continued)

59 *Sarcosphaera coronaria* (Jacq Cooke) Boud Protected Western Rhodope Mountains Golo Bardo Mountain Kraishte

60 *Secotium agaricoides* (Czern) Holl Rare species for Europe Eastern Rhodopes Mountains Znepole region Stara Planina Mountains Lozenska Mountain

61 *Sparassis crispa* (Wulf in Jacq) Fr Protected Rhodope Mountains

62 *Strobilomyces strobilaceus* (Scop Fr) Berk Protected Rila Mountains Sredna Gora Mountains Pirin Mountains

63 *Suillus sibiricus* Sing Rila Mountains Pirin Mountains *(Pinus peuce* communities) Bavuvi Doupki Reserve

64 *Trichaster melanocephalus* Czern Western Stara Planina Mountains Pirin Mountains, Lozenska Mountain

65 *Tuber aestivum* Vitt Protected Belasitsa Mountain, Strouma River valley

Appendix 5 Widely Distributed Macromycetes Species Playing an Important Role in the Functioning of Forest and Herbaceous Ecosystems of Bulgaria

1 *Amanita excelsa* (Fr) Bertillon A mycorrhizal fungus in spruce forests

2 *Auriscalpium vulgare* S F Gray A cone saprotroph in pine forests

3 *Calocera viscosa* (Pers Fr) Fr A saprotroph on pine wood

4 *Clavulina cinerea* (Bull Fr) Schroet A humus saprotroph in coniferous and deciduous forests

5 *Collybia peronata* (Bolt Fr) Kumm A litter saprotroph in deciduous and coniferous forests

6 *Coltricia perennis* (L) Murr A saprotroph on burned wood in coniferous mostly pine forests on sandy soil

7 *Cortinarius trivialis* Lge A mycorrhizal fungus in deciduous forests (oak hornbeam alder willow and other)

8 *Crepidotus mollis* (Schaeff Fr) Kumm A wood saprotroph (on twigs in the litter) in deciduous forests

9 *Cystoderma amianthinum* (Scop Fr) Fayod A humus and litter saprotroph among mosses in coniferous forests

10 *Cystoderma carcharias* (Pers) Fayod A litter saprotroph in coniferous forests

11 *Dermocybe cinnamomea* (L) Wunsche A mycorrhizal fungus in coniferous forests and under birch

12 *Entoloma leptopum* Noordel (= *E mammosum* (L) Hesler & Mos) A humus saprotroph in coniferous forests

13 *Fomes fomentarius* (L) Fr A dangerous parasite on deciduous trees – beech birch and others – in older deciduous forests

14 *Fomitopsis pinicola* (Sw Fr) Karst A dangerous parasite on coniferous trees mainly *P sylvestris*

15 *Ganoderma lipsiense* (Batsh) Atk (= *G applanatum* (Pers) Pat) A parasite and a saprotroph on deciduous wood (beech oak and others)

16 *Ganoderma lucidum* (Curt Fr) Karst A dangerous parasite on the roots of deciduous trees, mainly oaks

17 *Hebeloma crustuliniforme* (Bull) Quel A mycorrhizal fungus in open deciduous and mixed forests (oak birch hornbeam bushes and other)

18 *Heterobasidion annosum* (Fr) Bref A dangerous parasite on the roots of coniferous trees causing serious economic damage in the forests

19 *Hygrocybe conica* (Scop Fr) Kumm A humus saprotroph in mesophilic herbaceous communities

20 *Hygrophorus agathosmus* (Fr) Fr A mycorrhizal fungus in coniferous (spruce pine and other) forests

21 *Hygrophorus eburneus* (Bull Fr) Fr A mycorrhizal fungus in deciduous forests (beech oak hornbeam and others)

22 *Hygrophorus hypothejus* (Fr Fr) Fr A mycorrhizal fungus in coniferous mainly pine forests

23 *Hypholoma capnoides* (Fr Fr) Kumm A saprotroph or parasite on coniferous wood

24 *Inocybe geophylla* (Sow Fr) Kumm A mycorrhizal fungus in coniferous deciduous and mixed forests

25 *Lactarius controversus* (Pers Fr) Fr A mycorrhizal fungus in deciduous forests (birch willow hornbeam oak and others)

26 *Lactarius vellereus* (Fr) Fr A mycorrhizal fungus in various deciduous forests

27 *Lycoperdon pyriforme* Schaeff Pers A wood saprotroph in deciduous and coniferous forests

28 *Lyophyllum connatum* (Schum Fr) Sing A humus saprotroph in coniferous forests and herbaceous communities frequently in ruderal habitats

29 *Marasmius androsaceus* (L) Fr A saprotroph on wood and in the litter of deciduous and coniferous forests a very strong destructor of lignin

Appendix 5 Widely Distributed Macromycetes Species Playing an Important Role in the Functioning of Forest and Herbaceous Ecosystems of Bulgaria (continued)

30 *Melanoleuca melaleuca* (Pers Fr) Murr A humus saprotroph in forests and herbaceous communities
31 *Mycena alcalina* (Fr Fr) Kumm A saprotroph on coniferous wood
32 *Mycena cinerella* Karst A leaf debris and litter saprotroph in coniferous forests
33 *Mycena crocata* (Schrad Fr) Kumm A leaf debris and litter saprotroph in beech forests
34 *Mycena epipterygia* (Scop Fr) S F Gray A leaf debris and litter saprotroph in coniferous and deciduous forests and in herbaceous communities frequently amid mosses
35 *Mycena galericulata* (Scop Fr) Quel A wood saprotroph in deciduous forests
36 *Mycena polygramma* (Bull Fr) S F Gray A saprotroph on buried wood in deciduous and coniferous forests
37 *Mycena pura* (Pers Fr) Kumm A litter saprotroph in deciduous coniferous and mixed forests
38 *Mycena rosella* (Fr) Kumm A leaf debris and litter saprotroph in coniferous forests
39 *Mycena vulgaris* (Pers Fr) Kumm A leaf debris and litter saprotroph in coniferous forests
40 *Phallus impudicus* L Pers A mycorrhizal fungus (a humus saprotroph) in mesophilic deciduous forests (beech hornbeam oak and others)
41 *Phellinus igniarius* (L) Quel A dangerous parasite in deciduous forests and parks especially on willow
42 *Pholiota squarrosa* (Mtll Fr) Kumm A parasite and saprotroph on coniferous and deciduous wood
43 *Pluteus atromarginatus* (Sing) Kthner A saprotroph on buried wood in deciduous forests
44 *Piptoporus betulinus* (Bull Fr) Karst A parasite on birch trees
45 *Polyporus brumalis* (Pers) Fr A wood saprotroph (small twigs in the leaf debris) in deciduous forests
46 *Polyporus varius* (Pers) Fr A wood saprotroph (small twigs in the leaf debris) in deciduous forests
47 *Psathyrella candolleana* (Fr Fr) Mre A saprotroph on buried wood in deciduous forests and on bushes
48 *Pycnoporus cinnabarinus* (Jacq Fr) Karst A wood saprotroph in deciduous forests (beech birch oak and others)
49 *Rickenella fibula* (Bull Fr) Raith A briotroph Found among mosses in coniferous forests and in the alpine zone
50 *Russula delica* Fr A mycorrhizal fungus in deciduous and coniferous forests Frequently in ruderal habitats
51 *Russula foetens* Pers (Fr) A mycorrhizal fungus in deciduous and coniferous forests
52 *Russula ochroleuca* Pers A mycorrhizal fungus in deciduous and coniferous forests
53 *Russula queletii* Fr in Quel A mycorrhizal fungus in mountainous coniferous forests (spruce and pine)
54 *Russula rosea* Pers (= *R lepida* Fr) A mycorrhizal fungus in deciduous forests mainly under beech
55 *Russula sanguinea* Fr A mycorrhizal fungus in mountainous coniferous forests (pine spruce draft pine and others)
56 *Schizophyllum commune* Fr Fr A saprotroph on deciduous wood
57 *Stereum hirsutum* (Willd Fr) Pers A saprotroph on deciduous wood
58 *Strobilurus esculentus* (Wulf Fr) Sing A cone saprotroph in spruce forests Forms aspect in early spring
59 *Strobilurus stephanocystis* (Hora) Sing A cone saprotroph in pine forests Forms fruit bodies in early spring
60 *Strobilurus tenacellus* (Pers Fr) Sing A cone saprotroph in coniferous forests mainly pine Forms aspect in early spring
61 *Stropharia aeruginosa* (Curtis Fr) Quel A wood and litter saprotroph in deciduous and coniferous forests Ruderal species
62 *Stropharia semiglobata* (Batsch Fr) Quel A coprotroph on excrements on meadows and pastures including those in the alpine zone
63 *Trametes hirsuta* (Wulf Fr) Pil A saprotroph on deciduous wood (beech hornbeam and others)
64 *Trametes versicolor* (L) Pil A saprotroph on deciduous wood
65 *Tricholoma saponaceum* (Fr) Kumm A mycorrhizal fungus in deciduous and coniferous forests
66 *Tricholoma vaccinum* (Pers Fr) Kummer A mycorrhizal fungus in spruce forests in the mountains
67 *Xerula radicata* (Relh Fr) Dorfelt A humus saprotroph and a saprotroph on buried wood in deciduous forests (beech hornbeam oak and others)

Appendix 6 Most Widespread and Characteristic Edible Fungi in the Main Ecosystems of Bulgaria

I Coniferous forest ecosystems

1 Communities of *Picea abies* *Agaricus silvaticus* *Amanita rubescens* *Armillaria mellea* *Boletus edulis* *B erythropus* *Cantharellus cibarius* *Hydnum repandum* *Lactarius deliciosus* *Ramaria flava* *Sarcodon imbricatum* and *Tricholoma imbricatum*

2 Communities of *Pinus sylvestris* and *P nigra* *Agaricus silvaticus* *Boletus pinophilus* *Cantharellus cibarius* *Gyroporus castaneus* *Lactarius deliciosus* *Lepista nuda* *Suillus granulatus*, *S luteus* *Tricholoma flavovirens* *T portentosum* *T terreum*

II Deciduous forest ecosystems

1 Communities of *Fagus sylvatica* *Amanita rubescens*, *Clitopilus prunulus*, *Gyroporus castaneus*, *Lactarius piperatus*, *L volemus* *Lepista nuda* *Macrolepiota procera* *M rachodes* *Pleurotus ostreatus* *Polyporus squamosus* *Russula virescens*

2 Oak communities *Amanita caesarea* *Armillaria mellea* *Boletus edulis* *B erythropus* *Cantharellus cibarius* *Flammulina velutipes* *Gyroporus castaneus* *Hydnum repandum* *Lactarius volemus* *Lepista nebularis*, *L nuda*, *Russula cyanoxantha* *R vesca* *R virescens*

3 Mixed deciduous communities *Amanita rubescens* *Clitopilus prunulus* *Entoloma clypeatum* *Lactarius volemus*, *Leccinum scabrum*, *Lepista nebularis* *L nuda* *Pleurotus ostreatus*, *Polyporus squamosus* *Russula cyanoxantha* *R vesca*

4 Birch plantations *Clitopilus prunulus* *Leccinum rufum*

III Herbaceous ecosystems

1 *Agaricus arvensis* *A campestris* *Calocybe gambosa* *Camarophyllus pratensis* *Clitopilus prunulus* *Langermannia gigantea* *Lepista nuda* *Macrolepiota excoriata* *Marasmius oreades*

Appendix 7 Rare Macromycetes Species Published for the Reserves of Bulgaria (rare species are marked with an asterisk)

I Aidashlak Reserve Stara Planina Mountains

1 [1] *Clavicorona pyxidata* (Fr) Doty (= *Clavaria pyxidata* Fr)

2 [1] *Leccinum duriusculum* (S Schulzer in Fr) Sing

II Arkutino Reserve Southern Black Sea coast

1 *Pluteus leoninus* (Schaeff Fr) Kumm

III Bavuvi Dupki Reserve Pirin Mountains

1 *Amanita vaginata* (Bull Fr) Vitt
2 *Boletus edulis* Bull Fr
3 *B pinophilus* Pil &r Dermek
4 *B piperatus* Bull Fr
5 *Cantharellus cibarius* Fr
6 *Chroogomphus rutilus* (Schaeff Fr) O K Miller
7 *Clitocybe clavipes* (Pers Fr) Kumm
8 *Collybia butyracea* (Bull Fr) Kumm
9 *Dermocybe crocea* (Schaeff) Mos
10 *Gyroporus cyanescens* (Bull Fr) Quel
11 *Hydnum repandum* L
12 *Hygrophorus agathosmus* (Fr) Fr
13 *H eburneus* (Bull Fr) Fr
14 *Hypholoma capnoides* (Fr Fr) Kumm
15 *H sublateritium* (Fr) Quel
16 *Lactarius blennius* (Fr) Fr
17 *L mitissimus* (Fr) Fr
18 *Marasmius alliaceus* (Jacq Fr) Fr
19 *Mycena crocata* (Schrad Fr) Kumm
20 *M gelericulata* (Scop Fr) Quel
21 *M pura* (Pers Fr) Kumm
22 *Ramaria formosa* (Pers Fr) Quel
23 *Rhizopogon roseolus* (Fr Fr) Th M Fries
24 *Russula aurea* Pers
25 *R cyanoxantha* (Schaeff) Fr

Appendix 7 Rare Macromycetes Species Published for the Reserves of Bulgaria (rare species are marked with and asterisk) (continued)

III Bayuvi Dupki Reserve Pirin Mountains (continued)

26 *R delica* Fr emend Bres
27 *R foetens* Pers (Fr)
28 *R integra* (L Fr) Fr
29 *R paludosa* Britz
30 *Strobilurus esculentus* (Wulf Fr) Sing
31 *S stephanocystis* (Hora) Sing
32 *Stropharia aeruginosa* (Curtis Fr) Quel
33 *Suillus sibiricus* Sing
34 *Tricholoma saponaceum* (Fr) Kumm
35 *Tricholompsis rutilans* (Schaeff Fr) Sing
36 *Xerocomus chrysenteron* (Bull) Quel
37 *X. spadiceus* (Fr) Quel
38 *Xeromphalia campanella* (Batsch Fr) Mre
39 *Xerula radicata* (Relh Fr) Dorfelt

IV Beglika Reserve Rhodope Mountains

1 *Agaricus excellens* (Moell) Moell
2 *Alnicola cerodes* Fr
3 *Amylostereum laevigatum* (Fr) Boid
4 *Antrodia sinuosa* (Fr) Karst
5 *Boletus piperatus* Bull Fr
6 *Camarophyllus niveus* (Scop Fr) Karst
7 *Cenangium ferruginicum* Fr Fr
8 *Clitocybe clavipes* (Pers Fr) Kumm
9 *C dealbata* (Sow Fr) Kumm
10 *C fragrans* (With Fr) Kumm
11 *C gibba* (Pers Fr) Kumm
12 *C rufoalutacea* Metrod
13 *C vibecina* (Fr) Quel
14 *Collybia butyracea* (Bull Fr) Kumm
15 *C dryophila* (Bull Fr) Kumm
16 *Cortinarius acutus* R Hry
17 *C anomalus* (Fr Fr) Fr
18 *C caesiocanescens* Mos
19 *C glaucopus* (Schaeff Fr) Fr
20 *C hinnuleus* (Sow) Fr
21 *C lilacinopes* Britz
22 *C penicillatus* Fr
23 *Cudonia circinans* (Pers) Fr
24 *Cystoderma amiantinum* (Scop Fr) Fayod
25 *C carcharias* (Pers) Fayod
26 *C granulosum* (Batsch Fr) Fayod
27 *Dermocybe crocea* (Schaeff) Mos
28 *Erythricium hypnophilum* (Kars) J Erikss
29 *Galerina marginata* (Batsch) Kuthner
30 *Gomphidius glutinosus* (Schaeff Fr) Fr
31 *Hygrocybe punicea* (Fr) Kumm
32 *Hygrophorus agathosmus* (Fr Fr) Fr
33 *H langei* (Kthn) Pearson
34 *Hypholoma radicosum* Lge
35 *Inocybe abietis* Kthn
36 *I brunnea* Quel
37 *I malenconii* Heim
38 *Lactarius mitissimus* (Fr) Fr
39 *L zonarioides* Kuthner &r Romagn
40 *Lamprodema carestiae* (Ces &r De Not)
41 *Lyophyllum connatum* (Schum Fr) Sing
42 *Marasmius androsaceus* (L) Fr
43 *Melanoleuca strictipes* (Karst) Muir (= *M cyanosa* (Sacc) Konr &r Maubl = *M subalpina* (Britz) Bresinsky &r Stangl)
44 *Melastiza chateri* Boud
45 *Nyctalis asterophora* Fr
46 *Omphalina pyxidata* (Bull Fr) Quel
47 *O umbratilis* (Fr) Quel
48 *Otidea auricula* (Schff) Rehm
49 *Peziza irina* Quel
50 *Pholiota flammans* (Fr) Kumm
51 *Physarum bitectum* G Lister
52 *Pluteus atromarginatus* (Sing) Kuhner
53 *Russula albonigra* (Krbh) Fr
54 *R lutea* (Huds Fr) S F Gray
55 *R nauseosa* (Pers) Fr
56 *R queletii* Fr in Quel
57 *R rosea* Pers
58 *R turci* Bres
59 *R velenovskyi* Melz &r Zv
60 *Scutellinia umbrorum* (Fr) Kuntze
61 *Stropharia melasperma* (Bull Fr) Quel
62 *Tricholoma imbricatum* (Fr Fr) Kumm
63 *Tricholomopsis decora* (Fr) Sing
64 *Tubaria minutalis* Romagn

V Bistrishko Branishte Reserve Vitosha Mountain

1 *Cheilymenia stercorea* (Pers) Boud
2 *Gomphidium maculatus* Fr
3 *Hirneola auriculajudae* (Bull Fr) Berk
4 *Leptoglossum muscigenus* (Bull Fr) Karst
5 *Mycena sanguinolenta* (Alb Schw Fr) Kumm
6 *Pseudoplectania nigrella* (Pers Fr) Fuckel
7 *Trichoglossum hirsutum* (Pers Fr) Boud

Appendix 7 Rare Marcomycetes Species Published for the Reserves of Bulgaria (rare species are marked with and asterisk) (continued)

VI Karakouz Reserve Northeastern Bulgaria

1 *Amanita citrina* (Schaeff) Pers
2 *A pantherina* (DC Fr) Krombh
3 *A rubescens* Pers Fr
4 *A vaginata* (Bull Fr) Vitt
5 *Armillaria mellea* (Vahl Fr) Kumm
6 *Auricularia mesenterica* (Dickson Fr) Pers
7 *Bolbitius vitellinus* (Pers Fr) Fr
8 *Boletus luridus* Schaeff Fr
9 *B pulverulentus* Opat
10 *B queletii* S Schulzer
11 *Calocybe gambosa* (Fr) Sing
12 *Cantharellus cibarius* Fr
13 *C cinereus* Fr Pers
14 *Chlorosplenium aeruginosum* (Oeder S F Gray de Notaris)
15 *Clavaria fragilis* Holmsk Fr
16 *C inaequalis* Mtll Fr emend R H Petersen
17 *C maxima* (Schaeff) Morg
18 *Clavariadelphus pistillaris* (L) Donk
19 *Clavulina amethystina* (Bull Fr) Donk
20 *C cinerea* (Bull Fr) Schroet
21 *C coralloides* (L) Schroet
22 *Clitocybe gibba* (Pers Fr) Kumm
23 *Collybia butyracea* (Bull Fr) Kumm
24 *C dryophila* (Bull Fr) Kumm
25 *C peronata* (Bolt Fr) Kumm
26 *Coprinus atramentarius* (Bull Fr) Fr
27 *C picaceus* (Bull Fr) S F Gray
28 *Cortinarius collinitus* (Sow Fr) Fr
29 *Coprinus disseminatus* (Pers Fr) S F Gray
30 *Coryne sarcoides* (Jacq Fr) Tul
31 *Craterellus cornucopioides* (L) Pers
32 *C konradii* R Mair
33 *Crepidotus mollis* (Schaeff Fr) Kumm
34 *Cyathus striatus* (Huds) Willd Pers
35 *Disciotis venosa* (Pers) Boud
36 *Exidia glandulosa* (Bull) Fr
37 *Flammulina velutipes* (Curt Fr) Karst
38 *Fomes fomentarius* (L) Fr
39 *Geastrum fimbriatum* Fr
40 *G smardae* V J Stanek
41 *Gyromitra infula* (Schff) Fr
42 *Helvella sulcata* Afz Fr
43 *Humaria hemisphaerica* (Wiggers Fr) Fuckel
44 *Hydnum repandum* L
45 *Hygrocybe psittacina* (Schaeff Fr) Wunsche
46 *Hygrophorus chrysodon* (Batsch Fr) Fr
47 *Hypholoma fasciculare* (Huds Fr) Kumm
48 *H sublateritium* (Fr) Quel
49 *Inocybe geophilla* (Sow Fr) Kumm
50 *Lachnea livida* (Shum) Gill
51 *Lactarius glaucescens* (Crossland) Pearson
52 *L insulsus* (Fr) Fr
53 *L piperatus* (L Fr) Pers
54 *L pyrogalus* (Bull Fr) Fr
55 *L serifluus* (DC Fr) Fr
56 *L vellereus* (Fr) Fr
57 *L volemus* (Fr) Fr
58 *Leccinum griseum* (Quel) Sing
59 *Lentinus cyathiformis* (Fr) Bres
60 *Lenzites betulinus* (L) Fr
61 *Lepiota atra* (Konig Fr) Boud
62 *Lepista nuda* (Bull Fr) Cke
63 *Leptopodia elastica* (Bull) Boud
64 *Leucoagaricus pudicus* Bull
65 *Macrolepiota rachodes* (Vitt) Sing
66 *Marasmius rotula* (Scop Fr) Fr
67 *Meripilus giganteus* (Pers Fr) Karst
68 *Merulius tremellosus* Schrad Fr
69 *Morchella esculenta* Pers , ex St Amans
70 *Mycena melugena* (Berk &r Curt in Cke)
71 *M galericulata* (Scop Fr) Quel
72 *M pura* (Pers Fr) Kumm
73 *Otidea cochleata* (L in St Amans) Fuckel
74 *Peziza badia* Pers Fr
75 *Phacolus schweinitzii* (Fr) Pat
76 *P rutilus* (Pers) Pat
77 *Phallus impudicus* L Pers
78 *Pluteus atricapillus* (Secr) Sing
79 *P leonitus* (Schaeff Fr) Kumm
80 *P nanus* (Pers Fr) Kumm
81 *Psathyrella candolleana* (Fr Fr) Mre
82 *Ramaria condensata* (Fr) Quel
83 *R flaccida* (Fr) Bourd
84 *Ramariopsis corniculata* (Schaeff Fr) R H Petersen
85 *Russula adusta* Fr
86 *R cyanoxantha* (Schaeff) Fr
87 *R delica* Fr
88 *R emetica* (Schaeff) Pers Fr
89 *R foetens* Pers Fr
90 *R lutea* (Huds Fr) S F Gray
91 *R melliolens* Quel
92 *R vinescens* (Schaeff emend Pers)
93 *Sarcoscypha coccinea* (Fr) Lambotte
94 *Schizophyllum commune* Fr Fr
95 *Scleroderma citrinum* Pers
96 *Stereum hirsutum* (Willd Fr) Pers
97 *Trametes gibbosa* (Pers Fr) Fr
98 *Tremella mesenterica* Retz Fr
99 *Tricholoma columbetta* (Fr) Kumm
100 *T scalpturatum* (Fr) Quel
101 *Tubaria furfuracea* (Pers Fr) Gill
102 *Urnula craterium* (Schw) Fr
103 *Xerocomus chrysenteron* (Bull) Quel
104 *X subtomentosus* (L) Quel
105 *Xerula radicata* (Relh Fr) Dorfelt
106 *Xylaria polymorpha* (Pers Mérat) Dumortier

Appendix 7 Rare Macromycetes Species Published for the Reserves of Bulgaria (rare species are marked with and asterisk) (continued)

VII Ostritsa Reserve Golo Bardo Mountain

1 *Agaricus campestris* L
2 *Alnicola bohemica* (Vel) Sing
3 *Amanita pantherina* (DC Fr) Krombh
4 *A phalloides* (Fr) Link
5 *A rubescens* Pers Fr
6 *A strobiliformis* (Paulet ex Vitt) Bert
7 *A vaginata* (Bull Fr) Vitt
8 *Boletus edulis* Bull Fr
9 *B fechtneri* Vel
10 *B lundus* Schaeff Fr
11 *Bovista plumbea* Pers
12 *Calocera cornea* (Batsch Fl) Fr
13 *Calocybe gambosa* (Fr) Sing
14 *Calvatia utriformis* (Bull) Jaap
15 *Cantharellus cibarius* Fr
16 *Clitocybe gibba* (Pers Fr) Kumm
17 *C odora* (Bull Fr) Kumm
18 *C tornata* (Fr) Kumm
19 *Clitopilus prunulus* (Scop Fl) Kumm
20 *Collybia dryophila* (Bull Fl) Kumm
21 *C fusipes* (Bull Fr) Quel
22 *C obscura* Favre
23 *C peronata* (Bolt Fl) Kumm
24 *Coprinus micaceus* (Bull Fr) Fr
25 *C picaceus* (Bull Fl) S F Gray
26 *Cortinarius amoenolens* R Hry ex Orton
27 *C autoturbinatus* (Secr) Lge
28 *C cotoneus* Fr
29 *C crocolitus* Quel
30 *Craterellus cornucopioides* (L) Pers
31 *Crepidotus variabilis* (Pers Fl) Kumm
32 *Entoloma porphyrophaeum* (Fr) Karst
33 *Flammulina velutipes* (Curt Fl) Karst
34 *Geastrum fimbriatum* Fr
35 *Grifola frondosa* (Dick Fl) S F Gray
36 *Hebeloma sinapizans* (Paulet Fl) Gill
37 *Hygrocybe conica* (Scop Fl) Kumm
38 *Hygrophorus eburneus* (Bull Fl) Fr
39 *Hypholoma fasciculare* (Huds Fl) Kumm
40 *Inocybe asterospora* Quel
41 *I cervicolor* (Pers) Quel
42 *I godeyi* Gill
43 *I incarnata* (Pers Fr) Bres
44 *I patouillardii* Bres
45 *Laccaria laccata* (Scop Fr) Berk &r Br
46 *L tortilis* (Bolt) Cke
47 *Lactarius piperatus* (L Fr) Fr
48 *L subdulcis* (Bull Fr) S F Gray
49 *L volemus* (Fr Fr) Fr
50 *L zonarius* (Bull Fr) Fr
51 *Leccinum griseum* (Quel)
52 *Lepiota oreadiformis* Vel
53 *Lycoperdon perlatum* Pers Pers
54 *L pusillum* Pers
55 *Macrolepiota excoriata* (Schaeff Fr) Kumm
56 *M procera* (Scop Fr) Sing
57 *Marasmiellus ramealis* (Bull Fr) Sing
58 *Marasmius androsaceus* (L Fl) Fr
59 *M epiphyllus* (Pers Fr) Fr
60 *M oreades* (Bolt Fr) Fr
61 *M rotula* (Scop Fr) Fr
62 *Megacollybia platyphylla* (Pers Fr) Kotl ex Pouz
63 *Mycena epipterigia* (Scop Fr) S F Gray
64 *M galericulata* (Scop Fr) Quel
65 *M pelianthina* (Fr) Quel
66 *M polygramma* (Bull Fr) S F Gray
67 *M pura* (Pers Fl) Kumm
68 *Phallus impudicus* L Pers
69 *Pleurotus eryngii* (DC Fl) Quel
70 *Polyporus brumalis* (Pers Fr) Fr
71 *P tuberaster* (Pers Fl)
72 *P varius* (Pers Fr)
73 *Psathyrella candolleana* (Fr Fr) Mre
74 *Ramaria formosa* (Pers Fr) Quel
75 *Russula aurea* Pers
76 *R cyanoxantha* Schaeff Fr
77 *R maculata* Quel in Quel &r Rose
78 *R rosea* Pers
79 *Schizophyllum commune* Fl Fr
80 *Schizopora paradoxa* (Schrad Fr) Donk
81 *Stereum hirsutum* (Willd Fr) Pits
82 *Tephrocybe rancida* (Fr) Donk
83 *Trametes hirsuta* (Wilf Fr) Pil
84 *T versicolor* (L) Pil
85 *Tremella mesenterica* Retz Fr
86 *Tubaria furfuraceae* (Pers Fr) Gill
87 *Vascellum pratense* Pers Pers
88 *Xerula radicata* (Relh Fr) Dorfelt

VIII Parangalitsa Reserve Rila Mountains

1 *Amylocystis lapponicus* (Rom) Sing
2 *Antrodia serialis* (Fl) Donk
3 *A sinuosa* (Fl) Karst
4 *A xantha* (Fl) Kyv
5 *Bjerkandera adusta* (Willd Fr) Karst
6 *Calocera viscosa* (Pers Fr) Fr
7 *Clavulina rugosa* (Bull Fr) Schroet
8 *Coniophora puteana* (Schum Fr) Karst
9 *Dentipellis fragilis* (Pers Fr) Donk
10 *Evidia plana* (Wiggers) Donk

Appendix 7 Rare Macromycetes Species Published for the Reserves of Bulgaria (rare species are marked with and asterisk) (continued)

VIII Parangalitsa Reserve Rila Mountains (continued)

11 *Fomes fomentarius* (L Fr) Fr
12 *Fomitopsis pinicola* (Sw Fr) Karst
13 *F rosea* (Alb &r Schw Fr) Karst
14 *Ganoderma lipsiense* (Batsch) Atk
15 *Gloeophyllum abietinum* (Bull Fr) Karst
16 *G odoratum* (Wulf Fr) Imazeki
17 *G sepiarium* (Wulf Fr) Karst
18 *G trabeum* (Pers Fr) Murr
19 [1]*Guepinia helvelloides* DC Fr
20 *Heterobasidion annosum* (Fr) Bref
21 *Hymenochaete cruenta* (Pers Fr) Donk
22 *Hypholoma fasciculare* (Huds Fr) Kumm
23 *H sublateritium* (Fr) Quel
24 *Ischnoderma benzoinum* (Wahlenb) Karst
25 *Kuehneromyces mutabilis* (Schaeff Fr) Sing &r A H Smith
26 *Megacollybia platyphylla* (Pers Fr) Kotl &r Pouz
27 *Merulioposis taxicola* (Pers) Bond in armasto
28 *Merulius tremellosus* Schrad Fr
29 *Mycena haematopoda* (Pers Fr) Kumm
30 *M laevigata* (Lasch) Quel
31 *Oligia tomentosa* (Fr) Karst
32 *Osmoporus odoratus* (Fr) Sing
33 *Panellus mitis* (Pers Fr) Sing
34 *Paxillus atromentosus* (Batsch Fr) Fr
35 *P panuoides* (Fr Fr) Fr
36 *Phaeolepiota aurea* (Mattuschka Fr) Mre ex Konr &r Maubl
37 *Phaeolus schweinizii* (Fr) Pat
38 *Phellinus hartigii* (All &r Schnabl) Pat
39 [1]*P nigrolimitatus* (Rom) Bourd et Galz
40 *Phleogena faginea* (Fr Fr) Link
41 *Pholiota flammans* (Fr) Kumm
42 *P squarrosa* (Mtll Fr) Kumm
43 *Phyllotopsis nidulans* (Pers Fr) Sing
44 *Pleurotus pulmonarius* (Fr) Quel
45 *Pluteus atromarginatus* (Sing) Kuthner
46 *Polyporus ciliatus* Fr Fr
47 *Pseudohydnum gelatinosum* (Scop Fr) Karst
48 *Rigidoporus sanguinolentus* (A et S Fr) Donk
49 *Sceletocutis amorpha* (Fr) Kotl et Pouz
50 *Spongiporus caesius* (Schrad Fr) David
51 *S stypticus* (Pers Fr) David
52 *Stereum hirsutum* (Willd Fr) Pers
53 *S sanguinolentus* (Alb &r Schw Fr) Fr
54 *Trametes hirsata* (Wulf Fr) Pil
55 *Trichaptum abietinum* (Pers in J F Gmelin Fr) Ryv
56 *T hollii* (J C Schmidt Fr) Kreisel
57 *Tricholomopsis rutilans* (Schaeff Fr) Kumm
58 *Tyromyces ptychogaster* (Ludwig) Donk

IX Silkosiya Reserve Strandzha Mountain

1 *Clitopilus rhodophyllus* (Bres) Sing
2 [1]*Hericium coralloides* (Scop Fr) S F Gray
3 [1]*Ramaria stricta* (Pers Fr) Quel
4 *Trametes versicolor* (L) Pil

X Shabanitsa Reserve Rhodope Mountains

1 *Agaricus silvicola* (Vitt) Sacc
2 *Albatrellus confluens* (Alb & Schw Fr) Kotl &r Pouz
3 [1]*A cristatus* (Schaeff Fr) Kotl &r Pouz
4 *A ovinus* (Schaeff Fr) Korl &r Pouz
5 *Amanita aspera* (Fr) S F Gray
6 *A excelsa* (Fr) Bertillon
7 *A rubescens* Pers Fr
8 *A vaginata* (Bull Fr) Vitt
9 *Armillaria mellea* (Vohl Fr) Kumm
10 *Boletus edulis* Bull Fr
11 *Camarophyllus niveus* (Scop Fr) Karst
12 *Cantharellus cibarius* Fr
13 [1]*Catathelasma imperiale* (Quel) Sing
14 *Clitocybe gibba* (Pers Fr) Kumm
15 *Coltricia perennis* (L) Murr
16 *Cortinarius glaucopus* (Schaeff Fr) Fr
17 *C hinnuleus* (Sow) Fr
18 *C varicolor* (Pers Fr) Fr
19 *Dermocybe crocea* (Schaeff) Mos
20 *Gomphidius glutinosus* (Schaeff Fr) Fr
21 *Hydnellum suaveolens* (Scop Fr) Karst
22 *Hygrocybe punicea* (Fr) Kumm
23 [1]*Hygrophorus nemoreus* (Pers Fr) Fr
24 *Hypholoma capnoides* (Fr Fr) Kumm
25 *Lactarius deliciosus* (L) S F Gray
26 *L scrobiculatus* (Scop Fr) Fr
27 *Leccinum rufum* (Schaeff) Kreisel
28 *Lepiota clypeolaria* (Bull Fr) Kumm
29 *Lepista nebularis* (Batsch Fr) Harmaja
30 *Lycoperdon perlatum* Pers Pers
31 *Macrolepiota rachodes* (Vitt) Sing
32 *Phellodon tomentosus* (L) Banker
33 *Pholiota squarrosa* (Mtll Fr) Kumm
34 *Ramaria aurea* (Schaeff) Quel
35 *R flava* (Schaeff Fr) Quel
36 [1]*Rhodopyllus hebes* Romagn
37 *Russula adusta* Fr

Appendix 7 Rare Macromycetes Species Published for the Reserves of Bulgaria (rare species are marked with and asterisk) (continued)

X Shabanitsa Reserve Rhodope Mountains (continued)

38 *R delica* Fr emend Bres
39 *R densifolia* Gill
40 *R foetens* Pers Fr
41 *R lutea* (Huds Fr) S F Gray
42 *R olivacea* (Schaeff) Pers
43 *Sarcodon imbricatus* (L) Karst
44 *Tricholoma flavovirens* (Pers Fr) Lundell
45 *T portentosum* (Fr) Quel
46 *T saponaceum* (Fr) Kumm

XI Sheiba reserve Northern Black Sea coast

1 *Entoloma rhodopolum* (Fr Fr) Kumm

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Biodiversity of Non-Vascular Plants in Bulgaria

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SUMMARY

This report is divided into four sections, each of which examines a different group of organisms

Algae

Research on algae in Bulgaria began in 1890 and still continues This research has been carried out in different water basins and aquatic biotopes (saltwater fresh water running water and still waters) as well as in soils and other non aquatic biotopes All categories of procaryotic and eucaryotic algae have been studied but no type of algae can be said to have been completely researched" according to its composition and distribution around Bulgaria Chrysophyta, Cryptophyta, Xanthophyta, and Bacillariophyta are the least studied types At the community level rivers as well as some lakes and wetlands also require further investigation

The variety of algae in Bulgaria presently encompasses about 3000 species (more than 1800 variations and forms) from approximately 550 genera of 11 groups Three new genera more than 60 species and a great number of variations and forms have been described in the country The Bulgarian algae flora can be estimated as quite rich The draining of lakes and wetlands as well as progressive contamination are basic factors that have had adverse effects on the diversity of algae and the biocenoses essential to their existence New protected areas are to be established in order to stop this process of deterioration

Mosses

Research on mosses began at the turn of the century and still continues A number of regions – the Danubian plain Sredna Gora etc – are not sufficiently studied There is also a need to review the genera that are especially difficult to examine Diversity among the mosses that have been studied amounts to 668 species in 195 genera There are no known endemics Nineteen species are recognized as rare Three protected areas with characteristic brvo geographical elements have been established The extensive destruction of forests has had a negative influence on the diversity of mosses The draining of lakes and wetlands, along with other anthropogenic factors adds to this negative effect New protected areas for mosses have not been envisioned

Hydatophytes, Neustophytes, and Helophytes

Research on these non vascular plant forms has largely parallelled that of the Bulgarian flora in general Systematic studies were carried out from the 1930s to the 1970s These studies also provided a foundation for understanding the basic communities Various research methods were used during different periods Some of the water basins of the country have not yet been studied

Altogether, 187 species have been identified 42 (19 genera) hydatophytes, 13 (8 genera) neustophytes, 128 (69 genera) helophytes, and 4 (4 genera) hydato neustophytes None of these are endemics, but some are rare species and 4 species are considered extinct The greatest diversity is found in lakes and wetlands along the Danube River, in the Black Sea, and in sev eral of the large river valleys The draining of lakes and wetlands has proved to be the chief negative fac tor, primarily in inland regions and along the Danube Dam construction has not only had a negative impact on diversity, but has also destroyed some interesting lakes and wetlands The proclamation of new pro tected areas has been planned and could have a sub stantial impact on the preservation of this diversity

Lichens

Research on lichens began at the turn of the cen tury and still continues It is mainly concerned with the flora These investigations have been primarily floristic in character A number of regions (Sredna Gora the Danubian Plain etc) are still not fully in vestigated Some groups are not thoroughly studied or need to be reviewed Thus far 709 species from 147 genera have been described It is difficult to identify endemic and rare species with substantial certainty The main negative factor affecting lichens is the de struction of forests in a great number of regions of the country In some regions, air pollution is also a nega tive influence New protected areas have not been planned

ALGAE

Background of Algae Research

Research on Bulgaria's algae flora began during the last decade of the last century (Istvanffi 1890 Petkov 1898 1899) During the last few decades of the present century, research was continued and expanded mainly by Stefan Petkov He worked very hard to study the Bulgarian algae flora His publications contain data on all divisions of the algae flora and especially on the green algae and algae with linked spores He described a great number of new species varieties, and forms Almost all of his publications contain drawings of established species thus initiating the iconography of the Bulgarian algae While Petkov focused his research on freshwater basins he also studied the Black Sea Petkov published data on various regions in Bulgaria and studied more systematically and in greater detail the wetlands and lakes along the Danube (Petkov 1911), at Vitosha Mountain (Petkov, 1922 1928), in the Pirin Mountains (Petkov 1925 1929) and in the Rila Mountains (Petkov 1939) among other areas He also studied the unfavorable impact of anthropogenic factors on the algae flora (Petkov 1929 etc) Petkov was the first chairman of the Union of the Protection of the Nature, which was founded in 1928

The next stage of algae research in Bulgaria began in the 1960s It is characterized by extensive studies that resulted in a great number of publications (see bibliography) Modern methods and principles were applied using floristic, horiologic cenological, and ecological data The investigators narrowed the scope of their work to focus on basic groups of algae as well as particular water basins and biotopes

Vodenicharov directed his efforts towards freshwater basins and studied in detail wetlands on Lulin Mountain (Vodenicharov 1959), the high mountain lakes in the Rila and Pirin Mountains (Vodenicharov 1957, 1958, 1959, 1960 1962) the lakes and wetlands of the Rhodope Mountains (Kirjakov and Vodenicharov, 1984 1987 1988), and certain rivers (Vodenicharov and Kirjakov 1986 1987) These studies focused mainly on green algae algae with linked spores blue green algae and freshwater red algae (Vodenicharov 1960 Vodenicharov et al 1991) and resulted in the description of new genera (Vodenicharov and Benderliev 1971 Vodenicharov, 1989) and species (Vodenicharov 1960 1963 Vodenicharov and Kirjakov, 1970 1986 Vodenicharov and Benderliev 1971 and others)

Petrova's research focused entirely on phytoplankton in the Black Sea and some seaside lakes (Petrova 1959 1971 Petrova Karadzova 1973 1993) She published abundant information on the composition and qualitative and quantitative dynamics of algal populations She pointed out the periodic changes in these populations and attributed them to solar activity and to the tendency towards eutrophication under the influence of anthropogenic factors We base our comparisons estimations, and discoveries on her systematic and continuous research Research in the last few years on the phytoplankton and especially algae 'blooms,' in the Black Sea has been performed primarily by Moncheva (Moncheva, 1987 1992)

Draganov studied the cave and soil blue green algae (Draganov 1960 1981) describing some new species (Draganov 1964 1968 1985) and algae cenoses (Draganov 1977) Lately he has focused his research on the algae of the Danube River and adjacent wetlands and lakes (Draganov et al , 1987, Draganov and Stoyneva, 1988 1991) This research is presently being conducted by Stoyneva (Stoyneva, 1987 1991)

Temniskova published floristic and ecologic data on temporary water basins and rice fields (Temniskova Topalova 1967 1968) She first studied flagellate groups of algae (Temniskova Topalova, 1965 1975), but later focused on flint algae (Temniskova Topalova and Misaleva 1982 Temniskova Topalova and Dimitrova 1988) primarily fossil species

Dimitrova studied predominantly the Black sea macrophytes She investigated in detail their composition and distribution analyzed the geographic elements and attempted to define areas of the Bulgarian coast on the basis of macrophytobenthos (Dimitrova, 1969 Dimitrova Konaklieva, 1973 1987, etc)

Kirjakov has been considered the most outstanding researcher of the Bulgarian algae flora over the last two decades He has published extensive floristic and horologic data on different groups of freshwater algae, primarily green, blue green, and lately Euglenophyta and freshwater red algae (Kirjakov, 1969 1989) He has placed special emphasis on the difficult genera *Scenedesmus* (Kirjakov 1976 1978, 1980) and also described several new species (Kirjakov, 1970 1983, 1989) He has studied in detail the algae flora in lakes and wetlands in the Rhodope Mountains (Kirjakov and Vodenicharov, 1984, 1987, 1988) and in several rivers (Kirjakov and Vodenicharov 1986), as well as the phytoplankton of fish breeding basins

The famous Bulgarian hydrobiologist Valkanov performed extensive research dedicated to flagellate heterotrophic and autotrophic organisms He also described new species and genera (Valkanov 1926-1968) and provided significant assistance to investigations of wetlands and lakes, especially in the high mountains and along the Black Sea coast (see below)

The phytoplankton in artificial and natural water basins in Bulgaria have been studied mainly by hydrobiologists (Najdenov and Sais 1977, 1985 Sais, 1977, 1978 etc) Algae were used as bio indicators in a number of publications concerned with the assessment of biological conditions in the water basins in Bulgaria (e g Angelov, 1964, 1968, Draganov and Stoynova, 1991, Vodenicharov and Kirjakov 1986 1987) Several foreign scientists have researched algae in the Black Sea and freshwater basins (Lepsi 1925 1931 Roubal 1947

Starmach 1964 1969, Kawecka 1974 1976) Vodenicharov et al (1971) provided a partial summary of this knowledge in the *Flora of Bulgaria* though it requires substantial supplements

Gaps in Knowledge

The algae flora of Bulgaria is relatively well studied Research has been undertaken on all sections of prokaryotic and eukaryotic algae although we cannot consider this work complete The flagellate forms (Chrysophyta Cryptophyta Dinophyta, as well green algae) have been studied the least We rely strongly on research on the flint algae and on the systematic and critical investigation of difficult groups such as Desmidiales, Zygnemales Chlorococcales and filiform green algae

Various water basins have been studied but the data is quite scanty especially on the algae of both small and big rivers (the Maritsa Strouma Tundzha Mesta, and the tributaries of the Danube) A number of regions can be regarded as insufficiently researched – the Danubian plain (and some other plains) Sredna Gora the Western Border Mountains and parts of the Stara Planina Mountains

Typically research on a particular water basin or region has been performed only once This greatly hinders or makes impossible precise modern evaluations and the delineation of the changes that have taken place over time Research it should also be noted has employed various methods and has focused on particular groups (while the flint algae have been most often excluded)

Diversity of Algae

A total of about 3000 algae species, in approximately 550 genera have been discovered in various water basins and non aquatic biotopes in Bulgaria These are classified in 11 sections – one prokaryotic and 10 eukaryotic (Table 1) More than 1800 varieties and forms are described Three genera, more than 60 species and many varieties and forms previously unknown were discovered in the course of research of Bulgaria s algae flora Some of these are included in the European monographs guides, and floras The algae flora in Bulgaria may thus be characterized as highly diverse The reasons for this can be attributed to the diversity of water basins and of physical and geographic conditions

Rare and Endemic Species

There is a widespread view that algae are cosmopolitan in their distributions However many species are found only under particular ecological conditions and in certain biotopes and water basins On the other hand the lack of sufficiently complete and systematically collected data for Bulgaria makes the identification of particular species as "endemic' and "rare" very difficult and uncertain Hence, such categories of algae species are not presented here (except for the macrophytes of the Black Sea see below)

Freshwater Algae

Various types of water basins and biocenoses in Bulgaria are of great interest in characterizing the biological diversity of algae and in estimating the danger of losses changes and even extinctions of species

There are many high mountain lakes in Bulgaria of glacial origin Most are small shallow and not very rich in algae The algae flora of these lakes has many specific features and differs greatly from the flora of other lakes in Bulgaria Some areas, and even whole lakes, that have been heavily silted have turned into wetlands and support a greater abundance of algae species Some high mountain lakes in the Urdinia cirque in the Rila Mountains have been thoroughly researched and their characteristic algae communities fully described

Two groups of mountain lakes and wetlands in Bulgaria – Smolyanski and Chairski – have been most thoroughly studied More than 750 species varieties and forms from about 190 genera of eukaryotic and prokaryotic algae have been discovered in them, including genera and species previously unknown This flora as a whole has many unique features, including an interesting component of hydatophytes neustophytes, and helophytes

There is little recent information concerning the lakes and wetlands along the Danube River and the Black Sea The last summary was published 30 years ago (Ivanov et al , 1964) These water bodies all have diverse and abundant algae floras mainly characteristic of eutrophic lakes They have many unique features when compared to other groups of lakes, and in assessing them as endangered lakes, the presence of hydatophytes neustophytes and helophytes in them should be considered

As mentioned above the algae flora of rivers is poorly studied Some have been shown to contain diverse and abundant species of freshwater red algae and it is likely that flint algae will be shown to play an important role in all of them Of great interest are mountain rivers and streams that support characteristic rheophiles and that have been affected relatively slightly by pollution

Black Sea Algae

As a result of long years of systematic investigations we have much data available concerning the Black Sea especially as regards its phytoplankton The phytoplankton in the Black Sea and elsewhere in Bulgaria consist mainly of the Bacillariophyta and Dinophyta Chrystophyta, Euglenophyta, Chlorophyta and Cyno

phyta are also present In the period 1981 1990 a total of 134 species varieties, and forms were discovered along the Bulgarian coastline, including 67 Bacillario phyta and 56 Dinophyta This diversity is not uniform in the different regions For example, studies conducted in the years 1983 1986 revealed 111 species, varieties and forms in Varna Bay while in the nearby region of Cape Kaliakra only 68 were found The level of phytoplank ton diversity is probably lowest in Bourgas Bay

Over the period 1954-1990 the composition of Black Sea phytoplankton has undergone substantial changes A change in the relationship between the Ba cillariophyta and Dinophyta has been determined The formerly dominant Bacillariophyta have gradually been overcome by the Dinophyta This is true in terms of both number and biomass In the years 1954-1970 the biomass of the Bacillariophyta exceeded by 10 times that of the Dinophyta, in the period 1971 1990 this situation reversed as the Dinophyta exceeded the Bacillariophyta by about 4 times In addition, the Prorocentrum mini mum (*Exuviella cordata*) appeared near the coasts and began to play an important role In coastal water basins ports, and bays local algae blooms occurred every year and every season, and even became permanent, at the same time, regional blooms in the open water areas have shown cyclic development

Changes in the phytoplankton community of open water areas are related to cyclic changes in hydrome tereologic factors and solar activity Changes in the composition number and biomass of phytoplankton in coastal areas are due to the progressive process of eu trophication under the influence of natural and anthro pogenic factors Eutrophication results in blooms some of which have had catastrophic effects "Red tides' have appeared since 1971

A total of 157 species are included in the composi tion of the Black Sea macrophyte benthos which in turn constitutes about 53% of the macrophyte flora of the Black Sea These species belong to 82 genera, 43 fami lies, and 25 orders of the sections Rhodophyta, Phaeo phyta and Chlorophyta The first section is most thor oughly represented (55% of all species) the other two are represented by approximately equal numbers of spe cies

Fourteen Black Sea floristic regions can be identi fied on the basis of the microphytes One is the Bulgar ian Black Sea coast which ranks fourth in abundance of species after the southern coast of Crimea, Sevastopol Bay and the Novorussiiski Bay A substantial portion of the macrophyte species along our coast are widely spread, though some are characteristic of particular ar eas Red algae dominate in all areas of the Bulgarian Black Sea coast, the spring flora being the most abun dant

This review is based on data collected prior to 1977 The picture has since changed in essential ways (according to unpublished data by Dimitrova offered es pecially for this report) A considerable decrease in populations has been observed and a complete extinction of some species For several years it has been rare to find along the Bulgarian coasts *Dasya bayloviana*, *Padin pavonia* *Nemalion helminthoides* *Cladostephus verti cillatus*, *Laurencia pinnatifida* *Dilophus fasciola* and other species Extinction of the populations of *Cysto seira barbata* and *Cystoseira crinita* in some regions has been established

Gelidiela antipai, *Laurencia coronopus*, *Desmo trichum punctarioides*, *Enteromorpha meotica* are macrophytes on the Bulgarian coast that are endemic to the Black Sea

Twenty two species are rare or endangered (Table 2)

Sixteen species can be considered economically valuable (Table 3)

The microphytobenthos was studied only in relation to the flint algae A total of 385 species varieties and forms from 61 genera were identified *Podosira pellu cida* is the only dominant in the surface bottom sedi ments of the Bulgarian shelf

Threats to the Algae Flora

Considerable changes in vegetation take place in connection with the natural silting of lakes and wetlands Different stages of these processes can be observed in many lakes and wetlands in Bulgaria The effects of sil tation generally begin at the periphery and progress to wards the interior However in lakes in the Rhodope Mountains, these effects have been observed to start at the center

Changes caused by anthropogenic factors are the greatest and the fastest Such factors including drying drainage and construction Many water basins suffer particularly from strong unfavorable influences that have increased over the last several decades – the pollution caused by industrialization the intensification of agri culture and the growth of cities A number of karstic springs with interesting algae flora have disappeared as a result of damming of the water There are almost no thermal springs remaining in Bulgaria whose water is not retained by dams

Recommendations

In order to protect the diversity of algae species and communities, it is necessary above all to observe strictly the statute regarding existing protected areas, and particularly those in which there are water basins Moreover we believe that it is necessary to declare new protected areas Listed here are three areas in which algae flora and vegetation are especially im portant Other areas, connected with the hydato phytes, neustophytes and helophytes are noted later in this paper

1 The springs of the Mladezhka River and the river it self near the village Mladezhko in the Strandzha Mountain region This part of the river is very rich in different freshwater red algae Such abundance is not known in other regions of the country

2 The area of Markovi Kladentsi in the Ograzhden Mountain area Rare species of flint algae and a relatively diverse flora are found here

3 In the region of the village Varvara near the mouth of the Veleka River In this region of the Bulgarian Black Sea coast about two thirds of all species of macrophytes are concentrated A great number of endemic and rare species for the Black Sea are found here

MOSSES

Background of Bryological Research

Research on the moss flora of Bulgaria began in the early 1900s (Velenovski, 1902, Kovachev, 1902 1905) and continued under both Bulgarian (mainly Arnaudoff 1909 1914) and foreign scholars (see bibliography) It has intensified in the second half of the century (primarily Petrov 1955 1986) The information on the moss flora was summarized in the *Guide to the Mosses of Bulgaria* (Petrov 1975)

Research on mosses has focused primarily on the taxonomic components in different regions of the coun try The Vitosha Pirin, Strandzha Belasitsa Rhodope and other mountains are the best studied areas The bryogeographical investigations have been published since the 1950s (e g Petrov 1955 1958 1986) Petrov (1975) provided a review of the studies of the moss flora

Gaps in Knowledge

In general the bryoflora of Bulgaria and the chorology of the different species have not yet been suf ficiently studied Until recently, bryological studies were not undertaken systematically or on a wide scale There have been almost no recurrent or continuing studies in any one region As a result the data are insufficient to draw conclusions about historical changes and trends

The least studied areas are the Danubian plain southeastern Bulgaria the western border forests Sredna Gora and the southernmost regions of the valleys along the Strouma Mesta and Maritsa Rivers

More thorough studies of some difficult genera – *Riccia Lophozia Marsupella Scapania Cephaloziella Sphagnum Tortulla Pholia Bryum Plagyothecium* – are needed

Moss Diversity

The moss flora of Bulgaria consists of a total of 668 species from 195 genera and 69 families (Table 4) The family *Ricciaceae* in the subclass Marchantiidae contains the most species 10 out of the 11 species in this family are from the genus *Riccia* The families Lophoziaceae (25 genera, 13 species from the genus of Lophozia) and Scapaniaceae (19 genera, 16 species from Scapania) are the most species-rich in the subclass Jungermanniidae The subclass of Sphagnidae is fairly well represented in our bryoflora with 23 species The greatest diversity at the subclass level is found within the Bryidae The most diverse families are Pottiaceae (20 genera 66 species) and Dicranaceae (19 genera 51 species) Six other families include more than 20 species Grimmiaceae Bryaceae, Orthatrichaceae, Amblystegiaceae Brachytheciaceae and Hypnaceae The Bulgarian bry oflora can thus be considered relatively rich for a country located in the temperate zone

Many Bulgarian mosses are found only in particular regions It would be premature to classify them as 'rare' since present studies do not cover equally all floristic re gions of the country However a limited number (19) of species can be designated as 'rare" (Table 5) All of these are illustrated in Petrov (1975) and represented in the bryological section of the herbarium of the Institute of Botany at the Bulgarian Academy of Sciences With regard to these species and given the types of habitats where they occur it is virtually certain that future more detailed studies will not increase the number of their lo cations

Some of the more characteristic bryogeographic elements can be found in the Bistritsa Reserve (Vitosha Mountain) the Parangalitsa Reserve (Rila Mountains) and the Tisata Reserve (the Kresna Gorge in the valley of the Strouma River) (See Table 6)

Threats to the Moss Flora

A number of factors have influenced and still have an adverse effect on the moss diversity in Bulgaria The main negative factor is the destruction of forests in many regions of the country beginning centuries ago but con tinuing into the present The most severely affected for ests are in the lowland regions and the low forest belts The distribution of a number of forest species is re stricted in this way This might also be why some species of our moss flora went extinct or are in danger of extinc- tion

The partial or complete systematic drainage of wa ter basins and wetland areas beginning in the first dec ades of this century, has also had a negative impact on the diversity of the moss flora in Bulgaria This has re sulted in drastic changes in the microclimate of the re spective regions and the destruction of the habitats of certain moss species

The construction of large dams ("Iskar" in the Sofia region, "Topolnitsa' close to Srednogorie "G Dimitrov' in the Kazanlak region, and others) changes the micro climate and destroys areas that support moss vegetation

The construction of roads and highways the growth of the cities and high levels of air pollution (particularly in certain regions) are other negative factors influencing moss diversity in Bulgaria

The preservation and maintenance of existing protected areas contributes to the retention of Bulgaria's moss diversity No suggestions for new protected areas have been made so far in connection with the mosses

HYDATOPHYTES, NEUSTOPHYTES, AND HELOPHYTES

Background of Research

Research on higher plants in and around water basins is currently performed as part of general botanical research in Bulgaria These studies are floristic and horologic in nature, and are summarized in the *Flora of the Peoples Republic of Bulgaria*, 1963 1989, Kitanov and Penev, 1963 Stojanov et al 1966 1967 Kitanov and Kitanov 1990 and other publications

The first systematic investigations on hydatophytes neustophytes and helophytes in Bulgaria were undertaken about 1930 (Jordanov 1929 1931) In addition to floristic and horologic studies they included phytogeographic and ecological analyses Some of the wetlands and lakes inside the country (Straldzhansko in Iambolsko Dragomansko Aldomirovsko and Kazichenesko in Sofiusko etc) were described in greater detail

Some algological (Petkoff 1911 1938 1939 Vodenicharov 1962) and hydrobiological publications (Valkanov 1932 Michajlova Nejcheva 1961) include data on hydatophytes neustophytes and helophytes from a number of lakes wetlands river basins and dam sites Since 1970 more extensive phytocenological and ecological studies have been conducted As a result of these studies 45 formations with 71 associations have been identified A number of questions concerning the development of the communities and the influence of anthropogenic factors have been clarified including the origin and establishment of plants in artificial water basins Other investigations have examined the primary biological productivity of several widely distributed communities and their dominant species The necessity of preserving diversity and some characteristic ecosystems have also been explored Kochev and Jordanov (1981) provides a summary of this information Vodenicharov (1959) contributed a brief guide to the hydatophytes neustophytes and helophytes Ivanov et al (1964) reviewed the flora of the lakes and wetlands of Bulgaria

Gaps in Knowledge

Essential gaps in knowledge result from the lack of systematic research on the water basins in Bulgaria Research has been done at different times with different objectives and methods Thus the available information is incomplete and heterogeneous It does not offer a solid basis for comparative analysis or for estimates of changes in the biological diversity and communities of particular water basins Only a few investigators have made special efforts to do systematic and continuous research

Diversity of Hydatophytes, Neustophytes, and Helophytes

The Bulgarian flora includes 187 species of hydatophytes, neustophytes and helophytes (Table 7) 42 species of hydatophytes from 19 genera and 16 families 13 species of neustophytes from 8 genera and 6 families 4 species of hydato neustophytes from 4 genera and 3 families and most numerous 128 species of helophytes from 69 genera and 30 families (Kochev and Jordanov 1981) It should be noted that the differentiation of helophytes from hydrohygrophytes is not always sufficiently clear

Altogether the hydatophytes neustophytes and helophytes constitute about 5% of the composition of the Bulgarian flora Thirty eight species have been declared endangered rare and extinct (5% of all species included in the 1984 *Red Data Book of the Peoples Republic of Bulgaria Vol I Plants*) 13 hydatophytes 7 neustophytes and 18 helophytes There are no endemics for Bulgaria or the Balkan peninsula among these groups Only 3 species (*Nymphaea alba Nuphar luteum Trapa natans*) are protected by law Four species (out of 29 altogether for Bulgaria) – *Caldesia parnassifolia Salix rosmarinifolia Peucedanum palustre* and *Hottonia palustris* – are considered extinct Small isolated regions of distribution in Bulgaria are known for some species

Although the hydatophytes neustophytes, and helophytes constitute an insignificant part of the Bulgarian flora they deserve special attention They play an important part along with algae in aquatic and wetland communities (especially as primary producers and as cover and reproductive sites for animals) They also deserve attention in relation to the unfavorable changes that many water basins are experiencing

The diversity of hydatophytes and neustophytes is concentrated in the lakes and wetlands along the Danube River and the Black Sea In some of these aquatic communities the population of certain species is particularly high There are few lakes in the interior of the country and the artificial ones (created by dams) are in general deficient in hydatophytes and neustophytes

Helophytes can be found in the Danube River and Black Sea along some river basins (especially the Maritsa River) and in the mouths of some rivers (e g the Kamchia and Ropotamo) Only a few species are found along the Bulgarian coast of the Black Sea *Zostera marina Zostera nana Potamogeton pectinatus Zannichellia palustris Ruppia maritima* and *Ruppia cirrhosa*

There are many small high mountain lakes in Bulgaria (more than 200 in the Rila and Pirin Mountains) The species diversity in these lakes is limited but a number of species such as *Isoetes setacea Subularia aquatica* and *Sparganium angustifolium* occur only in these lakes

Threats to Hydatophytes, Neustophytes, and Helophytes

Natural water basins occupy considerably less of Bulgaria's territory today than they did at the beginning of the century There were about 200 000 hectares of natural water basins and wetlands at the turn of the century (Kochev 1989) by the 1960s only about 11 000 hectares remained (Ivanov et al 1964) Other authors point out that these data are incomplete since not all water basins – or what was left of them – were considered (Kochev 1989) There is no doubt however that the total area of aquatic ecosystems in this country has decreased drastically in recent decades

This decrease has become a major factor influencing negatively the diversity and distribution of hydatophytes neustophytes and helophytes in Bulgaria It is connected with the gradual increase in drainage in Bulgaria since the first decades of this century undertaken to increase the amount of arable land in the country This resulted in the complete destruction or substantial drying up of many interior water basins (e g the Dragomansko blato, the Straldzhansko blato and the Chokluovo blato) Most extensively affected are the wetlands and lakes along the Danube river (e g Archarsko, Tsibarsko, Ostrovsko Svishtovsko, and Bardimsko)

Similar alterations have affected to a somewhat lesser extent, wetlands and lakes along the Black Sea coast (e g Pomoriisko Diavolsko, and Karaachko) Such decreases in the area of these aquatic communities restrict the distribution of the plants characteristic for them As a result several species have become extinct in Bulgaria In this manner *Caldesia parnassifolia* and *Aldrovanda vesiculosa* disappeared along with the Dragomansko blato (the latter species was found in Srebarna Lake during more precise floristic investigations undertaken in the last few years see Bajev 1988) The drainage of the Kazichensko blato resulted in the extinction of *Hottonia palustris* Similarly the destruction of the Chokluovo blato led to the extinction of *Peuceda num palustre* and *Salix rosmarinifolia*

Another factor affecting negatively the distribution and (especially) the composition of the hydatophytes and neustophytes is the building of dams About 1800 small and 30 large dams were built in Bulgaria prior to 1962 Ten of these created reservoirs with areas greater than 5 km (comprising a total of about 178 km^2) Some interesting wetlands were flooded by these dams For example the Batak' dam destroyed the Batashko blato A number of interesting species were extirpated as a result including *Nymphaea alba* (a protected species!) The 'Rabisha' dam has flooded the wetland of Rabishko (in the area of Belogradchishko), where a very interesting population of *Nuphar luteum* (another protected species!) could be found The artificial water basins are very poor in hydatophytes and neustophytes and even in helophytes in general This is due to the periodic and substantial changes in the water level and the slow rate of reproduction and stabilization in the flora and vegetation

Another major factor that has had and continues to have a negative effect is the contamination of water basins by waste water from industrial enterprises utilities, livestock operations, and the extensive use of fertilizers on arable lands This results in considerable changes in the physical and chemical conditions – and therefore in the flora and vegetation – of rivers, lakes and wetlands Eutrophication affects most of the country's natural and artificial water basins Specific components of the flora and vegetation in the Bulgarian lakes, wetlands and rivers have disappeared Some water basins are devoid of living organisms or support only the most resistant species

Recommendations

Above all the statute governing important existing protected areas – including the Srebarna Reserve (Silistrensko) the Arkutino Reserve (Burgasko), and the Marichini Ezera Reserve (Rila Mountains) – should be strictly observed in order to preserve the hydatophytes, neustophytes and helophytes, as well as the communities in which they are included

Additional protected areas need to be established (Kochev and Jordanov, 1981, Kochev 1989) This will ensure better protection not only of certain species but also of the communities that are characteristic of the different types of water basins in Bulgaria Areas requiring special attention include

1 High mountain lakes

High mountain lakes are located within the boundaries of the Pirin and Rila National Parks Despite this protected status it is necessary to provide special protection for the following groups of lakes

- Urdini ezera (NW Rila Mts) These lakes contain, in addition to hydatophytes such as *Sparganium angustifolium, Utrivularia minor, Subularia aquatica*

and *Callitriche palustris* a rich algae flora There are communities that include *Primula deorum* *Primula farinosa*, *Leontodon rileense* and other close relatives The cirques contain portions of the marble veins that are rarely found in the Rila Mountains and that support special floristic elements

- Popovi and Kremenski Lakes (in the central part of the Pirin Mts) which have a rich flora that includes hydatophytes and algae, some of which are very rare (*Isoetes Nostoc Zettersteditii*, etc)

2 Mountain lakes and wetlands

- The Smolianski (above the town of Smolian) and Chairski (Devinsko) lakes and wetlands They have a very rich flora that includes rare species such as *Utricularia vulgaris Carex limosa Potentilla palustris Drosera rotundifolia Menyanthes trifoliata* and *Sparganium minimum*

3 Lakes and wetlands along the Danube River (according to Kochev and Jordanov 1981)

- Martvo blato (close to Belene)
- Blato Kayakush (Svishtovsko)
- part of the lake located close to the village of Batin (Roussensko)
  the lake Malak Preslavets (Silistrensko)

4 Lakes and wetlands along the Black Sea coast (partly according to Kochev and Jordanov 1981)

- Durankulashko (Blatnishko) lake (only the eastern area)
  Shablensko lake (see also section on algae above)

5 Lakes and wetlands in the interior part of the country
- Aldomirovsko (Sofiisko)

Suggestions have been made to restore some of the lakes and wetlands that had been drained such as the wetland of Chokluovo blato Further discussions of this idea and its potential need to be undertaken

Certain individual species not found in the existing or suggested new protected areas are also suggested for suggested for listing as protected species (Kochev and Jordanov 1981) Fourteen of these species are listed in Table 8

LICHENS

Background of Research on Lichens

Research on lichens in Bulgaria began at the turn of this century under Kazandzhiev (1900 1906) Nikolov another Bulgarian also worked in this area (Nikolov 1928 1937) Several foreign scholars conducted research as well (see the bibliography) A summary of research undertaken before the 1960s can be found in *Flora of Bulgaria Lichens* (Popnikolov and Zelesova, 1964) Research on lichens has continued up to the present

Research has mainly involved the collection of specimens from various regions and publication of the results Certain regions have been studied in greater detail – Vitosha Mountain (Nikolov, 1931), Zapadna Stara Mountain and Vrachanski Balkan (Nikolov 1937) Slavyanka and Belasitsa Mountains (Nikolov 1937) and the Pirin Mountains (Ivanov 1990) Only the genus *Usnea* has been studied monographically (Motyka and Zelesova 1962) The following mountains have been studied in the same way the Rhodopes Rilas Pirins and Vitosha as well as some parts of the Stara Planina Mountains and Black Sea coast

Gaps in Knowledge

The diversity of lichens is not yet well studied in some regions including the Western Border Mountains Sredna Gora the Danubian plain and a substantial part of the Rhodope Mountains

Caliciales (Collemataceae) which are currently thought to occur mainly in the vicinity of the Mediterranean sea are not sufficiently investigated The cristose lichens and more particularly those located on limestone rocks (*Verrucaria Aspicilia Caloplaca*) also require further study The data on such difficult groups as *Lecideaceae* and *Alectoria* needs to be reviewed and updated

Further expansion and development of studies is rather difficult due to the lack of an efficient herbarium in Bulgaria

Diversity and Endemism

Thus far 709 species of lichen have been found in Bulgaria (Popnikolov and Zelesova, 1964, Ivanov, unpub data, 1993) They belong to 147 genera from 51 families (Table 9) The majority of genera (101) and species (564) belong to the order *Lecanorales*

Most of the species in Bulgaria have been reported at only one locality This is usually a reflection of the

lack of thorough and systematic investigations There fore rare species cannot be identified with sufficient certainty Based on the data in the literature (Popnikolov and Zelesova 1964) the 25 species listed in Table 10 may be considered as such

There are only a few endemics among the lichens of Bulgaria This is due to their wide ecological ranges and preferences for particular substrata If we take into ac count the insufficient amount of research on our lichen flora and that of the Balkan peninsula we can assume endemism for the time being for those taxa that have been described in Bulgaria and for which there are no records of occurrence outside Bulgaria With the excep tion of *Pertusaria kasandjeffii* (a species that also occurs outside of Bulgaria) this includes 14 taxa (Table 11)

Threats to Lichen Diversity

A number of factors have adversely affected lichen diversity in Bulgaria The destruction of forests in many regions (especially the lowlands and the low mountain belts) has proved to be a crucial factor in the extinction of lichens requiring specific substrata and microclimatic conditions The construction of dams, highways, and roads also narrows the diversity of substrata and changes the microclimate Urban expansion and air pollution re sulting from the industrialization of the country are among the most powerful negative factors Whole re gions of the country suffer from intensive air pollution (e g Srednogorie Devnia and Dimitrovgrad)

Recommendations

The preservation and maintenance of existing pro tected areas ensures to a large extent the protection of the lichen diversity No new protected areas are recom mended at this time

Table 1 Biodiversity in Bulgaria Algae

Division	Order	Family	Genus	Species	Var + Forms
Cyanophyta	9	27	57	368	84
Rhodophyta	9	23	43	154	24
Chrysophyta (incl Primnesiophyta)	7	20	49	107	5
Xanthophyta (incl Eustigmatophyta)	4	12	20	67	9
Bacillariophyta	8	30	77	524	852
Phaeophyta	9	15	26	43	6
Cryptophyta	1	1	4	10	2
Dinophyta	3	3	25	125	8
Euglenophyta	2	5	23	245	120
Chlorophyta (incl Zygnemophyta)	17	51	218	1339	717
Charophyta	1	1	5	16	3
Total	70	188	547	2998	1830

Table 2 Rare and Endangered Black Sea Macrophytes

Nemalion helminthoides (Vell) Batt
Apoglossum ruscifolium (Turn) J Ag
Dasya baylouviana (Gmel) Mont
Dasyopsis spinella (Ag) Zanard
Gracilaria verrucosa (Huds) Papenf
Chondrya tenuissima (Good et Wood) Ag
Chondrya dasyphylla (Wood) Ag
Laurencia pinnatifida (Gmel) Lamour
Vertia filiformis (J Ag) Zanard
Striaria attenuata (Ag) Grev
Petalonia zosterifolia (Reinke) Kuntze
Cladostephus verticillatus (Lightf) Ag
Stilophora rhizodes (Ehrh) J Ag
Punctaria plantaginea (Roth) Grev
Dilophus fasciola (Roth) Howe
Dilophus ligulata (Kützz) Feldm
Padina pavonia (L) Gaill
Enteromorpha flexuosa (Wulf) J Ag
Enteromorpha clathrata (Roth) Grev
Cladophora coelothrix Kützz
Chaetomorpha aerea (Dillw) Kützz
Bryopsis plumosa (Huds) Kützz

Table 3 Economically Important Black Sea Macrophytes

Porphyra leucosticta Thor
Gelidium latifolium (Grev) Born et Thur
Gymnogongrus griffithsiae (Turn) Mart
Phyllophora nervosa (DC) Grev
Polysiphonia subulifera (Ag) Harv
Polysiphonia denudata (Dillw) Kützz
Ceramium rubrum (Huds) Ag
Ceramium diaphanum (Lightf) Roth
Laurencia obtusa (Huds) Lamour
Cystoseira barbata (Good et Wood) Ag
Cystoseira crinita Bory
Ulva rigida Ag
Enteromorpha linza (L) J Ag
Chaetomorpha linum (Müll) Kützz
Cladophora vagabunda (L) Hoek
Cladophora sericea (Huds) Kützz

Table 4 Biodiversity in Bulgaria Mosses

Class and sub class	Order	Family	Genus	Species
Anthoceratopsida	1	1	2	2
Marchantiopsida				
Marchantiidae	1	9	13	26
Jungermanniidae	2	23	40	139
Bryopsida				
Sphagnidae	1	1	1	23
Andreaeidae	1	1	1	1
Bryidae	14	34	138	477
Total	20	69	195	668

Table 5 Rare Species of Mosses in Bulgaria

Mannia androgyna (L) Evans
Riccia crustata Corb
Fossombronia husnotii Corb
Scapania verrucosa Heeg
Mylia anomala (Hook) S Gray
Jungermannia exsertifolia Stef ssp cordifolia (Dum) Vana
Pedinophyllum interruptum (Nees) Kaal
Buxbaumia aphylla Hedw
Dicranum polysetum Sw
Schistidium agassizii Sull et Lesg
Grimmia torquata Hornsch ex Grev
Bryum canariense Brid
Aulacomnium androgynum (Hedw) Schwaegr
Helodium blandowii (Web et Mohr) Warnst
Scorpidium scorpioides (Hedw) Limpr
Calliergon giganteum (Schimp) Kindb
Scorpidium cuspidatum (Brid) Fleisch et Loeske
Ctenidium procerrimum (Mol) Lindb
Orthothecium rufescens (Brid) B S et G

Table 6 Brvogeographic Elements in Protected Areas in Bulgaria

1 Bistritsa Reserve (Vitosha Mountain)

Gymnomitrium concinnatum (Lightf) Corda *Calypogeia sphagnicola* (H Arn et J Perss) Warnst et Loeske *Blepharostoma trichophyllum* (L) Dum *Trichocolea tomentella* (Ehrh) Dum *Andreaea rupestris* Hedw *Tortula norvegica* (Web) Wahlenb ex Lindb , *Desmatodon latifolius* (Hedw) Brid , *Orthotrichum stellatum* Brid *Bryum gemmiparum* De Not *Helodium blandowii* (Web et Mohr) Warnst *Homalothecium nitens* (Hedw) Robins

2 Parangalitsa Reserve (Rila Mountains)

Encmonotus myriocarpus (Carring) Pears *Marsupella adusta* (Nees emend Limpr) Spruce *Gymnomitrion apiculatum* (Schiffn) K Mull *Polytrichum sexangulare* Brid *Dicranum tauricum* Sap *Oxystegus tenuirostris* (Hook et Tayl) A J E Sm *Hydrogrimmia mollis* (B S et G) Loeske *Blindia acuta* (Hedw) B S et G *Orthotrichum obtusifolium* Brid *Philonotis rigida* Brid *Hydrohypnum smithii* (Sw) Broth

3 Tisata Reserve (Kresna gorge in the Strouma River valley)

Targionia hypophylla L *Oxymitra paleacea* Bisch ex Lindenb *Riccia gougetiana* Durieu et Mont *Tortula laevipilla* (Brid) Schwaegr *Tortula* papilosa Wils *Crossidium squamigerum* (Viv) Jur *Pottia starckeana* (Hedw) C Mull *Grimmia laevigata* (Brid) Brid *Funaria muhlenbergii* Turn

Table 7 Biodiversity in Bulgaria Hydatophytes, Neustophytes, and Helophytes

1 Hydatophytes

Lycopodiophyta
- Isoetaceae
  - *Isoetes setacea*

Magnoliophyta
- Potamogetonaceae
  - *Potamogeton gramineus* L
  - *Potamogeton lucens* L
  - *Potamogeton praelongus* Wulfen
  - *Potamogeton perfoliatus* L
  - *Potamogeton crispus* L
  - *Potamogeton friesii* Rupr
  - *Potamogeton acutifolius* Link
  - *Potamogeton pusillus* L
  - *Potamogeton trichoides* Cham et Schlecht
  - *Potamogeton pectinatus* L
  - *Groenlandia densa* (L) Fourr
- Ruppiaceae
  - *Ruppia cirrhosa* (Petagna) Grande
  - *Ruppia maritima* L
- Zannichelliaceae
  - *Zannichellia palustris* L
- Zosteraceae
  - *Zostera marina* L
  - *Zostera nana* Roth
- Najadaceae
  - *Najas marina* L
  - *Najas minor* (All) Goss et Germ
  - *Najas graminea* Del
- Hydrocharitaceae
  - *Elodea canadensis* Michx
  - *Vallisneria spiralis* L
- Ranunculaceae
  - *Ranunculus aquatilis* L
  - *Ranunculus trichophyllus* Chaix
- Ceratophyllaceae
  - *Ceratophyllum demersum* L
  - *Ceratophyllum muricatum* Cham
  - *Ceratophyllum submersum* L
- Droseraceae
  - *Aldrovanda vesiculosa* L
- Brassicaceae
  - *Subularia aquatica* L
- Callitrichaceae
  - *Callitriche palustris* L
  - *Callitriche cophocarpa* Sendtner
  - *Callitriche stagnalis* Scop
  - *Callitriche platycarpa* Kutz
- Elatinaceae
  - *Elatine alsinastrum* L
  - *Elatine triandra* Schkuhr
  - *Elatine hydropiper* L
- Haloragaceae
  - *Myriophyllum spicatum* L
  - *Myriophyllum verticillatum* L
- Primulaceae
  - *Hottonia palustris* L
- Lentibulariaceae
  - *Utricularia minor* L
  - *Utricularia vulgaris* L
  - *Utricularia australis* R Br

Table 7 Biodiversity of Bulgaria Hydatophytes, Neustophytes, and Helophytes (continued)

2 Neustophytes

Polypodiophyta
- Salviniaceae
  - *Salvinia natans* (L) All
- Azollaceae
  - *Azolla filiculoides* Lam
  - *Azolla caroliniana* Willd
- Marsileaceae
  - *Marsilea quadrifolia* L

Magnoliophyta
- Potamogetonaceae
  - *Potamogeton natans* L
  - *Potamogeton polygonifolius* Pourr
  - *Potamogeton fluitans* Roth
- Hydrocharitaceae
  - *Hydrocharis morsus ranae* L
- Lemnaceae
  - *Lemna gibba* L
  - *Lemna minor* L
  - *Lemna trisulca* L
  - *Spirodela polyrhiza* (L) Schleid
  - *Wolffia arrhiza* (L) Horkel

Magnoliophyta
- Nymphaceae
  - *Nuphar lutea* (L) S et S
  - *Nymphaea alba* L
- Trapaceae
  - *Trapa natans* L
- Menyanthaceae
  - *Nymphoides peltata* (S G Gmel) Kuntze

3 Helophytes

Polypodiophyta
- Thelypteridaceae
  - *Thelypteris palustris* Schott

Magnoliophyta
- Typhaceae
  - *Typha latifolia* L
  - *Typha angustifolia* L
  - *Typha schuttleworth* Koch et Sonder
  - *Typha laxmannii* Lepech
  - *Typha australis* Schum et Thonn
- Sparganiaceae
  - *Sparganium erectum* L
  - *Sparganium neglectum* Beery
  - *Sparganium angustifolium* Michx
  - *Sparganium minimum* Wallr
  - *Sparganium emersum* Rehm
- Alismataceae
  - *Alisma gramineum* Lej
  - *Alisma plantago aquatica* L
  - *Alisma lanceolatum* With
  - *Sagittaria sagittifolia* L
  - *Sagittaria latifolia* Willd
  - *Caldesia parnassifolia* (Bassi) Parl
- Butomaceae
  - *Butomus umbellatus* L
- Hydrocharitaceae
  - *Stratiotes aloides* L
- Poaceae
  - *Leersia oryzoides* (L) Sw
  - *Digraphis arundinaceae* (L) Trin
  - *Calamagrostis lanceolata* Roth
  - *Beckmannia eruciformis* (L) Host
  - *Phragmites australis* (Cav) Trin
  - *Glyceria aquatica* Wahlenb
  - *Glyceria plicata* Fries
  - *Glyceria fluitans* R Br
- Cyperaceae
  - *Pierus flavescens* (L) Reichenb
  - *Juncellus serotinus* (Rottb) Clarke
  - *Cyperus glaber* L
  - *Cyperus longus* L
  - *Cyperus glomeratus* L
  - *Cyperus rotundus* L
  - *Cyperus fuscus* L
  - *Eriophorum latifolium* Hoppe
  - *Eriophorum gracile* Koch
  - *Eleocharis palustris* (L) R et S
  - *Eleocharis quinqueflora* (Hartm) Schwarz
  - *Eleocharis uniglumis* (Link) Schult
  - *Isolepis supina* (L) R Br
  - *Scirpus sylvaticus* L
  - *Schoenoplectus mucronatus* (L) Palla
  - *Schoenoplectus lacustris* (L) Palla
  - *Schoenoplectus tabernaemontani* (Gmel) Palla
  - *Schoenoplectus litoralis* (Schrad) Palla
  - *Schoenoplectus triqueter* (L) Palla
  - *Bolboschoenus maritimus* (L) Palla
  - *Schoenus ferrugineus* L
  - *Cladium mariscus* (L) R Br
  - *Carex disticha* Huds
  - *Carex paniculata* L
  - *Carex buekii* Wimm
  - *Carex acuta* L
  - *Carex gracilis* Curt
  - *Carex distans* L
  - *Carex pseudocyperus* L
  - *Carex riparia* Curt
  - *Carex acutiformis* Ehrh
  - *Carex stellulata* Good
  - *Carex vesicaria* L
  - *Carex linosa* L

Table 7 Biodiversity in Bulgaria Hydatophytes, Neustophytes, and Helophytes (continued)

3 Helophytes (continued)

Araceae
Acorus calamus L
Juncaceae
Juncus maritimus Lam
Juncus subnodosus Schrk
Juncus articulatus L
Juncus thomasii Ten
Amaryllidaceae
Leucojum aestivum L
Iridaceae
Iris pseudacorus L
Gladiolus palustris Gaud
Orchidaceae
Orchis cordigera Fries
Gymnadenia frivaldskyana Hampe
Epipactis palustris (L) Crantz
Liparis loeselii (L) Rich
Salicaceae
Salix rosmarinifolia L
Polygonaceae
Rumex hydrolapathum Huds
Rumex palustris L
Persicaria amphibia (L) S F Gray
Persicaria minor (Huds) Opiz
Persicaria hydropiper Opiz
Persicaria lapatifolia (L) S F Gray
Persicaria maculata (Raf) S F Gray
Caryophyllaceae
Myosoton aquaticum (L) Moench
Silene asterias Griseb
Ranunculaceae
Caltha polypetala Hochst
Caltha palustris L
Caltha cornuta Schot
Ranunculus pseudofluitans (Syme) Newb
Ranunculus spaerospermus Boiss et Blanche
Ranunculus lingua L
Ranunculus circinatus Sibth
Ranunculus sceleratus L
Droseraceae
Drosera rotundifolia L
Brassicaceae
Cardamine rivularis Schur
Cardamine amara L
Nasturtium officinale L
Rosaceae
Potentilla palustris (L) Scop
Fabaceae
Lathyrus palustris L
Violaceae
Viola palustris L
Lythraceae
Lythrum salicaria L
Apiaceae
Cicuta virosa L
Sium latifolium L
Sium lancifolium Reib
Berula erecta (Huds) Coville
Oenanthe aquatica (L) Poir
Oenanthe fistulosa L
Oenanthe banatica Heuff
Oenanthe silaifolia Bieb
Oenanthe stenoloba Schur
Peucedanum palustre (L) Moench
Primulaceae
Primula farinosa L
Primula deorum Vel
Samolus valerandi L
Lysimachia nummularia L
Lysimachia thyrsiflora L
Lysimachia vulgaris L
Gentianaceae
Gentiana nivalis L
Menyanthaceae
Menyanthes trifoliata L
Lamiaceae
Mentha aquatica L
Scrophulariaceae
Pedicularis palustris L
Scrophularia alata Gilib
Asteraceae
Eupatorium canabinum L
Aster tripolium L
Pulicaria dysenterica (L) Cass
Petasites kablikianus Tausch
Petasites officinalis (L) Gaertn
Petasites albus (L) Gaertn
Senecio paludosus L
Leontodon rhoensis Hayek
Sonchus palustris L

Table 8 Species of Hydatophytes, Neustophytes, and Helophytes Recommended for Protection

Potamogeton praelongus Wulfen
Potamogeton trichoides Cham et Schlecht
Zostera nana Roth
Najas graminea Del
Calamagrostis lanceolata Roth
Schoenus ferrugineus L
Acorus calamus L
Caltha polypetala Hochst et Lorent
Ranunculus circinatus Sibth
Ceratophyllum muricatum Cham
Lysimachia thyrsiflora L
Pedicularis palustris L
Utricularia neglecta Lehmann
Sonchus palustris L

Table 9 Biodiversity in Bulgaria Lichens

Order	Family	Genus	Species
Arthoniales	5	5	16
Dothidiales	1	4	15
Verrucariales	1	8	53
Pyrenulales	4	5	11
Caliciales	3	10	19
Ostropales	1	2	7
Graphidales	2	3	5
Lecanorales	26	101	564
Lichenes Imperfecti	3	3	7
Families of unclear systematic state	5	6	12
Total	51	147	709

Table 10 Rare Species of Lichens in Bulgaria

Staurothele bacilifera Arn
Microglaena modesta (Nyl) Smith
Normandina pulchella (Borr) Nyl
Stenocybe pullatula (Ach) Stein
Cyphelium tigillare Ach
Sphaerophorus globosus (Huds) Vain
Thyrea pulvinata (Schaer) Mass
Peccania coralloides Mass
Leptogium cyanescens (Hoffm) Koerb
Heppia nunicola Nyl
Massalongia carnosa (Dicks) Koerb
Lobaria linita (Ach) Rabh
Sticta sylvatica (Huds) Ach
Solorina bispora Nyl
Nephroma lusitanicum Schaer
Peltigera lepidophora (Nyl) Vain
Lecidea lucida Ach
Catinaria laureri (Hepp) Degel
Icmadophila ericetorum (L) A Z
Lecania nylanderiana Mass
Phlyctis agelaea (Ach) Fw
Parmelia trichotera Hue
Allectoria pellucida Mot
Usnea longissima Ach
Heterodermia speciosa (Wulf) Trev

Table 11 Endemic Taxa of Lichens in Bulgaria

Verrucaria bulgaria Szat
Collema rhodopense Szat
Acarospora bulgaria H Magn et Szat
Pertusaria Kasandjeffii Szat
Alectoria degenii Szat
Alectoria pellucida Mot
Parmelia pulla f bulgaria Gyel
Lecidea macrocarpa f microcarpa Szat
Lecidea incongrua f ochracea Szat
Aspicilia cinerea f ochraceoferruginea Szat
Aspicilia cinerea f olivaceoatra Szat
Aspicilia cinerea f corticola Szat
Physcia aipolia f nikoloffii Gyel
Physcia stellaris f viridescens Gyel et Nik y

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Biodiversity of Vascular Plants in Bulgaria

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INTRODUCTION

Although Bulgaria's territory is small its flora is characterized by considerable species richness The number of higher plant species in Bulgaria – about 3550 3750 – is greater than that in many larger countries The same can be said of other groups of plants – algae (about 4000), mosses (670) lichens (600) and ferns (52) (These figures are not final, since field investigations continue)

The structure of Bulgarian plant diversity can be illustrated by looking at one of the best studied groups – the seed plants (3476 species) Native gymnosperms – all of which are trees and shrubs including conifers in the families *Pinaceae* and *Cupressaceae* – amount to fifteen species If the angiospermous trees and shrubs are added the Bulgarian phanerogamous flora adds up to 359 species Seven hundred to 1000 years ago most of Bulgaria up to an altitude of 2200 2300 meters above sea level (a s l) was covered with trees and shrubs At that time the forests were probably richer in species than at present (forests currently cover only about 31% of the territory of Bulgaria) Today much of the Bulgarian forest cover consists of wood cultures poor in species diversity The herbaceous angiosperm flora is the richest in species (3241), the majority of which are perennials This abundance of perennials reflects the moderate continental climate of Bulgaria, which is favorable for their occurrence and establishment

HISTORY OF BOTANICAL INVESTIGATIONS

Over the last thirty years, taxonomic research in Bulgaria has developed intensively due both to internal and external factors The relative degree of economic and social progress in the country has had a favorable effect on natural science research in general Major taxonomic and floristic studies in neighboring countries and the rest of Europe have also favored this development The completion of the remarkable *Flora of Turkey* the *Flora SR Srbje* the elaboration of a project for Analytica flora Jugoslaviae " and the recent Flora of Greece" project all reflect the intensification of taxonomic and floristic studies in this region These activities provide an ever increasing and improving base for the continental project "Flora Europaea

Four main periods can be identified in the development of floristic and taxonomic research on the Bulgarian flora

1 The period prior to the publication of Velenovsky's *Flora Bulgarica* (1891, 1898) during which studies were performed almost exclusively by foreign botanists

2 The period up to the publication of Stojanov and Stefanov's *Flora na Bulgaria* (1924 1925), characterized by very intensive floristic studies by both Bulgarian and foreign botanists

3 The period up to the publication of the first volume of *Flora RP Bulgaricae* (Jordanov, 1963) [*Flora of the People's Republic of Bulgaria* – ed], characterized by the first monographic and taxonomic revisions of genera or sections including *Colchicum Centaurea Dianthus Cerastium* and *Anthemis*

4 The last thirty years, which marks the successful realization of the nine volumes of *Flora RP Bulgaricae*, the major project of taxonomic botany in the country and the compilation of the first local flora of Vitosha Mountain the Pirin Mountains, and Dobrudzha

This last period has seen great advances in a number of key areas of research As taxonomic investigations have progressed modern methods have been introduced – karyological, cytotaxonomical, embryological, anatomical, chemical, palynological, and biometrical (Kuzmanov, 1974) Taxonomic studies and species concepts have been influenced by the ideas and methods of biosystematics and cytotaxonomy (Kozuharov and Kuzmanov 1968) The role of genetic cytological embryological chemical and experimental data in delimiting and describing taxa is better appreciated Nomenclatural problems have steadily received more attention especially in connection with the *Flora RP Bulgaricae* project This project has also stressed the importance of international collaboration herbarium material and literature have been exchanged on an scale previously unknown in Bulgaria Finally taxonomic

research in this period has also been characterized by the use of the type concept and typification of taxa (Kuzmanov, 1971)

The increased number of botanists devoted to floristics and taxonomy has not only contributed to the intensification of research in the recent past, but has also made possible recent discussions of a new project for the next decade a detailed local flora of the Rhodope Mountains This is to be undertaken by a group of botanists in Plovdiv

GAPS IN KNOWLEDGE

Current gaps in our knowledge of the higher plants of Bulgaria can be summarized as follows

1 The treatment of taxa by past and present authors has varied A revision of nearly 500 taxa is absolutely necessary This process has begun, but is not yet finished

2 Detailed chorological information for the distribution of certain species or species groups is lacking for the Sakhar region the Tundzha hilly region the eastern and western Rhodopes the western border mountains, and other areas These areas are poorly investigated because of their large area and difficult topography

3 We lack biodiversity information for the group of families from *Dipsacaceae* and *Asteraceae* (about 400 species) This information will appear in the last three volumes of the *Flora RP Bulgaricae*

4 Investigations on karyology and chromosome numbers are proceeding At present about 1500 populations from 1200 species are being studied

5 Only about 500 populations have been investigated statistically Because of the high number of endemic and relict species, such population level investigations are needed to ascertain the nature and direction (if any) of variation

6 In the past the mapping of the distribution of Bulgaria's higher plants was limited for political reasons The restrictions of the secret service made it impossible to use 1 20000 maps for field work

7 Pollen analysis, stomatal analysis, and microstructural analysis of the seed testa are progressing more slowly than biodiversity studies

8 Fundamental embryological investigations to help explain the process of speciation for many Bulgarian endemics are still insufficient

9 The effects of genetic drift in many of the rare and threatened species are not clear

10 From a botanical perspective the protected areas have not been equally or adequately inventoried at the species level

These knowledge gaps can be placed into two main groups those involving problems that require new research (chorology, genecology embryology statistics, karyology, chemotaxonomy etc), and those involving problems that require confirmation and checking (distribution, density of populations, morphology, more accurate descriptions based on the herbarium materials etc)

BIODIVERSITY OF HIGHER PLANTS IN BULGARIA

The higher plants of Bulgaria have been classified in 130 families and 872 genera with 3550 3750 species 847 subspecies and 2000 varieties Systematically the higher plants in the Bulgarian flora are grouped as follows Pteridophyta 58 species Gymnospermae 16 spp , Angiospermae - 3460 spp Monocotyledonae 568 spp and Dicotyledonae 2613 spp

The order Pteridophyta in Bulgaria is represented by 28 genera with 58 species organized in three classes Lycopodiopsida Equisetopsida, and Filicopsida Only *Salvinia natans* (L) All is annual the others are perennial The class Lycopodiopsida includes 8 species from 6 genera in three families (Isoetaceae, Lycopodiaceae, and Saliginellaceae) The class Equisetopsida is represented by 7 species from the genus *Equisetum* in the family Equisetaceae The Bulgarian flora of the class Filicopsida are grouped into 15 families Seven of these families are represented by single species within the genera *Adiantaceae Blechnaceae Cryptogrammaceae Hypolepidaceae, Marsileaceae Osmundaceae* and *Salviniceae* The best represented families are Aspidiaceae (10 species from 3 genera) and Aspleniaceae (11 species from 3 genera) The other 6 families – Athyriaceae Azollaceae, Ophioglossaceae Polypodiaceae Sinopteridaceae and Thelypteridaceae – are represented by one or two genera with 2 4 species The most widely spread pteridophyte species are *Athyrium filix femina* (L) Roth *Dryopteris filix mas* (L) Schott *Polystichum lonchitis* (L) Roth, and *Pteridium aquilinum* (L) Kuhn

Among the seed bearing higher plants, the most represented families are Fabaceae 278 spp Poa ceae 237 spp Asteraceae 470 spp , Rosaceae 207 spp Other well represented families include Caryo phyllaceae 187 spp Brassicaceae 169 spp, Apia ceae 147 spp , and Lamiaceae 130 spp Though not so rich in species several plant families, including

Pinaceae Fagaceae, and Aceraceae are of great signifi cance for the Bulgarian flora Many of the species in these families are dominants within forest ecosystems and form the basis for delineation of the main vegetation zones in Bulgaria

The families and genera richest in dominant species are Fagaceae (*Quercus* - 26 spp) Poaceae (*Festuca* 36 spp *Bromus* 26 spp *Poa* 14 spp) Fabaceae (*Trifolium* 59 spp , *Vicia* 36 spp *Lathyrus* 28 spp , *Medicago* 14 spp) Asteraceae (*Centaurea* 35 spp , *Anthemis* 14 spp *Senecio* 18 spp) Rosaceae (*Rosa* 44 spp *Potentilla* 34 spp *Alchemilla* 35 spp) Brassi caceae (*Cardamine* 17 spp *Allyssum* 13 spp) Caryo phyllaceae (*Dianthus* 22 spp *Minuartia* 19 spp *Cer astium* 18 spp), Lamiaceae (*Thymus* 25 spp *Stachys* 20 spp) There are 30 genera with more than 20 species 464 genera with between 10 and 20 species and 100 genera with more than 10 species

Most species in the Bulgarian flora are spread in the lowlands plains the belts of the xerotherm oak forests and the mesophyte and xeromesophyte oak and horn beam forests up to 700 900 m above sea level (a s l) The flora of the Stara Planina Mountains is the richest in species diversity Then follow the Rhodopes the Pirins the Rilas the calcareous mountains of Western Bulgaria Osogovo Mountain Strandzha Mountain and the low lands – the Strouma River valley the Thracian Plain the Tundzha hilly region the Black Sea coast together with Dobrudzha and the Danubian plain

In general the number of species present in these sub regions reflects not only the size of the massif (in the case of the mountain flora), but also their altitudinal and ecosystemic variation Altitudinally 2246 species occur in the zone between sea level and 500 m a s l 2137 spe cies from 500 to 1000 m a s l 780 species from 1000 to 2500 m a s l and 780 species at altitudes over 1800 m a s l Only 144 constant species occur above 2500 m a s l The flora that occurs on c ilcareous rock substrates is richer in species than that which occurs on a silicate base

Bulgarian plants can be grouped into perennials (2264 spp) biannuals (353 spp) and annuals (515 spp) The large number of perennial species combined with the high degree of variation in altitude ecological niches and phytoclimatic influences provides favorable condi tions for active evolutionary processes The conditions of ecological isolation provide the basis for speciation processes in Bulgaria with structural heterozygosity as the main evolutionary mechanism Heterozygosity leads to gradual speciation through chromosomal changes and diploidy and aneuploidy The incidence of polyploidy is much lower about 30%

A REVIEW OF THE TAXONOMIC LITERATURE

Over the last century some 10 000 articles on the Bulgarian flora have been published About 70% are directly concerned with the chorology of higher plants – their distribution in the country as a whole, their distribution in different regions the occurrence of spe cies new to science, and the occurrence of new species for the country or for a particular region Ten percent of these articles deal with questions of the evolution variation, and taxonomy of particular groups of higher plants The most completely studied plant families are Poaceae, Linaceae Caryophyllaceae, Scrophulari aceae Primulaceae, Rubiaceae, and Lamiaceae The remaining 20% of these scientific works concern anat omy morphology karyology stomatal analysis and other aspects of the biology of higher plants

A particularly important source of scientific in formation is *Flora RP Bulgaricae*, which summarizes all that has been learned about the Bulgarian flora at the species and subspecies level At this point nine volumes have been edited and a tenth is in press The plant families *Campanulaceae* and *Asteraceae* will be covered in the next three volumes These volumes provide information on nomenclature morphological peculiarities, intraspecific variation, distribution in the country and geographical distribution This flora is the only one which differs essentially from the synop ses and guides to higher plants that currently exist

The 213 articles listed at the end of this paper in clude the most important reports on Bulgarian tax onomical investigations, and illustrate the extent of, and advance degree of knowledge about, biological diversity in the Bulgarian flora, even at the population level

Endemics Speciation, Distribution, and Protection

At present about 170 species and 100 subspecies of angiospermous higher plants have been identified as Bulgarian endemics Among the 3500 species and 840 subspecies of higher plants described so far Bul garian endemics constitute about 4 86 per cent This is a relatively high ratio compared to the percentage of endemics in other European countries with larger ter ritories The proportion of endemic subspecies is even higher – 8 per cent The percentage of endemic spe cies would increase significantly if it included Balkan endemic species that occur in Bulgaria It is quite pos sible that some of them originated in Bulgaria (especially in the Rhodopes the Pirin Mountains and Slavyanka Mountain) and later on spread to other parts of the Balkan Peninsula This may have hap pened during various epochs of the Quaternary

Ongoing studies of species (and other taxa) that are currently considered Bulgarian endemics may lead to the identification of new habitats in other parts of the Balkan Peninsula Such is the case for example, for *Geum bulgaricum* Panc and *Astragalus physocalix* Fisch The first is found in the Rila Mountains and the second other in the Thracian plain Recently however both have been found in different parts of the former Yugoslavia

In general the occurrence of endemic plants in Bulgaria reflects the special habitats and genetic peculiarities of its flora The relatively high degree of endemism testifies to the richness of Bulgaria's characteristic ecological niches and its varied phytogenetic and phytoclimatic history

Families and Species

The family Asteraceae contains the greatest number of Bulgarian endemics – 38 species and 12 subspecies It is followed by Caryophyllaceae (18 spp , 10 subspp), Scrophulariaceae (11 spp , 14 subspp), Rosaceae (15 spp , 3 subspp), and Poaceae (12 spp , 4 subspp) Among the genera, the greatest number of Bulgarian endemics is to be found in the genus *Centaurea* from the family Asteraceae – 8 species and 16 subspecies It is followed by the genus *Verbascum* from the family Scrophulariaceae (8 spp 4 subspp) the genus *Anthemis* from the family Asteraceae (10 spp), the genus *Silene* from the family Caryophillaceae (6 spp 1 subsp) and the genus *Alchemilla* from the family Rosaceae (6 spp)

Distribution

The distribution of endemic Bulgarian higher plants is quite uneven and is related primarily to the presence of mountains Of all the mountain groups the Stara Planina Mountains are the richest in endemics Over 90 Bulgarian endemic species and subspecies occur there and more than 20 of them are local These include *Primula frondosa* Janka, *Betonica bulgarica* Deg et Neic , *Viola balcanica* Delip , *Festuca bosniaca* (Acht) Markgr Dannb , *Leontopodium alpinum* subsp *slavicum* Urum , *Alchemilla jumrukczalica* Pawl , and *Seseli degenii* Urum

The Rhodopes rank second in the number of endemics Over 80 species and subspecies of Bulgarian higher plant endemics are found there About 20% occur in that region only Among them are *Arenaria rhodopaea* Delip , *Rosa rhodopaea* Dim , *Quercus thracica* Stef et Ned *Ranunculus stojanovii* Delip , *Gypsophila tekirae* Stef *Lilium rhodopaeum* Delip and *Scabiosa rhodopensis* Stoj et Stef

Third in rank are the Pirin Mountains Over 70 endemic species and subspecies have been recorded there more than 30 of which are local or narrowly regional Pirin endemics Some of the most typical are *Arenaria pirinica* Stoj *Centaurea achtarovii* Urum *Papaver degenii* (Urum et Jav) Kusm *Brassica jordanoffii* O E Schulz, *Oxytropis urumovii* Deg *Verbascum davidovii* Murb *Festuca pirinica* Horv ex Markgr Dannb , *Linum alpinum* subsp *pirinicum* Petrova, and *Carex piratensis* Acht

Fourth in rank are the Rila Mountains where about 50 species and subspecies of Bulgarian higher plant endemics can be found Ten of these are confined to that mountain massif alone Typical endemic species here are *Quercus mestensis* Bond et Ganc *Rheum rhaponticum* L *Anthemis orbelica* Panc and *Primula deorum* Vel

The other mountains rank as follows Vitosha (25 spp and subspp), Strandzha (19) Sredna Gora (12) Belasitsa (8), Osogovo (6)

Relatively few endemic species and subspecies are found in the lowlands and the low mountain foothills In the lowlands they are preserved mainly in the lower hills with shrub and herbaceous vegetation where they were undoubtedly widespread in the past Here occur *Chamaecytisus kovacevii* (Vel) Rothm , *Linum tauricum* subsp *bulgaricum* (Podp) Petrova, *Onosma thracica* Vel , *Medicago rhodopea* Vel , *Galium rhodopeum* Vel , *Festuca thracica* (Acht) Markgr Dannb , *Limonium bulgaricum* Ancev, *Verbascum dieckianum* Borb et Deg *Crepis stojanovii* T Georg , *Bromus moesiacus* Vel , *Astracantha autoscensis* (Ivanisch) Podl and others Some species in this group have quite small populations as for example, *Quercus thracica* Stef et Ned *Eranthis bulgaricus* Stef *Linum tauricum* subsp *bulgaricum* (Podp) Petrova *Hedysarum grandiflorum* subsp *bulgaricum* Koz *Hypericum setiferum* Stef , *Anthemis argyrophylla* (Hal et Georg) Vel and *Tulipa splendens* Delip

Balkan endemics comprise a sizable part in the composition of the Bulgarian higher flora They number about 200 species and subspecies Many were first identified and described in Bulgaria and so carry the name or names of Bulgarian mountains and scientists Examples include *Dianthus drenovskyanus* Rech fil , *Geum bulgaricum* Panc , *Rhamnus rhodopeus* Vel *Alchemilla bulgarica* Rothm *Oxitropis urumovii* Jav , *Viola permensis* W Becker *Lathraea rhodopaea* Dingl *Geum rhodopeum* Vel *Haberlea rhodopensis* Friv *Festuca rhoeensis* (Hack et Hay) Markgr Dannb and *Fritillaria drenovskii* Deg et Stoj

Many of the Balkan higher endemics occur mainly in Bulgaria This is the case for example, with *Silene skorpilii* Vel *Dianthus microlepis* Boiss *Aquilegia aurea* Janka *Astracantha thracica* (Griseb) Podl , *Acer heldreichii* Orph ex Boiss , *Alkanna stribrnyi* Vel *Satureja pilosa* Vel *Verbascum adrianopolitanum* Podp and *Festuca valida* (Uechtr) Penzes The group of Balkan endemics includes *Abies borisii regis* Matf and *Pinus peuce* Griseb the second of which is widespread in the Bulgarian mountains and an extremely valuable forest tree in terms both of economics and ecology

A number of factors account for the high proportion of Bulgarian and Balkan endemics in the higher flora of our country Of major importance are

- Bulgaria's location at the crossroads of three phytoclimatic regions – the European deciduous forest, the Asian steppe and the Mediterranean,
- the variety of climatic conditions due to the high mountain massifs lowlands plains and the influ

ence of the Black and Aegean Seas, these allow various vegetation elements – arctic subarctic mid dle European steppe, and mediterranean – to occur here

- the wide range of ecological niches within the sepa rate natural regions (bioclimatic zones altitudinal belts etc) due to the complex topography and the highly variable rock substrates, soil types, and hydrological conditions and
- the rich geological history of our lands

Age and Classification of Endemics

Based on the degree of taxonomic specificity and the geographical isolation associated with it Bulgarian endemics can be placed in the following categories

1 Relict endemics

These are morphologically isolated species with no relations of the genus or section in the Balkan Peninsula Such are the species that were formed during the Terti ary and endured the glacial epochs of the Quaternary in habitats that were relatively far from the centers of gla ciation Relict endemics form the smallest group in the Bulgarian flora Because the territory that is now in cluded within Bulgaria has been glaciated several times surviving Tertiary relicts are not very numerous (as a rule they are morphologically primitive and have low chro mosome numbers) Within this group fall most of the Balkan endemics such as *Aesculus hyppocastanum* L *Viola delphinantha* Boiss and *Centhranthus kellereri* (Stoj Stef et T Georg) Stoj et Stef

2 Old endemics or palaeoendemics

These are morphologically or geographically iso lated species that are however, represented on the Bal kan Peninsula or in neighboring territories by other though not always closely related single or several spe cies Such are *Pinus peuce* Griseb *Pinus heldreichii* Christ *Lathraea rhodopea* Dingl , *Ramonda serbica* Panc *Aquilegia aurea* Janka *Astracantha aitosensis* (Ivanisch) Podl *Astracantha thracica* (Griseb) Podl , *Erianthus bulgaricus* Stef , *Gypsophila tekirae* Stef *Acer heldreichii* Orph ex Boiss *Festucopsis sancta* (Janka) Meld *Bromus moesiacus* Vel and *Anthemis argyrophylla* (Hall et Georg) Vel Most endemics of this type occur in the lowlands and the lower mountain belt (up to 1000 1200 m) which indicates their thermophilic nature and therefore their affiliation with warmer climates

3 Comparatively old species (semipalaeoendemics)

These are morphologically and geographically or ecologically well differentiated species belonging to gen era or sections well represented in Bulgaria or the Bal kan Peninsula and that are very often isolated from other species by physical boundaries (e g seas) This group includes *Edrianthus serbicus* Panc , *Primula deorum* Vel , *Primula frondosa* Janka the species from the genus *Saxifraga* and its various sections – *Saxifraga stribrnyi* Vel , *S ferdinandi coburgi* Kell et Sund , *Arenaria rhodopaea* Delip *Alopecurus iliensis* (Hack) Pawl and *Viola perinensis* W Becker Most of the endemics of this type occur in the medium and high mountain belt, mainly on calcareous ground sometimes, however, coming down to the lower mountain belts

4 Comparatively young (semi recent) species

These are morphologically well differentiated spe cies with close taxonomic relations in the Balkan Peninsula or in other neighboring countries To this group belong species within the genera *Lilium* (*L rhodopaeum* Delip *L jankae* Kern and *L albanicum* Griseb) *Tulipa* (*T urumoffii* Hay *T thracica* Dav and *T rhodopaea* (Vel) Vel) *Verbascum* (*V decorum* Vel *V dieckianum* Borb et Deg , *V juruk* Stef , and *V minutiflorum* Vel) *Galium* (*G rhodopeum* Vel , *Colchicum* (*C davidovii* Stef and *C diampolis* Delip et Ceschm) and the species *Gentianella bulgarica* (Vel) Holub and *Fritillaria drenovskii* Deg et Stoj

5 Microspecies

These are species distinguished by fewer characters growing in one and the same or in neighboring areas (sympatric) Included in this category are mainly the apomictic complexes of a clonal nature such as species from the genera *Alchemilla* (*A pirinica* Pawl *A achtarovii* Pawl , *A jumrukczalica* Pawl , *A pawlowskii* As senov, and *A asteroantha* Rothm) *Rosa* (*R pontica* Dim , *R parilica* Dim *R bulgarica* Dim and other ro ses) and *Hieracium* (*H samokovense* T Georg *H stefanoffii* Zahn et Markgr *H jankae* Uechtr *H pirinicolum* T Georg , and *H heuffelii* Janka

SPECIATION CENTERS

Centers of speciation are areas where the most active speciation processes take place In the Bulgarian flora local speciation centers developed in areas where contacts between various populations and species oc curred as a result of encounters during migrations at dif ferent times and of varied duration

Primary speciation centers are those that were not occupied by forest communities in the past Secondary speciation centers are those that are situated in former forest areas most often destroyed as a result of human activities In Bulgaria, the first type is represented by the high mountain centers – above 2000 m altitude The secondary centers are situated on the mountain slopes and in the foothills and lower hills Speciation centers also differ in their basic rock composition – calcareous serpentinite (basic or ultra basic) and silicate Their boundaries are determined using available information about their floristic complexes (Velcev, ed , 1992)

The main difference between typical speciation centers and refugia is that the former includes, apart from old and young species a relatively high degree of genetic variability in current populations Refugia include primarily stabilized species that lack such variability Consequently, from the viewpoint of their dwellers, they belong to the categories of old and comparatively old species However, the genetic aspects of the Bulgarian speciation centers are insufficiently studied

Distribution and Concentration of Endemic Taxa

According to the number of endemic taxa they contain the Bulgarian floristic regions can be classified as follows

1 Bulgarian endemics

The Rhodopes 39 species Stara Planina 31, Pirin Mountains 27, Thracian plain 20 Black Sea coast 17 Tundzha hilly region 12 Rila Mountains 11 Slavyanka Mountain 11 Northeastern Bulgaria 10 Strandzha mountain 10, Balkan foothill region 9 Znepole region 6 Strouma River valley 4 Danubian plain 3, Western border mountains 1 Vitosha region 1 Mesta River valley 1

2 Balkan endemics

The Rhodopes - 56 species Pirin Mountains 40, Stara Planina 36 Slavyanka Mountain 31 Rila Mountains 22, Znepole region 17 Tundza hilly region 14, Thracian plain 13, Black Sea coast 12, Strouma River valley 12 Vitosha region 12 Balkan foothill region 10 Strandzha mountain 7 Belasitsa 6 Northeastern Bulgaria 6 Sredna Gora Mountain 5 Western border mountains 5 Osogovo Mountain 4 Danubian plain 3 Mesta River valley 2, Sofia region 2

THREATS TO THE NATURAL FLORA

As a result of developments in agriculture stock breeding, timber production and other forms of land use, the natural ecosystems over vast areas of Bulgaria (about 2/3 of the total territory) have been drastically altered Because of forest destruction in the lower mountain vegetational belt and hilly regions the problem of soil erosion (especially on the southern slopes of the Stara Planina Mountains the eastern Rhodopes the southern and western slopes of the Pirin Mountains and Ograzden) is widespread In order to obtain new lands for agriculture, many natural wetlands and lakes have been drained

Pastures that are overcrowded with cattle and sheep lose many species and suffer destruction of their grass cover Many of the original species are replaced by harsh inefficient herbs or grasses such as *Nardus stricta*, which is a dominant species in many high mountain meadows The late haymaking practiced normally in most districts of the country, combined with irregular irrigation make the meadows rich in weeds and ruderals Consequently, the hay is rough

Air pollution is an indirect but important influence on the degradation of the vegetation This is becoming more dangerous to the point of causing definite alterna tions in microclimatic conditions

These forces have led to the loss of diversity within the genepool and of species such as *Aldrovanda vesiculosa Hottonia palustris Salix rosmarinifolia* and *Astragalus physocalyx* These and many others have been permanently lost, and illustrate not only the irreversibility of such losses but the deep structural changes that subsequently occur within their ecosystems

Over the last several decades, national goals called for the building of many factories dams houses, blocks of flats power stations, and mines And they were built The road and the railway networks had to be enlarged as well And they were The rising demand for building materials caused an increase in forest exploitation which in some regions had an immediate impact on the water resources

Meanwhile industry began to show the other side of the coin to nature The increasing occurrence of smog has resulted in the degradation of many plant communities e g in the southern slopes of the Stara Planina Mountains between the towns of Zlatitsa and Pirdop (where new copper works were situated), on Golo Bardo Mountain (site of the 'Pernik" mines and metalurgic works) and in central Thrace (site of the "Maritsa Iztoc" mines)

Unforeseen and unfavorable changes have arisen due to changes in the hydrology of some river systems as a result of the building of artificial lakes and dams

In addition, one must not underestimate the effects of resort complexes and tourist movement (so strong nowadays) on the natural ecosystems, as well as the insufficiently regulated gathering of herbs

And last but not least the deep reorganization in the system of agriculture – the incorporation of the land in collective farms and the subsequent intensification of chemical fertilization and extensive use of pesticides – should also be mentioned as having had a definite impact on the natural and semi natural plant communities

PROTECTION OF THE NATURAL FLORA

The 1930s saw the rise of a real scientific movement for protection of Bulgaria's natural flora and vegetation The first reserves aimed at conserving species considered rare and diminishing (mainly endemics and relicts) were created at that time However the rates of exploitation of the natural environment were far stronger and more advanced than the measures taken to protect the flora and vegetation of Bulgaria

These results of general economic development might have been considered unavoidable At the same time however, efforts to balance these impacts with protective measures began A number of serious meas ures for nature protection were realized New reserves and national parks – Vitosha Mountain Vihren Peak in the Pirin Mountains Ostritsa Peak of Golo Bardo Mountain Cervenata Stena in the central Rhodopes – were established A long list of endemic relict species and species threatened with extinction was prepared in order to protect the taxa in greatest danger as well as some natural complexes The problems seemed to have been solved in reality however they have not In the 1985 *Red Data Book of the People's Republic of Bulgaria, Volume 1 Plants* it is noted that during the last fifty years 31 species of higher plants have gone extinct One hundred and fifty species are threatened with extinction Five hundred and seventy four species are noted to be of special scientific interest while 330 species are pro tected by the Law of Protection of Nature

Planning has now begun to address the plant con servation situation Part of this effort is the Concept for the Protection of the Natural Flora and Vegetation elaborated by the Institute of Botany of the Bulgarian Academy of Sciences The following basic ideas underlie the Concept

1 The building of a system of reservations and na tional parks that includes all interesting and ecologi cally rich floristic and vegetational regions

2 The protection of habitats with rare, endemic and relict plants and phytocoenoses not included, for whatever reason in the reservations as botanical localities of special importance

3 The protection of very old trees and other unique representatives of the flora and vegetation by desig nating them as living memorials

4 The reintroduction of extinct plant species and res toration of phytocoenoses in the natural habitats

5 The replacement of cultivated plant species and va rieties in new habitats or botanical gardens

6 The permanent maintenance of a definite percent age of woodland in the different regions of the country

7 The organizing of lumbering hay production pas ture and gathering of medicinal plants in confor mity with natural timber production capacity and vegetational growth

These measures should be coordinated with the state program for a) diminishing and ultimately eliminating the smog problem b) elaborating programs for the pro tection of nature in every botanical region or district of the country and c) reestablishing the natural balance in areas where it has been violated

The observance of the requirements for preserva tion of the natural environment and the organization of concrete measures for this preservation are the responsi bilities of specialized agencies However effective solu tions to environmental problems and particularly the fu ture relations between people and the flora and vegeta tion are possible only if they rest on a solid scientific foundation In this respect, we have witnessed consider able delay and only recently have we begun to build the base for a deeper systematic approach

In view of this situation Bulgarian botanical science should devote itself to the following tasks

1 Establish and determine the botanical components of special importance for the aims of plant protec tion

2 Determine the regimen and means of protection for these particular botanical components

3 Efficiently control the way in which the different protection measures are put into practice

The first task seems to be the most urgent It is be ing addressed through several ongoing projects of the In stitute of Botany the *Flora RP Bulgariceae*, vegetation mapping the *Chromosome Atlas of Higher Plants* and the *Vegetation Cover of Bulgaria*

Efforts should be directed to the protection of plants and phytocoenoses characteristic of particular regions and natural zones of floristic diversity as a whole and of the basic plant communities The varied ecological con ditions in this country demand variable standards for fu ture vegetation restoration projects The need to use our plant resources more efficiently should be met by taking greater advantage of our rich natural genetic resources so as to favor natural selection within the ecosystems of Bulgaria and the natural evolutionary processes in the flora of the Balkan Peninsula

These tasks demand urgent and intensive scientific studies As already mentioned, various objects need to be protected by various management regimes and meas-ures Some measures will be trans sectional in

nature Others including the establishment of monitor ing stations will be more localized All will need to be based on investigations of various ecological niches and their characteristics and inhabitants either species or phytocoenoses Monitoring stations in particular are needed to determine the nature of the changes – artificial or natural progressive or regressive adaptive or non adaptive – at various locations over time These studies require periodic inventory of the biological com ponents on different levels of taxonomic and biological organization as well as mapping methods that contribute to an understanding of their environmental dynamics (e g , through phenological studies that reveal their sea sonal plasticity)

Inseparable from immediate measures to protect and restore the natural environment and particularly the flora and vegetation are long term measures intended to mobilize the whole nation and especially the youth We need special efforts to educate the citizenry about the idea of nature protection – the permanent and multidi rectional persuasion of the people that the natural plant resources are not inexhaustible and that their destruction is of extreme danger to human society

Protection of Endemics

The populations of most Bulgarian endemics are relatively small and widely scattered This has troubled Bulgarian botanists for some time (Stojanoff 1934 Ste fanoff and Kitanov 1962) Later studies of the problem of the loss of native plant diversity (Kozuharov 1975, 1977 Kuzmanov, 1978 1981) focused on the protection of the most fragile part of Bulgarian flora – the endemic species and subspecies – based on our knowledge of their origins population structures and history

The first concrete steps to protect endemic plants were taken in 1931 when the first Bulgarian reserve was established Since then about 400 protected natural ar eas have been created among them 11 National parks and 89 reserves (including 17 biosphere reserves and 2 UNESCO world heritage sites) They include the Doupki Dzhindzhiritsa Reserve in the Pirin Mountains, Alibotouch Reserve on Slavyanka Mountain, Koupena Tchervenata Stena Trigradsko Zdrelo and Vasil Ko larov Reserves in the Rhodopes Dzhendema Reserve in the central Stara Planina Mountains Kaliakra Reserve on the northern Black Sea coast Silkossia Reserve on Strandzha Mountain Mariski Ezera and Parangalica Reserves in the Rila Mountains and Torfeno Braniste on Vitosha Mountain Among these are some of the most important biological "hotspots" and speciation cen ters in Bulgaria However, the system of protected natu ral areas needs to be expanded to include more of the active speciation centers to secure for the long term the full diversity of the Bulgarian flora and to provide greater stabilization to the Bulgarian ecosystems

The problem lies in the manner in which these most fragile members of the plant communities should be protected Some centers of speciation – for example those within the alpine and the subalpine belts – can be included as links in a chain of reserves This would allow opportunities for the automatic exchange of ge netic material and the continual functioning of natural selection processes within them Other reserves can be developed in areas where the primary plant communities have been replaced and where people need to pay at tention to retaining early successional stages (through for example occasional pasturing or mowing) Many species are adapted to a regular pattern of plowing and fallowing Such are a number of annual, mainly cereal species, including wild wheat and barley These and oth ers may prove to be valuable sources of genetic material for their cultivated relatives In short, protection of the gene pool of endemic and relict plants is of primary im portance for the protection and restoration of the plant diversity that has developed in our country through the ages

In 1952, twenty years after the first Bulgarian re serve was established the Department for Environment Protection in the Ministry of Forests took steps to intro duce legal measures for the protection of some species and the endemic genepool Sixty three species in the Bulgarian flora that were considered extremely rare and threatened were declared to be protected Seventeen of these species are regional (Bulgarian and Balkan) en demics Eight are Bulgarian endemics *Astracantha aito sensis* (Ivanisch) Podl , *Daphne kosanin* Stoj , *Tulipa rhodopea* (Vel) Vel *Tulipa urumoffi* Hay *Rheum raponticum* L *Pulsatilla slavjankae* (Zimm) Jord et Koz *Primula frondosa* Janka and *Primula deorum* Vel Some highly local endemics have been included among the Balkan endemics including *Haberlea rhodopensis* Friv *Ramonda serbica* Panc *Viola delphinantha* Boiss *Tulipa thracica* Dav *Saxifraga stribrnyi* Vel *Fritillaria drenovskii* Deg and *Lilium rhodopaeum* Delip

The small number of endemics thus protected re flected the lack of information or knowledge of Bulgar ian endemism at the time as well as incomplete under standing of the reasons such measures were required Among the threatened species listed the greatest number belonged to the Scrophulariaceae in the genera *Verbas cum* (9 species) and *Veronica* (6) and the Liliaceae in the genera *Centaurea* (5) and *Tulipa* (4) Among the rare species, the greatest number belonged to the genera *Anthemis* (6) and *Alchemilla* (5) With our increased understanding of endemism it is now possible to revise the lists of officially protected species and to update the *Red Data Book* information on them

Current and Potential Uses of Plant Resources

Many medicinal plants are the sole sources of raw materials for the pharmaceutical industry More than 55

species of Bulgarian plants are used to produce extracts other medical substances and a range of medicines (nivaline, gluacine vincarpane, reflavit, neutracid ergo tamine cratemon phytodont etc)

More than 100 types of tea, utilizing over 70 species of wild and cultivated medicinal Bulgarian plants have been developed and approved Species from the genera *Rosa Matricaria Valeriana Melissa Mentha Crataegus Tilia* among others have been used in the preparation of these teas *Leucojum aestivum Valeriana Vinca Clavi ceps purpurea Verbascum nobile Silybum marianum, Crataegus* and *Artemisia* are of the greatest economic significance

About ten wild species are used as sources of ethe real oils concretes and absolue (including *Geranium Matricaria Salvia Mentha, Melissa*) Other plants are widely used in the production of cosmetics, leathers, natural dyes and other goods

The genetic diversity of wild plants also holds great potential for future improvements in land use and for enlarging the cultivated flora Genera that are important in this regard and that have definite economic signifi cance as well include

▪ Forage plants

Fabaceae *Medicago Trifolium, Esparseta, Vicia Lathyrus*
Poaceae *Festuca Poa Sesleria Brachypodium* perennial species of *Bromus*

▪ Fruit trees

Rosaceae *Pyrus Rosa Rubus*

▪ Plants rich in ethereal oils

Geraniaceae *Geranium Erodium*
Ranunculaceae *Ranunculus*
Apiaceae *Chaerophyllum, Anthriscus Sesel Angelica*
Lamiaceae *Mentha Thymus Saturea Melissa Salvia*

▪ Plants rich in alkaloids and glycosides

Ranunculaceae *Thalictrum Adonis*
Papaveraceae *Fumaria, Corydalis*
Asteraceae *Achillea Artemisia Matricaria Aster Centaurea*
Gentianaceae *Gentiana Centhaurium*
Scrophulariaceae *Verbascum*
Vincaceae *Vinca*

▪ Ornamental plants

Volaceae Asteraceae Liliaceae Scrophulariaceae Boraginaceae

▪ Plants for reforestation

Fagaceae *Quercus, Fagus, Carpinus*
Aceraceae *Acer campestris Acer pseudoplatanus*
Salicaceae *Salix, Populus*
Oleaceae *Fraxinus*

Particularly suitable for the forage industry are many species from the following genera of Poaceae *Agrostis Bromus, Festuca Brachypodium Phleum Alopecurus Poa Briza* and *Dactylis* Some foreign forms of these taxa have been cultivated already in Bulgaria but they are not very well adapted to the specific envi ronmental conditions of the country
Seed production of the Bulgarian forms of these taxa is necessary as well

Some species from Fabaceae are of high forage quality They are also an important source of genetic material for the improvement of the forage base These species belong to the following genera *Anthylis, Espar seta Trigonella* yellow perennial *Medicago Lathyrus Melilotus Galega* and *Trifolium* Many of these species are melliferous as well

Some of the annuals have a very short vegetative growth period and are suitable for use as cover crops and green manures (e g *Vicia Pisum Trifolium*) These can provide more effective use and conservation of soil nu trients moisture and biota

The many species of wild medicinal plants are of great interest in efforts to enlarge the variety of cultivated plants Many of these plants have been gathered and used locally for centuries Their supply in the wild how ever is limited – raising the question of their potential for cultivation In fact some of these have been culti vated already (e g *Matricaria officinalis*) but not as widely as necessary Nearly 20 species from the follow ing genera are suitable for cultivation *Rhamnus, Valer ana, Glycyrrhiza, Fumaria, Geranium Rubia, Cen thaurium, Centaurea, Viola*, and *Malva*

Many wild plants are highly suited for use in park arrangement landscaping and urban planting as well as for pot flowers This group includes over 70 species of plants from about 10 families (Araceae Caryophyl liceae, Campanulaceae, Liliaceae, Paeoniaceae, Scro phulariaceae Asteraceae Violaceae Iridaceae Ranun culaceae)

FRAGILITY

As noted above the biological diversity of Bulgarian plants is threatened by a variety of forces and these to gether determine the degree of ecosystem stability upon which the plants depend If we consider fragility to in crease as stability decreases the following areas can be considered especially fragile

Destabilization Due to Pollution

According to periodic assessments of the state of pollution in different regions of the country the following zones can be considered to be particularly fragile All are around large cities with industrial centers

- Assenovgrad metallurgic pollution near the Tcherven ata Stena Reserve
- Burgas chemical works near lake ecosystems, sand complexes, and unique relict plant associations, one nearby national park and many reserves
- Vratsa chemical pollutants near unique habitats of endemic species, chemical pollution causing acid precipitation near habitats of rare and endemic species
- Devnzha chemical pollution near unique complexes of dense forests
- Dimitrovgrad chemical pollution with great negative effects on human populations and all components of the natural environment
- Kurdzali metallurgic and chemical pollution a 700% increase in the lead content of the soil has been established all ecosystems are threatened by impacts
- Pernik metallurgic pollution near a reserve with a high concentration of endemic and relict species
- Plovdiv metallurgic pollution as a result of which five species from the natural flora of the Thracian plain have disappeared
- Russe chemical and metallurgic pollution combined with transboundary transport of chlorine compounds on the brink of total degradation of the natural vegetation
- Sofia chemical and metallurgic pollution near the Vitosha National Park
- Vitosha Mountain a particularly high degree of dust contamination
- Srednogorie metallurgic and chemical pollution, entire portions of the natural vegetation have been destroyed by local acid precipitation the concentration of arsenic in the soil is 500% above the standard

The ecosystems around these industrial centers are totally destabilized and thus can be regarded as particularly fragile They require urgent aid

Destabilization Due to Transboundary Pollution

Transboundary pollution is of special concern in three main regions a) along the Danubian plain as a result of the transport of pollutants from Romania b) in the central Stara Planina Mountains as a result of the transport of pollutants from central Europe and c) in the Strandzha Mountain region as a result of the transport of pollutants from Turkey

Destabilization Due to Human Presence and Intensive Tourism

Human presence and especially the occurrence of intensive tourism, is responsible for destabilization in the following ways and places

- The state of the vegetation of the high peaks of the Pirin Mountains the Rila Mountains Vitosha Mountain, and Osogovo Mountain is very unstable due to the trampling of the meadows and contamination by tourist wastes
- The state of the vegetation near water sources along the main tourist corridors is destabilized as a result of trampling of the meadows and tourist wastes
- Sand dunes are used most intensively in the summer which coincides with the period of maximum vegetative growth That is why dune vegetation complexes are strongly affected, despite the fact that they lie largely within the boundaries of national parks and reserves
- The natural conditions in the dense longose forests have been greatly modified as a result of changes in the water and salt regime The number of herbaceous species in these forests has declined 30% in the last 10 years

These kinds of habitats can be reconstructed if natural conditions are restored This could be achieved in about 15 years

PROTECTED AREAS

Almost all the most interesting habitats have been identified and protected to some degree A few areas could be added to the existing network

1 The habitats of many rare and threatened plants (about 15 species) concentrated eastwards from Targoviste near the village of Prolaz

2 The habitat of Strandzha relics and endemics along the river Kovatch near the town of Malko Tarnovo

3 The habitats of rare and threatened species (about 15 species) near the village of Bankzha and the town of Tran

In addition we recommend that the following specific actions be taken with regard to the protected areas

1 Inventories of the protected sites should be completed and investigations of their natural genetic diversity undertaken

2 Develop a ranger service in order to provide every reserve with effective protection

3 Adopt taxes and fees for visits to the reserves to establish a fund for use in nature protection activities

GENERAL RECOMMENDATIONS

We also offer the following more general recommendations

1 Develop genecological analysis on the basis of available data and more active field work

2 Complete the microtopographical mapping (1 20000) project

3 Develop a national biomonitoring system for observation and management of the Natural parks and Reserves

4 Establish a national information bank for the protected areas

5 Create an independent agency for environmental protection

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora

Extinct

Aldrovanda vesiculosa L
Angelica archangelica L
Astragalus physocalyx Fisch
Caldesia parnassifolia (Bassi) Parl
Cardamine parviflora L
Carex rupestris Bell ex All
Centaurea immanuelis loewii Deg
Cynoglossum germanicum Jacq
Ferula orientalis L
Genista germanica L
Halimione portulacoides (L) Aellen
Hammarbia paludosa (L) Kuntze
Heleocharis carniolica Koch
Hottonia palustris L
Hypericum setiferum Stef
Lathyrus pancicii (Juris) Adam
Linum pallasianum Schult
Liparis loeselii Rich
Lotus uliginosus Schkuhr
Lysimachia thyrsiflora L
Onopordon brachteatum Boiss et Heldr
Peucedanum palustre (L) Moench
Pimpinella major (L) Huds
Rubus hercynicus G Braun ex Focke
Salix rosmarinifolia L
Scabiosa cosmoides Boiss
Tetragonolobus maritimus (L) Roth
Teucrium botrys L
Veronica euxina Turrill
Vicia abbreviata Fisch ex Spreng
Viola pumila Chaix

Threatened

Aegilops dichasians (Zhuk) Humphries
Aegilops pontica (Deg) Waleff
Aesculus hippocastanum L
Aethionema arabicum (L) Andrs ex Schulz
Agropyron litorale (Host) Dum
Alchemilla bandericensis Pawl
Alchemilla mollis (Buser) Rothm
Allium montanum F W Schmidt
Alopecurus thracicus Penev et Koz
Androsace obtusifolia All
Anemone sylvestris L
Anthemis argyrophylla (Hal et S Georg) Vel
Apium nodiflorum (L) Lag
Apocynum venetum L
Arabis collina Ten
Arabis nova Vill
Artemisia pedemontana Balbis
Asplenium lepidum Presl
Astragalus cornutus Pall
Astrodaucus litoralis (Bieb) Drude
Bromus lanceolatus Roth
Bupleurum longifolium L
Campanula versicolor Andrews
Capsella thracica Vel
Caragana frutex (L) C Koch
Carex disticha Huds

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Carex ferruginea Scop
Carex pirinensis (Acht) Acht
Castanea sativa Mill
Centaurea amplifolia Boiss et Heldr
Centaurea rupestris L
Centaurium maritimum (L) Fritsch
Cerastium velenovskyi Hayek
Chamaecytisus ratisbonensis (Schaeff) Rothm
Cladium mariscus (L) R Br
Colchicum borisii Stef
Colchicum davidovii Stef
Convolvulus elegantissimus Mill
Convolvulus holosericeus Bieb
Cortusa matthioli L
Corynephorus divaricatus (Pourr) Breistr
Crassula tillaea Laster Garl
Cressa cretica L
Cynoglossum rotatum Vel
Cypripedium calceolus L
Dianthus urumoffii Stoj et Acht
Dracocephalum thymiflorum L
Dracunculus vulgaris Schott
Elyna bellardii (All) Koch
Ephedra campylopoda C A Mey
Epilobus trilobata Roem
Euphorbia allepica L
Euphorbia lucida Waldst et Kit
Euphrasia drosocalyx Freyn
Frankenia pulverulenta L
Fritillaria meleagroides Patrin
Galanthus nivalis L
Galium rubioides L
Galium stojanovii Deg
Genista pilosa L
Gentiana acaulis L
Gentiana lutea L
Gentiana punctata L
Goniolimon besserianum (Schult ex Reichenb) Kusn
Goniolimon tataricum (L) Boiss
Herminium monorchis (L) R Br
Hippocrepis unisiliquosa L
Hippophae rhamnoides L
Hornungia procumbens (L) Hayek
Inula spiraeifolia L
Inula viscosa (L) Aiton
Isolepis supina (L) R Br
Laserpitium archangelica Wulf
Lathyrus montanus Bernh
Lathyrus saxatilis (Venth) Vis
Lathyrus transsilvanicus (Spreng) Fritsch
Lens ervoides (Brign) Grande
Leucojum aestivum L
Ligularia sibirica (L) Gass
Limonium asterotrichum (Salmon) Salmon
Limonium latifolium (Sm) O Kuntze
Limonium meyeri (Boiss) O Kuntze
Matthiola odoratissima (Bieb) R Br
Medicago carstiensis Wulf
Menyanthes trifoliata L
Micromeria juliana (L) Benth ex Reichenb
Middendorfia borystenica (Schrank) Trautv
Minuartia mesogitana (Boiss) Hand Mazz
Nuphar lutea (L) Sibth et Sm
Nymphaea alba L
Onosma rhodopaea Vel
Paeonia mascula (L) Mill
Paeonia tenuifolia L
Pallenis spinosa (L) Gass
Pancratium maritimum L
Peucedanum ruthenicum Bieb
Pleurospermum austriacum (L) Hoffm
Polypodium australe Fee
Pyracantha coccinea Roem
Pyrola rotundifolia L
Quercus mestensis Bond et Gan
Quercus thracica Stef et Ned
Rhododendron ponticum L
Rubus macrophyllus Weihe et Nees
Rubus thyrsiflorus Weihe et Nees
Ruta graveolens L
Salix pentandra L
Saxifraga aizoides L
Saxifraga androsacea L
Saussurea discolor DC
Sedum magellense Ten
Sedum zollicoferi Herm et Stef
Sideritis taurica Steph ex Willd
Sisymbrium polymorphum (Murr) Roth
Sium sisarum L
Spiraea crenata L
Spiraea hypericifolia L
Spiraea salicifolia L
Syringa vana (Paller et Mitterp) Neilr
Taxus baccata L
Thalictrum foetidum L
Thelypteris palustris Schott
Trachystemon cretticum (Willd) D Don
Trifolium ligusticum Balb ex Loisel
Trifolium phleoides Pourr ex Willd
Trifolium rubens L
Trifolium spumosum L
Trifolium squarrosum L
Trigonella spicata Sibth et Sm
Tulipa aureolina Delip
Tulipa hageri Heldr
Tulipa rhodopaea Vel
Tulipa splendens Delip
Tulipa urumoffii Hayek
Turgeniopsis foeniculacea (Fenzl) Boiss
Utricularia minor L
Utricularia neglecta Lehm

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Vaccinium arctostaphylos L
Verbascum anisophyllum Murb
Verbascum boissii Stef Gat
Verbascum bugulifolium Lam
Verbascum davidoffii Murb
Verbascum dieckianum Borb et Deg
Verbascum humile Janka
Verbascum jankeanum Panc
Verbascum jordanovii Stef Gat
Verbascum juriuc Stef
Verbascum laguirus Fisch et C A Mey
Verbascum nobile Vel
Verbascum pseudonobile Stoj et Stef
Verbascum rupestre (Dav) I K Ferguson
Verbascum thracicum Vel
Verbascum urumovii Stoj et Acht
Veronica grisebachii S M Walters
Veronica spicata L subsp *velutina* D Peev
Vicia amphicarpa Dorth

Rare

Acanthus spinosus L
Acer heldreichii Orph
Achillea biebersteinii Afan
Achillea leptophylla Bieb
Achillea thracica Vel
Adiantum capillus veneris L
Adonis microcarpa DC
Adonis wolgensis Stev
Aegilops speltoides Tausch
Agropyron varnense (Vel) Hayek
Alchemilla achtarovii Pawl
Alchemilla anisiaca Wettst
Alchemilla asteroantha Rothm
Alchemilla bulgarica Rothm
Alchemilla catachnoa Rothm
Alchemilla erythropoda Juz
Alchemilla fissa Gunther et Schummel
Alchemilla gracillima Rothm
Alchemilla grossidens Buser
Alchemilla heterophylla Rothm
Alchemilla indivisa (Buser) Rothm
Alchemilla jumrukczalica Pawl
Alchemilla pawlowskii Assenov
Alchemilla pirinica Pawl
Alchemilla plicatula Gand
Alchemilla pyrenaica Dufour
Alchemilla straminea Buser
Alchemilla viridiflora Rothm
Alkanna primuliflora Griseb
Alkanna stribrnyi Vel
Allium angulosum L
Allium cupanii Rafin
Allium stojanovii I Kowatschev
Alyssum cuneifolium Ten
Alyssum pulvinare Vel
Alyssum stribrnyi Vel
Amygdalus webbii Spach
Anagallis minimus (L) Krause
Anchusa hybrida Ten
Anchusa stylosa Bieb
Andrachne telephioides L
Androsace hedraeantha Griseb
Anemone narcissiflora L
Anethum graveolens L
Angelica pancicii Vand
Anthemis auriculata Boiss
Anthemis gaudium solis Vel
Anthemis jordanovii Stoj et Acht
Anthemis macrantha Heuff
Anthemis orbelica Panc
Anthemis regis borisii Stoj et Acht
Anthemis rumelica (Vel) Stoj et Acht
Anthemis sancti johannis Stoj Steff et Turrill
Anthemis stribrnyi Vel
Anthemis virescens Vel
Aquilegia aurea Janka
Aquilegia vulgaris L
Arabis allionii DC
Arabis ferdinandi coburgii Kell et Sund
Arabis jacquinii Beck
Arabis muralis Bertol
Arctostaphylos uva ursi (L) Spreng
Arenaria pirinica Stoj
Arenaria rhodopaea Dehp
Arenaria rigida Bieb
Argusia sibirica (L) Dandy
Aristolochia rotunda L
Armeria alpina Willd
Artemisia eriantha Ten
Artemisia lerchiana Weber
Artemisia pontica L
Asperula capitata Kit ex Schultes
Asperula involucrata Wahlenb
Asperula suberosa Sibth et Sm
Asplenium cuneifolium Viv
Asteroliniion linum stellatum (L) Duby
Astragalus aitossiensis Ivanisch
Astragalus centralpinus Br Bl
Astragalus excapus L
Astragalus fraxinifolius DC
Astragalus sesameus L
Astragalus thracicus Griseb
Astragalus wilmottianus Stoj
Asyneuma kellerianum Stef
Athyrium alpestre (Hoppe) Rylands
Atropa belladonna L

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Aubrieta columnae Guss
Aubrieta gracilis Sprun ex Boiss
Aubrieta intermedia Heldr et Orph ex Boiss
Barbarea bracteosa Guss
Barbarea stricta Andrz
Bartschia alpina L
Blackstonia perfoliata Huds
Brachypodium sanctum Janka
Brassica jordanoffii O E Schultz
Buglossoides glandulosa (Vel) R Fern
Bunium ferulaceum Sibth et Sm
Bupleurum baldense Turra subsp *gussonei* (Arc) Tutin
Bupleurum flavum Fors
Bupleurum fontanesii Guss ex Caruel
Bupleurum Gerardii All
Cachrys alpina Bieb
Callitriche hamulata Kutz ex Koch
Callitriche stagnalis Scop
Calluna vulgaris (L) Salisb
Caltha cornuta Schott Nym et Kotschy
Caltha polypetala Hochst
Calystegia soldanella (L) R Br
Campanula latifolia L
Campanula pusilla Hke
Campanula transsilvanica Schur ex Andrae
Cardamine tuberosa Penzes et Vida
Carduus rhodopaeus Vel
Carduus thracicus (Vel) Hayek
Carduus uncinatus Bieb
Carex distachya Desf
Carex heleonastes Ehrh
Carex limosa L
Carex punctata Gaud
Carum graecum Boiss et Heldr
Carum multiflorum (Sibth et Sm) Boiss subsp *strictum* (Griseb) Tutin
Celtis caucasica Willd
Centaurea achtarovii Urum
Centaurea arenaria Bieb ex Willd
Centaurea atropurpurea Waldst et Kit
Centaurea dubia Suter
Centaurea gracilenta Vel
Centaurea inermis Vel
Centaurea kamciensis Kocev et Gancev
Centaurea kerneriana Janka
Centaurea mannagettae Podp
Centaurea parilica Stoj et Stef
Centaurea rumelica Boiss
Centaurium turcicum (Vel) Ronn et Fritsch
Cerastium gracile Duf
Ceratophyllum muricatum Cham
Cercis siliquastrum L
Chamaecytisus danubialis ((Vel) Rothm
Chamaecytisus frivaldszkyanus (Deg) Kuzm
Chamaecytisus kovacevii (Vel) Rothm
Chamaecytisus neicefii (Urum) Rothm
Cheilanthes persica (Bory) Mett ex Kuhn
Chondrilla urumovii Deg
Cicer montbretii Jaub et Spach
Cicuta virosa L
Circaea alpina L
Cirsium alatum (S G Gmelin) Bobrov
Cirsium bulgaricum DC
Cirsium oleraceum (L) Scop
Cistus salvifolius L
Clematis alpina (L) Mill
Cleome ornithopodioides L
Colchicum bivonae Guss
Colchicum diampolis Delip et Ceschm
Colchicum rhodopaeum I Kovatschev
Convolvulus compactus Boiss
Convolvulus lineatus L
Convolvulus suendermannii Bornm
Corispermum marschalii Stev
Corispermum nitidum Kit
Crambe tataria Sebeok
Crepis bithynica Boiss
Crepis nicaeensis Balbis
Crepis schachtii Baebcok
Crepis stojanovii Georg
Crithmum maritimum L
Crocus olivieri J Gay
Crocus tommasinianus Herb
Crucianella latifolia L
Cryptogramma crispa (L) R Br
Cyclamen coum Mill
Cystopteris regia (L) Presl
Danthoniastrum compactum (Boiss et Heldr) Holub
Daphne blagayana Freyer
Daphne cneorum L
Daphne kosanin (Stoj) Stoj
Daphne laureola L
Daphne oleoides Schreb
Daphne pontica L
Delphinium albiflorum DC
Delphinium halteratum Sibth et Sm
Delphinium peregrinum L
Dianthus carthusianorum L
Dianthus drenowskianus Rech fil
Dianthus kladovanus Degen
Dianthus nardiformis Janka
Dianthus stribrnyi Vel
Digitalis laevigata Waldst et Kit
Diphasium alpinum (L) Rothm
Diphasium complanatum (L) Rothm
Diplachne bulgarica Bornm
Draba athoa (Griseb) Boiss
Draba carinthiaca Hoppe
Draba tomentosa Clairv
Drosera rotundifolia L
Dryopteris villarii (Bell) Woyn ex Schinz et Thell

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Echinophora sibthorpiana Guss
Echium plantagineum L
Edraianthus serbicus (Kern) Petr
Elatine alsinastrum L
Elatine triandra Schkuhr
Empetrum nigrum L
Epimedium pubigerum (DC) Morren et Decne
Erianthus bulgaricus (Stef) Stef
Erica arborea L
Erigeron vichrensis Pawl
Erodium absinthoides Willd subsp *elatum* (Form) Davis et Robertis
Erodium hoefftianum G A Mey
Eryngium creticum Lam
Eryngium maritimum L
Eryngium palmatum Panc et Vis
Erysimum comatum Panc
Erysimum cheiranthoides L
Euphorbia paralias L
Euphorbia peplis L
Ferula heuffelii Griseb
Festuca callieri (Hack) Markgr
Festuca pirinica Horvat ex Markgr Dannenb
Festuca rupicola Heuff
Festuca vaginata Waldst et Kit ex Willd
Festuca xanthina Roem et Schult
Fibigia clypeata (L) Medic
Ficus carica L
Fritillaria drenovskyi Deg et Stoj
Fritillaria graeca Boiss et Sprun
Fritillaria orientalis Adams (= Tenella)
Fritillaria pontica Wahl
Fritillaria stribrnyi Vel
Fumaria thuretii Boiss
Galium boreale L
Galium bulgaricum Vel
Galium procurrens Ehrend
Galium rhodopaeum Vel
Gaudinia fragilis (L) Beauv
Gentiana frigida Haenke
Gentianella amarella (l) Born
Gentianella crispata (Vis) Holub
Gentianella lingadinensis (Wettst) Holub
Gentianella praecox (A et J Kern) Dostal
Geranium bohemicum L
Geranium caeruleatum Schur
Geranium macrostyllum Boiss
Geranium tuberosum L
Geum bulgaricum Panc
Geum rhodopaeum Stoj et Stef
Globularia trichosantha Fisch et C A Mey
Glycyrrhiza glabra L
Goniolimon dalmaticum (C Presl) Reichenb fil
Goodiera repens (L) R Br
Groenlandia densa (L) Fourr
Gypsophila tekirae Stef
Gypsophila trichotoma Wend
Haberlea rhodopensis Friv
Halimione pedunculata (L) Aellen
Haplophyllum balcanicum Vand
Haplophyllum thesioides Pall
Hedysarum grandiflorum Pall
Hedysarum tauricum Pall ex Willd
Heptaptera triquetra (Vent) Tutin
Heracleum angustisectum (Stoj et Acht) D Peev
Hesperis macedonica Adam
Hesperis theophrasti Borb
Hieracium stefanoffii Zahn
Hippomarathrum cristatum (DC) Boiss
Hippuris vulgaris L
Huetia cynapioides (Guss) Ball
Hymenocarpus circinatus (L) Savi
Hypecoum ponticum Vel
Hypericum androsaemum L
Hypericum boissieri Petr
Hypericum calycinum L
Hypochaeris cretensis (L) Ch et B
Ilex aquifolium L
Isoetes setaceae Lam
Juncus acutiflorus Ehrh
Juncus ranarius Song et Perr
Juncus triglumis L
Juniperus sabina L
Jurinea ledebourii Bunge
Jurinea tzar ferdinandii Dav
Kentrianthus kellereri Stoj et Stef
Kernera saxatilis (L) Reichenb
Koeleria brevis Stev
Lamium bifidum Cyr
Laserpitium krapfii Grantz
Laserpitium siler L
Lathrea rhodopaea Dingler
Lathyrus grandiflorus Sibth et Sm
Lathyrus palustris L
Legouzia pentagonia Thell
Lemna gibba L
*Leontodon rilo*ensis Hayek
Leontopodium alpinum Gass
Lepidotis inundata (L) C Born
Lepidotrichum uechtritzianum (Bornm) Vel
Ligularia glauca (L) O Hoffm
Lilium albanicum Griseb
Lilium jankae Kern
Lilium rhodopaeum Delip
Limodorum abortivum (L) Sw
Limonium gmelinii (Willd) O Kuntae
Limonium vulgare Mill
Lindernia procumbens (Krock) Philcox
Linum elegans Sprun ex Boiss
Linum extraaxillare Kit
Linum tauricum Willd subsp *bulgaricum* (Podp) Petrova

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Linum uninerve (Roch) Borb
Lithospermum sibthorpianum Griseb
Lloydia serotina (L) Reichenb
Logfia gallica (L) Cosson
Lotonomis genistoides (Fenzl) Benth
Ludwigia palustris (L) Elliot
Lupinus albus L
Luzula deflexa Koz
Malcolmia angulifolia Boiss et Orph
Malcolmia serbica Panc
Marsia nana (DC) Batt
Marrubium frivaldskyanum Boiss
Marsilea quadrifolia L
Medicago constricta Dur
Medicago coronata (L) Bart
Medicago litoralis Rhode ex Loisel
Medicago rhodopaea Vel
Melampyrum bihariense A Kern
Melica altissima L
Merendera rhodopaea Vel
Merendera sobolifera C A Mey
Mespilus germanica L
Meum athamanticum Jacqu
Micromeria frivaldskyana (Deg) Vel
Micropyrum tenellum (L) Link
Minuartia diljanae P Pan
Minuartia rhodopaea (Deg) Koz et Kuzm
Minuartia mediterranea (Lebed) K Maey
Minuartia rumelica P Pan
Minuartia saxifraga (Friv) Graebn
Minuartia stojanovii (Kitan) Koz et Kuzm
Moehringia grisebachii Janka
Moehringia jankae Griseb
Morina persica L
Nepeta parviflora Bieb
Nepeta ucrainica L
Nigella orientalis L
Nonnea obtusifolia (Willd) DC
Nymphoides peltata (S G Gmel) O Kuntze
Oenanthe angulosa Griseb
Oenanthe lachenalii Gmel
Oenanthe millefolia Janka
Oenanthe pimpinelloides L
Oenanthe tenuifolia Boiss et Orph
Ononis adenotricha Boiss
Ononis repens L
Onosma aucheranum DC
Opopanax chironium (L) Koch
Orchis globosa L
Orchis militaris L
Orchis papilionacea L
Orchis provincialis Balb
Orobanche serbica Beck et Petr
Otanthus maritimus (L) Hoffm et Link
Oxytropis urumovii Jav
Papaver degenii (Urum et Jav) Kuzm
Parapholis incurva (L) C E Hubb
Pastinaca umbrosa Stev ex DC
Pedicularis oederi Vahl
Pedicularis palustris L
Peplis alternifolia Bieb
Petasites kablickianus Tausch ex Berchtold
Petkovia orphanidea (Boiss) Stef
Petrorhagia alpina (Habl) Ball et Heywood
Petrorhagia tessala (Boiss) Ball et Heywood
Petrosimonia brachiata (Pall) Bunge
Peucedanum olygophyllum (Griseb) Vand
Peucedanum vittijugum Boiss
Phalaris tuberosa L
Phyteuma confusum Kern
Plantago bellardii All
Plantago cornuti Gouan
Plantago tenuiflora Waldst et Kit
Platanus orientalis L
Poa autosensis Koz et Stoeva
Poa pirinica Stuj et Acht
Polycnemum heuffelii Lang
Polygala acarnanica (Chodat) Koz et Petrova
Polygala alpestris Reichenb
Polygala amarella Grantz
Polygala carniolica Kern
Polygala hospita Heuff
Polygala monspeliaca L
Polygala rhodopaea (Vel) Janch
Polygala supina Schreb
Potamogeton mucronatus Schrad ex Sond
Potamogeton praelongus Wulf
Potamogeton trichoides Cham et Schlecht
Potentilla apenina Ten
Potentilla chrysantha Trevir
Potentilla emili popii Nyarady
Potentilla fruticosa L
Potentilla montenegrina Pant
Potentilla nicici Adam
Potentilla palustris (L) Scop
Prangos ferulacea (L) Lindl
Primula deorum Vel
Primula frondosa Janka
Primula halleri G F Gmel
Primula vulgaris Huds subsp *sibthorpii* (Hoffm) Smith et Forest
Pulmonaria mollissima Kern
Pulsatilla halleri (All) Willd
Pulsatilla pratensis (L) Mill
Pulsatilla slavjankae (Zimm) D Jord et Koz
Pulsatilla vernalis (L) Mill
Pyrola media Swartz
Pyrus bulgarica Khutath et Sachok
Quercus coccifera L
Quercus hartwissiana Stev
Ramonda serbica Panc
Ranunculus sphaerospermus Boiss et Blanche

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Ranunculus stojanovii Delip
Reichardia picroides (L) Roth
Rhamnus alpinus L
Rheum rhaponticum L
Rhinanthus javorkae Soo
Rhododendron myrtifolium Schott et Kotschy
Rhynchocorys elephas (L) Griseb
Ribes nigrum L
Rindera umbellata (Waldst et Kit) Bge
Romulea bulbocodium (L) Seb et Mauri
Rubus oblongoobovatus Mark
Rubus vepallidus Sudre
Saccharum ravennae (L) Murrey
Sagina maritima G Don
Salix hastata L
Salix retusa L
Salvia forskaohlei L
Salvia scabiosifolia Lam
Salvia verbenaca L
Samolus valerandi L
Saponaria stranjensis D Jord
Satureja rumelica Vel
Saxifraga ferdinandi coburgi Kell et Sund
Saxifraga marginata Sternb
Saxifraga mollis Sm
Saxifraga retusa Gouan
Saxifraga sprunerii Boiss
Saxifraga stribrnyi (Vel) Podp
Scabiosa atropurpurea L
Scabiosa rhodopensis Stoj et Stef
Scandix australis L
Schoenus ferrugineus L
Scilla bithnica Boiss
Scorpiurus subvillosus L
Scorzonera parviflora Jacq
Scrophularia laciniata Waldst et Kit
Secale rhodopaeum Delip
Secale sylvestre Host
Sedum actinense Tineo
Sedum kostovii Stef
Sedum stefco Stef
Sedum tchernokolevii Stef
Sempervivum ciliosum Graibn
Sempervivum velenovskyi Ceschm
Senecio doria L
Senecio paludosus L
Senecio pancicii Deg
Senecio umbrosus Waldst et Kit
Serapias vomeracea (Burm) Briq
Serratula bulgarica Acht et Stoj
Seseli bulgaricum Ball
Seseli degenii Urum
Seseli rhodopaeum Vel
Sesleria alba Sibth et Sm
Sibbaldia procumbens L
Sideritis lanata L
Sideritis scardica Griseb
Silaum silaus (L) Schinz et Thell
Silene alpina (Lam) Thomas
Silene caliacrae D Jord et P Panc
Silene chlorantha (Willd) Ehrh
Silene cretica L
Silene euxina Rupr
Silene graeca Boiss et Sprun
Silene hawfelii Soo
Silene nutans L
Silene pernica Hayek
Silene velcevii D Jord et P Pan
Silene velenovskyana D Jord et P Pan
Sison amomum L
Smyrnium rotundifolium Mill
Soldanella carpatica Vierch
Sonchus palustris L
Sparganium affine Schnizl
Sparganium minimum Wallr
Spiranthes autumnalis Rich
Stachys arenariaeformis Rouy
Stachys balcanica Ball
Stachys bulgarica (Deg et Neic) Hayek
Stachys maritima Gouan
Stachys scardica (Griseb) Hayek
Stachys serbica Panc
Stachys thracica Dav
Stefanoffia daucoides (Boiss) H Wolff
Stipa lessingiana Trin et Rupr
Stratiotes aloides L
Streptopus amplexifolius (L) DC
Subularia aquatica L
Sueda heterophylla (Kar et Kit) Bunge ex Boiss
Symphyandra wanneri (Rochel) Heuff
Symphytum tauricum Willd
Taraxacum bessarabicum (Horn) Hand -Mazz
Taraxacum bithynicum DC
Taraxacum hoppeanum Griseb
Taraxacum megalorrhizon (Forsk) Hand Mazz
Teucrium lamiolium D'Urv
Theligonum cynocrambe L
Thesium linophyllon L
Thymus nikolovii (Deg et Urum) Stoj et Stef
Thymus pernicus (Vel) Stoj Stef et Kit
Tilia rubra DC
Trachelium jacuinii (Sieber) Boiss
Thrachystemon orientalis (L) D Don
Tragopogon balcanicus Vel
Tragopogon stribrnyi Hayek
Trapa natans L
Trifolium constantinopolitanum Ser
Trifolium globosum L
Trifolium physodes Stev ex Bieb
Trifolium spumosum L
Triglochin maritima L

Appendix 1 Species of Extinct, Threatened, and Rare Higher Plants in the Bulgarian Flora (continued)

Trinia glauca (L) Dumort subsp *carniolica* (Kern) H Wolff
Trinia ramosissima (Fisch ex Trev)Koch subsp *longipes* (Borb) Soo
Trollius europaeus L
Turritis pseudoturritis (Boiss et Heldr) Vel
Thypha shuttleworthii Koch et Sond
Urospermum picroides (L) F W Smidt
Utricularia vulgaris L
Valeriana dioscoridis Sibth et Sm
Valeriana montana L
Valeriana simplicifolia (Reichenb) Kabath
Valerianella bulgarica Vel
Valerianella eriocarpa Desv
Verbascum adrianopolitanum Podp
Verbascum decorum Vel
Verbascum eriophorum Godr
Verbascum purpureum (Janka) Hub Mor
Verbascum roripifolium (Hal) I K Ferguson
Verbena supina L
Veronica austriaca L subsp *neicevii* (Deg) D Peev
Veronica austriaca L subsp *tenuissima* Deg et Dren
Veronica chamaedrys L subsp *krumovii* D Peev
Veronica kellerera Deg et Urum
Veronica rhodopaea (Vel) Deg ex Stoj et Stef
Veronica turrilliana Stoj et Stef
Vicia barbazitae Ten et Guss
Vicia dumetorum L
Vicia incisa Bieb
Vicia pisiformis L
Vicia truncatula Fisch ex Bieb
Viola balcanica Delip
Viola delphynantha Boiss
Viola gracilis Sibth et Sm
Viola grisebachiana Vis
Viola orbelica Panc
Viola orphanidis Boiss
Viola palustris L
Viola perinensis Becker
Viola pyrenaica Ramond ex DC
Viola rhodopeia Becker
Viola speciosa Pant
Viola stojanowii Becker
Vulpia bromoides (L) S F Gray
Vulpia unilateralis (L) Stace
Wolffia arrhiza (L) Hork ex Wimmer

Appendix 2 Pteridophyte Species in the *Red Data Book*

Adiantum capillus veneris L
Asplenium cuneifolium Viv
Asplenium lepidum C Presl
Athyrium distentifolium Opiz
Cheilanthes persica (Bory) Mett et Kuhn
Cryptogramma crispa (L) R Br
Cystopteris alpina (Lam) Desv
Diphasiastrum alpinum (L) Holub
Diphasiastrum complanatum (L) Holub
Dryopteris pallida (Bory) Maire et Petitm
Isoetes lacustris L
Lycopodiella inundata (L) Holub
Marsilea quadrifolia L
Osmunda regalis L
Polypodium cambricum L
Thelypteris palustris Schott

Appendix 3 Pteridophyte Species Protected By Law

Adiantum capillus veneris L
Asplenium cuneifolium Viv
Diphasiastrum complanatum (L) Holub
Lycopodiella inundata (L) Holub
Marsilea quadrifolia L
Osmunda regalis L
Polypodium cambricum L

Appendix 4 Species of Endemic, Relict, Rare, and Threatened Plants in the Strandzha Mountain Region of Southeast Bulgaria

Local Endemics

Anthemis jordanovii Stoj et Acht
Saponaria stranjensis D Jord
Veronica turrilliana Stoj et Stef

Relicts (Tertiary)

Acer campestre L
Acer tataricum L
Alnus glutinosa (L) Gaertn
Carpinus betulus L
Carpinus orientalis Mill
Celtis australis L
Celtis caucasica Willd
Clematis vitalba L
Corylus avelana L
Cotinus coggygria Scop
Daphne pontica L
Fagus orientalis Lipsky
Fraxinus ornus L
Hedera helix L
Ilex colchica
Lonicera etrusca Santi
Mespilus germanica L
Phyllirea media L
Populus tremula L
Prunus laurocerasus L
Pyracantha coccinea Roem
Quercus cerris L
Quercus daleschampii Ten
Quercus hartwissiana Stev
Rhododendron ponticum L
Salix alba L
Salix caprea L
Smilax excelsa L
Taxus baccata L
Trapa natans L
Ulmus laevis Pall
Vaccinium arctostaphyllos L
Viscum album L

Balkan endemics

Anchusa thessala Boiss et Sprun
Asphodeline liburnica Rchb
Centaurea amplifolia Boiss et Heldr
Comandra elegans Rchb
Crocus biflorus Mill
Genista rumelica Vel
Lepidotrichum uechtritzianum (Bornm) Vel
Oenanthe tenuifolia Boiss et Orph
Onobrychis alba (W K) Desv
Onobrychis calcarea Vandas
Orobanche esulae Panc
Silene thymifolia Sibth et Sm
Trifolium dalmaticum Vis
Verbascum adrianopolitanum Podp
Veronica turrilliana Stoj et Stef

Endangered

Apocynum venetum L
Astragalus litoralis (M B) Drude
Euphorbia lucida W K
Goniolimon besserianum (Schult ex Rchb)Kuzn
Goniolimon tataricum (L) Boiss
Leucojum aestivum L
Nuphar lutea (L) S et S
Nymphaea alba L
Paeonia tenuifolia L
Pancratium maritimum L
Pyracantha coccinea Roem
Rhododendron ponticum L
Trachystemon orientalis (L) D Don
Tulipa thracica Dav

Threatened by extinction

Androchne telephioides L
Argusia sibirica (L) Dandy
Calystegia soldanella (L) R Br
Centaurea arenaria Bieb ex Willd
Cicer montbretii Jaub et Spach
Hedysarum tauricum Pall ex Willd
Heptaptera triquetra (Vent) Tutin
Hypecoum ponticum Vel
Lemna gibba L
Logfia gallica (L) Cosson et Germ
Medicago litoralis Rhode ex Loisel

Appendix 5 Species of Extinct, Threatened, and Rare Plants of the Rila Mountains of Southwest Bulgaria

Extinct

Anthemis macrantha Heuff [1*]
Carex rupestris Bell ex All [*]
Hypecoum ponticum Vel [1*]
Lathraea rhodopaea Dingler [*1]
Limodorum abortivum (L) Sw [1*]
Orchis militaris L [*1]
Pedicularis palustris L [1*]
Pleurospermum austriacum (L) Hoffm [*]
Primula halleri G F Gmel [*1]
Rubus hercynicus G Braun ex Focke[*]
Silene velenovskyana D Jord et P Panov [*1]
Vicia abbreviata Fisch ex Spreng subsp *orbelica* (Stoj et Stef) Kuzm [*]
Vicia truncatula Fish ex Bieb [*]

[*] extinct from Bulgarian flora totally
[1*] extinct only from Rila Flora

Endangered

Alyssum pulvinare Vel
Anemone narcissiflora L
Anemone sylvestris L
Anthemis orbelica Panc
Anthemis sancti johannis Stoj Steff et Turrill
Aquilegia aurea Janka
Aquilegia vulgaris L
Arabis allionii DC
Athyrium alpestre (Hoppe) Rylands
Aubrieta gracilis Sprun ex Boiss
Artemisia eriantha Ten
Barbarea bracteosa Guss
Centaurea kerneriana Janka
Cicerbita plumieri (L) Kirschl
Clematis alpina (L) Mill
Cryptogramma crispa (L) R Br
Cystopteris regia (L) Presl
Diphasium alpinum (L) Rothm
Draba carinthiaca Hoppe
Drosera rotundifolia L
Galanthus nivalis l
Gentiana lutea L
Gentiana punctata L
Geum bulgaricum Panc
Juncus triglumis L
Juniperus sabina L
Lepidotis inundata (L) Born
Leontodon rilaensis Hayek
Ligularia glauca (L) O Hoffm
Lilium jankae Kern
Lloydia serotina (L) Reichenb
Lolium remotum Sehr
Luzula deflexa Koz
Menyanthes trifoliata L
Minuartia saxifraga (Friv) Graebn
Myosotis orbelica (Vel) N Andr et D Peev
Montia sibirica (L) Howell
Potamogeton praelongus Wulf
Potentilla montenegrina Pant
Pulsatilla vernalis (L) Mill
Quercus mestensis Bod et Ganc
Rheum rhaponticum L
Rubus melanoxylon Mueller et Wirtg
Rubus pectinatus Sudre et Gravet
Salix hastata L
Salix retusa L
Saussurea discolor (Willd) DC
Saxifraga androsacea L
Saxifraga carpatica Reichenb
Saxifraga retusa Gouan
Sedum kostovii Stef
Sedum stefco Stef
Sempervivum ciliosum Graibn
Sempervivum velenovskyi Ceschm
Sorbus aucuparia L subsp *fenenkiana* Georg et Stoj
Sparganium affine Schnizl
Spiranthes autumnalis Rich
Streptopus amplexifolius (L) DC
Subularia aquatica L
Taraxacum bithynicum DC
Taxus baccata L
Thlaspi praecox Wulf subsp *cuneifolium* (Griseb) Clapham
Tragopogon balcanicus Vel
Trollius europaeus L
Turritis pseudoturritis (Boiss et Heldr) Vel
Verbascum jankaeanum Panc
Veronica fruticosa L
Vicia amphicarpa Dort

Rare

Aconitum firmum Reichenb
Acer heldreichii Orph
Alchemilla catachnoa Rothm
Alchemilla erythropoda Juz
Alchemilla fissa Gunter et Schummel
Alchemilla garcensis Pawl
Alchemilla gracillima Rothm
Alchemilla pawlowskii Assenov

Appendix 5 Species of Extinct, Threatened, and Rare Plants of the Rila Mountains of Southwest Bulgaria (continued)

Alchemilla pyrenaica Dufour
Alchemilla reniformis Busser
Anagallis minimus (L) Krause
Androsace hedraeanthea Griseb
Angelica pancicii Vand
Arctium nemorosum Lej
Arctostaphyllos uva ursi (L) Spreng
Armeria alpina Willd
Astragalus australis (L) Lam
Asyneuma trichocalycinum (Ten) K Maly
Atropa belladonna L
Bartschia alpina L
Bupleurum Gerardii All
Callitriche hamulata Kutz ex Koch
Carum multiflorum (Sibth et Sm) Boiss subsp *strictum* (Griseb) Tutin
Chaerophyllum bulbosum L
Cheilanthes marantheae (L) Domin
Coralliorrhiza trifida Chatel
Dryopteris dilatata (Hoffm) A Gray
Empetrum nigrum L
Euclidium syriacum R Br
Fritillaria scorpioidea Vel
Galium boreale L
Gentiana frigida Haenke
Gentianella engadinensis (Wettst) Holub
Geranium bohemicum L
Geranium reflexum L
Geum reptans L
Herniaria glabra L
Herniaria nigrimontium FR Hermann
Hieracium sericophylum Neic et Zahn
Hieracium trebevicianum K Maly
Lathyrus grandiflorus Sibth et Sm
Listera cordata (L) R Br
Minuartia recurva (All)Schinz et Thell subsp *orbelica* (Vel) Graebn
Oxytropis campestris (L) DC
Pedicularis hoermanniana K Maly
Pedicularis oederi Vahl
Peucedanum olygophyllum (Griseb) Vand
Potentilla regis boissii Stoj
Primula deorum Vel
Primula farinosa L subsp *exigua* Vel
Pyrola media Swartz
Rhododendron myrtifolium Schott et Kotschy
Rhodiola rosea L
Rosa mollis Sm
Saxifraga adscendens L subsp *discolor* (Vel) Kuzm
Senecio nemorensis L subsp *bulgaricus* (Vel) Koz et N Andr
Senecio pancicii Deg
Seseli rigidum W K subsp *puberula* D Peev
Sibbaldia procumbens L
Silene heuffelii Soo
Silene pusilla W K
Soldanella carpatica Vierch
Stellaria palustris Retz
Symphyandra wanneri (Rochel) Heuff
Swertia perennis L
Thymus heterotrichus Griseb
Trifolium bulgaricum Schreb subsp badium
Trifolium nigrescens Viv subsp nigrescens
Utricularia vulgaris L
Valeriana montana L
Veronica kellereri Deg et Urum
Veronica rhodopaea (Vel) Deg ex Stoj et Stef
Vicia dumetorum L
Vinca major L subsp *balcanica* (Penzes) Koz et Petr
Viola orbelica Panc
Viola rhodopeia Becker

Appendix 6 Species of Endangered and Rare Plants in the Pirin Mountains of Southwest Bulgaria

Endangered

Alchemilla bandericensis Pawl
Anemone sylvestris L
Brassica jordanovii O E Schultz
Carex ferruginea Scop
Carex pirinensis (Acht) Acht
Castanea sativa Mill
Elyna bellardii (All) Koch
Euphrasia drosocalyx Freyn
Galanthus nivalis L
Galium stojanovii Deg
Gentiana lutea L
Gentiana punctata L
Goniolimon tataricum (L) Boiss
Laserpitium archangelica Wulf
Ligularia sibirica (L) Cass
Menyanthes trifoliata L
Taxus baccata L
Trigonella spicata Sibth et Sm
Utricularia minor L
Verbascum davidoffii Murb

Appendix 6 Species of Endangered and Rare Plants in the Pirin Mountains fo Southwest Bulgaria (continued)

Rare

Alchemilla bulgarica Rothm
Alchemilla pirinica Pawl
Alkanna stribrnyi Vel
Anemone narcissiflora L
Aquilegia aurea Janka
Arabis allionii DC
Arabis ferdinandi coburgii Kell et Sund
Arabis jaquinii Beck
Arabis muralis Bertol
Arctostaphyllos uva ursi (L) Spreng
Arenaria pirinica Stoj
Aristolochia rotunda L
Armeria alpina Willd
Artemisia eriantha Ten
Asperula suberosa Sibth et Sm
Astragalus fraxinifolius DC
Astragalus sesameus L
Asyneuma kellereianum Stef
Aubrieta columnae Guss
Aubrieta gracilis Sprun ex Boiss
Barbarea bracteosa Guss
Bartschia alpina L
Brassica jordanoffii O E Schultz
Callitriche hamulata Kutz ex Koch
Campanula latifolia L
Campanula transsilvanica Schur ex Andrae
Carum graecum Boiss et Heldr
Centaurea achtarovii Urum
Cryptogramma crispa (L) R Br
Daphne cneorum L
Daphne kosanini (Stoj) Stoj
Daphne oleoides Schreb
Diphasium alpinum (L) Rothm
Draba carinthiaca Hoppe
Drosera rotundifolia L
Dryopteris villarii (Bell) Woyn ex Schinz et Thell
Empetrum nigrum L
Erigeron vichrensis Pawl
Festuca pirinica Horvat ex Markgr -Dannenb
Fritillaria drenovskyi Deg et Stoj
Fritillaria orientalis Adams (= Tenella)
Gentiana frigida Haenke
Gentianella engadinensis (Wettst) Holub
Geranium macrostyllum Boiss
Heracleum angustisectum (Stoj et Acht) D Peev
Hieracium stefanoffii Zahn
Isoetes setaceae Lam
Kentranthus kellereri Stoj et Stef
Kernera saxatilis (L) Reichenb
Leontodon rilocnsis Hayek
Leontopodium alpinum Gass
Lilium jankae Kern
Linum elegans Sprun ex Boiss
Medicago constricta Dur
Minuartia rhodopaea (Deg) Koz et Kuzm
Minuartia saxifraga (Friv) Graebn
Minuartia stojanovii (Kitan) Koz et Kuzm
Ononis adenotricha Boiss
Oxytropis urumovii Jav
Papaver degenii (Urum et Jav) Kuzm
Petasites kablicktianus Tausch ex Berchtold
Petkovia orphanidea (Boiss) Stef
Petrorhagia alpina (Habl) Ball et Heywood
Petrorhagia tessala (Boiss) Ball et Heywood
Poa pirinica Stoj et Acht
Polygala amarella Grantz
Polygala monspeliaca L
Polygala rhodopaea (Vel) Janch
Potentilla apenina Ten
Primula halleri G F Gmel
Pulmonaria mollissima Kern
Pyrola media Swartz
Rhamnus alpinus L
Rhinanthus javorkae Soo
Rhynchocorys elephas (L) Griseb
Saxifraga ferdinandii coburgi Kell et Sund
Saxifraga sprunerii Boiss
Saxifraga stribrnyi (Vel) Podp
Scrophularia laciniata Waldst et Kit
Sedum kostovii Stef
Sempervivum ciliosum Graibn
Senecio pancicii Deg
Sibbaldia procumbens L
Sideritis scardica Griseb
Silene velenovskyana D Jord et P Pan
Subularia aquatica L
Taraxacum bithynicum DC
Thymus pernicus (Vel) Stoj Stef et Kit
Tragopogon balcanicus Vel
Trollius europaeus L
Utricularia vulgaris L
Veronica austriaca L subsp *tenuissima* Deg et Dren
Veronica kellereri Deg et Urum
Viola grisebachiana Vis
Viola orbelica Panc
Viola pyrenaica Ramond ex DC

Appendix 7 Species of Plants Rich in Ethereal Oils

Acorus calamus L
Anethum graveolens L
Angelica sylvestris L
Apium graveolens L
Carum carvi L
Chamomilla recutita (L) Rausch
Coriandrum sativum L
Foeniculum vulgare Mill
Geranium macrorrhizum L
Hyssopus officinalis L
Melissa officinalis L
Origanum vulgare L ssp *vulgare*
Origanum vulgare L ssp *hirtum* (Link) Jetswaart
Salvia officinalis L
Salvia sclarea L
Satureja montana L
Thymus serpillum L

Appendix 8 Species of Food Plants

Castanea sativa Mill
Chenopodium bonus henricus L
Cornus mas L
Corylus avellana L
Daucus carota L
Fragaria vesca L
Heracleum sibiricum L
Humulus lupulus L
Mentha spicata L ssp *spicata*
Mespilus germanica L
Prunus spinosa L
Pyrus communis L
Raphanus raphanistrum L
Ribes nigrum L
Rosa canina L
Rubus caesius L
Rubus idaeus L
Rumex acetosa L
Sinapis arvensis L
Sorbus aria Crantz
Sorbus aucuparia L
Sorbus domestica L
Urtica dioica L
Vaccinium myrtillus L
Vaccinium vitis idaea L

Appendix 9 Species of Melliferous Plants

Acer campestre L
Aesculus hyppocastanum L
Althaea officinalis L
Anchusa officinalis L
Anethum graveolens L
Angelica sylvestris L*Anthylis vulneraria* L
Arctium lappa L
Berberis vulgaris L
Berteroa incana (L) DC
Brassica nigra (L) Koch
Cannabis sativa L
Capsella bursa pastoris (L) Medic
Carduus acanthoides L
Carduus nutans L
Carlina acanthifolia All
Cercis siliquastrum L
Cichorium intybus L
Cirsium arvense (L) Scop
Clematis vitalba L
Clinopodium vulgare L
Crataegus monogyna Jacq
Daucus carota L
Dipsacus laciniatus L
Echium vulgare L
Foeniculum vulgare Mill
Genista tinctoria L
Geranium macrorrhizum L
Hedera helix L
Lamium purpureum L
Lathyrus pratensis L
Lathyrus tuberosus L
Leonurus cardiaca L
Ligustrum vulgare L
Lotus corniculatus L
Melilotus officinalis (L) Pall
Melilotus albus Med
Melissa officinalis L
Mentha spicata L ssp *spicata*
Mespilus germanica L
Nepeta cataria L
Ononis spinosa L
Ononis arvensis L
Onopordon acanthium L
Origanum vulgare L ssp *vulgare*
Paeonia peregrina Mill
Paliurus spina christi Mill
Papaver rhoeas L
Raphanus raphanistrum L
Rubus caesius L
Rubus idaeus L
Salvia officinalis L
Salvia pratensis L

Appendix 9 Species of Melliferous Plants (continued)

Salvia sclarea L
Sambucus ebulus L
Sambucus nigra L
Satureja montana L
Sorbus aucuparia L
Sorbus domestica L
Stellaria media L
Syringa vulgaris L
Teucrium chamaedrys L
Tilia cordata Mill
Tilia platyphyllos Scop
Tilia tomentosa Moench
Trifolium alpestre L
Trifolium hybridum L
Trifolium patens Schreb
Trifolium repens L
Ulmus glabra Huds
Ulmus laevis Pall
Ulmus minor Mill
Viburnum lantana L
Viburnum opulus L
Vicia cracca L
Vinca minor L
Viola odorata L
Viola tricolor L
Viscum album L

Appendix 10 Species of Medicinal Plants

Achillea millefolium L
Achillea clypeolata S et S
Acorus calamus L
Adonis vernalis L
Aesculus hippocastanum L
Agrimonia eupatoria L
Allium ursinum L
Alnus glutinosa Gaertn
Althaea officinalis L
Anagalis arvensis L
Anchusa officinalis L
Anethum graveolens L
Angelica sylvestris L
Apium graveolens L
Arctium lappa L
Arctostaphylos uva ursi (L) Spreng
Aristolochia clematitis L
Artemisia absinthium L
Artemisia santonicum L
Artemisia alba Turra
Arum maculatum L
Asarum europeum L
Asplenium trichomanes L
Astragalus glycyphyllos L
Atropa belladonna L
Berberis vulgaris L
Betonica officinalis L
Betula pendula Roth
Bistorta major Gray
Brassica nigra (L) Koch
Bryonia alba L
Cannabis sativa L
Capsella bursa pastoris (L) Med
Carduus acanthoides L
Carlina acanthifolia All
Carum carvi L
Castanea sativa Mill
Centaurium erythraea Rafn
Centaurea cyanus L
Chamomilla recutita (L) Rausch
Chelidonium majus L
Chenopodium bonus henricus L
Cichorium intybus L
Clematis vitalba L
Clinopodium vulgare L
Cnicus benedictus L
Colchicum automnale L
Consolida regalis Gray
Convallaria majalis L
Coriandrum sativum L
Cornus mas L
Corylus avellana L
Cotinus coggygria Scop
Crataegus monogyna Jacq
Cynodon dactylon (L) Pers
Datura stramonium L
Dictamnus albus L
Digitalis lanata Ehrh
Dryopteris filix mas (L) Schott
Ecbalium elaterium (L) A Rich
Elymus repens (L) Gould
Equisetum arvense L
Eryngium campestre L
Euphrasia officinalis L
Filipendula vulgaris Moench
Foeniculum vulgare Mill
Fragaria vesca L
Frangula alnus Mill
Fraxinus excelsior L
Fraxinus ornus L
Fumaria officinalis L
Galega officinalis L
Galium aparine L
Galium odoratum (L) Scop
Galium verum L
Genista tinctoria L
Gentiana asclepiadea L
Gentiana cruciata L
Geranium macrorrhizum L
Geranium sanguineum L

Appendix 10 Species of Medicinal Plants (continued)

Geum urbanum L
Glaucium flavum Grantz
Glycyrrhiza glabra L
Gypsophila paniculata L
Hedera helix L
Helleborus odorus W et K
Helichrysum arenarium (L) Moench
Heracleum sibiricum L
Herniaria glabra L
Herniaria hirsuta L
Hieracium pilosella L
Humulus lupulus L
Hypericum perforatum L
Hyssopus officinalis L
Inula helenium L
Juniperus communis L
Juniperus oxycedrus L
Leonurus cardiaca L
Leucojum aestivum L
Linaria vulgaris Mill
Lithospermum officinale L
Malva sylvestris L
Marrubium vulgare L
Melilotus officinalis (L) Pall
Melissa officinalis L
Mentha pulegium L
Menyanthes trifoliata L
Nasturcium officinalis Br
Ononis spinosa L
Ononis arvensis L
Onopordon acanthium L
Orchis maculata L
Origanum vulgare L ssp *vulgare*
Origanum vulgare L ssp *hirtum* (Link) Jetswaart
Paeonia peregrina Mill
Paliurus spina christi Mill
Papaver rhoeas L
Petasites hybridus (L) Gaertn
Persicaria hydropiper (L) Epach
Peucedanum officinale L
Phyllitis scolopendrium (L) Newm
Physalis alkekengi L
Pimpinella saxifraga L
Pinus sylvestris L
Plantago lanceolata L
Plantago major L
Polygonum aviculare L
Polypodium vulgare L
Potentilla erecta (L) Rausch
Potentilla reptans L
Primula veris L
Prunus spinosa L
Pulmonaria officinalis L
Quercus cerris L
Quercus pedunculiflora C Koch
Quercus robur L
Rhamnus cathartica L
Rhodiola rosea L
Ribes nigrum L
Rosa canina L
Rubia tinctorum L
Rubus caesius L
Rubus idaeus L
Rumex alpinus L
Ruscus aculeatus L
Ruta graveolens L
Salix alba L
Salix purpurea L
Salvia officinalis L
Sambucus ebulus L
Sambucus nigra L
Saponaria officinalis L
Satureja montana L
Sedum acre L
Sideritis scardica Grsb
Silybum marianum (L) Gaertn
Sinapis arvensis L
Solanum dulcamara L
Solidago virga aurea L
Sorbus aucuparia L
Sorbus domestica L
Stellaria media L
Symphytum officinale L
Syringa vulgaris L
Tamus communis L
Tanacetum vulgare L
Taraxacum officinale Web
Teucrium chamaedrys L
Teucrium polium L
Thalictrum minus L
Thymus serpillum L
Tilia cordata Mill
Tilia platyphyllos Scop
Tilia tomentosa Moench
Trigonella coerulea (L) Ser
Tussilago farfara L
Urtica dioica L
Urtica urens L
Vaccinium myrtillus L
Vaccinium vitis idea L
Valeriana officinalis L
Veratrum lobelianum Bernh
Verbascum nobile Vel
Verbascum phlomoides L
Verbascum thapsiforme Scrod
Verbena officinalis L
Veronica officinalis L
Vinca minor L
Viola odorata L
Viola tricolor L
Viscum album L

Appendix 11 Species of Plants With Technical Uses

Abies alba Mill
Acer campestre L
Acer platanoides L
Alnus glutinosa Gaertn
Betula pendula Roth
Cannabis sativa L
Carpinus betulus L
Carpinus orientalis L
Chenopodium bonus hericus L
Cotinus coggygria Scop
Fagus orientalis Lipsky
Fagus sylvatica L
Fraxinus excelsior L
Fraxinus ornus L
Gypsophila paniculata L
Juniperus communis L
Juniperus oxycedrus L
Paliurus spina christi Mill
Picea abies (L) Karst
Pinus sylvestris L
Pinus nigra Arm
Pinus peuce Grsb
Pinus mugo Turra
Platanus orientalis L
Populus alba L
Populus canescens (Ait) Sm
Populus nigra L
Populus tremula L
Quercus cerris L
Quercus frainetto Tenore
Quercus pedunculiflora C Koch
Quercus pubescens Willd
Quercus robur L
Salix alba L
Salix fragilis L
Salix purpurea L
Saponaria officinalis L
Ulmus glabra Huds
Ulmus laevis Pall
Ulmus minor Mill

Appendix 12 Species of Forage Plants

Agropyrum cristatum (L) Gaertn
Agrostis capillaris L
Agrostis canina L
Agrostis rupestris All
Alopecurus pratensis L
Alopecurus rendlei Eig
Alopecurus myosuroides Huds
Antoxantum odoratum L
Anthylis vulneraria L
Arrhenatherum elatius (L) Beauv ex J et C Presl
Avena fatua L
Berteroa incana (L) DC
Briza media L
Bromus arvensis L
Bromus erectus Hugs
Bromus inermis Lyss
Bromus mollis L
Calamagrostis arundinaceae (L) Roth
Calamagrostis epigeios (L) Roth
Carex curvula All
Carex hirta L
Carex ovalis Good
Carex pallescens L
Chrysopogon gryllus (L) Trin
Coronilla varia L
Cynodon dactylon (L) Pers
Cynosurus cristatus L
Cynosurus echinatus L
Dactylis glomerata L
Daucus carota L
Deschampsia caespitosa (L) Beauv
Elymus arenarius L
Elymus repens (L) Gould
Festuca airoides Lam
Festuca fallax Thull
Festuca myurus L
Festuca paniculata (L) Schinze et Thell
Festuca poaeformis Host
Festuca pratensis Huds
Festuca pseudovina Hack et Wiesd
Festuca valida (Uechtr) Penzez
Holcus lanatus L
Holcus mollis L
Hordeum bulbosum L
Lathyrus aphaca L
Lathyrus hirsutus L
Lathyrus nissolia L
Lathyrus pratensis L
Lathyrus sylvestris L
Lathyrus tuberosus L
Lolium perenne L
Lolium multiflorum Lam
Lotus corniculatus L
Luzula campestris (L) DC
Medicago arabica (L) Hugs
Medicago falcata L
Medicago lupulina L
Melica ciliata L
Melilotus officinalis (L) Pall
Melilotus albus Med
Nardus stricta L
Onobrychis alba (W et K) Desv
Onobrychis arenaria (Kit) DC
Onobrychis viciifolia Scop

Appendix 12 Species of Forage Plants (continued)

Phleum alpinum L
Phleum phleoides (L) Karst
Phleum pratense L
Poa alpina L
Poa annua L
Poa bulbosa L
Poa palustris L
Poa pratensis L
Poa sylvicola Guss
Sesleria coerulea (L) Ard
Sesleria comosa Vel
Trifolium alpestre L
Trifolium arvense L
Trifolium campestre Schreb
Trifolium hybridum L
Trifolium incarnatum L
Trifolium montanum L
Trifolium patens Schreb
Trifolium pratense L
Trifolium repens L
Urtica dioica L
Vicia angustifolia Grufb
Vicia bithynica L
Vicia cracca L
Vicia grandiflora Scop
Vicia hirsuta (L) S F Gray
Vicia tenuifolia Roth
Vicia tetrasperma (L) Schreb
Vicia varia Host
Vicia villosa Roth

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Plant Community Ecology in Bulgaria

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SUMMARY

In Bulgaria, systematic research in the field of plant community ecology began in the early 1950s and is now in a period of rapid development Detailed information about the composition, structure and dis tribution of plant communities is available for much of the country However, some areas remain less thor oughly studied, including the Rhodope Mountains, the northern flank of the Stara Planina and Pirin Moun tains the Black Sea region, and the steppe elements in northeastern Bulgaria Moreover, study results, where they are available are often marred as a result of in sufficient equipment and limited possibilities for com parison with other Balkan and European countries (due primarily to differences in phytocenological schools) Publication of scientific information is hin dered by grave financial conditions and other difficul ties

Plant ecologists have so far described 1,000 plant associations, belonging to about 800 formations in Bulgaria A number of these are relict and endemic communities and rare in Bulgaria Bulgarian endemic species prevail in 27 communities, while Balkan en demics predominate in 77 others The greatest variety of habitats and plant communities occurs in the larger Bulgarian mountain ranges the Stara Planina, Rila Pirin Rhodope Slavyanka and Strandzha In gen eral, human activity has affected these communities less extensively than others Other communities that are highly valuable from a conservation standpoint in clude sand dunes and other habitats along the Black Sea coast, longose forests, steppe communities, the Mediterranean elements in the valleys of the Strouma and Mesta Rivers mesophytic meadows in the plains and macrophytic vegetation around water basins These communities are among those that have been most severely affected by human activity

The most significant threats to natural vegetation in Bulgaria are extensive logging the replacement of natural forest communities by plantations of *Pinus sylvestris* and *Pinus nigra* unrestricted grazing construction and urban development and pollution from industry transport, and household waste In order to address these threats and protect biodiversity within Bulgaria s plant communities conservation strategies should be based on the theoretical principles of modern ecology

A BRIEF HISTORY OF PLANT COMMUNITY ECOLOGY IN BULGARIA

In Bulgaria, plant community ecology (or phyto-cenology) became an autonomous branch of science about 1950 Prior to that information about phytoce nology was found primarily in phytogeographic and forestry studies The findings in some of these early studies closely resemble those reported in the latest research on plant communities Early information about phytocenology can also be found in the publica-tions of the many authors who worked in this field before 1950 Of particular note are the works of Davidov (1912) Adamovich (1909), Stoyanov (1922 1926, 1927, 1928, 1929, 1941), Stefanov (1923) and Yordanov (1931 1936 1939, 1944)

The works of Stoyanov were especially important He studied the vegetation of Alibotoush (1922), the origin of the xerothermic plant element (1926), Bul garia's riparian forests (1928 1929) and the charac teristics of Bulgaria's major phytocenoses (1941) Equally important were the works of Stefanov on phytogeographic elements in Bulgaria (1943) tor faceous vegetation (1931), the occurrence of steppe vegetation (1936) and plant interactions in the Bul garian part of Strandzha Mountain (1939)

Most phytocenological studies in the 1950s inves tigated the composition structure, distribution and dynamics of plant communities, and the influence of environmental conditions on community characteris tics This approach continued to develop in the fol lowing decades

At first, systematic phytocenological research con centrated on the study of meadow and pasture vege tation The results were published in the monograph *Meadow and Pasture Vegetation in Bulgaria* (1964) At the same time (especially in the 1960s), research was begun on the vegetation of specific mountains or parts of mountains as well as some plains areas These can be regarded as regional phytocenological studies Typical examples include studies of the vegetation of the eastern part of Lyulin Mountain (Ganchev, 1952) Golo Bardo (Stoyanov and Ahtarov, 1953), southern Dobroudzha (Stoyanov et al , 1955), the Elena part of the Stara Planina Mountains (Stoyanov et al 1955) the regions of Troyan and Teteven (Velchev, 1958) the Ograzhden Mountain and valley of the Strouma River (Ganchev, 1958) the eastern Rilas (Bondev

1959) Lozen Mountain (Ganchev, 1961) the region of Dragoman-Belediehan (Velchev, 1962) the north western Rilas (Ganchev, 1963), the Stara Zagora lowlands (Ganchev, 1965a 1965b), Berkovska and Chiprovska Mountains (Bondev, 1966) the Troyan part of the Stara Planina Mountains (Kochev, 1969) and Vrachanska Mountain (Velchev 1971)

Research also focused on separate ecological vegetation types Examples include ephemeroid vegetation in the southern parts of the country (Stoyanov and Ahtarov, 1951), halophytic vegetation in Bulgaria (Ganchev et al , 1971), hygrophytic and mesohygrophytic vegetation in the Palakaria River valley (Drazheva, 1963), psammophytic and other vegetation in the Black Sea region (Velchev and Bon dev, 1982, Meshinev et al 1982), and macrophytic vegetation around water basins (Yordanov and Ko chev, 1976 Kochev, 1983 Kochev 1989)

Research also focused on formations and associa tions of special interest to science especially those that contained relict, endemic rare and threatened spe cies for Bulgaria and for the Balkan Peninsula as a whole *Acer monspessulanum* in northwestern Bul garia (Velchev et al , 1965) *Kentranthus kellereri* (Velchev and Vassilev 1970) *Convolvulus compactus* (Velchev 1970) *Astragalus augustifolius* (Velchev and Vassilev 1984) *Ramonda serbica* (Velchev et al 1973) *Pinus peuce* in the Stara Planina Mountains (Velchev 1973) *Aesculus hippocastanum* (Kochev and Gorounova 1972) *Juniperus excelsa* (Velchev et al , 1984) *Astragalus aitosensis* (Velchev and Bondev, 1975) *Pancratium maritimum* (Velchev and Vassilev, 1976) and *Potentilla fruticosa* (Meshinev 1973 Meshinev, 1975) These works contributed signifi cantly to the establishment of the composition and distribution of these plant taxa to our understanding of the ecological conditions under which they occur, and to our appreciation of problems related to their conservation

The first published maps of Bulgarian vegetation were produced in the late 1960s (Bondev et al 1969) These maps laid the foundation for the application of cartographic methods in the study of vegetation and plant ecology Subsequently, large scale maps of the vegetation of separate regions (Velchev, 1971, Rous-sakova 1986, Kochev, 1976) and small scale maps of the vegetation of the country as a whole (Bondev, 1973, Bondev, 1991) were prepared In connection with these efforts, information was published on pri mary and secondary vegetation in Bulgaria (Bondev 1973a) and on edificators and dominants in the coun try's vegetation cover (Bondev, 1973b) In retrospect the production of these maps and the publication of this scientific information were of great significance This work provided the scientific basis for programs and plans for the rational use, management, and pro tection of Bulgaria's natural vegetation

Over the last fifteen years studies related to envi ronmental protection have gained a central position in Bulgarian phytocenology These studies have exam ined several issues of critical importance including the influence of pollution on plant communities, the nega tive impact of other anthropogenic factors, and the vegetation of protected areas (e g Bondev et al 1980 Vassilev 1980, Bondev and Velchev 1977 Meshinev et al 1982, Velchev and Vassilev, 1983, Bondev et al , 1983, Velchev et al , 1983, Kochev et al , 1983, Meshinev and Katerova, 1983, Meshinev and Vassilev, 1983, Velchev and Bondev, 1984a, 1984b, Nikolov and Nikolov, 1984, Velchev et al , 1985, Velchev et al , 1985, Meshinev, 1985, Meshinev and Todorova 1985) It was during this same period that the first program for complex ecological research using permanent experimental sites was established (Velchev et al 1983) Also important in this regard are the works of Velchev and Bondev (1985), Velchev (1962 1971, 1983) and Velchev et al (1989), which are synoptic and problem-raising in character

This brief survey does not embrace a number of phytocenological works related to the study of biologi cal productivity metabolism and other aspects of plant ecology We believe that important though this work has been, it is less directly relevant to the devel opment of a National Biological Diversity Conserva tion Strategy

MAJOR GAPS IN KNOWLEDGE AND RESEARCH NEEDS

As the above review indicates the study of plant community ecology in Bulgaria has made remarkable progress in recent decades Extensive information about the composition, structure and distribution of the major plant communities has been gained There are highly competent experts in the research institutes who continue to conduct research in this field But while acknowledging that we have a wealth of avail able information, we should also note that certain gaps exist These shortcomings are understandable at the present stage of research and should draw the atten tion of future researchers

- First and foremost, we lack complete systematic information and a full inventory of the vegetation in Bulgaria

- While the small-scale vegetation maps are indeed useful their use is limited A large scale (M=1 200 000) vegetation map project that has been underway for several decades now has run into serious difficulties Its progress is very slow and in the last few years has come to a virtual standstill due to a lack of funds

- Our knowledge of the different plant communities in Bulgaria was accumulated over a long period of time while anthropogenic changes have taken place very quickly Thus some of the available results are of only historical value In a number of cases they are of little use in comparative analyses

- Because of past restrictions and present financial difficulties our knowledge of the vegetation of neighboring countries is very poor It is virtually impossible to understand the laws of plant community distribution in the Balkans if scientists cannot study these communities directly by themselves and in partnership with our colleagues in neighboring countries Joint research and plant protection projects are rare

- In accordance with the principles of the "dominant species" school which has prevailed in Bulgaria past phytocenological studies did not lead to the development of a standard classification system as did work in other phytocenological schools (e g , the Braun Blanquet school) Thus our research results are not comparable with those in the countries of Central and Western Europe Bulgarian experts are familiar with the main principles of the Braun Blanquet school, but they are not acquainted with its research methods or classification system Many of them are aware that training in this field is urgently needed to facilitate comparative research and analysis Initial steps have been taken to overcome this problem, but a complete solution will require considerable money and time

- Under the former totalitarian system scientific experts were forced to observe complicated secrecy rules This resulted in a series of restrictions that did not allow scientists to cite the exact geographic coordinates of any object, including natural territories! They were not allowed to publish accurate information about environmental pollution Published maps were distorted Many works could not be published in foreign journals and magazines Contacts between Bulgarian scientists and colleagues in the west were restricted As a result, Bulgarian experts could not take advantage of scientific advances in the west while colleagues outside the country were unable to take advantage of work performed here

- A detailed inventory of vegetation in a number of protected areas (primarily reserves) was prepared but this valuable material was never published for lack of money The work resulted only in an unpublished report to the Ministry of Environment The authors' efforts to find sponsors have so far remained fruitless Naturally they are discouraged and lacking the means to publish their findings they are unenthusiastic about conducting further research This is especially regrettable in that some of the studied areas are biosphere reserves, and hence of global significance Even more frustrating is the fact that publishing in Bulgaria in comparison with other parts of the world, is quite inexpensive!

- Technical equipment in Bulgaria is indeed very poor and far behind modern standards Land rovers are necessary for on site work The need for modern computers and software is also urgent

- University curricula for biology students need to be revised to improve the quality and applicability of their special training Opportunities and resources for young scientists to study in leading foreign institutes and laboratories are very limited

- The opportunities for participation in international symposia congresses conferences and seminars are also limited

- Our specialized libraries receive few of the important scientific publications

Areas in Need of Further Study

Information about the plant communities in the Rhodopes the Pirin Mountain, the Piedbalkan region, and the Tundzha plain is fragmentary (see Map 8) Parts of these regions (for example, the southern Pirins and the Dobrostanski massif of the Rhodopes) have been studied but the results were never published In formation about some specific habitats – the riparian forests along the Kamchia River sand dune and coastal vegetation fragments of steppe vegetation in northeastern Bulgaria groups of rock vegetation in the central part of the Stara Planina Mountains and the southern Rhodopes mesophytic meadow vegetation – is insufficient

Taxonomic Richness

Bulgaria despite its small territory is characterized by a great variety of plant communities More than one thousand types have been described so far Most of these are forests the rest are shrub grass and aquatic macrophyte communities It is supposed that the variety of plant associations is much larger (Appendix 1 presents 800 plant species which are dominant in the plant communities They are essentially representative of diversity at the community or plant formation level) Several factors account for this great degree of community diversity

- ***Bioclimatic influences*** Each of the various bioclimatic zones in Bulgaria – the mid European steppe Black Sea and Mediterranean) – is related to spe

cific vegetational and floristic features In some areas two or more bioclimatic factors combine to create specific environmental conditions lending additional nuance to plant community composition and structure

- ***Orographic conditions*** The diversity of plant communities is, to a great extent, attributable to the diverse orographic conditions The mountainous nature of the Bulgarian landscape results in a considerable richness of environmental conditions and localized habitats

- ***Glaciation*** During the last glacial period, the highest mountains in Bulgaria – the Rilas and Pirins – were partially covered with ice The Rhodopes, Strandzha, and central part of the Stara Planina Mountains were not glaciated Thus certain relict species and communities were preserved there

Rare Communities

Unlike studies of flora and fauna, which are characterized by a clear concept of "rare" plant and animal species (as listed in the *Red Data Book*), phyto cenology lacks clearly defined criteria for assigning plant communities to this category Proposals to develop a "Green Book" of rare or threatened phytocenoses are not new, but realization of this goal lies in the distant future

A "rare" category would most probably include the relict communities that are of special scientific interest, such as *Fagus orientalis-Rododendron ponticum* in the Strandzha region *Fagus sylvatica Laurocerasus officinalis* in the central part of the Stara Planina Mountains, *Aesculus hyppocastanum* on Preslavska Mountain *Pinus heldreichii* in the Pirins and on Slavyanka Mountain, *Castanea sativa* in Belasitsa and the western part of the Stara Planina Mountains *Pinus peuce* in the Pirins Rilas, and the central part of the Stara Planina Mountains, *Quercus coccifera* in the valley of the Strouma River, *Juniperus excelsa* in the Kresna gorge and the central Rhodopes *Cercis siliquastrum* on Preslavska Mountain and *Pinus nigra Ostrya carpinifolia* in the southern Rhodopes The majority of these are confined to a few or even a single locality (Map 9)

There are some unique communities of Bulgarian endemics *Quercus protoroburoides* in the Rila Mountains *Astragalus aitosensis* in the eastern part of the Stara Planina Mountains, *Astragalus thracica* in the Tundzha plain and the eastern Rhodopes, *Jurinea tzar ferdinandii* in the western and eastern parts of the Stara Planina Mountains and the eastern part of the Predbalkan region, *Centranthus kellereri* in the northern Pirins and Vrachanska Mountain, *Festuca pirinensis* in the Pirins, *Festuca stojanovi* in the western part of the Stara Planina Mountains and the western border mountains, *Primula deorum* in the Rila Mountains, *Festuca balcanica* in the central part of the Stara Planina Mountains and Vrachanska Mountain (Map 10) Equally significant are the plant communities where Balkan endemics are dominant (Map 11) (Appendix 2 contains a complete list of the communities where Bulgarian or Balkan endemics prevail)

There is no complete list of the various habitats of these communities and no attempts have been made to classify them Preparations for the participation of Bulgarian experts in the CORINE program will allow opportunities to use the classification system that has been adopted by the European Community member countries involved in the program (See *Habitats of the European Community* in CORINE Biotopes Manual, Part 2, 1991) As research under the CORINE programme has not yet begun, here we shall try to adapt Bulgarian habitats to the European classification system only in the broader categories

1 ***Coastal and halophytic communities***
The Black Sea coast and open waters, and their hydrophytic vegetation

11 *Ocean and seas*

11 1 *Open marine waters*
Pelagic biocenoses Characterized by their planktonic communities and by the composition of their surface feeding faunas (fish sea mammals and seabirds)

11 2 *Seabed*
Benthic communities of animals and algae occupying the sea floor in the infralittoral, circalittoral, and deeper zones

11 3 *Marine vascular vegetation*
Beds of submerged marine vascular vegetation, except those of brackish seas (e g , *Zostera marina*)

11 4 *Brackish sea vascular vegetation*

15 *Salt marshes with halophytic vegetation*
Found in the coastal zone and in some inland areas consisting of typical halophytic communities such as *Salicornia herbaceae* Their role in the structure of the vegetation cover is limited

16 *Coastal sand dunes and sand beaches*

16 1 *Sand Beaches*
These either lack vegetation or are covered by annual communities (e g , *Cakile maritima*)

16 2 *Dunes*
These are covered by psammophytic

vegetation dominated by *Leymus racemosus* ssp *sabulosus Ammophylla arenaria, Cion ura erecta Sylene thymifolia* etc

18 *Cliffs and rocky shores*
Steep rocky shores adjacent to the sea In addition to their botanical significance they are often important nesting sites for sea birds

2 ***Non-marine waters***

22 *Standing fresh water*
Lakes ponds, and pools of natural origin containing fresh (i e , non saline) water Also man made freshwater bodies

22 4 *Aquatic vegetation*
Communities of *Lemna Spirodela Wolfia Utricularia, Potamogeton, Nymphaea, Nuphar* etc

23 *Standing brackish and salt water*

24 *Running water*
All rivers and streams Riverbank vegetation *Salix, Populus Alnus Typha Phragmites*

3 ***Scrub and grassland***

31 *Heath and scrub*

31 4 *Alpine and boreal heaths*
Dryas octopetalla, Bruckenthalia spiculifolia, Juniperus nana Found in the alpine and subalpine zones of all high mountains

31 5 *Dwarf mountain pine* (Pinus mugho) *scrub*
Forms zones in the Rila and Pirin Mountains Separate groups can be found in the Stara Planina Vitosha, and Rhodope Mountains

31 6 *Subalpine bush and tall herb communities*
Juniperus sibirica, Alnus viridis Salix herbacea Vaccinium myrtillus Vaccinium vitis idaea Rubus idaeus Found in the subalpine zones of all high mountains Their role in the structure of the vegetation cover is important The occurrence of *Chamaecytisus absinthyoides* in the Rhodopes Rilas Pirins and Slavyanka is more limited

31 7 *Hedgehog heaths*
Astragalus aitosensis

31 8 *Thickets*
Medio European rich soil thickets *Prunus spinosa Prunus mahaleb, Rosa* spp *Cornus mas, Cornus sanguinea, Crataegus monogyna, Lonicera xylosteum, Rhamnus catarticus, Clematis vitalba, Ligustrum vulgare Viburnum lantana, Viburnum opulus Cotoneaster integerrimus, Coryllus avellana*

32 *Sclerophyllous scrub*
Found chiefly in the southern parts of the country on highly eroded calcareous terrains mostly as secondary communities that have replaced former oak forests *Carpinus orientalis, Paliurus spina christi, Syringa vulgaris Cotynus coggyria, Quercus coccifera Juniperus oxycedrus Pistacia terebinthus, Ozyris alba Phylleirea latifolia*

35 *Dry siliceous grasslands*

35 2 *Medio European open siliceous grasslands*
Open formations of dry siliceous soils often species poor and with a strong representation of annuals (*Aira capillaris Nardurus lachenalii, Vulpia myuros, Filago arvensis Trifolium arvense, Trifolium campestre*) Perennials *Agrostis capillaris, Anthoxanthum odoratum*

36 *Alpine and subalpine grasslands*

36 1 Alpine formations of *Carex curvula Juncus trifidus, Agrostis rupestris*

36 2 Subalpine formations of *Sesleria comosa Festuca valida, Nardus stricta, Festuca nigrescens, Festuca poaeformis, Calamagrostis arundinaceae Senecio nemorensis*

37 *Humid grasslands*
Deschampsia caespitosa Juncus effusus, Juncus conglomeratus, Eryophorum latifolium Eryophorum vaginatum

38 *Mesophile grasslands*
Lowland and montane mesophile pastures and hay meadows

38 1 *Mesophile pastures*
Lolium perenne, Cynodon dactylon, Poa annua Agrostis capillaris

38 2 *Lowland hay meadows*
Festuca pratensis Poa pratensis Cynosurus cristatus Phleum pratense Arrenatherum elatius

38 3 *Xerophytic pastures*
Dichantium ischaemum Chrysopogon gryllus

4 ***Forests***

41 *Broad leaved deciduous forests*

41 1 *Beech forests*

41 11 *Central European acidophilous beech forests with woodrush* Medio European beech and, in higher mountains, beech fir or beech fir spruce forests on acid soils, with *Luzula luzuloides, Vaccinium myrtillus Pteridium aquilinum* Found in the western and central parts of the Stara Planina Sredna Gora Rhodope, and western border mountains

41 13 *Neutrophilous beech forests*
Medio European and Atlantic forests on neutral or near neutral soils with mild humus, characterized by a strong representation of species belonging to the ecological groups of *Anemone nemorosa, Lamium galeobdolon Galium odoratum* and *Melica uniflora* and in the mountains various *Dentaria* forming a richer and more abundant herb layer than in 41 11

41 16 *Beech forests on limestone*
They can be found in the southern parts of the country the Rhodopes and southern Pirin Mountains

41 17 *Southern medio European beech forests*
Including *Ostrya carpinifolia* on calcareous rocky terrains and *Laurocerasus officinalis* in the central part of the Stara Planina Mountains

41 19 *Balkanic beech forests*
Fagus moesiaca dominant Found in the Predbalkan region to the Shoumen plateau to the north and along the border between the eastern and the central part of the Stara Planina Mountains

41 191 Forests of *Fagus orientalis*
Can be found in the eastern part of the Balkan Mountains and in the Strandzha region South-euxinic species are found in the undergrowth

41 2 *Oak Hornbeam forests*
Quercus petraea and *Carpinus betulus* dominant Limited role in the structure of the vegetation cover Found in the mesophile oak and hornbeam belts of most Bulgarian mountains

41 3 *Ash forests*
Fraxinus excelsior dominant Limited role in the structure of the vegetation cover

41 7 *Thermophilous and supra mediterranean oak woods*
Quercus pubescens dominant Occupies the southern flanks with dry and shallow soils mostly in the lower parts of the mountains

41 8 *Hop hornbeam oriental hornbeam and mixed thermophilous forests*

41 9 *Chestnut woods*
Can be found in the Berkovsitsa region of the Stara Planina Mountains and in Belasitsa

41 A *Hornbeam woods*
Limited occurrence in the mesophile oak and hornbeam belt

41 D *Aspen woods*
Limited occurrence in the beech belt

41 H *Other deciduous woods*
Most of Bulgarian oak forests belong here as they have not been included in the CORINE classification

41 H 1 *Lowland forests of Quercus pedunculiflora*
In the lowlands and plains in northeastern Bulgaria and the Thracian lowland Once occupied rich moist soils now almost entirely destroyed as a result of extensive clearing

41 H 2 *Xeromesophytic woods of Quercus cerris* and *Quercus frainetto*
The two species form pure, monodominant communities but are most often found in mixed forests Important for the structure of the vegetation cover Widely spread in the whole country Secondary communities are predominant

41 H 3 *Forests dominated by Quercus virgiliana*
Can be found mostly in northeastern Bulgaria and the Predbalkan region

41 H 4 *Quercus daleshampii* forests
Widely spread forming the mesophile oak belt in the mountains

41 H 5 *Quercus polycarpa* forests
Can be found in the eastern part of the Stara Planina Mountains and on Strandzha

41 H 6 *Quercus protoroburoides* forests
Occupy a specific niche above timber line in a single locality in the Rilas

42 *Coniferous woodland*

42 1 *Fir forests*
Occupy the zone between the beech and the spruce forests mostly on the northern mountain flanks on rich moist soil Dominated by *Abies alba*

42 1 B 6 *Abies alba* ssp *borissi regis* forests
Limited occurrence in the southernmost parts of the country the southern Rhodopes Slavyanka, Belasitsa

42 2 *Spruce forests*
Conifer forests dominated by *Picea abies* Important in the structure of coniferous forests Cover extensive territories mostly on the northern flanks of the higher mountains

42 5 *Scotch pine forests*
Dominated by *Pinus sylvestris* Cover extensive territories in the mountains mostly in the Rhodopes They can be found most often on the southern flanks on shallow eroded soils

42 6 *Black pine forests*
Dominated by *Pinus nigra* Occupy mostly calcareous terrains in the southern parts of the country

42 7 *Pinus leucodermus* forests
On calcareous terrains in the Pirins and Slavyanka

42 73 *Pinus peuce* forests
Found on silicate terrains in the higher parts of the Rilas, Pirins, and the central part of the Stara Planina Mountains

44 *Alluvial and very wet forests and brush*

44 1 *Salix* spp brush or arborescent formations along flowing water subject to periodic flooding

44 3 *Medio European ash alder woods*
Alnus glutinosa formations on soils Periodically inundated by the annual rise of the river level, but otherwise well drained and aerated during low water

44 B *Platanus orientalis* forests
In river valleys in the southern part of the country

5 *Bogs and marshes*

6 *Inland rocks screes and sands*

6 1 *On siliceous terrains*
Mostly in the central part of the Stara Planina, Rila and Pirin Mountains

6 2 *On calcareous terrains*
In the Danubian plain, Rila, southern Pirin, and Slavyanka Mountains

8 *Agricultural land and artificial landscapes*

ECOLOGICAL SERVICES

In principle all plant communities provide services to other components of the natural ecosystems in which they are found The communities of macrophytic aquatic plants around inland water basins have such specific functions for water birds A number of plant communities provide seasonal shelter and food for migratory birds More detailed information on this matter should be prepared with the cooperation of zoologists

FRAGILITY (high, medium, low)

Annual communities are the most fragile *Trachinia distachya*, *Psilurus incurvus*, *Vulpia myurus*, *Vulpia ciliata* etc They are highly sensitive to climatic changes and especially to changes in temperature and soil moisture In years with more favorable conditions they grow plentifully and form specific communities mostly in areas where competition with other plants is less severe In unfavorable climatic conditions they can remain dormant

The medium fragility group includes several types of plant communities

1 Riparian forests

They are directly dependent on the moisture regime Even the smallest deviation upsets the forests specific composition and structure Unfortunately such deviations now occur regularly due to the total xerophilization of the conditions as a result of anthropogenic activity Specialists in this field are well familiar with this problem (for example, along the Kamchia River)

2 Psammophytic vegetation on sand dunes

Psammophytes occupy limited areas They develop on a specific substratum outside of which they are unable to survive They also fall within the zone of very high anthropogenic pressure The construction of resorts and the active presence of countless tourists have serious impacts upon their natural composition Recent research has shown that dune vegetation has been also been subject to unfavorable changes in natural successional processes as a result of progressive stabilization of the sand substratum

3 Mesophile meadows

Communities dominated by *Festuca pratensis*, *Poa pratensis* *Poa sylvicola* *Alopecurus pratensis* and other mesophilic species These species are good fodder plants but in the last few decades the areas where they occur have been reduced Biologically, mesophile meadows are highly sensitive to the regime of underground waters Under conditions of insufficient moisture they change into xerophile pastures, which are usually dominated by *Chrysopogon gryllus* When moisture is abundant they often change into hygrophile acidic grass formations The species with high fodder value are also vulnerable to grazing When overtrampled, they are replaced by xerophile pasture species In addition fertilization creates conditions for ruderalization

4 In principle all communities that for various reasons occupy small areas and are fragmentary and unable to maintain their natural homeostasis belong to this group

The third lowest fragility group includes some Mediterranean formations *Juniperia excelsae* *Quercetea cocciferae* *Phyllereeta mediae*, and *Pistacicta terebintae* Bulgaria is the northernmost area of their occurrence, so they are relatively unstable

KNOWN THREATS

We have no concrete data so far as regards the negative impact of certain problems of the global biosphere the thinning of the ozone layer the greenhouse effect and desertification

Unfavorable changes in the vegetation cover are related to direct and indirect forms of anthropogenic influence on a regional scale As a result of human activity the conditions under which plants exist have deteriorated and plant communities have suffered considerable degradation The first of these changes is the reduction in the area of forest communities, which in turn has resulted in a decrease in the biological and environment forming role of the vegetation cover Deforestation is particularly severe on the southern flank of the Stara Planina Mountains in the eastern Rhodopes, at Ograzhden in the southern Pirins and in the lower mountain slopes of western Bulgaria As a result the upper timber line has been lowered in the Rila Pirin, and the Stara Planina Mountains

Over 70% of the *Quercus cerris* and *Quercus frainetto* forests consist of shoots and shrubs *Quercus daleshampii* forests are severely affected by degradation processes *Castanea sativa* forests are in poor condition All these unfavorable changes are due to extensive cutting The forest complexes in the oak belt which fall in the highly urbanized zone are in even worse condition

Human beings have also caused widespread damage by converting forest communities into agricultural lands and pastures by eradicating, burning, and uprooting them

The mesophile meadows in valleys and plains are subject to extreme anthropogenic pressures Over the last several decades they have suffered large scale plowing and were destroyed over the greater part of their original area Changes have taken place in their composition and their fodder value because of changes in the moisture regime the use of fertilizers and pesticides, and grazing combined with haying Few areas of mesophile meadow have been included in protected areas (mostly to protect the habitats of *Leucojum aestivum*)

River bed corrections and other hydromeliorative activities including the ill founded policy of draining water basins along the Danube and Maritsa Rivers and in other parts of the country have led to the destruction of entire aquatic ecosystems together with the macrophytic plant communities that were typical for them

Construction of roads powerlines canals rail roads houses and industrial complexes has also resulted in the immediate destruction of natural communities

Advanced degradational processes have taken place in highland pastures as a result of uncontrolled grazing Over half of their area is occupied by *Nardus stricta* The species composition from the point of view of fodder quality has also deteriorated The presence of weeds and ruderal species has increased

Data on the negative impact of industrial pollution is available in regions with large enterprises, including the oil processing plant in Bourgas the chemical works in Devnia, and the metallurgical plants in Kremikovtsi and Srednogorie Information has been published about disturbances in the production process, the intensity of photosynthesis, and changes in the composition and structure of natural plant communities in these areas

SITES CONTAINING THE MOST REPRESENTATIVE SAMPLE OF BULGARIAN BIODIVERSITY

1 The Pirin (especially the southern) Mountains
2 Rila Mountains
3 The central part of the Stara Planina Mountains
4 The western and central Rhodope Mountains
5 The valley of the Strouma River

6 Strandzha Mountain
7 The Black Sea region
8 Kabioushka Mogila (a hill near Shoumen)
9 The Preslav part of the Stara Planina Mountains
10 Belasitsa

PLANT COMMUNITIES OF PROVEN OR POTENTIAL ECONOMIC IMPORTANCE

- For wood material and products *Quercus cerris Quercus frainetto, Quercus daleshampii, Quercus polycarpa Fagus sylvatica Fagus sylvatica* ssp *moesiaca Fagus orientalis Picea abies Pinus sylvestris Pinus nigra Pinus peuce Pinus heldreichii*

- As natural sources of fodder meadow communities, dominated by *Poa pratensis Festuca pratensis, Poa sylvicola* and *Alopecurus pratensis* pasture communities, dominated by *Agrostis capillaris Dichantium ischaemum, Chrysopogon gryllus Festuca nigrescens* and *Nardus stricta*

- For the needs of pharmaceutical industry mesophile meadows with representation of *Leucojum aestivum Tilia* spp forests *Artemisia* spp *Inula helenium Ruta graveolens Thymus* spp *Cotynus coggygria Urtica dioica Matricaria chammomilla* and other communities

- For the needs of food industry (in limited degree) *Vaccinium myrtillus Vaccinium vitis idaea Rubus idaeus Prunus spinosa*

For the distribution of these communities see Bondev s (1991) Map of Bulgaria's Vegetation (M=1 600,000)

CONSERVATION RECOMMENDATIONS

Bulgaria has so far achieved good results in environmental protection The network of protected natural areas includes the greater part of the plant communities that are of interest from the point of view of conservation At the same time these results are inadequate from the point of view of modern standards for environment optimization

The biodiversity conservation strategy should determine the maximum desirable percentage of protected territories in the country s total area The experience of the developed countries should be used bearing in mind that Bulgaria has fortunately managed to preserve vast areas of natural complexes

The existing network of protected areas is quite fragmented There are too many small reserves like Amzovo Patleina and Momin Grad The present state of the reserve network should be reassessed and smaller reserves of lesser significance should be placed in a lower category of protected areas

When creating new reserves, the following requirements should be considered they should be large enough to include buffer zones and should include not only the primary, best preserved plant communities, but also secondary ones, thus providing an opportunity for observation of natural regeneration processes

It is vitally important that these areas be guarded properly This is the most serious problem at present and almost invariably exists in all protected areas

Bulgaria lacks experience in the management of national parks this is a field in which foreign assistance will be required

More active publicity and outreach work is needed to engage the population in environmental protection

The concept of rational use of natural resources should be given priority among the leading concepts in the strategy The strategy currently uses the term 'natural resources' in its broadest sense, including biodiversity This term should rather be used in a narrower sense i e to refer to "economic resources" That would allow the creation of a clear concept of their rational use that corresponds to their production potential

As regards the general approach to environmental protection the theoretical principles of modern ecology should be applied Knowledge of the structural and functional characteristics of natural ecosystems is essential for their proper conservation We are deeply convinced that it is impossible to manage systems that have not been studied thoroughly

From the point of view of ecology there are no valueless species Every biological species is the result of millions of years of evolution and if natural selection has endowed it with the ability to exist, we must admit that it occupies a position of importance in the structural and functional organization of the ecosystems where it occurs Even the smallest blade of grass, even a plain and minor insect, contribute to nature's integrity just as the smallest components in a complicated timing mechanism are essential to its accurate functioning

Appendix 1 List of Plant Communities predominated by Bulgarian endemic species

Distributed in Eastern Stara Planina
Astragalus aitosensis mixtoherbosa
Astragalus aitosensis Dichantium ischaemum
Astragalus aitosensis Festuca dalmatica
Astragalus aitosensis Alyssum tortuosum
Astragalus aitosensis Poa bulbosa

Distributed in Slavyanka
Convolvulus sundermanii Festucopsis sancta

Distributed in Central and Vrachanska Stara Planina
Festuca balcanica Sesleria coerulea
Festuca balcanica Festuca poaeformis
Festuca balcanica Poa ursina
Festuca balcanica
Festuca balcanica Achillea ageratifolia
Festuca balcanica Saxifraga rocheliana

Distributed in Pirin (Orelyak)
Festuca pirinensis Sesleria coerulans
Festuca pirinensis Astragalus angustifolius
Festuca pirinensis mixtoherbosa

Distributed in Stara Planina
Festuca stojanovi + Poa badensis
Festuca stojanovi Carex humilis
Festuca stojanovi Paeonia tenuifolia
Festuca stojanovi Poa bulbosa

Distributed in Eastern and Western Rila
Festuca riloensis + Carex curvula
Festuca riloensis
Festuca riloensis Sesleria comosa

Distributed in Chepan and in Eastern Stara Planina
Jurinea tzar ferdinandii Helianthemum canum
Jurinea tzar ferdinandii Bromus riparius

Distributed in Pirin and Vrashanska Stara Planina
Kentranthus kellereri

Distributed in Rila Mountains
Primula deorum Sphagnum sp div
Primula deorum Scirpus caespitosus

Appendix 2 List of Plant Communities predominated by Balkan endemic species

Distributed in Slavyanka Mountains
Abies alba ssp borissi regis + Pinus heldreichii
Abies alba ssp borissi regis + Pinus heldreichii Fagus sylvatica

Distributed in Preslavska Mountains
Aesculus hippocastanum Carpinus betulus
Aesculus hippocastanum Aegopodium podagraria
Aesculus hippocastanum mixtoherbosa

Distributed in Pirin, Slavyanka and Rila
Chamaecytisus absintioides mixtoherbosa
Chamaecytisus absintioides Daphne oleoides

Distributed in Rila Mountain
Festuca amethystina ssp kummeri + Festuca poaeformis

Distributed in Vrachanska Mountain
Festuca panciciana Poa badensis
Festuca panciciana Satureja montana
Festuca panciciana Achillea clypeolata
Festuca panciciana

Distributed in Pirin and Slavyanka Mountains
Festuca penzesii + Sesleria coerulans
Festuca penzesii Festuca dalmatica
Festuca penzesii mixtoherbosa
Festuca penzesii Stipa pulcheriana
Festuca penzesii Astragalus angustifolius

Distributed in Southern Pirin and Slavyanka Mountains
Festucopsis sancta
Festucopsis sancta Sesleria coerulans
Festucopsis sancta Stipa pulcheriana
Festucopsis sancta Sesleria rigida

Distributed in Rila, Pirin, Vitosha and Stara Planina
Festuca valida
Festuca valida Nardus stricta
Festuca valida + Deschampsia caespitosa
Festuca valida + Festuca paniculata
Festuca valida Sesleria comosa
Festuca valida Festuca poaeformis
Festuca valida Agrostis rupestris
Festuca valida Calamagrostis arundinacea
Festuca valida Veratrum lobelianum
Festuca valida Deschampsia flexuosa

Distributed in Rila and Pirin Mountains
Genista rumelica
Genista rumelica mixtoherbosa
Genista rumelica Dichantium ischaemum
Genista rumelica Poa bulbosa
Genista rumelica Psilurus aristatus

Distributed in Central Stara Planina and Rhodopes
Haberlea rhodopaensis

Appendix 2 List of Plant Communities predominated by Balkan endemic species (continued)

Distributed in Besaparski hills

Inula aschersoniana + Agropyron brandze + Koeleria glaucovirens
Inula aschersoniana Dichantium ischaemum Asphodeline lutea
Inula aschersoniana Dichantium ischaemum Teucrium polium
Inula aschersoniana Koeleria glaucovirens Alyssum tortuosum
Inula aschersoniana Agropyron brandze Helianthemum canum
Inula aschersoniana

Distributed in Rila, Pirin, and Central Strara Planina

Pinus peuce Vaccinium myrtillus
Pinus peuce Vaccinium myrtillus Luzula nemorosa
Pinus peuce Vaccinium myrtillus Calamagrostis arundinacea
Pinus peuce Pteridium aquilinum
Pinus peuce Calamagrostis arundinacea
Pinus peuce Vaccinium vitis idaea
Pinus peuce + Picea abies Vaccinium myrtillus
Pinus peuce + Picea abies Luzula nemorosa Vaccinium myrtillus
Pinus peuce + Pinus sylvestris Vaccinium vitis idaea
Pinus peuce + Picea abies + Pinus sylvestris Vaccinium myrtillus Calamagrostis arundinacea
Pinus peuce + Pinus heldreichii + Pinus sylvestris Calamagrostis arundinacea
Pinus peuce Fagus sylvatica
Pinus peuce Juniperus sibirica

Distributed in Verenishko Bardo and Shiroka Mountains

Ramonda serbica
Ramonda serbica Geranium macrorrhizum
Ramonda serbica Festuca dalmatica
Ramonda serbica Sesleria rigida
Ramonda serbica Dianthus petraeus
Ramonda serbica + Ceterach officinarum
Ramonda serbica Galium purpureum

Distributed in Rila, Vitosha, Pirin Mountains

Sesleria comosa Festuca airoides
Sesleria comosa Carex curvula
Sesleria comosa Festuca riloensis
Sesleria comosa Carex laevis
Sesleria comosa Nardus stricta
Sesleria comosa + Poa ursina Campanula alpina
Sesleria comosa Avena scheuchzeri
Sesleria comosa Genista depressa
Sesleria comosa

Distributed in Central and Vrashanska Stara Planina

Sesleria latifolia
Sesleria latifolia Festuca dalmatica
Sesleria latifolia Stipa joannis
Sesleria latifolia Satureja montana

Distributed in Coastal Dunes

Silene thymifolia Medicago marina

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Invertebrates (Non-Insecta) in Bulgaria

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SUMMARY

The first investigations of the Bulgarian invertebrate fauna were carried out in the 1800s by Bulgarian and foreign scientists The invertebrates however remain insufficiently researched In this paper we focus on the most studied groups of invertebrate animals Protozoa Nematoda, Oligochaeta (Lumbricidae) Mollusca, Crustacea (Isopoda) Arachnida and Myriapoda

A review of previous research suggests that these groups have been comparatively well investigated from a taxonomic and faunistic standpoint The major gaps in knowledge involve insufficient ecological research the lack of a "Red Data Book" for the invertebrate fauna in Bulgaria and inadequately studied areas within the country

The different groups of the Bulgarian invertebrate fauna have not been studied to the same extent (see Table 1) In general, however, species richness is high Rare endemic and relict species are examined in detail The total number of rare species for all groups is 991, or 22 6% of all species Territories harboring the highest number of rare species are the Black Sea coast (222), Vitosha Mountain (182) the western Rhodope Mountains (93), the Strouma River valley (87), and Strandzha Mountain (86) Some of these species are widespread in Europe or Asia but in Bulgaria inhabit the periphery of their ranges This accounts for their restricted occurrence and rarity Other species, however are as rare in Bulgaria as in Europe or other geographic regions

Table 1 Species Richness

Animal Groups	Number of Taxa Researched						% of Estimate
	Phylum	Class	Order	Family	Genus	Species	
Protozoa	7	15	52	185	584	1800	60%
Nematoda	-	-	9	54	140	517	60%
Oligochaeta				1	8	54	80%
Mollusca		3	11	88	93	432	85%
Crustacea			1	15	34	93	85%
Arachnida		-	6	89	445	1266	80%
Myriapoda		2	7	15	59	215	85%
Total	7	20	86	447	1327	4377	

The endemic taxa in Bulgaria are divided into two groups, Bulgarian and Balkan, because some are found in adjacent territories of the Balkan Peninsula The total number of endemic invertebrate species and subspecies found in Bulgaria is 387, or 8 8% of all species and subspecies The regions with the greatest number of endemic species (Bulgarian/Balkan) are the western Rhodope Mountains (82/20) western Stara Planina Mountains (74/19) Pirin Mountains (57/14) central Stara Planina Mountains (49/16) and Rila Mountains (42/10) Because of the high incidence of endemism in these territories they should have priority in any effort to formulate and realize a national biodiversity conservation strategy

The unique communities of Bulgarian invertebrate fauna are situated in forest mountain and high mountain ecosystems, in karst terrains and cave habitats in coastal habitats (beach sand dunes, lakes bogs) and in river valley and gorge valley habitats The high mountain peat bogs glacier lake systems mountain streams caves and coastal wetlands are of utmost importance for the survival of many groups

The most susceptible to negative human impacts are the cave animals but all groups are highly sensitive to the application of chemicals Other threats to the survival of the invertebrate fauna are discussed and combined into several groups

A number of conservation recommendations are offered including concrete suggestions for controlling negative human impacts These recommendations re

flect the general judgment that conservation of the threatened populations of invertebrate animals does not entail protection of individual organisms but protection of their natural habitats

INTRODUCTION

The invertebrate fauna inhabiting the territory of Bulgaria is insufficiently researched Different groups of invertebrates have been investigated to varying degrees some are well researched, while others are insufficiently studied or have not been studied at all This presents difficulties in trying to assess the current state of the Bulgarian invertebrate fauna For this reason we focus our attention on specific groups of invertebrate animals that are relatively well studied – Protozoa Nematoda Oligochaeta (Lumbricidae), Mollusca Crustacea (Isopoda), Arachnida and Myriapoda

A BRIEF SURVEY OF INVERTEBRATE RESEARCH IN BULGARIA

The first investigations on Protozoa began about 80 years ago The pioneering scientists in this area were M Popov (Infusoria Rhizopoda) T Morov (Sporozoa) and S Konsulov (Opalinata) Later taxonomic and faunistic research was undertaken by P Patev (1924 1926) (Testacea) A Vulkanov (1928 1964) (Rhizopoda Heliozoa) A Zheli azkova Paspaleva (Infusoria) and Vulkanova (1981) (Foraminifera) In the last 40 years investigations have focused mainly on parasitic protozoan Coccidia (Golemansky 1975 1990 Kyuldzhieva 1981 Mincheva, 1966 Kostowa 1989), Amoeba (Kuitova Mincheva 1979), Mixozoa (Grupcheva 1968 1969) and Gregarina (Duhlinska 1990) Free living protozoa and fresh water soil and marine rhizopods and infisoria are comparatively well studied (Decheva 1965 1992 Golemansky 1967 1980 Todorov 1987 1992)

Research on free living and plant parasitic nematodes begin during the 1960s Much information on the nematodes of Bulgaria was accumulated in this period due to the efforts of a number of researchers Andrashi (1958) D Stojanov (1961 1992) Sh Katalan Gateva (1961 1992) Choleva (1959-1992) L Bodurova (1975 1992) O Bajcheva (1974 1992) S Nedelchev (1983 1992) V Peneva (1985 1992), and A Aleksiev (1986 1992)

The first information concerning lumbricids (Oligochaeta) in Bulgaria was published by Rosa (1897) The next investigations came much later with the work of Chernosvitov (1934 1937) Twenty years later research in this area continued with Michailova (1963 1966) and Plisko (1963) More recently contributions have been made by Ducvhlinska (1973 1990), Zel (1986) and Milojkova (1990)

The first research on Bulgarian Mollusca was performed by the foreign scientists Rossmassler (1835 1859) Mousson (1859) and Jickely (1874) Jurinich (1906) became the first Bulgarian to study the Mollusca Also very active at this time were Hesse (1911 1916) and Wohlberedt (1911) After World War II many foreign and Bulgarian malacologists carried out research including Drensky (1946 1947) Angelov (1959 1983) Urbansky (1960 1979) Ridel (1960 1975) Hudec (1964 1971) Pinter (1968 1970) Abadzhieva (1957 1984), and Damjanov (1969 1975) In recent years, much data has been gathered through hydrobiological research on Bulgarian rivers (Russev 1963 1990) and the Black Sea (Marinov, 1960 1990)

Hristovich (1892) reported the first information on the terrestrial isopods Much later, very important contributions are found in Verhoeff 1926 1936), Strouchal (1939), and Frankenberger (1940 1941) Twenty years later Vandel (1965 1967) described many new species for the Bulgarian isopod fauna The investigations of Andreev in the last two decades (1970 1990) have been very important

Research on Bulgarian arachnids begin during the last century when Pavesi (1876) reported data on spiders and other arachnids Hristovich (1892) later provided similar information Jurinich was also a pioneer in this area publishing the first information on the genus *Euscorpius* in Bulgaria (1904)

Redicorcev (1928) performed the first faunistic studies of pseudoscorpions This research continued with the work of Hadzhy (1939) Bajer (1949) Beron (1968), Churchich (1973 1981) and Manhert (1971 1974)

The first important contributions on Bulgarian opiliones were made by Roewer (1926 1957) After Roewer many articles by Kratochvil (1951 1959) Martens (1966-1969) Shilhavy (1965 1966), and Starega (1963 1976) appeared More recently Mitov has been active in this area (1990 1992)

After initial efforts by Pavesi (1876), Drensky began systematic studies on spiders that continued for many years (1909 1955) His articles examined the mountain and high mountain fauna, the cave spiders ecology and zoogeography His *Catalogue of the Spiders of the Balkan Peninsula* remains a very important contribution Recent investigations have been undertaken by Deltshev (1968 1992) and Blagoev (1989 1992)

The very few data on Solifugae in Bulgaria are a result of the work of Drensky (1932) Viets (1926 1940), Arndt (1943) and Casper (1951) pioneered the study of Bulgarian water Acari In the last 20 years, systematic investigations have been carried out by Petrova (1966 1985) Storkan (1936) was the first to study the Tarsonemina Subsequently, Sawulkina (1976) and Dobrev (1990 1991) continued this line of research

Jurinich (1904) provided the earliest information

on myriapods in Bulgaria After him Verhoff (1926 1937) and, twenty years later Strasser (1960 1975), Gulichka (1967 1968) Matic (1967-1969) Kachmarck (1969 1975) Golemansky 1964 1969) and Ribarov (1986 1989) were active researchers in this field

As this brief survey of research on the invertebrate fauna in Bulgaria illustrates, investigations have been performed over the decades by both Bulgarian and foreign researchers This speaks to the great interest within and beyond the country in the fauna of Bulgaria

GAPS IN KNOWLEDGE AND RESEARCH NEEDS

In general the Bulgarian invertebrate fauna are studied insufficiently and unequally across the separate classes orders and families This is why our attention has focused on specific groups The foregoing review of research suggests that these groups have been comparatively well studied from a taxonomic and faunistic standpoint Nevertheless, studies of the species composition of these groups are incomplete Ecological research is quite insufficient and fragmentary

What is the situation for each of the separate groups?

With regard to the free living Protozoa our knowledge of Amoeba Suctoria Foraminiferida and Tintinoidiidae is quite incomplete With the exception of Testacea the protozoa have not been the subject of ecological investigations Research on parasitic protozoans of domestic and wild animals in Bulgaria, mainly from the groups Sporozoa Microspora and Mixozoa is very deficient Many pathogenic organisms of great importance in determining the density of wild animal populations occur in these groups

Free living nematodes occur in almost every conceivable kind of ecologic niche and habitat but they are very insufficiently researched in Bulgaria A critical review of previous literature and data is greatly needed

The investigations on Oligochaeta touch only on the family Lumbricidae, the Euchitridae, Tubiphexidae, Criodrilidae and Haplotaxidae are totally unexplored

The groups of Mollusca are well studied in Bulgaria With the exception of Opistobranchia the species composition of the Black Sea fauna is quite clear Although much data on the distribution of mollusks in Black Sea biocoenoses and coastal lakes has been collected this body of knowledge has not been gathered into a single work The situation with the fresh water and terrestrial mollusks (Mesogastropoda Basomatophora) is similar despite many years of research a single authoritative work has not yet been written The stigobiontic gastropods (Hydrobiidae) are insufficiently studied in large part because the collecting of live materials is very difficult

The order Isopoda (Crustacea) is well studied from the faunistic perspective but ecological investigations have not been carried out The species composition of the families Armadillidae Porcellionidae, and Trachellipidae requires clarification

The arachnids in Bulgaria have not been studied as extensively as other invertebrate groups The scorpions and solifugae are represented in Bulgaria only by a single species but reliable information is very scanty These groups are not being explored at present

Only 36 species of pseudoscorpions have been identified in Bulgaria so far but as many as 150 200 species may occur The opiliones are well studied faunistically but only a few ecological investigations have been conducted

The spiders are a very large group, which leads to real difficulties for research The orthognatha spiders (Atypidae, Nemesidae) are very insufficiently explored Unstudied in many respects are the labidognatha spiders the families Dysderidae Pholcidae Linyphiidae Dictynidae, Amaurobiidae, Clubionidae, Gnaphosidae and Thomisidae The main gap is the lack of ecological research

Among the Acari, the groups Acaridae and Oribatei which are widespread in the soil substrates are largely unstudied For the Tarsonemina information is very scanty and the families Pygmephoridae and Tarsonemidae are totally unexplored

The species composition of the myriapods in Bulgaria is well known but ecological investigations have not been carried out In summary, the main gap in research on these invertebrate groups is the lack of ecological and zoogeographical studies Almost nothing has been done to protect these groups The one exception is the cave (stigobiontic) fauna which is protected by the law There is no red data book for the invertebrate animals of Bulgaria This is an critical gap in the exploration and conservation of biodiversity in Bulgaria

GEOGRAPHIC AREAS REQUIRING FURTHER STUDY

The topography of Bulgaria is quite varied comprising high mountains wide plains long river valleys and deep gorges and an extensive sea coast with beaches and dunes This geographic variety is the main reason that the Bulgarian invertebrate fauna has been insufficiently explored

The main territories requiring further study vary according to the different invertebrate groups

- For the Protozoa (especially as concerns the soil fauna) the western border mountains Osogovo Maleshevska Ograzhden Belasitsa and Strandzha Mountains the Sakhar hilly region and the Rila Pirin and Stara Planina Mountains

- For the Nematoda the Pirin, Rila, Stara Planina

Sredna Gora Vitosha and western border mountains

- For the Oligochaeta the western border mountains and the Sredna Gora and Predbalkan Mountains
- For the Mollusca the Sredna Gora and Belasitsa Mountains
- For the Crustacea (Isopoda) the Sredna Gora Mountains and the high elevations of the Rila, Pirin and Stara Planina Mountains
- For the Arachnida the Sredna Gora Mountains, the alpine zone of the Rila Pirin, and Stara Planina Mountains, the border mountains, and Dunavska Ravnina
- For the Myriapoda the western border mountains

In general the least explored territories for the groups mentioned are the Sredna Gora and western border mountains, Osogovo, Vlahina Maleshevska, Ograzhden, Belasitca Slavyanka, Sturgach, and Strandzha Mountains and Sakhar

CURRENT ASSESSMENT

Species Richness

Although the different groups of Bulgarian invertebrate fauna have been studied to varying degrees research in general has revealed that species richness is high

Protozoa

1800 species from 7 phyla 15 classes, 52 orders 185 families and 548 genera 1340 species (74 3%) are free living 460 species (25 7%) are parasites of different groups of invertebrate and vertebrate animals The species richness of protozoa is high The established number of species is estimated to be about 60% of the total For some groups of the free living protozoa, the percentage is about 70, for the parasites, it is estimated that only about 25% have been identified

Nematoda

517 species from 9 orders 54 families, and 140 genera Species richness is high The established number of species is estimated to be about 60% of the total

Oligochaeta (Lumbricidae)

54 species from 8 genera of the family Lumbricidae Species richness is high The established number of species is estimated to be about 80% of the total

Mollusca

433 species from 3 classes 11 orders, and 88 families This total includes 108 marine species, 90 fresh water species, and 235 terrestrial species Species richness is high The established number of species is estimated to be about 85% of the total

Crustacea (Isopoda)

93 species from 15 families and 34 genera Species richness is high The established number of species is estimated to be about 85% of the total

Arachnida

1265 species from 6 orders, 55 families, and 437 genera The different orders are

Scorpiones 2 species from 1 family and 1 genus Species richness is low

Pseudoscorpiones 36 species from 6 families and 15 genera Species richness is low The established number of species is estimated to be about 25% of the total

Opiliones 45 species from 7 families and 26 genera Species richness is high The established number of species is estimated to be about 85% of the total

Araneae 750 species from 38 families and 288 genera Species richness is high The established number of species is estimated to be about 80% of the total

Acari (partim) 432 species from 2 suborders 36 families and 114 genera Species richness is high The established number of species is estimated to be about 60% of the total

Solifugae 1 species from 1 family and 1 genus

Myriapoda

215 species from 2 classes, 13 families, and 59 genera Species richness is high The established number of species is estimated to be about 85% of the total

These numbers will change as further research is undertaken At this time the total number of species from the examined groups is 4377

Rare Species

Rare species are present in the composition of every fauna Because they usually occur in single localities and in restricted populations they are easily threatened

Protozoa

The rare species are mainly free living protozoa from the groups Sarcomastigophora and Ciliophora

Among the Sarcomastigophora, 250 species (33 3%) are rare They are distributed in the different regions as follows Black Sea coast – 126 species Vitosha Mountain – 55 spp Pirin Mountains – 18 spp western Rhodope Mountains – 16 species and the Rila Mountains – 12 species

Among the Ciliophora, 172 species (29%) are rare They are distributed in the different regions as follows Black Sea coast – 93 species Vitosha Mountain – 33 spp Trakijska Nizina – 25 spp and Dunavska Ravnina – 7 spp

The greatest occurrence of rare species for the two groups are found along the Black Sea coast (219 species 51 8%) and on Vitosha Mountain (94 spp , 22 2%)

Nematoda

157 species (35 4%) are rare Occurrence is highest in Sofijska Kotlovina (41 species) the Strouma River valley (30 spp) the Rila Mountains (22 spp) and the Rhodope Mountains (11 spp)

Oligochaeta (Lumbricidae)

Eight species (14 8%) are rare They occur in the eastern Rhodopes and along the Black Sea coast (each represented by 2 species) and in western Dunavska Ravnina the Rila Mountains Belasitsa Mountain and Sredna Gora Mountain (each represented by one species)

Mollusca

Sixty taxa (13 8%) are rare The highest numbers of rare species are found in east Dunavska Ravnina (22 species) and Dobrudzha (14 species)

Crustacea (Isopoda)

Four species (4 3%) are rare They are found in the Rhodope Mountains (3 species) and the western Stara Planina Mountains (1 species)

Arachnida

Two scorpion species are rare *Euscorpius carpathicus* is widespread in Bulgaria but occurs in restricted populations *E germanus* occurs only in a limited area in the western Rhodope Mountains

Ten species (27 7%) of pseudoscorpions are rare These are found in the central (7 species) and western (3 species) Stara Planina Mountains

Fifteen species (33 3%) of opiliones are rare 8 species in the central Stara Planina Mountains 5 species in the Rila Mountains, and 4 species found along the southern Black Sea coast

The rare species of spiders number 167 (22 2%) They occur in Zemenski Prolom (65 species), the Pirin Mountains (35 spp) the western Stara Planina Mountains (28 spp) and along the Black Sea coast (27 spp)

Among the Acari, 128 species (56 6%) in the Prostigmata and 168 species (81 5%) in the Mesostigmata are recognized as rare The territories with the greatest number of rare species in the Prostigmata are Strandzha Mountain (66 species) the Black Sea coast (18 spp) the western Stara Planina Mountains (13 spp) the Pirin Mountains (11 spp) and the western Rhodopes (10 spp) in the Mesostigmata Vitosha Mountain (64 species) the Strouma River valley (50 spp), the eastern Rhodopes (41 spp), and the central Dunavska Ravnina (34 spp)

Myriapoda

Nine species (8 7%) of the class Chilopoda and seven species (6 2%) of the class Diplopoda are rare Rare species of Chilopoda occur in the Stara Planina Mountains the western Rhodope Mountains Vitosha Mountain, Strandzha Mountain and the Black Sea coast (one species each) Rare species of Diplopoda occur in the Rila Mountains the western Rhodopes and along the Black Sea coast (one species each)

The total number of rare species for all groups is 991 (29 9% of all species) This proportion can be considered moderate Territories with the greatest number of rare species are the Black Sea coast (222) Vitosha Mountain (219) the western Rhodope Mountains (93), the Strouma River valley (87) Strandzha Mountain (86), Trakijska Nizina (83) and the Rila Mountains (76)

Some of these species are widespread in Europe or Asia but in Bulgaria inhabit the periphery of their ranges This accounts for the restricted distribution and rarity of their populations However there are some species that are as rare in Bulgaria as in Europe or other geographic regions An example of such a species is *Coelotes microlepidus* (Araneae) known only from the region of Garda Lake in North Italy and Zemenski Prolom in southwestern Bulgaria

Endemism[1]

The endemic taxa of invertebrate animals found in Bulgaria are divided into two groups Bulgarian endemic species and Balkan endemic species Some

of the species that occur only in Bulgaria are restricted to very small areas – a single cave for example Oth ers are more widespread within Bulgaria Still others c in also found in adjacent territories in neighboring countries (North Greece, North Turkey Macedonia Serbia and South Romania) these are classified as Balkan endemic species Endemic species are not es tablished for all of the examined invertebrate groups We will discuss only those groups in which endemic species are found

Nematoda

The extent of endemism among the Nematodes is not sufficiently clarified For this reason, the recogni tion of endemic species should be considered condi tional With this in mind 24 endemic species of nematodes – Tylenchida (10) Dorylamida (13) and Aphelenchida (1) – are recognized This is 4 6% of all species a low level of endemism They are found in the Rila Mountains (9 species) the Rhodope Moun tains (5 spp) and Sofijska Kotlovina (3 spp)

Oligochaeta (Lumbricidae)

Ten endemic species and subspecies in the Oligo chaeta (Lumbricidae) are established This is 18 5% of all taxa a moderate degree of endemism The group consists of 4 Bulgarian and 6 Balkan endemic species The Bulgarian endemics are distributed in the central Stara Planina Mountains (3 species) the west ern Stara Planina Mountains (2 spp) Vitosha Moun tain (2 spp) the Strouma River valley (2 spp) and the Rila Mountains Pirin Mountains Rhodope Mountains Belasitsa Mountain, and Zemenski Prolom (1 species each) The Balkan endemics occur in the Strouma River valley (2 species), Belasitsa Mountain (2 spp) Slavyanka (2 spp), Dobrudzha (2 spp) Trakijska Nizina (2 spp) and the central Stara Plan ina Mountains Vitosha and eastern Predbalkan Mountains (1 species each) The Strouma River valley and Stara Planina Mountains can be considered as possible centers of species generation

Mollusca

There are 116 endemic taxa in the Mollusca – 20 marine taxa 13 stigobiontic taxa and 83 terrestrial taxa This amounts to 26 9% of all species, a moderate level of endemism The level is higher in some families (e g 62 % of Hydrobiidae 71 % of Clausiliidae 71%) This is probably due to the intensive process of species gen eration in these groups in the Balkan peninsula

Of the 96 established non marine endemic taxa 63 (65 6) are Bulgarian and 33 (34 4%) are Balkan The Bulgarian endemics are distributed in the karst terrains of the Stara Planina Mountains (16 species) the western Rhodope Mountains (14 spp) the Pirin Mountains (13 spp) the central Stara Planina Mountains (9 spp) the Rila Mountains (8 spp) eastern Dunavska Ravnina (8 spp) Strandzha Mountain (6 spp), Vitosha Mountain (6 spp) and central Predbalkan Mountains Trakijska Nizina Slavyanka Mountain and the southern Black Sea coast (5 spp each)

The distribution of Balkan endemic species is similar They are found in the western Rhodope Mountains (9 species) the Pirin Mountains (7 spp) the central Stara Planina Mountains (7 spp) and the west ern Stara Planina Mountains (6 spp) The Stara Plan ina Mountains and Rhodope Mountains can thus be considered as possible centers of species generation

Crustacea (Isopoda)

There are 47 endemic species among the Crusta cea 50 54% of all species This represents a high level of endemism

Thirty nine (41 9%) of these are Bulgarian endem ics They are distributed in the western Stara Planina Mountains (15 species), the eastern Stara Planina Mountains (6 spp) and the central Stara Planina Mountains the Rhodope Mountains and the northern Black Sea coast (5 spp each)

Eight species (8 6%) are Balkan endemics They are found in the western Stara Planina Mountains (3 spp) western and eastern Rhodope Mountains (2 spp each) and along the Black Sea coast (1 species) The Stara Planina Mountains and Rhodope Mountains can be considered as possible centers of species generation This assertion is supported by the fact that 22 species within this group are troglobionts

Arachnida

Nine species of Pseudoscorpiones (25% of all spe cies) are Bulgarian endemics This is a moderate level of endemism The species are found in the central Stara Planina Mountains (7 species) western Stara Planina Mountains (2 spp) and on Vitosha Mountain (1 sp) They occur only in caves and six are troglobionts There are no Balkan endemic species of pseudoscorpi ons

Fifteen species of Opiliones (33 3% of all species) are endemics This is a moderate level of endemism Ten of these (22 2%) are Bulgarian endemics and are distributed in the western and central Stara Planina Mountains (6 species each), the western Rhodope Mountains (5 spp) in the Rila Mountains and along the southern Black Sea coast (4 spp each) and in the Pirin Mountains (3 spp) Five species (11 1%) are Balkan endemics and are found on Vitosha Mountain (5 spe cies), in the central Stara Planina Mountains and in the Sredna Gora Mountains (4 spp each) and in the east ern Stara Planina Mountains and Zemenski Prolom (3 spp each) Six of the total of 15 endemic species are troglobionts

Within the Araneae 40 species (5 3%) are endemics a relatively low level of endemism The Bulgarian endemics number 29 (3 8%) and are found in the Pirin Mountains (13 species) the western Rhodope Mountains (7 spp) the Rila Mountains and western Stara Planina Mountains (5 spp each), and at Vitosha Mountain and in the eastern Rhodope Mountains (4 spp each) The Balkan endemics number 11 (1 47%) and are found in the western Stara Planina Mountains (3 species) in the central Stara Planina Mountains on Vitosha Mountain and at Zemenski Prolom (2 spp each) Among the spiders only two species are troglobionts

In the Acari 15 species (6 6% of all species) of Prostigmata and 6 (3 4% of all species) of Mesostigmata are endemic This represents a low level of endemism Of the 18 Bulgarian endemic species in this group 13 belong to the Prostigmata and 5 to the Mesostigmata The prostigmata species occur mainly on Strandzha Mountain (4 species) and in the Pirin Mountains the Strouma River valley and along the southern Black Sea coast (3 spp each), the mesostigmata species occur on Vitosha Mountain (3 spp) and in the Rila Mountains, the western Rhodope Mountains, at Belasitsa Mountain and along the southern Black Sea coast (2 spp each) Of the Balkan endemic species 2 belong to the Prostigmata and one to the Mesosigmata The prostigmata species are found in the Strouma River valley and the mesostigmata species along the southern Black Sea coast

Myriopoda

The Myriapoda include 44 endemic species (42 7% of all species) within the class Chilopoda and 60 endemic species (53 6% of all species) within the class Diplopoda This represents a high rate of endemism

Of the Bulgarian endemic species 39 are in Chilopoda and 54 in Diplopoda The former occur primarily in the western Rhodope Mountains (16 species) and in the Stara Planina Mountains and on Strandzha Mountain (10 spp each) The latter occur in the Stara Planina Mountains (19 spp) and in the western Rhodopes (17 spp)

Of the Balkan endemic species 5 are in Chilopoda are 6 in Diplopoda The former are found in the western Rhodope Mountains (4 species) the Pirin Mountains (2 spp), and in the western Stara Planina Mountains on Vitosha Mountain, and in the Sredna Gora Mountains (1 species each) The latter are found in the western Rhodope Mountains and Stara Planina Mountains (4 species each) and in the Pirin Mountains on Strandzha Mountain and in the Sredna Gora Mountains (1 species each)

Of great importance are the caves in the Stara Planina Mountains and the Rhodope Mountains where 24 endemic species are found 22 of which are troglobionts

The total number of endemic species from all groups is 387 (8 8% of all species) Of these 68 are Balkan endemic species (1 6% of all species) The overall degree of endemism is relatively low This estimate however should be considered in relative terms, since there are no recognized endemics within the largest group, the Protozoa

The regions with the greatest number of endemic species (Bulgarian/Balkan) are the western Stara Planina Mountains (56/14) the western Rhodope Mountains (52/13) the Pirin Mountains (48/10) the central Stara Planina Mountains (39/14) Vitosha Mountain (20/8) Strandzha Mountain (16/6) and the Black Sea coast (15/9) (see Table 2)

The spatial distribution of Bulgarian and Balkan endemic species is quite similar For this reason territories containing the greatest number of endemic species should have priority in implementing the national biodiversity conservation strategy

Relict Species

We will mention here only relict species that were not covered under the above discussion of endemic species This includes only relict species of Mollusca The total of 33 species (7 62%) are divided between two groups caspian (aquatic species) and tertiarian (terrestrial species) The greatest number of terrestrial species are found on Strandzha Mountain (9 species) and along the southern Black Seacoast (8 species)

Ecosystems and Unique Communities

The high level of species richness and the presence of many endemic species illustrate quite clearly the unique character of the Bulgarian invertebrate fauna This in turn reflects the rich genetic makeup of this fauna and the special geographic position of the country – on the border between Europe and Asia on one side and adjacent to the Mediterranean basin on the other As a result this fauna contains typical middle-European mediterranean eurosiberian arctoalpian and subtropical faunistic elements The topography climate, and paleogeographic history have been critical factors in creating and maintaining many unique faunal communities

These ecosystems and communities are concentrated within different regions for the different invertebrate groups

The Bulgarian Black Sea coast is of great importance in terms of Protozoan communities As part of a unique sea basin with low salt concentration (15 18%) and a relatively high concentration of hydrogen sulphide the Black Sea coast supports a rich protozoan fauna comprised mainly of species from the genera *Centropyxiella Pomoriella Alepiella Ogdeniella* and *Corthionella* Black Sea protozoa play an important role in the ecosystem as links in the trophic chains of the vertebrate marine animals

A very rich and diverse protozoan fauna occurs in the high mountain peat bogs glacier lake systems and mountain streams These are found primarily in the alpine zone of the Rila and Pirin Mountains

Table 2 Distribution of Non Insecta Endemic (BG Bulgarian, BK Balkan), Relict, and Rare Species in Bulgaria

Geographic Territories	Endemic		Relict	Rare	Total	%
	BG	BK				
Dounavska Ravnina						
West	0	2	6	6	14	0 99
Central	1	0	1	47	49	3 48
East	12	5	6	53	76	5 40
Predbalkan						
West	4	0	1	0	5	0 36
Central	9	3	1	3	16	1 14
East	0	0	1	1	2	0 14
Stara Planina						
West	74	19	1	57	151	10 72
Central	49	16	1	42	108	7 67
East	17	4	5	19	45	3 20
Prehodna Oblast						
Kraishtensko Konyavska	14	7	0	71	92	6 53
Sofiyska kotlovina	7	0	3	46	56	3 98
Golo bardo	0	0	0	1	1	0 07
Vitosha	25	10	3	181	219	15 55
Plana	1	1	0	0	2	0 14
Sredna Gora	0	5	0	0	5	0 36
Ihtimanska	0	0	3	0	3	0 21
Sashtinska	4	3	0	1	8	0 57
Surnena	0	0	0	4	4	0 28
Trakiyska nizina	16	11	6	83	116	8 24
Sakharo Tundzhanska	2	1	3	4	10	0 71
Strandzha	32	8	9	86	135	9 59
Bourgaska nizina	0	0	3	0	3	0 21
Rila Rhodope Massif						
Osogovo	3	1	0	0	4	0 28
Rila	42	10	2	76	130	9 23
Pirin	57	14	1	59	131	9 30
Srednostroumska dolina	13	3	4	87	107	7 60
Ograzhden	4	2	0	13	19	1 35
Belasitsa	4	3	0	9	16	1 14
Slavyanka	6	6	0	1	13	0 92
Rhodope	0	0	3	0	3	0 21
West	82	20	2	93	197	13 99
East	17	7	4	3	31	2 20
Black Sea Coast	0	0	2	222	224	15 91
North to Dobrudzha	18	8	3	38	67	4 76
South	19	11	8	49	87	6 18
Total	71	319	30	991	1408	

For free living soil and water Nematoda the forest and high mountain ecosystems are especially significant Characteristic of these communities are species from the genera *Dorylamida Monhysterida*, and *Mononchida*, among others Important territories in this regard are Vitosha Mountain and the Rila, Pirin and Rhodope Mountains

The lumbricids (Oligochaeta) are important components of soil ecosystems Unique communities are found in the Strouma and Mesta River valleys, where the mediterranean influence is quite strong The wet lands of the Black Sea coast also support important communities of lumbricids

Highly important in terms of Mollusca communities

are those areas that contain the greatest number of en demic species limestone terrains of the Stara Planina Mountains the Pirin Mountains, and the southern Black Sea coast Very distinctive communities of relict species are found on Strandzha Mountain and coastal limestone terrains

Endemism is very high among the Crustacea (Isopoda) Consequently, there are many unique com munities of endemic species, distributed mainly in the forests and caves of the Stara Planina and Rhodope Mountains

Unique communities are found among all the groups of Arachnida For pseudoscorpions the forest and cave habitats in the Stara Planina Mountains and on Vitosha Mountain are highly important, for Opilio nes the forest, cave, and high mountains habitats in the Stara Planina Rila, Pirin and Rhodope Mountains and on Vitosha Mountain as well as the coastal habitats of Black sea Spiders (Araneae) are widely distributed and occur in most kinds of habitats Very distinctive and important however are the communities occurring in the high mountain habitats of the Rila Pirin, and Rho dope Mountains Vitosha Mountain and the Stara Planina Mountains, as well as the karst terrains and caves in the mountains and coastal habitats of the Black Sea

For the Acari as well as the Myriapoda the most important communities occur in the same critical habi tats as do communities discussed under the previous groups

For the Bulgarian invertebrate fauna as a whole, then, the unique communities are situated mainly in forest mountain and high mountain ecosystems in karst terrains and cave habitats in coastal and aquatic habi tats (beach, sand dunes lakes and bogs), and in the river valley and gorge valley habitats

Critical Habitats

Certain areas or habitats are of critical importance for the survival of many groups

Of great importance for all groups are the high mountain peat bogs that occur in all the high mountains of Bulgaria (Rila Pirin Rhodope Stara Planina and Vitosha) The mountain streams and the glacial lake systems of the high mountains are of utmost importance for Protozoa and Acari, and certainly for the other groups as well The snow drifts on the high mountain peaks are very important for the arctic alpine species

Caves are also highly critical habitats They are limited in extent and distribution and play an important role in underground ecosystems Cave habitats are characterized by high (100%) and constant humidity constant temperature (7 12° C) and constant darkness These conditions are obligatory for those animals that inhabit caves especially troglobionts Cave faunal communities are unique and protection of the special cave environments is essential to their survival Very important in this respect are caves in the Stara Planina Mountains (e g Temnata dupka, Suhata peshtera, Cerovskata Dinevata peshtera Meshata dupka Le denika Morovica, Dryanovskata, Ponora) and in the western Rhodope Mountains (Yagodinska peshtera Ledenicata, Sbirkovata peshtera, Borikovskata peshtera and others)

Very distinctive and ecologically important are the coastal habitats of the Black Sea This transition zone is of great importance for biodiversity in all invertebrate groups The destruction of these habitats will be perni cious for many species

Fragility and Known Threats

The groups examined above vary in their sensitivity to negative human impacts

The most susceptible are the cave animals This pertains to all troglobionts (Mollusca Crustacea, Arachnida Myriapoda) The contemporary exploitation of caves produces a wide range of human impacts These impacts trigger many problems for the conserva tion of both the biotic and abiotic characteristics of caves Cave fauna, it should be noted, are not less vulnerable because of their relative degree of isolation or inaccessibility Human impacts are reported to have affected cave populations and even led to their extinc tion Despite their high density, Protozoa and Nema toda are highly sensitive to the application of chemicals (especially in agricultural systems) This is of concern for the Oligochaeta and Mollusca as well

The sensitivity of the Isopoda Arachnida, and Myriapoda to most common human activities is moder ate However, they are also highly sensitive to the ap plication of chemicals

Representative Sites

For Protozoa the Bulgarian Black Sea coast and high mountain habitats of the Rila Pirin Rhodope Stara Planina, and Vitosha Mountains

For Nematoda the forest habitats of the Rila and Rhodope Mountains, the soil habitats of Sofijska Kotlo vina and the valleys of the Strouma and Mesta Rivers

For Oligochaeta (Lumbricidae) the Rila Pirin Rhodope Stara Planina, and Vitosha Mountains the Black Sea coast, and the valleys of the Strouma, Mesta, Maritsa, and Tundzha Rivers

For Mollusca the Stara Planina, Pirin, Rila, western Rhodope and Strandzha Mountains and the Black Sea coast

For Crustacea (Isopoda) the Stara Planina Rhodope and Strandzha Mountains

For Arachnida for Scorpiones – the western Rho dope Mountains and Iskurski Prolom for Pseudoscorpiones – the western and central Stara Planina Moun tains for Opiliones – the Stara Planina, Rila, Pirin and Rhodope Mountains, and the Strouma River valley, for

Solifugae – the Strouma River valley for Araneae – the Rila Pirin Rhodope Stara Planina and Vitosha Mountains the Black Sea coast and the valleys of the Strouma Mesta Maritsa and Tundzha Rivers

For Acari the Rila Pirin and western Rhodope Mountains and the Black Sea coast

For Myriapoda the Rila Pirin western Rhodope and Strandzha Mountains

HISTORIC, CURRENT AND POTENTIAL THREATS

The invertebrate fauna in Bulgaria is subject to a variety of forces that threaten its members with annihilation and extinction Historically, these forces have included glaciation during the Pleistocene climate change the cutting of the forests, agricultural and other specific human land use activities Today, the threats to the survival of the invertebrate biota are very significant and can be classified into several groups

The impact of draining of coastal wetlands and small rivers on the species diversity of Protozoa Acari and others groups is very pernicious

Another widespread problem is the pollution of water basins which severely affects the survival of populations of aquatic organisms from different invertebrate groups

The fauna of the coastal dune and salt soils is greatly threatened by the construction of resorts (buildings camp sites roads etc) This is of special concern at Beliya bryag by Kavarna in the district of Sinemorete, and at most of resort sites along the Black Sea coast

Invertebrate biodiversity is threatened by the planting of large areas with crops and the use of pesticides in these croplands Such problems affect the valleys of the Strouma, Mesta Maritsa Tundzha, and other rivers These regions are of utmost importance for the biodiversity of all invertebrate groups

A real threat for the high mountain invertebrate fauna is the building of ski roads rope lines and lifts and the treating of ski roads with chemicals The high mountain invertebrate animals are very sensitive to the application of chemicals

A further threat to mountain ecosystems is the cutting of forests and the plowing of some mountain terrains These have strong negative impacts on biodiversity and the density of the populations of every invertebrate group

Development of caves has become a real threat to populations of invertebrate cave animals The paving of cave pathways has reduced their numbers and in many cases the fauna along these passages have disappeared The creation of artificial galleries as well as the modification of existing ones appears to be a common procedure in the development of caves This intervention leads to alterations in the abundance and diversity of the existing organisms as a result of rapid micro climatic change

Finally the invertebrate fauna occurring on sites near towns is very strong threatened by urban development

RECOMMENDATIONS

One main idea should guide the conservation of invertebrate animals in Bulgaria successful conservation requires not the protection of individual organisms or species but protection of their natural habitats

This will require, first of all, strict control over the pollution of water basins and the draining, canalization, and damming of different water sources Water diversions, which entail the drainage of large areas, need to be brought under control as well One such project, for example will require the diversion of waters from the basin of the Strouma River to that of the Maritsa River Such projects can place under severe threat a large proportion of the endemic relict and rare invertebrate species

Severe controls are needed to curtail the draining and pollution of the coastal wetlands and of the small rivers feeding the Black Sea Construction of resorts near the Black Sea should proceed only after ecological experts have prepared reports and impact assessments

A large problem for the diversity of the invertebrate fauna is the impact of human agricultural activity Here the only real solution is the adoption of ecologically sound methods of agriculture, This however will require a long period of time For the time being, it is most necessary to place the application of chemicals under severe control

In the future development of caves and construction (of any sort) in high mountains should go forward only after ecological experts have prepared reports and impact assessments All applications of chemicals should be prohibited in these areas

Sites containing the most representative samples of Bulgaria's biodiversity are concentrated in the mountains along river valleys and on the Black Sea coast This suggests that new protected areas need to be established in these regions Existing national parks – Vitosha Pirin and Stara Planina – should be expanded and certain critical parts of the parks should be given reserve status

The endemic taxa are concentrated in the western Rhodope Mountains For this reason a portion of the Rhodopes should be designated a national park

Several reserves have been designated on Strandzha Mountain These should be combined into a national park

Urbanization of the Black Sea coast and the valleys of the Strouma Mesta, Maritsa, and Tundzha Rivers is a significant problem In these areas, the situation can be improved by creating new natural reserves

Finally it should once again be emphasized that the conservation of populations of invertebrate animals does not require protection of the individuals but protection of their natural habitats

Appendix 1 Rare Protozoa (Dr Vasil Golemansky, Dr Milco Todorov)

SARCOMASTIGOPHORA SARCODINA
AMOEBIDA
Amoeba bulgarica Pateff 1932
Vitosha Mountain Kostinbrod
Amoeba echinata Pateff, 1932
Vitosha Mountain
Amoeba lanceolata Pateff 1924
Plovdiv
Biomyxa agregata Valkanov 1934
Sofia
Chichkovia reticulata Valkanov, 1931
Kadievo
Pateria bistadialis Valkanov, 1931
Sofia

TESTACEA ARCELLINIDA
CENTROPYXIDAE
Alepiella tricornuta Golemansky 1970
Black Sea
Centropyxiella gibbula Valkanov 1970
Black Sea
Centropyxiella platystoma Golemansky, 1981
Black Sea
Cyclopyxis pirini Golemansky, 1974
Pirin Mountains Popovo ezero Vitosha Mountain Platoto

COCHLIOPODIDAE
Gocevia pontica Valkanov, 1932
Black Sea

HYALOSPHENIIDAE
Pomoriella valkanovi Golemansky 1970
Black Sea

MICROCHLAMYIDAE
Microchlamys sylvatica Golemansky Skarlato & Todorov 1987
Vitosha Mountain Bistrishko Branishte

PARAQUADRULIDAE
Paraquadrula madarica Valkanov 1962
Madara

MONOTHALAMIDA
PHRYGANELLIDAE
Phryganella microps Valkanov 1963
Varna

GROMIIDA
ALLOGROMIIDAE
Euglyphinopsis pontica Valkanov 1970
Black Sea
Rhumbleriella filosa Golemansky 1970
Black Sea

AMPHITREMATIDAE
Paramphitrema pontica Valkanov, 1970
Black Sea

CYPHODERIIDAE
Campascus vulgaris Valkanov, 1934
Brackish water

EUGLYPHIDAE
Euglyphella delicatula Valkanov, 1964
Strandzha Mountain
Playfairina valkanovi Golemansky 1966
Vitosha Mountain Platoto Rhodope Mountains Beglika

GROMIIDAE
Leptogromia operculata Valkanov 1970
Black Sea
Ogdeniella maxima Golemansky, 1970
Black Sea

PSAMMONOBIOTIDAE
Chardezia caudata Golemansky, 1970
Black Sea
Corythionella pontica Golemansky, 1970
Black Sea
Messemvriella filosa Golemansky, 1973
Black Sea

LABYRINTHOMORPHA
Labyrinthodyction magnificum Valkanov, 1972
Black Sea
Labyrinthula valkanovi (Valkanov) Karling 1941
Black Sea

SPOROZOA GREGARINIDA
Gregarina troglophili Golemansky & Lipa, 1991
H Troglophilus neglectus
Rhodope Mountains "Imamova doupka" cave
Lepismatophila plusiocampae Tashev & Golemansky 1973
H Plusiocampa bureschi
Lakatnik "Temnata doupka" and "Zidanka" caves
Stenophora berori Golemansky 1973
H Balkanopetalum armatum
Belidie han "Kolibata" caves
Stenophora bulgarosomae Golemansky 1973
H Bulgarosoma meridionale
Rhodope Mountains "Yagodinska" cave
H Bulgarosoma bureschi
Vratsa "Ledenika" cave
Stenophora gervaisiae Golemansky & Lipa 1991
H Gervaisia costata
Rhodope Mountains "Er kyupriya" cave

Appendix 1 Rare Protozoa (continued)

Stenophora serbojuli Golemansky & Lipa, 1991
H Serboiulus speleophilus
Vidin "Vodna pech" cave
Stenophora typhloiuli Golemansky & Tashev 1973 H Typhloiulus bureschi
Lakatnik "Temnata doupka" cave

CILIOPHORA PROSTOMATIDA
TRACHELOCERCIDAE
Trachelocerca curvirostre Valkanov 1934
Brackish water
Trachelotaphis toteri Kovaleva & Golemansky 1979
Black Sea

Appendix 2 Endemic Species of Nematoda (Dr Vlada Peneva)

DORYLAIMIDA
ALAIMIDAE
Alaimus macer Andrassy, 1958
Rila Mountains

APHELENCHIDIDAE
Aphelenchoides speciosus Andrassy, 1958
Stara Planina Mountains

DIPHTHEROPHORIDAE
Diphtherophora bataki Nedelchev & s'Jacob 1993
Western Rhodope Mountains Batak
Diphthrophora bulgarica Gateva & Aleksiev, 1988
Rila Mountains Parangalitsa
Diphtherophora curvata Gateva & Aleksiev, 1988
Rila Mountains Parangalitsa
Diphthrophora malkovi Choleva & Nedelchev 1992
Western Rhodope Mountains
Diphtherophora vitoshae Nedelchev & s'Jacob, 1993
Vitosha Mountain
Diphtherophora wasilevi Choleva & Nedelchev, 1992
Thrace Pazardzhik
Tylolaimophorus bulgaricus (Anrassy, 1958)
Rhodope Mountains, Kostinbrod

DORYLAIMIDAE
Mesodorylaimus meyli Andrassy, 1958
Western Rhodope Mountains

QUASDIANEMATIDAE
Eudorylaimus algeri (Andrassy 1958)
Vitosha Mountain Pirin Mountains
Eudorylaimus bureshi (Andrassy 1958)
Rila Mountains
Eudorylaimus perspicuus (Andrassy, 1958)
Stara Planina Mountains, Pirin Mountains
Eudorylaimus simus (Andrassy, 1958)
Rila Mountains

TYLENCHOLAIMELLIDAE
Tylencholaimellus marianae Andrassy 1958
Western Rhodope Mountains

TYLENCHIDA
BELONOLAIMIDAE
Geocenamus gateri Budurova 1988
Kostinbrod
Telotylenchus lanceolatus Budurova 1988
Kostinbrod

PRATYLENCHIDAE
Pratylenchoides katalani Gateva & Aleksiev 1990
Rila Mountains Parangalitsa
Pratylenchoides wassilevi Stojanov & Baicheva 1988
General Toshevo

TYLENCHIDAE
Filenchus baloghi (Andrassy 1958)
Western Rhodope Mountains Dragalevtsi
Filenchus butteus (Thorne & Malek 1968)
Rila Mountains Parangalitsa
Filenchus thornei (Andrassy 1954)
Strandzha-Sakhar Gabar
Filenchus uliginosus (Brzeski 1977)
Strandzha Mountain Novo Panicharevo
Malenchus paramonovi Gateva & Aleksiev, 1990
Rila Mountains Parangalitsa
Tylenchus parangalici Gateva & Aleksiev 1990
Rila Mountains Parangalitsa

Appendix 3 Rare Species of Nematoda (Dr Vlada Peneva)

AREOLAIMIDA
CYLINDROLAIMIDAE
Cylindrolaimus monhystera Schneider, 1937
Rhodope Mountains
Protoplectus inquirendus (Andrassy 1958)
Rila Mountains
Protoplectus tenuis (Bastian 1865)
Thrace

CHROMADORIDA
CYATHOLAIMIDAE
Chromadora tenicola (de Man 1880)
Rila Mountains

DORYLAIMIDA
ACTINOLAIMIDAE
Actinolaimus cinctus Cobb in Thorne, 1939
Rila Mountains

ALAIMIDAE
Alaimus editorus de Man, 1880
Sofia district
Ditylenchus anchilisposum (Tarjan, 1958)
Kostinbrod

APHELENCHIDAE
Aphelenchus cylindricaudatus (Steiner, 1926)
Petrich
Aphelenchus mirzai Das, 1960
Pirin Mountains
Aphelenchus solani (Steiner 1935)
Thrace
Aphelenchoides arcticus Sanwal 1965
Petrich
Aphelenchoides cyrtus Paesler 1973
Western Rhodope Mountains
Aphelenchoides kuehnii Fisher 1898
Thrace
Aphelenchoides trivialis Franklin & Siddiqi, 1963
Petrich
Aprutidus guidetti Scognamiglio, 1974
Strandzha Mountain?
Seinura mali Fuch, 1931
Dragalevtsi
Seinura oxiurus (Paesler 1987)
Blagoevgrad

DIPHTHEROPHORIDAE
Diphthrophora communis de Man, 1880
Kostinbrod
Diphthrophora granata Husain & Khan 1967
Dragalevtsi
Diphthrophora kazachstani Razzhivin 1971
Rila Mountains Parangalitsa
Diphthrophora obesus Thorne 1939
Kosinbrod
Diphthrophora vanoyei de Coninck, 1931
Sofia district

DORYLAIMIDAE
Dorylaimus caszabi Andrassy, 1959
Blagoevgrad
Dorylaimus termophilus Meyl, 1953
Kostinbrod
Mesodorylaimus abberans Loof, 1969
Novo Panicharevo
Mesodorylaimus luci Brzeski & Sczygiel, 1961
Novo Panicharevo

DORYLAIMOIDIDAE
Dorylaimoides bulbosus Sczygiel, 1965
Rila Mountains Parangalitsa

LONGIDORIDAE
Longidorus macrosoma Hooper, 1961
Eastern Rhodope Mountains
Longidorus africanus Merny, 1966
Pleven
Longidorus attenuatus Hooper 1961
Blagoevgrad Pazardzhik
Longidorus closelongatus Stoyanov, 1964
Blagoevgrad, Kovachitsa
Longidorus leptocephalus Hooper, 1961
Hadzhi Dimovo
Longidorus profundorum Hooper, 1965
Kostinbrod
Longidorus sylphus Thorne, 1939
Stara Planina Mountains, Blagoevgrad
Paralongidorus maximus (Butschli, 1874)
Varna
Xiphinema basilgoodev Coomans, 1961
Kostinbrod
Xiphinema neovuittenezi Dalmasso 1969
Bourgas
Xiphinema opisthohysterum Siddiqi, 1961
Kostinbrod
Xiphinema turcicum Luc & Dalmasso 1963
Bourgas, Kostinbrod, Vinarevo

MONONCHIDAE
Mononchus sigmaturus (Cobb 1917)
Thrace

NORDIIDAE
Enchodelus arcuatus (Thorne, 1939)
Rila Mountains
Enchodelus thorne Baqri & Jairajpuri, 1974
Sofia district

NYGOLAIMIDAE
Nygolaimus brachyurus de Man 1880
Blagoevgrad

Appendix 3 Rare Species of Nematoda (Dr Vlada Peneva) (continued)

Nygolaimus hartingii de Man, 1880
Pirin Mountains, Blagoevgrad

PRODORYLAIMIDAE
Prodorylaimus brigdammensis (de Man 1876)
Varna

QUASDIANEMATIDAE
Eudorylaimus angulosus (Thorne & Swanger, 1936)
Rila Mountains
Eudorylaimus brunettii Meyl, 1953
Kostinbrod
Eudorylaimus diminutivus (Thorne & Swanger 1936)
Western Rhodope Mountains
Eudorylaimus discolaimoides (Andrassy 1958)
Rila Mountains
Eudorylaimus gracilis (de Man 1876)
Pirin Mountains
Eudorylaimus humulis (Thorne & Swanger, 1936)
Western Rhodope Mountains
Eudorylaimus maritus Andrassy 1959
Rila Mountains
Eudorylaimus nodus (Thorne & Swanger 1936)
Vitosha Mountain
Eudorylaimus parvus (de Man 1880)
Western Rhodope Mountains
Eudorylaimus rhopalocercus (de Man 1876)
Petrich Stara Planina Mountains Pirin Mountains

TRICHODORIDAE
Trichodorus aequalis Allen 1957
Rila Mountains Parangalitsa
Trichodorus velatus Hooper, 1972
Varna Plovdiv
Trichodorus virulferus Hooper 1963
Western Rhodope Mountains

TYLLENCHOLAIMELLIDAE
Tylencholaimellus affinis (Brakenhoff, 1914)
Pirin Mountains
Utahnema tenuidens Thorne, 1939
Blagoevgrad

ENOPLIDA
CRYPTONCHIDAE
Aulolaimus oxycephalus de Man, 1880
Blagoevgrad

IRONIDAE
Ironus ignavus Bastian, 1865
Rila Mountains

OXYSTOMINIDAE
Bastiania gracilis de Man, 1876
Western Rhodope Mountains

TRYPILIDAE
Trypila affinis de Man 1880
Kostinbrod
Trypila papillara Butschli 1873
Rila Mountains

MONHYSTERIDA
MONHYSTERIDAE
Eumonhystera similis (Butschli, 1873)
Stara Planina Mountains
Eumonhystera dispar (Bastian 1865)
Varna
Eumonhystera simplex (de Man, 1880)
Stara Planina Mountains
Monhysterella stagnalis Bastian, 1865
Varna

RHABDITIDA
BUNONEMATIDAE
Bunonema tuerkorum Sachs, 1949
Vitosha Mountain

CEPHALOBIDAE
Acrobeloides labiatus Ivanova 1968
Blagoevgrad
Acrobeloides maximus (Thorne 1925)
Pirin Mountains
Cervidellus serratus (Thorne, 1925)
Blagoevgrad
Chiloplacus deconincki Coomans 1962
Strandzha Mountain Novo Panicharevo
Chiloplacus demani (Thorne 1925)
Thrace
Chiloplacus obtusicaudatum (Kreis 1930)
Strandzha Mountain Novo Panicharevo
Chiloplacus sclerovaginatus Sumenkova & Razzhivin 1968
Petrich
Eucephalobus laevis Thorne, 1937
Karlovo
Eucephalobus longicaudatus (Butschli 1873)
Blagoevgrad

CHAMBERSIELLIDAE
Macrolaimus crucis Maupas 1900
Thrace

DIPLOGASTERIDAE
Demaniella cibourgensis Steiner 1914
Thrace Harmanli
Diplogaster longicauda Claus 1862
Thrace Haskovo
Diplogaster microcerca Wollenweber, 1921
Thrace Pazardzhik

Appendix 3 Rare Species of Nematoda (Dr Vlada Peneva) (continued)

Diplogaster tenuis Schneider 1923
Blagoevgrad
Diplogasteritus superbus (Paesler 1946)
Rila Mountains Samokov
Diplogastrellus gracilis (Butschli 1876)
Karlovo

PANAGROLAIMIDAE
Microncma minutum Korner 1954
Western Rhodope Mountains
Panagrolaimus goodey Rhum 1956
Rila Mountains Parangalitsa
Panagrolaimus paetzoldi Goodey 1963
Prisan
Panagrolaimus verucosus Fuchs 1930
Gabur

RHABDITIDAE
Coarctadera kolbi (Sachs 1950)
Thrace Kazanka, Vishegrad
Mesorhabditis marinensis (Meyl 1953)
Thrace
Mesorhabditis oschei (Korner in Osche 1952)
Blagoevgrad
Mesorhabditis ultima (Korner in Osche 1952)
Thrace
Pelliodites hartmani (Sachs 1952)
Thrace Vishegrad
Phasmarhabditis hermaphrodita (Schneider 1859)
Blagoevgrad
Protorhabditis tristis (Hirshmann 1952)
Varna
Protorhabditis xylocola (Korner in Osche 1952)
Petrich
Rhabditis guignardi Maupas 1900
Thrace
Rhabditis intermedia de Man 1880
Stara Planina Mountains
Rhabditis marionis Maupas 1899
Blagoevgrad

TERATOCEPHALIDAE
Euteratocephalus palustris (de Man 1880)
Pirin Mountains

TYLENCHIDA
ANGUINIDAE
Ditylenchus geraerti Paramonov 1970
Dragalevtsi
Ditylenchus minutus Husain & Khan 1967
Kostinbrod
Subanguina askenasyi (Butschli 1873)
Thrace Pazardzhik

BELONOLAIMIDAE
Geocenamus hexincisus Jairajpuri & Baqri, 1971
Rila Mountains Parangalitsa
Geocenamus mamilatus (Tabar Jimenez, 1966)
Kostinbrod
Geocenamus nothus (Allen 1955)
Kostinbrod
Geocenamus sphaerocephalus Ivanova 1982
Thrace Asenovgrad
Trophurus maratwadensis Suryawanshi 1971
Kostinbrod
Trophurus minesotensis (Caveness, 1958)
Dragalevtsi
Tylenchorynchus brevilineatus Williams 1960
Katuntsi
Tylenchorynchus clarus Allen, 1955
Thrace Asenovgrad
Tylenchorynchus irregularis Wu 1969
Kostinbrod
Tylenchorynchus latus Allen 1955
Kostinbrod
Tylenchorynchus mexicanus Knobloch & Laughlin 1973
Dragalevtsi
Tylenchorynchus sulcatus de Guiran 1967
Kostinbrod

CRICONEMATIDAE
Criconema raskii (Goodey, 1963)
Pleven
Criconemella mongolensis (Andrassy 1964)
Rila Mountains Parangalitsa
Criconemella pseudosolivaga de Grisse, 1964
Western Rhodope Mountains
Criconemella solivaga (Andrassy, 1962)
Rila Mountains Parangalitsa
Crossonema menzeli (Stephanski, 1924)
Western Rhodope Mountains M Turnovo
Ogma hungaricum Andrassy, 1962
Strandzha Bulgari, Western Rhodope Mountains Gramatikovo

HEMICYCLIOPHORIDAE
Hemicycliophora labiata Colbran 1960
Kostinbrod

HOPLOLAIMIDAE
Helicotylenchus breviglans Sher 1965
Kostinbrod
Helicotylenchus platyurus Perry in Perry Darling & Thorne 1959
Kostinbrod

Appendix 3 Rare Species of Nematoda (Dr Vlada Peneva) (continued)

Rotylenchus alpinus Eroshenko, 1976
Rila Mountains Parangalitsa
Rotylenchus brevicaudatus Colbran 1962
Dragalevtsi
Scutellonema communae van der Berg & Heyns 1973
Karlovo

NEOTYLENCHIDAE
Hexatylus intermedius Christie, 1938
Blagoevgrad

NOTHOTYLENCHIDAE
Nothotylenchus affinis Thorne 1941
Kostinbrod
Nothotylenchus drymoculus Rhum 1956
Blagoevgrad
Nothotylenchus utschini Gagarin, 1974
Kostinbrod

PARATYLENCHIDAE
Gracilacus idalima (Raski 1962)
Dobrudzha Turnovtsi
Paratylenchus bucowinensis (Micoletky 1922)
Stara Planina Mountains Cherepish
Paratylenchus elachistus Steiner 1949
Kazanluk
Paratylenchus minusculus Tarjan 1960
Blagoevgrad
Trophonema arenaria (Raski, 1956)
Katuntsi

PRATYLENCHIDAE
Pratylenchus flakkensis Seinhors, 1968
Sofia district
Pratylenchus goodey Sher & Allen, 1953
Blagoevgrad
Pratylenchus hexincisus Taylor & Jenkins 1957
Dragalevtsi
Pratylenchus loosi Loof, 1960
Kostinbrod
Pratylenchus mulhandi Nandakumar & Khera 1970
Dragalevtsi
Pratylenchus pinquicaudatus Corbett 1969
Dobrich
Pratylenchus subpenetrans Taylor & Jenkins, 1957
Dragalevtsi

TYLENCHIDAE
Aglenchus parvus (Siddiqi 1963)
Petrich
Basiria abberans (Thorne 1949)
Dragalevtsi
Basiria graminofila Siddiqi 1959
Kazanluk
Basiria minor Geraert 1968
Rila Mountains Parangalitsa
Basiria obliquus (Thorne & Malek 1968)
Dragalevtsi
Basiria tumida (Colbran 1960)
Dragalevtsi
Boleodorus acutus Thorne & Malek 1968
Kostinbrod
Boleodorus impar Khan & Basir 1964
Kostinbrod
Boleodorus rafiqi Husain & Khan, 1964
Kostinbrod
Gracilanea gracloides (Micoletzky 1925)
Pirin Mountains
Psilenchus clavicaudatus (Micoletzky 1922)
Dragalevtsi
Tylenchus ritai Siddiqi, 1963
Kazanluk

Appendix 4 Bulgarian Endemic Species of Lumbricidae (Asst Prof Gabriela Milojkova)

Allolobophora biserialis Cern 1934
Zemen Lyulin Mountain, Vratsa ("Ledenika" cave), Sliven ("Dolna maza" cave) Kresna, Predela Vitosha Mountain
Allolobophora bulgarica Cern 1934
Bourgas (v Kyupriya) Vitosha Mountain, Kotel ("Kipilovska" cave), Strandzha Mountain (Grudovo) Belasitsa Mountain Predela
Allolobophora tuleskovi (Cern , 1934)
Pirin Mountains Kresna, Simitli
Dendrobaena rhodopensis (Cern 1937)
Rhodope Mountains, Teteven Mountain Rila Mountains (Maliovitsa Borovets)

Appendix 5 Balkan Endemic Species of Lumbricidae (Asst Prof Gariela Milojkova)

Allolobophora antiqua (Cern 1938)
Belasitsa Mountain Petrich Slavyanka Mountain
Allolobophora dobrogeana (Pop 1938)
Gurkovo Polyana Makedonka Smolnitsa
Allolobophora mechadiensis Rosa 1895
Bulgarin, Harmanli
Allolobophora rebeli Rosa, 1897
Stara Planina Mountains (Botev vruh) Sliven, Pazardzhik Slavyanka Mountain, Ograzhden Mountain Vitosha Mountain
Allolobophora robusta Rosa, 1895
Veliko Turnovo
Octodrilus exacystis (Rosa 1896)
Dubnitsa Gotse Delchev

Appendix 6 Rare Species of Lumbricidae (Asst Prof Gabriela Milojkova)

Allolobophora carpatica Cogn 1927
Haskovo Dervish mogila
Allolobophora dubiosa (Orl 1881)
Varna Beloslav lake, Ezerovo Kamchiya, Veleka
Allolobophora georgii Mich 1890
Petrich Belasitsa Mountain
Allolobophora leoni Mich 1891
Silistra
Dendrobaena hortensis (Mich 1890)
Stara Zagora
Dendrobaena hrabei (Cern , 1934)
Rila Mountains, Rhodope Mountains
Octodrilus gradinescui (Pop, 1938)
Varna v Beloslav
Octodrilus racovitzai (Pop, 1938)
Haskovo

Appendix 7 Bulgarian Endemic Species of Mollusca (Dr Zdravko Hubenov)

GASTROPODA PROSOBRANCHIA
MESOGASTROPODA
HYDROBIIDAE
Belgrandiella bureschi Angelov 1976
Trun Bankya
Belgrandiella hessei Wagner, 1927
Stara Planina Mountains "Lakatnik' cave
Belgrandiella pussilla Angelov 1959
Stara Planina Mountains "Lakatnik" cave
Caverniste zaschevi (Angelov 1959)
Stara Planina Mountains Iskrets Tserovo
Hauffenia lucidulus Angelov 1967
Dobroudzha Rousalka
Iglica acicularis Angelov 1959
Stara Planina Mountains Iskrets
Insignia macrostoma Angelov 1972
Stara Planina Mountains Teteven
Paladilhiopsis bureschi Wagner, 1927
Stara Planina Mountains "Lakatnik" cave
Pontobelgrandiella angelovi (Pinter 1968)
Stara Planina Mountains Shipka
Pontobelgrandiella bulgarica (Angelov 1972)
Stara Planina Mountains Teteven
Pontobelgrandiella nitida (Angelov 1972)
Stara Planina Mountains Teteven

GASTROPODA PULMONATA
STYLOMMATOPHORA
CLAUSILIIDAE
Bulgarica bajula (Schmidt 1868)
Rhodope Mountains Bachkovo
Bulgarica fraudigera (Rossmassler, 1839)
Rhodope Mountains Chepelarska River, Bachkovo, Yugovo, Mostovo Stara Planina Mountains Lakatnik
Bulgarica hiltrudae Nordsieck 1974
Stara Planina Mountains Cherepishki manastir
Bulgarica pagana bulgarica (Kuster 1861)
Stara Planina Mountains Lakatnik Turnovo
Bulgarica urbanski Nordsieck 1974
Stara Planina Mountains Sliven
Bulgarica varnensis (Pfeiffer 1848)
Stara Planina Mountains Vratsa Stoletov Troyan Lakatnik, Rouse Bleak Sea coast Aladzha Sozopol Arkoutino Eastern Rhodope Mountains Strandzha Mountain Malko Turnovo
Bulgarica vratzatica Likharev 1972
Stara Planina Mountains Vrattsata, Ledenika
Carinigera damjanovi Likharev 1972
Gotsedelchevska kotlovina Koprivlen
Euxina persica paulhessei (Lindholm, 1925)
South Bleak Sea coast Resovska River Silistar River Veleka River Arkoutino Agalina Kiten, Primorsko Strandzha Mountain Malko Turnovo, Padaloto
Idyla castalia boschi Nordsieck 1973
Pirin Mountains Bansko Bunderitsa Vihren
Idyla castalia pirostoma (Boettger 1880)
Pirin Mountains Bunderishki choukar
Idyla pinteri Nordsieck, 1973
Rhodope Mountains Dospat Skalnite mostove

Appendix 7 Bulgarian Endemic Species of Mollusca (Dr Zdravko Hubenov) (continued)

Laciniaria macilenta (Rossmassler 1842)
Rhodope Mountains Chepelarska valley Asenovgrad Narechen
Macedonica brabenecl Nordsieck 1974
Rhodope Mountains Smolyan
Macedonica frauenfeldi redeli Urbanski 1977
Trun Erma River
Macedonica macedonica pirinensis Jackel 1954
Pirin Mountains Slavyanka Mountain Gotsev vruh
Macedonica marginata frivaldskyana (Rossmassler, 1839)
Pirin Mountains Bunderitsa
Macedonica marthae Sajo 1968
Pirin Mountains Vichren
Macedonica zilchi Urbanski, 1971
Rhodope Mountains Trigrad
Mentissela rebeli (Sturany 1897)
Stara Planina Mountains Sliven Eastern Dounavska ravnina Kaspichan Provadiya Black Sea coast Beloslav Varna Bourgas, Velcka River Silistar River Rezovska River Strandzha Mountain
Pseudalinda bajula (Schmidt, 1868)
Rhodope Mountains Stara Planina Mountains
Pseudalinda musalicae Urbanski 1969
Rhodope Mountains Moursalitsa Golyam Perelik Chepelare
Pseudalinda rhodopaium Urbanski 1960
Rhodope Mountains Bachkovski manastir Chepelarska River
Pseudalinda serbica (Moellendorff 1873)
Osogovo Mountain
Vestina ranojevici ranojevici (Pavlovic 1912)
Rhodope Mountains Beglika Pirin Mountains Bunderishka valley Bansko

ENINAE
Zebrina kindermanni kindermanni (Pfeiffer 1847)
South Black Sea coast Bourgas Ajtos

HELICIDAE
Helicigona buresi (Wagner 1927)
Stara Planina Mountains Lakatnik
Helicigona pelia (Hesse 1912)
Stara Planina Mountains Vitosha Mountain, Rila Mountains
Helicigona polinskii pirinensis (Wagner 1927)
Pirin Mountains Bayuvi doupki Kamenitsa, Sinanitsa
Helicigona polinskii polinskii (Wagner 1927)
Pirin Mountains Vichren, Bunderitsa Kamenitsa Sinanitsa
Helicigona sztolcmani (Wagner 1927)
Pirin Mountains Bayuvi doupki
Helicigona trizona balcanica (Kobelt, 1876)
Stara Planina Mountains Lakatnik Troyanski manastir Dryanovski manastir Vitosha Mountain Rhodope Mountains Kostenets Velingrad Predbalkan Turnovo Lovech Dobroudzha
Helicigona trizona haberhauen (Sturany 1897)
Rhodope Mountains Pirin Mountains Bunderitsa Slavyanka Mountain Rila Mountains Rilski manastir
Helix locuium oniximicia Bourguignat, 1860
South Black Sea coast Slunchev bryag, Bourgas, Sozopol, Ropotamo, Michourin Ahtopol

HYGROMIIDAE
Helicella obvia razlogi Pinter, 1969
Rhodope Mountains Velingrad Pazardzhik
Helicella spiruloides Wagner 1916
Black Sea coast Balchik Kavarna Varna Pobiti Kamuni Dourankoulak Michourin Arkoutino
Monacha carascaloides (Bourguignat, 1855)
Black Sea coast, Trakiyska nizina, Predbalkan
Monacha pilosa Pinter 1969
Black Sea coast Ropotamo River Michourin Lozenets

LIMACIDAE
Deroceras agreste transcaucasicum Hudec & Vasatko, 1971
Pirin Mountains Vihren
Deroceras bulgaricum Grossu 1969
Trakiyska nizina Svilengrad
Deroceras bureschi (Wagner, 1934)
Western Stara Planina Mountains Vitosha Mountain Rila Mountains Plana Mountain, Pirin Mountains (Gotse Delchev) Rhodope Mountains
Lehmannia brunneri (Wagner 1931)
Stara Planina Mountains Vitosha Mountain Rila Mountains Pirin Mountains Osogovo Mountain Rhodope Mountains

MILACIDAE
Milax parvulus Wiktor 1968
Stara Planina Mountains Rhodope Mountains Kurdzhali Zemen Vitosha Mountain Strandzha Mountain Zvezdets Black Sea coast Silistar River Trun
Milax verrucosus Wiktor 1969
Stara Planina Mountains Gabrovo, Teteven, Cherni Osum, Shipka, Iskar River Dubnika
Tandonia pinteri (Wiktor 1975)
Rhodope Mountains Choudni mostove, Smolyan, Devin
Tandonia pirinana Wiktor 1983
Pirin Mountains Gotse Delchev Koprivlen, Melnik

Appendix 7 Bulgarian Endemic Species of Mollusca (Dr Zdravko Hubenov) (continued)

ORCULIDAE
Orcula zilchi Urbanski, 1960
South Black Sea coast, Strandzha Mountain
Pagodulina subdola brabenecl Hudec & Vasatko 1971
Rhodope Mountains Smolyan, Mostovo Bachkovo, Narechen, Trakiyska nizina Plovdiv

PUPILLIDIDAE
Argna macrodonta macrodonta (Hesse 1916)
Stara Planina Mountains Gara Lakatnik Trakiyska nizina Plovdiv

ZONITIDAE
Carpatica bielawskii Riedel, 1963
South Black Sea coast Sozopol Rezovska River Strandzha Mountain Malko Turnovo Gramatikovo
Lindbergia uminskii Riedel, 1960
Stara Planina Mountains Troyan Teteven Vezhen
Vitrea neglecta Damjanov & Pinter, 1969
Stara Planina Mountains Vratsa Sliven Predbalkan Veliko Turnovo Kyustendil Rhodope Mountains Chepelarska River Devin Smolyan, Velingrad

Appendix 8 Balkan Endemic Species of Mollusca (Dr Zdravko Hubenov)

GASTROPODA PROSOBRANCHIA
MESOGASTROPODA
HYDROBIIDAE
Pseudamnicola consociella (Frauenfeld 1863)
Varna Gebedzhensko ezero, Aladzha manastir Stara Planina Mountains Bouchin prohod
Sadleriana viescens Kustei
Strandzha Mountain Malko Turnovo Stara Planina Mountains Bachkovski manastir

GASTROPODA PULMONATA
STYLOMMATOPHORA
CLAUSILIIDAE
Bulgarica fritillaria (Rossmassler 1839)
Eastern Stara Planina Mountains Trakiyska nizina Plovdiv Maritsa Sandansko Petrichka kotlovina Petrich Stroumeshnitsa River
Bulgarica thessalonica (Rossmassler 1839)
Trakiyska nizina Rhodope Mountains Sredna Gora Mountains Bogdan Strandzha Mountain Black Sea coast
Delima schuetti Brandt 1962
Slavyanka Mountain
Macedonica frauenfeldi frauenfeldi (Rossmassler 1856)
Stara Planina Mountains Iskar River Vratsa Dragoman
Macedonica macedonica macedonica (Rossmassler 1839)
Pirin Mountains
Vestina petrovici (Pavlovic 1912)
Stara Planina Mountains Belogradchik
Vestina roschitzi nordsieckiana Urbanski 1979
Stara Planina Mountains Belogradchik

ENINAE
Chondrula macedonica macedonica Wagner 1915
Strouma River downstream
Zebrina detrita inflata (Kobelt 1877)
Slavyanka Mountain Gotsev vruh Pirin Mountains Bunderitsa Rhodope Dospat
Zebrina varnensis (Pfeiffer 1847)
Bulgarian Black Sea coast Shabla Rousalka Kaliakra, Balchik Bourgas Ahtopol

FERUSSACIIDAE
Cecilioides aciculoides (Jan, 1832)
Stara Planina Mountains Rhodope Mountains Western Bulgaria Strouma and Mesta River valleys Maritsa River Black Sea coast Veleka River Dobroudzha Predbalka Veliko Turnovo
Cecilioides spelaeus (Wagner, 1914)
Plovdiv HELICIDAE
Helicigona trizona rumelica (Rossmassler 1838)
Rhodope Mountains Bachkovo, Dospat Tirgrad, Shiroka luka Smolyan Asenovgrad Bachkovski manastir Haskovo Slavyanka Mountain Pirin Mountains Melnik Plovdiv Dobroudzha

HELICODONTIDAE
Lindholmiola corcynensis corcynensis (Deshayes 1839)
All of Bulgaria
Lindholmiola corcynensis pirinensis Jaeckel 1954
Rila Mountains Rhodope Mountains Devin Pirin Mountains Sinanitsa

HYGROMIIDAE
Helicella macedonica Hesse 1928
Pirin Mountains Bunderitsa Predel Vihren Slavyanka Mountain Gotsev vruh
Helicella rhabdotoides (Wagner 1927)
Trun Kyustendil Stara Planina Mountains Etropole Gara Lakatnik Predbalkan Lovech Veliko Turnovo Varna

Appendix 8 Balkan Endemic Species of Mollusca (Dr Zdravko Hubenov) (continued)

Trichia erjavecı (Brusina 1870)
Trun Stara Planina Mountains Troyanski manastır Sakhar hilly region Svilengrad Rhodope Mountains Batak Black Sea coast Ropotamo River Slunchev bryag

LIMACIDAE
Deroceras sturanyi (Simroth 1894)
Sofiysko pole Kostinbrod Mihaylovgrad Levcha, Mirovtsi Plovdiv Harmanli Kyustendil Haskovo Trun Black Sea coast Nesebr Rezovo
Deroceras thersites (Simroth, 1886)
Rhodope Mountains Momchilgrad Strandzha Mountain Malko Turnovo Michourin) Sakhar hilly region Bleak Sea coast Zlatni pyasutsi Rezovo
Limax carbonarius Boettger 1885
Rila Mountains Rilski manastir Pirin Mountains Bunderitsa valley Melnik
Limax conemenosi Boettger 1882
Vitosha Mountain Bosnek Kyustendil Pirin Mountains Blagoevgrad Doupnitsa Stara Planina Mountains Sinite kamuni Kazanluk Gabare
Limax macedonicus Hesse 1928
Rila Mountains Skakavitsa Rhodope Mountains Trigrad Haskovo Momchilgrad Sakhar hilly region Topolovgrad Sredna Gora Starozagorski bani Bleak Sea coast Varna Ropotamo River

MILACIDAE
Tandonia kuscen (Wagner, 1931)
All of Bulgaria

Tandonia serbica (Wagner 1931)
Trun Stara Planina Mountains Lakatnik, Vratsa, Troyanski manastir Sliven Pirin Mountains Rhodope Mountains Bachkovski manastir, Narechen Smolyan Zlatograd Madan Rila Mountains Skakavitsa Rilski manastir Vitosha Mountain Malashevska Mountain Slavyanka Mountain Petrich

PUPILLIDIDAE
Argna macrodonta rumelica (Hesse, 1916)
Dunavska ravnina Lom Bulgarian Bleak Sea coast Strandzha Mountain Stara Planina Mountains Trakiyska nizina Plovdiv

ZONITIDAE
Daudebardia wiktori Riedel 1967
Western Stara Planina Mountains Nishava River Rhodope Mountains Asenovgrad, Bachkovo Erkvupriya Mostovo Smolyan, Zlatograd
Oxychilus deilus malinowskii (Pfeiffer 1865)
Eastern Rhodope Mountains Eastern Stara Planina Mountains Dobroudzha Strandzha Mountain
Paraegopis frivaldskyanus (Rossmassler, 1848)
Stara Planina Mountains Karlovo Predbalkan Veliko Turnovo Rhodope Mountains Chepelarska River Kurdzhali
Vitrea bulgarica Damjanov & Pinter, 1969
Osogovo Mountain Stara Planina Mountains Rhodope Mountains Rila Mountains Pirin Mountains Slavyanka Mountain
Vitrea sturanyi (Wagner 1907)
Rhodope Mountains Velingrad Trigrad

Appendix 9 Caspian Relict Species of Mollusca (Dr Zdravko Hubenov)

BIVALVIA EULAMELLIBRANCHIATA
CARDIIDAE
Hypanis colorata (Eichwald 1829)
Black Sea (subfossil) Kaliakra, Varnenski zaliv
Hypanis plicata relicta (Milachevitch 1916)
Black Sea (subfossil) Kaliakra

DREISSENIDAE
Dreissena distincta (Andrusov 1897)
Black Sea (subfossil)

Dreissena polymorpha (Pallas 1771)
Danube River Varnensko, Beloslavsko, Mandrensko, Bourgasko Lakes Kamchia Veleka Rivers

GASTROPODA PROSOBRANCHIA
ARCHAEOGASTROPODA
NERITIDAE
Theodoxus danubialis (Pfeiffer 1828)
Rivers Danube, Iskar Yantra, Ogosta, Rositsa Rousenski, Lom Vit, Zlatna Panega

Appendix 9 Caspian Relict Species of Mollusca (Dr Zdravko Hubenov) (continued)

Theodoxus pallasi Lindholm 1924
Black Sea (subfossil)
Theodoxus pilidei (Milachevitch 1912)
Black Sea (subfossil)

MESOGASTROPODA
HYDROBIIDAE
Lithoglyphus naticoides (Pfeiffer 1828)
Rivers Danube Yantra Rositsa Rousenski Lom Vit

MELANIIDAE
Clessiniola variabilis Eichwald 1841
Black Sea (subfossil), Danube River?
Fagotia acicularis (Ferussac, 1823)
Rivers Danube (Vidin Silistra) Yantra Rositsa Rousenski Lom Vit Ogosta Zlatna Panega
Micromelania lincta Milachewitch, 1908
Lakes Varnensko Gebedzhensko Mandrensko Danube River?

Appendix 10 Tertiary Relict Species of Mollusca (Dr Zdravko Hubenov)

GASTROPODA PULMONATA
BASOMMATOPHORA
ELLOBIIDAE
Ovatella myosotis (Draparnaud 1801)
Black Sea coast

PUPILLIDAE
Laurina anglicata (Wood 1828)
Southern Black Sea coast Veleka and Silistar Rivers
Laurina cylindracea (Da Costa 1778)
Southern Black Sea coast Strandzha Mountain Malko Turnovo

STYLOMMATOPHORA
OLEACINIDAE
Poiretia algira (Bruguiere 1792)
Sandansko Petrichka and Mestenska kotlovini

ORCULIDAE
Orcula bulgarica Hesse 1915
Dobroudzha Vitosha Mountain

SUBULINIDAE
Rumina decollata (Linnaeus, 1758)
Varna

GASTROPODA PROSOBRANCHIA
MESOGASTROPODA
POMATIASIDAE
Pomatias elegans (Muller 1774)
Stara Planina Mountains, Sredna Gora Mountains Strouma and Mesta valley Rhodope Mountains Trakiyska nizina
Pomatias rivulare (Muller 1774)
Dounavska ravnina Stara Planina Mountains Trakiya Rhodope Mountains Black Sea coast Sredna Gora Mountains

GASTROPODA PULMONATA
STYLOMMATOPHORA
CLAUSILIIDAE
Euxina circumdata (Preiffer, 1848)
Southern Bleak Sea coast Sozopol Rezovska River, Strandzha Mountain Padaloto Malko Turnovo Gramatikovo
Galeata schwerzenbachi (Charpantier, 1852)
Bleak Sea coast Silistar River Veleka River Strandzha Mountain Malko Turnovo, Zvezdets
Megaleuxina circumdata (Wagner 1912)
Varna river Kamchiya river ropotamo river Rezovska ? Plovdiv
Serrulina serrulata (Pfeiffer 1847)
Bleak Sea coast river Kamchiya river Resovska

HELICIDAE
Helix figulina Rossmassler, 1839
Trakiyska nizina Kirilovo Starozagorski bani, Plovdiv, Asenovgradsko Chirpan, Haskovo Harmanli, Pirin Mountains Melnik Rhodope Mountains Kurdzhali Stara Planina Mountains Sliven
Helix pomacella Mousson, 1854
Black Sea coast Aytos Bourgas Sozopol river Ropotamo, Arkoutino, Agalina, Michourin Strandzha Mountain Malko Turnovo
Helix vulgaris Rossmassler, 1839
Dobroudzha Slivnitsa, Plovdiv Pazardzhik Asenovgrad, Harmanli, Gotse Delchev, Sandanski

LIMACIDAE
Krynickillus urbanskii (Wiktor, 1971)
Stara Planina Mountains Karlovo Troyan, Black Sea coast Obzor river Ropotamo Strandzha Mountain
Limax flavulus Linnaeus 1758
Black Sea coast, Sofia, Mihaylovgrad Harmanli Sliven Sestrimo

Appendix 10 Tertiary Relict Species of Mollusca (Dr Zdravko Hubenov) (continued)

ZONITIDAE
Oxychilus deilus rumelicus (Hesse 1913)
Western Rhodope Mountains Eastern Stara Planina Mountains Dobroudzha Strandzha Mountain Black Sea coast
Oxychilus hydatinus (Rossmassler 1838)
Dobroudzha Varna Veloko Turnovo Sredna Gora Mountains Vitosha Mountain Harmanli Rhodope Mountians Kurdzhali, Rila Mountains Rilski manastir Black Sea coast
Oxychilus moussoni (Kobelt 1878)
Stara Planina Mountains Kotel Sliven, Strandzha Mountain
Oxychilus urbanski Riedel, 1963
Stara Planina Mountains Kotel Sakhar hilly region South Black Sea coast
Vitrea pygmaea (Boettger 1880)
Strandzha Mountain Sakhar hilly region Rhodope Mountains Haskovo Stara Planina Mountains Black Sea coast

Appendix 11 Rare Species of Mollusca (Dr Zdravko Hubenov)

BIVALVIA EULAMELLIBRANCHIATA
SPHAERIIDAE
Pisidium bulgaricum Odhner, 1929 ?
Vitosha Mountain
Pisidium milium Held, 1836
Sofia Boyansko blato, Sofiysko pole
Pisidium moitessierianum (Paladilhe, 1866)
Danube Archar
Pisidium nitidum Jenyns 1832
Sofia Opitsvet
Pisidium obtusale (Pfeiffer, 1821)
Sofiysko pole, Samokov Mala cherkva
Pisidium subtruncatum (Malm 1855)
Samokovsko Maritsa River, Sofia Bezden
Pisidium supinum Schmidt 1850
Maslen nos, ? Danube Rouse

THRACIIDAE
Thracia papyracea (Poli 1791)
Black Sea Varnenski zaliv

UNIONIDAE
Pseudanodonta complanata (Rossmaessler, 1835)
Danube Lom Svishtov Rouse, Gebedzhensko blato Srebarna

FILIBRANCHIATA
ANOMIIDAE
Anomia ephippium Linnaeus 1758
Black Sea Varnenski zaliv

PECTINIDAE
Pecten jacobaeus (Linnaeus, 1758) ?
Black Sea Varnenski zaliv

GASTROPODA OPISTOBRANCHIA
LIMAPONTIIDAE
Limapontia capitata (Muller, 1773)
Black Sea Varna

PSEUDOVERMIDAE
Pseudovermis paradoxus Perejaslawtzeva, 1890
Black Sea Varna, Nesebur

GASTROPODA PROSOBRANCHIA
ARCHAEOGASTROPODA
NERITIDAE
Theodoxus fluviatilis (Linnaeus 1758)
Varna Devnenski izvori, Dunabe Svishtov

MESOGASTROPODA
ACICULIDAE
Acicula polita (Hartmann 1840)
South Black Sea coast river Silistar Varvara Kiten

ASSIMINEIDAE
Paludinella eliae rufostrigata (Hesse 1916)
Varna Varnensko ezero

HYDROBIIDAE
Bythinella austriaca (Frauenfeld 1857)
Rila Mountains Borovets Rhodope Mountains Pesgtera Smolyan, Sredna Gora Mountains Koprivshtitsa

MELANIIDAE
Fagotia esperi (Ferussac, 1823)
Danube Vidin Rouse Yantra Radanovo, Rousenski Lom Besarbovo Vit Yasen, Zlatna Panega Loukovit

NASSARIIDAE
Cyclonassa westerlundi (Brusina 1900)
Black Sea Varna

TORNIDAE
Tornus subcarinatus (Montagu, 1803)
Black Sea Sveta Anastasiya

VALVATIDAE
Valvata naticina Menke 1845
Danube Svishtov, Rouse
Valvata pulchella Studer 1820
Danube Kozlodouy, Rhodope Mountains Batashko blato

Appendix 11 Rare Species of Mollusca (Dr Zdravko Hubenov) (continued)

VIVIPARIDAE
Viviparus mamillatus Kuster 1852
Danube

GASTROPODA PULMONATA
BASOMMATOPHORA
ANCYLIDAE
Ferrissia wautieri (Mirolli 1960)
Sofia Kazichane Varna Beloslavsko ezero
South Black Sea coast Arkoutino

LYMNAEIDAE
Stagnicola corvus (Gmelin 1791)
Plovdiv Yambol marsh Stralszhansko Ormana, Varna

PHYSIDAE
Aplexa hypnorum (Linnaeus, 1758)
Stara Planina Mountains Kotlenski sprongs
Physa fontinalis (Linnaeus 1758)
Plovdiv Novoseltsi Kadievo Sofia Kazichane Danube rare only in the marches

PLANORBIDAE
Anisus spirorbis (Linnaeus, 1758)
Sofia Boyansko blato Danube Lom
Anisus vortex (Linnaeus 1758)
Plovdiv Varna Devnenski izvori Danube Krivina
Anisus vorticulus (Troschel, 1834)
Plovdiv Novoseltsi
Bathyomphalus contortus (Linnaeus 1758)
Plovdiv Sofia Kazichane
Gyraulus albus (Muller 1774)
Plovdiv Danube Svishtov Gyurgevo Oltenitsa
Gyraulus laevis (Adler 1838)
Danube Rouse
Hippeutis complanatus (Linnaeus, 1758)
Plovdiv Novoseltsi Kadievo
Planorbis carinatus Muller 1774
Plovdiv river Maritsa Danube

STYLOMMATOPHORA
CLAUSILIIDAE
Laciniana vetusta vetusta (Bielz, 1861)
Vitosha Mountain Belogradchik

ENIDAE
Chondrus tournefortianus (Ferussac 1821)
Varna
Chondrus zebra tantalus (Pfeiffer 1868)
Rhodope Mountains Asenovgrad Devin Persenk
Jaminia squalina squalina (Rossmassler 1848)
Black Sea coast Byala Nesebur

HELICODONTIDAE
Soosia diodonata (Ferussac 1821)
Vitosha Mountain Boyanski vodopad

HYDROMIIDAE
Helicella dejecta (Jan 1832)
Dobroudzha river Strouma
Helicella derbentina (Krynicki 1836)
Varna Dobroudzha
Trichia hispida (Linnaeus 1758)
Rhodope Mountains Trun

PUPILLIDAE
Laurria anglica (Wood, 1828)
South Bleak Sea coast river Veleka, Silistar
Laurria cylindracea (Da Costa 1778)
South Bleak Sea coast Malko Turnovo
Pupilla triplicata (Studer 1820)
Eastern Stara Planina Mountains

SUCCINEIDAE
Oxyloma elegans (Risso, 1826)
Harmanli, river Kamchiya river Ropotamo
Succinea putris (Linnaeus, 1758)
Varnensko ezero

VALLONIIDAE
Spelaeodiscus triatria triatria (Rossmassler 1839)
Western Stara Planina Mountains Ledenika Godech

VERTIGINIDAE
Columella edentula (Draparnaud, 1805)
Varna Zlatni pyasutsi, Rila Mountains Rilski manastir
Truncatellina costulata (Nilsson, 1822)
Strandzha Mountain Malko Turnovo, Elhovo
Truncatellina strobeli (Gredler, 1853)
North Rhodope
Vertigo alpestris (Adler 1830)
Vitosha Mountain, Rhodope Mountains Devin Trigrad Rila Mountains Stara Planina Mountains Botev Ledenica
Vertigo substriata (Jeffreys 1830)
Varna Zlatni pyasutsi, Plovdiv

VITRINIDAE
Semilimacella reitteri (Boettger 1880)
Rhodope Mountains Erkyupriya

ZONITIDAE
Vitrea transsylvanica (Clessin 1877)
Stara Planina Mountains Teteven Predbalkan Veliko Turnovo

Appendix 12 Bulgarian Endemic Species of Isopoda (Dr Stoice Andreev)

ARMADILLIDIIDAE
Armadillidium bulgaricum Frankenberger 1941
Strouma valley
Armadillidium elyssii Verhoeff, 1936
Central Stara Planina Mountains
Armadillidium rhodopinum Verhoeff 1936
Rhodope Mountains

LIGIDIIDAE
Ligidium golemanskii Andreev, 1992
Rhodope Mountains

ONISCIDAE
Armadillidium euxinum Verhoeff 1929
North Black Sea coast Evxinograd
Armadiloniscus bulgaricus Frankenberger, 1941
Black Sea coast

PLATYARTHRIDAE
Myrmekiocellio squamatus Verhoeff 1936
Zemenski prolom
Platyarthrus atanassovi Verhoeff, 1936
Eastern Dounavska ravnina
Platyarthrus messorum Verhoeff, 1936
Zemenski prolom

STYLONISCIDAE
Cordioniscus bulgaricus Andreev 1985
Osogovo Mountain

TRACHELIPIDAE
Trachelipus bugaricus bulgaricus Verhoeff, 1926
Central Stara Planina Mountains
Trachelipus bulgaricus bureschi Verhoeff 1926
Eastern Stara Planina Mountains *Trachelipus mirmicidarum* Verhoeff 1936
Zemenski prolom

TRICHONISCIDAE
Acychoniscus nabeleki Frankenberger, 1940
Black Sea coast
Balcanoniscus berori Vandel, 1965
Rhodope Mountains
Balcanoniscus corniculatus Verhoeff, 1926
Stara Planina Mountains
Balcanoniscus minimus Vandel, 1967
Central Stara Planina Mountains
Beroniscus capreolus Vandel 1967
Central Stara Planina Mountains
Bulgaronethes haplophthalmoides Vandel 1967
Rhodope Mountains
Bureschia bulgarica Verhoeff 1926
Western Stara Planina Mountains
Cyphoniscellus bulgaricus Vandel, 1967
Western Stara Planina Mountains
Cyphoniscellus gueorguievi Vandel, 1967
Western Stara Planina Mountains
Haplophthalmus intermedius Frankenberger, 1941
Black Sea coast
Hyloniscus crassicornis Verhoeff, 1926
Western and Central Stara Planina Mountains
Hyloniscus flammula Vandel 1965
Western Stara Planina Mountains
Hyloniscus pugionum Verhoeff, 1926
Central Stara Planina Mountains
Hyloniscus rilensis Mehely, 1929
Rila Mountains
Hyloniscus taborski Frankenberger 1940
Rila Mountains
Illyrionethes tranteevi Andreev (in press)
Slavyanka Mountain
Trichoniscus anophthalmus anophthalmus Vandel 1965
Western Stara Planina Mountains
Trichoniscus anophthalmus intermedius Vandel 1965
Dounavska ravnina Rouse (cave)
Trichoniscus berori Andreev 1985
Strandzha Mountain
Trichoniscus bononiensis Vandel 1965
Western Stara Planina Mountains
Trichoniscus bulgaricus Andreev, 1970
Stara Planina Mountains
Trichoniscus bureschi Verhoeff, 1926
Stara Planina Mountains
Trichoniscus raitchevi Andreev & Tabacaru, 1972
Rhodope Mountains
Trichoniscus tenebrarum Verhoeff, 1926
Central Stara Planina Mountains
Trichoniscus valkanovi Andreev 1985
Strandzha Mountain
Tricyphoniscus bureschi Verhoeff 1926
Western and Central Stara Planina Mountains

Appendix 13 Balkan Endemic Species of Isopoda (Dr Stoice Andreev)

PLATYARTHRIDAE
Platyarthrus reticulatus Radu, 1959
Dounavska ravnina

TRACHELIPIDAE
Protracheoniscus ubliensis (Verhoeff, 1901)
Western Stara Planina Mountains

TRICHONISCIDAE
Hylonuscus stancovici Pljakic, 1963
Western Stara Planina Mountains
Monocyphoniscus babadagensis Radu, 1965
Black Sea coast
Monocyphoniscus bulgaricus Strouhal, 1939
Rhodope Mountains Strandzha Mountain
Trichoniscus rhodopiense Vandel, 1965
Rhodope Mountains
Trichoniscus semigranulatus Buturovic 1960
Osogovo Mountain
Trichoniscus serbicus Pljakic, 1970
Western Stara Planina Mountains

Appendix 14 Rare Species of Isopoda (Dr Stoice Andreev)

ARMADILLIDIIDAE
Armadillidium elyssii Verhoeff, 1936
Central Stara Planina Mountains

ONISCIDAE
Armadillidium euxinum Verhoeff, 1929
North Black Sea coast Evximograd
Chaetophiloscia cellaria (Dolffus, 1864)
Rhodope Mountains
Chaetophiloscia elognata (Dolffus, 1896)
South Black Sea coast

Appendix 15 Bulgarian Endemic Species of Arachnida (Dr Christo Deltshev Dr Gergin Blagoev)

PSEUDOSCORPIONES
CHTHONIIDAE
Balkanoroncus bureschi (Redikorzev, 1928)
Teteven Sueva Doupka cave
Balkanoroncus hadzii Harvey 1991
Gornata Peshtera cave
Chthonius cavophilus Hadzi 1939
Glava Panega cave
Chthonius troglodites Redikorzev 1928
Karloukovo (caves) Pleven cave
Neobisium (Neoblothrus) beroni Beier 1963
Lakatnik Svinskata Doupka cave
Neobisium (Neoblothrus) bulgaricum (Redikorzev, 1928)
Jalovitsa cave (Golyama Zhelezna)
Neobisium intermedium Mahnert, 1974
Prolaz Doupkata cave
Neobisium kwartirnikovi Mahnert 1972
Vitosha Mountain Douhlata cave
Roncus mahnerti Curcic & Beron 1981
Botunya Vodnata Doupka cave

OPILIONES
GAGRELLIDAE
Leiobunum rumelicum Silhavy 1965
Stara Planina Mountains Pirin Osogovo, Rila Plovdiv Pazardzhik Vitosha

NEMASTOMATIDAE
Histricostoma drenskii Kratochvil 1958
Hvojnovska pestera (Sm2), Rila Predela, Melnik Belasitsa Klyuch, Western Rhodope Velingrad Pazardzik Rakitovo Batak Beglika, Satovcha Devin Hvojna, Narechen, Chepelare, Smolyan Notheast Rhodope Krumovgrad
Paranemastoma (Buresiolla) bureschi (Roewer, 1926)
Sofia Dinevata pestera (Sf 3) Svetata voda (Sf 4) Krivata pestera (Sf 5), Otechestvo (Sf 16) Doushnika (Sf 17), Mechata doupka (Sf 24), Svurdelo (Sf 26), Kolkina doupka (Sf 28), Zhidanka (Sf 29), Temnata doupka (Sf 30), Katsite (Sf 37) Propastta (Sf 43), Elata (Sf 48) Vodnata pestera (Sf 52), Radjova propast (Sf 59), Vratsa Reznjovete (Vr 16), Ledenika (Vr 17) Medenik (Vr 18) Golemata mecha doupka (Vr 19) Zmejova doupka (Vr 25), Garvanets (Vr 31) Lovech Siyuva doupka (Lv 18)
Paranemastoma (s str) *auringerum auringerum* (Roewer 1951)
Rhodope, Pazardzik, Batak Satovcha, Bourgas, Sozopol Beglika Smolyan Chepelare Pamporovo Pesteri Lednikata Dobrostan Shiroka luka Er Kyupria Mecha doupka

Appendix 15 Bulgarian Endemic Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev) (continued)

Paranemastoma (s str) *aurigerum joannae*
Starega 1976
Petrich Klyuch Belasitsa
Paranemastoma (s str) *aurigerum ryla* (Roewer 1951)
Rila Borovets Maljovitsa Parangalitsa Yakoroudi Rilski manastir Pirin Popina luka, Demyanitsa Bunderitsa, Begovitsa Bansko Vitosha, Western Rhodope Velingrad, Pestera Batak

PHALANGIIDAE
Eudasylobus beschkovi Starega, 1976
Petrich Bourgas Eminska Planina Mountains Banya, Nesebur Sozopol Strandza Yambol Kurdzali Plovdiv Sliven
Rilaena buresi (Silhavy 1965)
Strandza Malko Turnovo Bourgas, Eastern Stara Planina Mountains Eminska Planina Mountains Banya

PHALANGODIDAE
Paralola buresi Kratochvil 1951
Lakatnik (caves) Zidanka (Sf 29), Temnata doupka (Sf 30), Svinskata doupka (Sf 33), Kozharskata (Sf 34)

ARANEAE
LEPTONETIDAE
Protoleptoneta berori Deltshev 1977
Mihajlovgrad (cave)
Protoleptoneta bulgarica Deltshev, 1972
Caves Lovech, Vratsa, Mihajlovgrad

ZODARIIDAE
Zodarion pirini Drensky, 1921
Pirin Mountains, Vitosha Mountain Rila Mountains, Rhodope Mountains

NESTICIDAE
Nesticus berori Deltshev 1973
Plovdiv (cave)

LINYPHIIDAE
Antrohyphantes balcanica (Drensky 1931)
Central Stara Planina Mountains Teteven (cave) Troyan (9 caves)
Antrohyphantes rhodopensis (Drensky, 1931)
Western Rhodope Mountains (caves), Pirin Mountains Rila Mountains
Antrohyphantes sofianus (Drensky 1931)
Western Stara Planina Mountains (caves)
Araeoncus clivifrons Deltshev 1987
Pirin Mountains Rila Mountains
Centromerus bulgarianus (Drensky, 1931)
Western Stara Planina Mountains (caves)
Centromerus pauciaentatus Deltshev 1983
Pirin Mountains
Centromerus valkanovi Deltshev 1983
Varna Asparouhovo
Diplocephalus altimontanus Deltshev 1983
Pirin Mountains
Erigone longipalpis pirini Deltshev, 1983
Pirin Mountains
Lepthyphantes drenski Helsdingen, 1977
Vitosha Dragalevtsi
Lepthyphantes gueorguievi Deltshev, 1980
Rhodope Mountains (caves)
Lepthyphantes lithoclasicolus Deltshev 1983
Pirin Mountains
Lepthyphantes rectilamellus Deltshev, 1988
Pirin Mountains
Lepthyphantes trnovensis (Drensky 1931)
Western and Central Stara Planina Mountains (caves)
Metopobactrus orbelicus Deltshev, 1985
Pirin Mountains
Troglohyphantes bureschianus Deltshev 1975
Western Rhodope Mountains
Troglohyphantes drenski Deltshev 1973
Rhodope Mountains (cave)

LYCOSIDAE
Pardosa drenski Buchar, 1968
Vitosha Mountain Pirin Mountains Rila Mountains

AGELENIDAE
Coelotes drenski Deltshev, 1990
Eastern Stara Planina Mountains (cave)
Coelotes kulczynski (Drensky 1915)
Osogovo Mountain Pirin, Vitosha
Cryphoeca pirini (Drensky, 1921)
Pirin Mountains
Tegenaria montana Deltshev 1992
Pirin Mountains
Tegenaria rilaensis Deltshev 1992
Rila Mountains

AMAUROBIIDAE
Calobius balcanicus Drensky 1940
Rila Mountains

Appendix 16 Balkan Endemic Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev)

OPILIONES

NEMASTOMATIDAE

Carinostoma ornatum (Hadzi, 1940)
Vitosha Osogovo, Stara Planina Mountains, Sredna Gora, Asenovgrad Konyavska planina Kyustendil Sandanski Petrich Bansko

Paranemastoma (s str) *radewi* (Roewer, 1926)
Stara Planina Mountains Pestera Andaka (Gb 1) Bacho Kiro (Gb 2), Koumincheto (Gb 6) Marina doupka (Sf 20) Vodnata (Sf 52) Sofiya Iskursko defile Lakatnik, Petrochan Sredna Gora Vitosha Rila Vidin Vratsa, Lovech, Troyan Veliko Turnovo Gabrovo Kotel Kyustendil Batak Pazardzik Smolyan

Pyza bosnica (Roewer, 1919)
Stara Planina Mountains, Osogovo Vitosha Sredna Gora Rila, Western Rhodope

PHALANGIIDAE

Rilaena balcanica Silhavy 1965
Rila Petrich Blagoevgrad Gotse Delchev Vitosha Trun Pernik, Zlatna Panega, Lovech

TROGULIDAE

Dicranolasma thracium Gruber, 1970
Nesebur Stara Zagora Chirpan

ARANEAE

ZODARIIDAE

Zodarion getticum Weiss 1987
Zemen Skakavitsa

LINYPHIIDAE

Centromerus lakatnikensis (Drensky, 1931)
Western Stara Planina Mountains (caves)

Centromerus millen Deltshev, 1974
Eastern Rhodope Mountains (cave)

Lepthyphantes byzantinus Fage 1931
Caves Rouse Kotel Plovdiv, Yambol

Lepthyphantes centromeroides Kulczynski 1914
Western and Central Stara Planina Mountains Pirin Rila Rhodope (caves)

LYCOSIDAE

Pardosa roscai (Roewer 1951)
Dobrich Kamchiya Bourgas Sandanski

AGELENIDAE

Coelotes jurinitschi (Drensky, 1915)
Vitosha Mountain Western Stara Planina Mountains

Coelotes karlinskii (Kulczynski 1906)
Osogovo Mountain, Vitosha Mountain

Cybaeus balkanus Deltshev, 1997
Central Stara Planina Mountains Kazanluk

Histopona tianteevi Deltshev, 1978
Western Rhodope Mountains (caves)

Tegenaria bithyniae Brignoli, 1978
Strandzha Mountain (caves)

Tegenaria regispyrhi Brignoli 1976
Zemenski prolom

Appendix 17 Rare Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev)

SCORPIONES

EUSCORPIONIDAE

Euscorpius germanus croaticus Di Caporiacco 1950
Western Rhodope Mountains

PSEUDOSCORPIONES

CHTHONIIDAE

Balkanoroncus praeceps Curcic 1978
Teteven Gradeshnitsa (cave)

Chthonius tenuis L Koch 1873
Vratsa Ledenika cave

Chthonius tetrachilatus serbicus Hadzi 1937
Lovech Karloukovo (cave)

Neobisium hellenum Simon 1875
Lovech Karloukovo (cave)

Neobisium macrodactylum Daday 1888
Dryanovo (cave)

Neobisium simile L Koch 1873
Karloukovo (cave) Sliven Ledenika (cave)

Neobisium sylvaticum C L Koch 1835
Karloukovo (cave)

Roncus euchirus Simon 1879
Lovech (cave)

Roncus lubricus L Koch, 1873
Sofia Lakatnik (cave)

SOLIPHUGAE

GALEODIDAE

Galeodes graecus C L Koch 1842
Strouma valley

OPILIONES

GYANIIDAE

Amilenus aurantiacus (Simon 1881)
Trun Pernik Vrabcha Yamka cave (Pk 6)

ISCHYROPSALIDIDAE

Ischyropsalis manicata L Koch 1869
Stara Planina Mountains

Appendix 17 Rare Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev) (continued)

NEMASTOMATIDAE
Carinostoma elegans (Sorensen, 1894)
Rouse Razgrad, Isperih Stara Zagora, Eastern and Central Stara Planina Mountains Nesebur Shoumen, Kotel Gabrovo Veliko Turnovo
Mitostoma gracile (Redikorzev, 1926)
Troyan Kazanluk Kotel Shoumen Nesebur Malko Turnovo
Nematostoma lugubre (O F Muller, 1776)
Stara Planina Mountains Petrohan
Paranemastoma (s str) *silli* (Herman, 1871)
Rila, Kazanluk

PHALANGIIDAE
Lacinus ephippiatus (C L Koch, 1835)
Stara Planina Mountains Vratsa Ledenika Vitosha Mountain Boyanski vodopad
Oligolophus tridens (C L Koch 1836)
Rila Mountains
Opilio dinaricus Silhavy, 1938
Rila Mountains Borovets
Platybunus bucephalus (C L Koch, 1835)
Rila Mountains
Rilaena triangularis (Herbst 1799)
Pernik Trun, Sofia Petrohan, Vratsa Ledenika
Zacheus anatolicus (Kulczynski, 1903)
Bourgas

TROGULIDAE
Anelasmocephalus lycosinus (Sorensen, 1873)
Stara Planina Mountains
Dicranolasma giljarovi Silhavy, 1966
Strandzha Mountain Sozopol
Trogulus graecus Dahl, 1903
Petrich Kyustendil Dolna Koznitsa, Radomir Zemen Rilski manastir Bansko Gostin

ARANEAE
PHOLCIDAE
Hoplopholcus foiskali Thorell, 1871
Western Stara Planina Mountains (caves)

DYSDERIDAE
Dysdera asiatica Nosek 1905
Strandzha Mountain Malko Turnovo
Dysdera hungarica Kulczynski, 1897
Varna
Dysdera longilostris Doblika, 1853
Varna Sozopol
Dysdera westringi Cambridge, 1872
Ropotamo
Harpactea babori Nosek 1905
Varna
Harpactea rubicundus (C L Koch, 1839)
Varna
Harpactea sturanyi Nosek, 1905
Malko Turnovo Resovo

ERESIDAE
Eresus niger (Petagna 1787)
Rila Mountains Osogovo Mountain Pirin Mountains Vitosha Mountain

ZODARIIDAE
Zodarion morosum Denis, 1935
Melnik, Zemen
Zodarion thoni Nosek, 1905
Bourgas Malko Turnovo

UROCTEIDAE
Uroctea durandi Latreille 1809
Slavyanka Mountain, Petrich

METIDAE
Meta bourneti Simon 1922
Caves Strandzha Mountain Sakhar hilly region

NESTICIDAE
Nesticus eremita Simon, 1879
Shoumen (cave)

ARANEIDAE
Aculepeira carbonaria (L Koch 1869)
Rila Mountains, Pirin Mountains
Argiope lobata Pallas 1772
Melnik, Black Sea cost
Gibbaranea ulrichi Hahn, 1834
Melnik, Radomir

LINYPHIIDAE
Abacoproeces saltuum (C L Koch, 1872)
Zemen
Araeoncus anguineus (L Koch, 1869)
Vitosha Mountain Pirin Mountains
Araeoncus humilis (Blackwall 1841)
Western Stara Planina Mountains
Centromerus cavernarum (L Koch, 1872)
Caves Vidin Dryanovo, Kotel Malko Turnovo
Centromerus incilium (L Koch, 1881)
Zemen
Centromerus vindobonensis Kulczynski 1898
Zemen
Ceratinella brevis (Wider 1834)
Pirin Mountains
Ceratinella major Kulczynski 1894
Zemen
Cineta gradata (Simon 1881)
Pirin Mountains

Appendix 17 Rare Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev) (continued)

Diplocephalus foraminifer (Cambridge, 1875)
Pirin Mountains
Entelecara media Kulczynski, 1887
Pirin Mountains
Evansia merens O P Cambridge, 1900
Pirin Mountains
Gonatium nemorivagum (O P Cambridge 1875)
Zemen
Gonatium orientale Fage 1931
Pirin Mountains
Gonatium paradoxum (C L Koch 1869)
Zemen
Gongylidiellum latebricola O P Cambridge, 1871
Pirin Mountains
Hypomma cornutum (Blackwall 1833)
Zemen
Lepthyphantes alutacius Simon 1884
Vitosha Mountain Central Stara Planina Mountains (cave)
Lepthyphantes improbulus Simon 1929
Pirin Mountains
Lepthyphantes istrianus Kulczynski, 1914
Caves Western, Eastern Stara Planina Mountains, Rhodope Mountains, Strandzha Mountain Zemen
Lepthyphantes jacksonoides Van Helsdingen 1977
Western Rhodope Velingrad (cave)
Lepthyphantes mansuetus (Thorell, 1875)
Pirin Mountains, Vitosha Mountain Zemen
Lepthyphantes pillichi Kulczynski, 1915
Caves Vidin, Pleven
Lepthyphantes pinicola Simon, 1884
Pirin Mountains
Lepthyphantes pulcher (Kulczynski 1881)
Pirin Mountains
Meioneta simplicitarsis (Simon 1884)
Zemen
Pelecopsis kraussi Wunderlich 1980
Zemen
Porrhomma lativela Tretzel, 1956
Strandzha Mountain (cave)
Raebothorax paetulus O P Cambridge, 1875
Pirin Mountains
Sintula retroversa (O P Cambridge 1875)
Zemen
Sintula spinigera (Baloch 1935)
Zemen
Tallusia experta (O P Cambridge 1871)
Zemen
Tapinopa longidens (Wider 1834)
Vitosha Mountain Zemen
Trichopterna cito (O P Cambridge 1872)
Zemen
Walckenaeria alticeps (Denis 1952)
Zemen
Walckenaeria capito (Westring, 1861)
Sofia (cave) Pirin Mountains
Walckenaeria cuculata (C L Koch 1836)
Zemen
Walckenaeria fugax (O P Cambridge 1870)
Zemen
Walckenaeria vigilax (Blackwall 1853)
Pirin Mountains Zemen

THERIDIIDAE
Achaearanea ohlerti Thorell 1870
Pirin Mountains
Anelosimus vittatus (C L Koch, 1836)
Haskovo
Crustulina guttata (Wider, 1834)
Bourgas, Sozopol
Enoplognata afrodite Hippa & Oksala, 1983
Haskovo
Episinus angulatus (Blackwall, 1836)
Strouma valley
Neottiura suaveolens (Simon, 1879)
Sliven
Pholcomma gibbum (Westring 1851)
Varna, Sofia (cave)
Robertus frivaldszky (Chyzer 1894)
Vitosha Mountain, Teteven (cave)
Steatoda meridionalis (Kulczynski, 1894)
Slavyanka Mountain
Theridion berkeley Emerton, 1924
Plovdiv
Theridion pallens Blackwall 1834
Haskovo
Theridion petraeum L Koch, 1872
Pirin Mountains
Theridion refugus Drensky, 1929
Sofia
Theridion simile (C L Koch, 1836)
Eastern Stara Planina Mountains, Rhodope Mountains
Theridion varians Hahn, 1833
Sofia, Rila Mountains

LYCOSIDAE
Alopecosa etrusca (Lugetti & Tongiorgi, 1969)
Western Stara Planina Mountains, Zemen
Alopecosa fabrilis (Clerck 1757)
Lovech Sofiia Radomir Botevgrad
Alopecosa penthen (Nosek, 1905)
Western Stara Planina Mountains Zemen
Alopecosa pinetorum (Thorell 1856)
Vitosha Mountain
Alopecosa solitaria (Herman 1876)
Dragoman
Alopecosa striatipes (C L Koch 1837)
Kyustendil Bourgas Kostenets
Alopecosa sulzeri (Pavesi, 1873)
Vidin, Zemen

Appendix 17 Rare Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev) (continued)

Arctosa latitorax Lugetti & Tongiorgi 1965
Rilski manastir Zemen Haskovo South Dobroudzha
Arctosa perita (Latreille, 1799)
Rhodope Mountains Rila Mountains
Arctosa tbiliensis Mcheidze, 1946
Sandanski
Lycosa praegrandis C L Koch, 1836
Plovdiv
Pardosa alacris (C L Koch, 1833)
Shoumen, Sofia, Zemen
Pardosa bifasciata (C L Koch, 1834)
Vitosha Mountain, Rila Mountains, South Dobroudzha Kotel
Pardosa ferruginea (L Koch, 1870)
Belogradchik, Pirin Mountains Rila Mountains
Pardosa incerta Nosek, 1905
Pirin Mountains
Pardosa italica Tongiorgi 1966
Bourgas Shoumen
Pardosa luctinosa Simon 1876
Bourgas Shabla
Pardosa mixta (Kulczynski 1887)
Pirin Mountains, Rila Mountains
Pardosa nebulosa (Thorell 1872)
Sandanski Petrich
Pardosa nigra (C L Koch, 1834)
Pirin Mountains Rila Mountains
Pardosa paludicola (Clerck 1757)
Kyustendil
Pardosa pseudostrigillata Tongiorgi 1966
Varna Ropotamo Zemen
Pardosa tasevi Buchar, 1968
Vitosha Mountain
Pardosa vittata (Keyserling, 1863)
Shabla, Varna, Zemen, Bourgas, Sandanski
Tricca lutetiana (Simon, 1876)
Vidin, Zemen
Trochosa robusta (Simon, 1876)
Dragoman Ihtiman Samokov Stara Zagora

AGELENIDAE
Agelena orientalis C L Koch, 1841
Strandzha Mountain Malko Turnovo
Coelotes falciger Kulczynski, 1897
Dragoman Golo burdo Mountain Zemen
Coelotes longispinus Kulczynski 1897
Western Stara Planina Mountains Magoura cave
Coelotes microlepidus De Blauwe, 1973
Zemen
Tegenaria ferruginea (Pahzer, 1804)
Sofia, Rila Mountains Western Rhodope Mountains, Zemen
Tegenaria nemorosa Simon, 1916
Haskovo

ARGYRONETIDAE
Argyroneta aquatica (Clerck 1757)
Radomir Sofia

DICTYNIDAE
Argena subnigra (O P Cambridge, 1961)
Dragoman Zemen
Dictyna latens (Fabricius 1775)
Central Stara Planina Mountains, Pirin Mountains
Dictyna pusilla Thorell, 1856
Petrich
Nigma flavescens (Walckenaer, 1825)
Pirin Mountains, Sofia

TITANOECIDAE
Nursica albosignata Simon 1874
Varna
Titanoeca schineri L Koch, 1872
Bourgas
Titanoeca tristis L Koch, 1872
Rhodope Mountains, Zemen

LIOCRANIDAE
Agroeca brunnea (Blackwall 1833)
Bourgas
Agroeca pullata Thorell 1875
Zemen
Liocranum rutilans (Thorell, 1875)
Vitosha Mountain Zemen
Phrurolithus festivus (C L Koch 1835)
Zemen

CLUBIONIDAE
Cheiracanthium pennyi O P Cambridge 1874
Varna, Zemen
Cheiracanthium punctorium (Villers, 1789)
Petrich
Clubiona alpicola Kulczynski 1882
Pirin Mountains, Vitosha Mountain
Clubiona coerulescens L Koch 1867
Sofia, Zemen
Clubiona compta C L Koch 1839
Dragoman, Zemen
Clubiona genevensis L Koch 1867
Pirin Mountains
Clubiona lutescens Westring, 1851
Pleven, Zemen
Clubiona phragmitis C L Koch, 1843
Sofia, Bourgas
Clubiona similis L Koch, 1867
Bourgas, Zemen

GNAPHOSIDAE
Callilepis schuszteri (Herman 1879)
Lom Zemen

Appendix 17 Rare Species of Arachnida (Dr Christo Deltshev, Dr Gergin Blagoev) (continued)

Gnaphosa badia (L Koch, 1866)
Bourgas
Gnaphosa rhenana Mueller & Sch 1895
Zemen
Haplodrassus silvestris (Blackwall, 1833)
Zemen
Micaria aenea Thorell 1871
Pirin Mountains
Micaria formicaria (Sundevall, 1831)
Kyustendil Zemen
Micaria fulgens Walckenaer 1802
Berkovitsa Zemen
Micaria funerea Simon 1878
Pirin Mountains
Micaria romana L Koch 1866
Osogovo Mountain
Scotophaeus blackwalli (Thorell 1871)
Petrich
Zelotes caucasicus (C L Koch, 1866)
Varna Strandzha Mountain
Zelotes electus (C L Koch 1839)
Zemen
Zelotes exiguus (Mueller & Sch 1895)
Zemen
Zelotes hermanni (Chyzer 1897)
Zemen
Zelotes villicus (Thorell 1875)
Shoumen Zemen

ZORIDAE
Zora manicata Simon 1878
Zemen
Zora pardalis Simon 1878
Zemen
Zora spinimana (Sundewall 1833)
Haskovo Zemen

PHILODROMIDAE
Philodromus praedatus O P Cambridge 1871
Zemen
Philodromus vagulus Simon, 1875
Pirin Mountains
Tanatus vulgaris Simon, 1874
Rila Mountains, Zemen

THOMISIDAE
Oxyptila atomaria (Panzer, 1810)
Vitosha Mountain Zemen
Oxyptila blackwalli Simon 1875
Sofia, Zemen
Oxyptila nigrita (Thorell 1875)
Vitosha Mountain Zemen
Oxyptila rauda Simon 1875
Pirin Mountains
Oxyptila simplex (O P Cambridge 1862)
Zemen
Xysticus bonneti Denis 1937
Pirin Mountains
Xysticus lanio C L Koch 1824
Shoumen Zemen
Xysticus lineatus (Westring, 1851)
Zemen
Xysticus macedonicus Silhavy 1944
Pirin Mountains
Xysticus ninnii Thorell 1872
Sozopol Zemen
Xysticus striatipes L Koch, 1870
Petrich

SALTICIDAE
Chalcoscirtus infimus (Simon, 1868)
Plovdiv Kurdzhali
Eris nidicolens (Walckenaer, 1802)
Petrich, Shoumen
Euophrys obsoleta (Simon, 1868)
Harmanli Zemen
Euophrys petrensis C L Koch, 1837
Pirin Mountains, Kurdzhali
Heliophanus auratus C L Koch 1835
Pirin Mountains, Strandzha Mountain, Pleven
Heliophanus tribulosus Simon, 1868
Petrich Kyustendil
Leptorchestes berolinensis (C L Koch 1846)
Petrich, Berkovitsa
Menemerus taeniatus (L Koch 1867)
Shabla, Bourgas, Ropotamo
Pseudicius picaceus (Simon, 1868)
Sakhar hilly region
Saitis taurica Kulczynski, 1904
Melnik, Elhovo Malko Turnovo
Salticus mutabilis (Lucas 1846)
Bourgas
Synageles dalmaticus (Keyserling 1863)
Bourgas, Sliven, Petrich

Appendix 18 Bulgarian Endemic Species of Acari (Dr Dobrin Dobrev)

PROSTIGMATA

AXONOPSIDAE

Axonopsis orghidani Petrova 1967
Veleka riv Kachoula

HALACARIDAE

Halacarus (Halacarellus) phreaticus Petrova 1970
Varna, Sozopol, Kamchiya by Daskotna Kavatsite

Porolohmannella curvimandibulata Petrova, 1969
Polsko Kosovo

Porolohmannella cvetcovi Petrova, 1965
Shishmanovo Stara Zagora, Polikraishte

HYGROBATIDAE

Atractides asticae Petrova 1967
Veleka riv Kachoul, Veleka riv by Mladezhka riv

Atractides longiporus Petrova 1967
Veleka riv Kachoul

LEBERTIIDAE

Lebertia (P.) schischkoffi Viets 1926
Bansko

MIDEOPSIDAE

Mideopsis motasi Petrova, 1966
Ropotamo riv Balkanbas Gorni Chiflik

MOMONIIDAE

Momonisia phreatica Petrova, 1973
Veleka riv

PYGMEPHORIDAE

Pygmephorus brevispinus Savulkina 1976
Strouma and Mesta Valleys

SCUTACARIDAE

Lophodispus bulgaricus Dobrev, 1991
Petrich Roupite

Scutacarus calcaratus Storkan, 1936
Stara Planina Mountains

Scutacarus pirinicus Dobrev 1992
Pirin Mountains

MESOSTIGMATA

EPICRIIDAE

Epicrius bulgaricus Balogh, 1958
Vitosha Mountain

EVIPHIDIDAE

Pelethiphis anoxiae Koyum 1975
Arkoutino

LAELAPIDAE

Hypoaspis (S.) gibbosus Koyum 1979
Dolni Pasarel

MACROCHELIDAE

Gehlaspis bulgaricus Balogh, 1958
Rila Mountains Mala Tsurkva Rhodope Mountains, Belasitsa Mountain Vitosha Mountain

VEIGAIAIDAE

Gamasolaelaps dorotheae Koyum 1985
Rhodope Mountains Pamporovo Chepelare Pirin Mountains Vitosha Mt., Belasitsa Mountain

Appendix 19 Balkan Endemic Species of Acari (Dr Dobrin Debrev)

PROSTIGMATA

ATHIENEMANNIIDAE

Balkanohydracarus arveolatus Mot et Tan., 1948
Sinemorets

SCUTACARIDAE

Scutacarus spengleri Mahunka, 1974
Petrich Kozhouh Mountain

MESOSTIGMATA

EVIPHIDIDAE

Thinoseius kargi Hirschmann 1966
Nesebur

Appendix 20 Rare Species of Acari (Dobrin Dobrev)

PROSTIGMATA

ARRENURIDAE

Arrenurus haplurus Viets, 1925
Sinemorets

Arrenurus lundbladianus Mot et Tan 1958
Mladezhka riv Zvezdets

ATHIENEMANNIIDAE

Chappuisides hungaricus Szalay 1943
Sinemorets

Hungarohydracarus subterraneus Szalay 1943
Mladezhka riv Zvezdets

Appendix 20 Rare Species of Acari (Dr Dobrin Dobrev) (continued)

ATURIDAE
Aturus fontinalis Lundblad 1920
Veleka riv Mladezhka riv
Aturus natangensis Protz 1900
Veleka riv
Aturus paucisetus Mot et Tan, 1946
Veleka riv Kachoula Trigradska riv
Aturus spatulifer Piersig, 1904
Mladezhka riv

HYDRYPHANTIDAE
Protzia rugoza Walter 1918
Veleka riv
Thyopsis cancellata (Protz 1896)
Ivanski

HYGROBATIDAE
Atractides (P.) *polyporus* (Viets 1922)
Sozopol
Atractides acutirostris (Mot et Ang 1927)
Veleka riv
Atractides cisternarum (Viets, 1935)
Mladezhka riv
Atractides denticulatus Walter, 1947
Veleka riv Kachoul
Atractides distans (Viets, 1914)
Mladezhka riv Rakovishki monastery
Atractides latipalpis (Mot et Tan 1946)
Mladezhka riv
Atractides nodipalpis fluviatilis (Szalay 1929)
Veleka riv Kachoul, Mladezhka riv Western Stara Planina Mountains Byalata Voda
Atractides nodipalpis fonticolus (Viets 1920)
Mladezhka riv
Atractides nodipalpis sopronensis (Szalay, 1929)
Mladezhka riv Blagoevgrad
Atractides phreaticus (Mot et Tan, 1948)
Mladezhka riv
Atractides primitivus (Walter 1947)
Mladezhka riv
Atractides pumilus (Szalay 1946)
Mladezhka riv
Atractides pygmaeus (Mot et Tan 1948)
Mladezhka riv
Atractides sokolowi (Mot et Tan 1948)
Veleka riv, Blagoevgrad
Atractides subterraneus (Viets 1932)
Katoundere riv
Atractides walteri (Viets 1925)
Mladezhka riv
Hygrobates porrectus Koenike 1908
Veleka riv Mladezhka riv
Hygrobates properus Laska 1954
Mladezhka riv
Hygrobates trigonicus Koen 1895
Veleka riv Kachoul

LEBERTIIDAE
Lebertia (H.) *crenophila* Viets, 1920
Veleka riv
Lebertia (L.) *minutipalpis* (Viets, 1920)
Strandzha Mt Katoundere riv
Lebertia (L.) *rivulorum* (Viets, 1933)
Mladezhka riv
Lebertia (L.) *acuta minor* Laska, 1954
Mladezhka riv by Veleka riv
Lebertia (L.) *castalia* Viets, 1925
Botounya riv
Lebertia (L.) *celtica procera* Viets, 1920
Western Stara Planina Mountains Byalata Voda
Lebertia (L.) *fimbriata* Thor, 1899
Veleka riv
Lebertia (L.) *granulosa* Koen 1911
Lom riv Belogradchik
Lebertia (L.) *maglioi* Thor 1906
Botounya riv
Lebertia (L.) *rufipes reticulata* (Koenike 1919)
Strandzha Mt Katoundere riv
Lebertia (P.) *glabra* Thor, 1897
Veleka riv, Pirin Mountains Bansko
Lebertia (P.) *lineata* Thor, 1906
Starozagorski bani
Lebertia (P.) *saxonica* Thor, 1911
Eleshnitsa riv

MAMERSOPSIDAE
Bandakia corsica E. Ang 1951
Sinemorets

MOMONIIDAE
Stygomomonia latipes Szalay, 1943
Mladezhka riv Zvezdets Loucovska riv by Asenovgrad

NEOACARIDAE
Neoacarus hibernicus Halb, 1944
Ropotamo riv Veselie, Sinemorets

PONTARACHNIDAE
Pontarachna valkanovi Petrova, 1977
Black Sea by Veleka riv

PROTZIIDAE
Wandesia stygophila Szalay 1944
Veleka riv Kachoul Mladezhka riv Zvezdets

SCUTACARIDAE
Diversipes dilatatus Balogh et Mahunka 1962
Vitosha Mountain
Diversipes exhamulatus Michael 1886
Bansko
Imparipes histricinus Berlese 1903
Sofia, Vitosha Mountain Pirin Mountains

Appendix 20 Rare Species of Acari (Dr Dobrin Dobrev) (continued)

Imparipes hungaricus Balogh et Mahunka 1962
Asenovgrad
Imparipes longisetosus Willmann 1951
Rila Mountains
Imparipes myrmecophilus Mahunka 1972
Dolni Pasarel
Imparipes robustus Karafiat 1959
Pirin Mountains Javorov, Pirin Mountains
Bunderitsa Vihren
Imparipes sinae Mahunka et Zaki, 1984
Asenovgrad
Pygmodispus montanus Mahunka, 1964
Pirin Mountains Rozhen
Pygmodispus stefaninii Paoli, 1911
Preslav
Scutacarus angustus Mahunka 1970
Stara Planina Mountains
Scutacarus apodemi Mahunka 1963
Rhodope Mountains Bachkovo Asenovgrad
Scutacarus crassisetus var *plumosus* Paoli 1911
Pirin Mountains Bunderitsa Sinanitsa
Scutacarus echidna Berlese 1905
Pirin Mountains
Scutacarus eucomus Berlese 1908
Asenovgrad, Kambourovo
Scutacarus gigliolii Paoli 1911
Rila Mountains Borovets
Scutacarus gratus pilosetus Dobrev 1992
Stara Planina Mountains Romcha
Scutacarus hauseri Mahunka 1977
Stara Planina Mountains Romcha
Scutacarus lactificus Rack 1966
Vitosha Mountain
Scutacarus lineatus Karafiat 1959
Arkoutino
Scutacarus longisetus Berlese 1908
Stara Planina Mountains Romcha Asenovgrad
Scutacarus mihalyi Mahunka 1968
Vitosha Mountain Petrich Roupite
Scutacarus montanus Paoli, 1911
Rila Mountains Mousala, Pirin Mountains
Vihren Vitosha Mountain
Scutacarus nudus bisetus Karafiat 1959
Rila Mountains Borovets
Scutacarus pannonicus Willmann, 1951
Pirin Mountains
Scutacarus plumatus Rack 1964
Stara Planina Mountains
Scutacarus quadriangularis Paoli, 1911
Izvor Pirin Mountains Bunderishki preval
Scutacarus rakonczayi Mahunka, 1981
Balchik Tuzlata
Scutacarus simplex Paoli, 1911
Stara Planina Mountains Zlatitski prohod
Scutacarus spinosus Storkan, 1936
Pirin Mountains Vihren Stara Planina
Mountains
Scutacarus subsphaeroideus Mahunka 1978
Varna
Scutacarus subterraneus Oudemans 1913
Kambourovo Stara Planina Mountains
Scutacarus transfusionis Mahunka et Mahunka
Papp, 1980
Izvor
Scutacarus tridentinus Paoli, 1911
Vitosha Mountain
Scutacarus tumidulus Mahunka, 1965
Vitosha Mountain

STYGOTHROMBIIDAE
Charonothrombium racovitzai Mot et Tan 1946
Mladezhka riv Mladezhko

TORRENTICOLIDAE
Torrenticola (R) *cannexa* (Koenike 1908)
Veleka riv
Torrenticola (T) *amplexa* (Koen 1908)
Veleka riv Kachoul
Torrenticola (T) *barsica* (Szalay 1933)
Veleka riv Pripor
Torrenticola (T) *brevirostris* (Halbert 1911)
Veleka riv Kachoul
Torrenticola (T) *dudichi* (Szalay 1933)
Veleka riv Mladezhka riv
Torrenticola (T) *elliptica* Maglio 1909
Botounya riv
Torrenticola (T) *jeanneli* (Mot et Tan 1947)
Veleka riv Kachoul
Torrenticola (T) *latissima* (Viets, 1936)
Veleka riv
Torrenticola (T) *lativalvata* (Viets 1952)
Veleka riv Mladezhka riv
Torrenticola (T) *longirostris* (Szalay 1933)
Veleka riv Mladezhka riv
Torrenticola (T) *madritensis* (Viets, 1930)
Mladezhka riv
Torrenticola (T) *maglioi* (Koenike, 1908)
Veleka riv Kachoul
Torrenticola (T) *spinirostris* (Thor, 1897)
Veleka riv Kachoul

UNIONICOLIDAE
Neumania phreaticola Mot et Tan ,1948
Mladezhka riv Syutliyka riv
Unionicola crassipes (Mueller, 1776)
Zemen, Drouma riv

MESOSTIGMATA
ACROSIIDAE
Arctoseius cetratus (Sellnick, 1940)
Rila Mountains Borovets Strouma valley,
Vitosha Mountain

Appendix 20 Rare Species of Acari (Dr Dobrin Dobrev) (continued)

Arctoseius semiscissus (Berlese 1892)
Rhodope Mountains, Rouse Sandanski
Blattisocius keegani Fox 1947
Vitosha Mountain
Blattisocius tarsalis (Berlese, 1918)
Strouma valley Gigen
Cheiroseius borealis (Berlese, 1904)
Rila Mountains Malyovitsa Rouse
Cheiroseius cassiteridium Evans et Hyatt, 1960
Lebnitsa
Cheiroseius curtipes (Halbert 1923)
Lebnitsa
Cheiroseius mutilus (Berlese, 1916)
Baikal
Cheiroseius necorniger (Oudemans 1903)
Vitosha Mountain Lebnitsa, Sandanski Baikal
Iphidozercon minutus (Halbert 1915)
Rhodope Mountains Pamporovo - Chepelare, Rila Mountains Mala Tsurkva Vitosha Mountain
Lasioseius berlesei (Oudemans 1938)
Baikal Pleven Vitosha Mountain
Lasioseius confusus Evans 1958
Baikal Svishtov
Lasioseius furcisetus Athias Henriot, 1959
Rhodope Mountains V Kolarov
Lasioseius mcgregori Chant 1963
Lebnitsa Vitosha Mountain
Lasioseius nomus Athias Henriot 1959
Rouse
Lasioseius ometes (Oudemans 1903)
Rouse
Lasioseius thermophilus (Willmann 1942)
Sandanski
Lasioseius zerconoides Willmann 1953
Rhodope Mountains Pamporovo Chepelare
Leioseius magnanalis (Evans 1958)
Rila Mountains Vitosha Mountain
Leioseius montanulus Hirschmann 1966
Rhodope Mountains
Melichares juradeus Schweizer, 1949
Vitosha Mountain
Paragamania dentriticus (Berlese 1918)
Sandanski Baikal
Proctolaelaps cyllodi Samsinak 1960
Sandanski Pleven
Zerconopsis remiger (Kramer 1876)
Vitosha Mountain

AMEROSEIIDAE
Ameroseius cavernosus Westerboer 1963
Baikal
Ameroseius eumorphus Bregetova 1977
Lebnitsa Sandanski, Baikal Vitosha Mountain
Ameroseius imparisetosus Westerboer 1963
Rouse Mechka
Ameroseius lanatus Solomon 1969
Lebnitsa
Ameroseius macrochelae Westerboer, 1963
Rouse
Ameroseius pavidus (C L Koch 1839)
Gigen Baikal
Ameroseius plumosus Oudemans, 1902
Rhodope Mountains V Kolarov Strouma valley Gigen Baikal
Ameroseius sculptilis Berlese, 1916
Lebnitsa, Gigen, Baikal

ANTENNOSEIIDAE
Antennoseius bacatus Athias Henriot, 1961
Lebnitsa

EVIPHIDIDAE
Alliphis siculus (Oudemans, 1905)
Rhodope Mountains V Kolarov
Crassicheles concentricus (Oudemans, 1904)
Kresna
Crassicheles holsaticus (Willmann, 1937)
Rhodope Mountains Sandanski Vitosha Mountain
Eviphis ostrinus (C L Koch, 1836)
Rila Mountains Malyovitsa, Rila Mountains Mala Tsurkva, Vitosha Mountain
Iphidiosoma multiclavatum Willmann 1953
Belasitsa Mountain
Iphidiosoma physogastris Karg 1971
Vitosha Mountain
Thinoseius fucicola (Halbert 1920)
Nesebur
Thinoseius spinosus (Willmann, 1939)
Black Sea coast

LAELAPIDAE
Androlaelaps casalis myrmecophila Evans et Till 1966
Rila Mountains Mala Tsurkva, Vitosha Mountain, Rhodope Mountains Vasil Kolarov
Androlaelaps glasgowi (Ewing,1925)
Kalimantsi
Eulaelaps oudemansi (Turk 1945)
Gigen D Dabnik
Eulaelaps stabularis (C L Koch 1836)
Rhodope Mountains V Kolarov Vitosha Mountain
Holostaspis montana (Berlese 1891)
Rila Mountains Mala Tsurkva Vitosha Mountain Kutina
Hypoaspis (C) *acuta* (Michael 1891)
Rila Mountains Malyovitsa
Hypoaspis (C) *neocuneifer* Evans et Till, 1966
Svishtov, Vitosha Mountain
Hypoaspis (E) *sardoa* (Berlese, 1892)
Rila Mountains Mala Tsurkva

Appendix 20 Rare Species of Acari (Dr Dobrin Dobrev) (continued)

Hypoaspis (G) *asperatus* (Berlese 1905)
Strouma valley
Hypoaspis (G) *austriacus* (Sellnick 1935)
Blagoevgrad Pleven
Hypoaspis (G) *brevipilis* Bernhard, 1969
Rhodope Mountains Shadiitsa Lebnitsa Vitosha Mountain
Hypoaspis (G) *expolitus* Berlese 1905
Vitosha Mountain
Hypoaspis (G) *glabrosimilis* Hirschmann 1969
Belasitsa Mountain Svishtov, Rouse Pleven
Hypoaspis (G) *helianthi* Samsinak, 1958
Rhodope Mountains Markovo
Hypoaspis (G) *myrmecophila* (Berlese, 1892)
Kutina, Asenovgrad
Hypoaspis (P) *bombicolens* Canestrini 1884)
Vitosha Mountain
Hypoaspis (S) *miles* (Berlese 1892)
Stroumsko, Rouse
Laelaps agilis C L Koch 1836
Koulata
Ololaelaps placentula (Berlese 1887)
Vitosha Mountain
Ololaelaps sellnicki Bregetova et Koroleva 1964
Lebnitsa Stroumsko Vitosha Mountain
Ololaelaps veneta (Berlese 1903)
Blagoevgrad Stroumsko Vitosha Mountain
Pneumolaelaps colomboi Evans et Till 1966
Rhodope Mountains Orfei
Pneumolaelaps fuscicolens Oudemans 1903
Rhodope Mountains Orfei
Pseudoparasitus dentatus (Halbert 1920)
Klisoura Vitosha Mountain

MACROCHELIDAE
Geholaspis (L) *mandibularis* (Berlese, 1904)
Pleven
Geholaspis berlesei Valle 1953
Belasitsa Mountain
Geholaspis longispinosus (Kramer 1876)
Vitosha Mountain
Geholaspis ponticus Bregetova et Koroleva 1960
Vitosha Mountain
Macrocheles americana (Berlese, 1888)
Blagoevgrad, Sandanski, Baikal
Macrocheles carinatus (C L Koch 1839)
Pirin Mountains Sinanitsa
Macrocheles confusa (Foa 1900)
Lebnitsa Baikal
Macrocheles insignitus Berlese 1918
Baikal, Rouse, Pleven
Macrocheles martius (Hull 1925)
Rhodope Mountains Trigrad, Stroumsko
Macrocheles merdarius (Berlese, 1889)
Rhodope Mountains Pamporovo Chepelare Strouma valley, Baikal Gigen
Macrocheles montanus (Willmann, 1951)
Pirin Mountains Vitosha Mountain
Macrocheles penicilatus Berlese 1918
Sandanski
Macrocheles perglaber Filipponi et Pegazzano 1962
Black Sea coast, Kresna Lebnitsa
Macrocheles robustulus (Berlese 1904)
Strouma valley Baikal
Macrocheles tridentinus (G et R Canestrini, 1882)
Belasitsa Mountain, Vitosha Mountain

OLOGAMASIDAE
Gamasiphis pulchellus (Berlese 1887)
Sandanski
Sessiluncus hungaricus Karg 1964
Rouse Mechka

PACHYLAELAPTIDAE
Olopachys suecicus Sellnick 1950
Rila Mountains Mala Tsurkva Pleven Vitosha Mountain
Olopachys visotskajae Koroleva 1976
Rouse Razgrad
Pachylaelaps furcifer Oudemans 1903
Pleven Vitosha Mountain
Pachylaelaps hispani Berlese, 1908
Pleven Vitosha Mountain
Pachylaelaps imitans Berlese 1921
Bulgarene Stezherovo Vitosha Mountain
Pachylaelaps ineptus Hirschmann et Krauss, 1965
Belasitsa Mountain Vitosha Mountain
Pachylaelaps karawaiewi Berlese 1921
Blagoevgrad, Stroumsko Rouse
Pachylaelaps littoralis Halbert 1915
Vitosha Mountain
Pachylaelaps magnus Halbert, 1915
Pleven
Pachylaelaps pectinifer (G et R Canestrini, 1882)
Rhodope Mountains Pamporovo Chepelare, Strouma valley Rouse Mechka
Pachylaelaps regularis Berlese 1921
Vitosha Mountain
Pachylaelaps sculptus Berlese 1910
Rila Mountains Mala Tsurkva Vitosha Mountain
Pachylaelaps siculus Berlese 1892
Koulata
Pachyseius angustus Hyatt 1956
Vitosha Mountain
Pachyseius humeralis Berlese 1910
Rila Mountains Pirin Mountains Vitosha Mountain

PARASITIDAE
Gamasodes spiniger (Traegardh, 1910)
Rhodope Mountains, Pirin Mountains Sinanitsa, Vitosha Mountain

Appendix 20 Rare Species of Acari (Dr Dobrin Dobrev) (continued)

Holoparasitus caesus Micherdz, 1969
Pleven
Holoparasitus coronarium Karg, 1971
Vitosha Mountain
Holoparasitus excipiliger (Berlese 1905)
Vitosha Mountain
Holoparasitus tirolensis (Sellnick, 1968)
Vitosha Mountain
Parasitus (C) *kempersi* Oudemans 1902
Black Sea coast
Parasitus (C) *americanus* Berlese 1905
Starchevo
Parasitus (C) *celer* (C L Koch 1835)
Rhodope Mountains Strouma valley Baikal
Parasitus (C) *consanguineus* Oudemans et Voigts 1904
Strouma valley
Parasitus (C) *setosus* Oudemans et Voigts 1904
Strouma valley
Parasitus (E) *lunulatus* (Mueller 1859)
Rila Mountains Pirin Mountains Vitosha Mountain
Parasitus (E) *magnus* (Kramer 1876)
Sandanski Vitosha Mountain
Parasitus (N) *divortus* (Athias Henriot 1967)
Sandanski
Parasitus berlesei (Willmann 1935)
Vitosha Mountain
Parasitus fucorum (De Geer 1778)
Rhodope Mountains, Sofia Vitosha Mountain *Parasitus furcatus* (G et R Canestrini 1882)
Vitosha Mountain
Parasitus mustelarum Oudemans, 1903
Rhodope Mountains Rozhen Vitosha Mountain
Parasitus numerus (Karg, 1965)
Strouma valley Baikal
Parasitus oudemansi (Berlese 1903)
Vitosha Mountain
Parasitus traegardhi (Traegardh 1910)
Rhodope Mountains
Pergamasus brevicornis Berlese, 1903
Vitosha Mountain
Pergamasus lapponicus Traegardh, 1910
Vitosha Mountain
Pergamasus misellus Berlese, 1903
Rouse
Pergamasus neotruncatellus Schweizer 1961
Rhodope Mountains Orfei
Pergamasus parvulus Berlese, 1903
Southwest Bulgaria
Pergamasus septentrionalis (Oudemans 1902)
Kalimantsi G Dabnik
Poecilochirus necrophori Vitzthum 1930
Strouma valley
Poecilochirus subterraneus (Mueller, 1859)
Strouma valley
Saprogamasus gracilis Karg 1965
Blagoevgrad Stroumsko

PODOCINIDAE
Podocinum pacificum Berlese, 1896
G Dabnik

RHODACARIDAE
Asca aphidioides (Lin, 1958)
Maslen nos
Asca bicornis (Canestr et Fanzago, 1876)
Razgrad
Cyrtolaelaps chiropterae Karg 1971
Kalimantsi Rouse
Cyrtolaelaps minor Willmann 1952
Kalimantsi
Cyrtolaelaps mucronatus G et R Canestrini 1881
Rhodope Mountains V Kolarov
Gamasellus falciger (G et R Canestrini 1881)
Rhodope Mountains V Kolarov
Halolaelaps bacchusi (Hyatt 1956)
Strouma valley
Halolaelaps celticus Halbert 1915
Black Sea coast
Halolaelaps communis Goetz, 1966
Koulata
Halolaelaps curvisetosus (Leitner, 1946)
Blagoevgrad, Stroumsko
Halolaelaps saproincisus Hirschmann 1966
Koulata
Halolaelaps tuercorum Goetz 1966
Lebnitsa

SEJIDAE
Sejus togatus C L Koch 1836
Rhodope Mountains

VEIGAIAIDAE
Cyrthydrolaelaps incisus incisus Evans, 1955
Nesebur
Veigaia cervus (Kramer, 1876)
Rila Mountains Vitosha Mountain
Veigaia propinqua Willmann, 1936
Rhodope Mountains Orfei
Veigaia transisalae (Oudemans 1902)
Vitosha Mountain

ZERCONIDAE
Prozercon fimbriatus (C L Koch 1839)
Zlatna Panega
Prozercon traegardhi (Halbert 1923)
Rhodope Mountains V Kolarov Belasitsa Mountain, Katuntzi
Zercon andrei Sellnick 1958
Rhodope Mountains Trigrad Rouse
Zercon austriacus Sellnick 1958
Rhodope Mountains Pamporovo Chepelare
Zercon badensis Sellnick 1958
Rhodope Mountains Pamporovo Chepelare

Appendix 20 Rare Species of Acari (Dr Dobrin Dobrev) (continued)

Zercon balearicus Athias Henriot 1961
Kalimantsi
Zercon bartosi Halaskova 1970
Kalimantsi
Zercon berlesei Sellnick 1958
Vitosha Mountain
Zercon bulgaricus Balogh 1961
Rhodope Mountains
Zercon forsslundi Sellnick 1958
Rhodope Mountains Orfei, Rila Mountains
Vitosha Mountain
Zercon foveolatus Halaskova 1970
Kalimantsi, Vitosha Mountain
Zercon hungaricus Sellnick 1958
Rhodope Mountains Markovo Pleven Vitosha
Mountain
Zercon italicus Sellnick 1944
Vitosha Mountain
Zercon montigenus Blaszak 1972
Rhodope Mountains V Kolarov, Belasitsa
Mountain
Zercon moravicus Halaskova 1970
Rouse Mechka
Zercon peltatoides Halaskova 1970
Rhodope Mountains Shadiitsa Vitosha
Mountain
Zercon peltatus C L Koch 1836
Vitosha Mountain
Zercon plumatophilus Athias Henriot, 1961
Kalimantsi
Zercon romagniolus Sellnick 1944
Vitosha Mountain
Zercon sarasinorum Schweizer, 1949
Rhodope Mountains V Kolarov
Zercon serenus Halaskova 1970
Rhodope Mountains Pamporovo - Chepelare
Belasitsa Mountain, Vitosha Mountain
Zercon storkani Halaskova 1970
Vitosha Mountain
Zercon tuberosus Willmann 1936
Rhodope Mountains Shadiitsa
Zercon vacuus C L Koch, 1839
Pleven Vitosha Mountain

Appendix 21 Bulgarian Endemic Species of Myriapoda (Dr Gergin Blagoev)

CHILOPODA
GEOPHILIDAE
Geophilus balcanicus Kaczmarek 1972
Rila Borovets Partizanska polyana Stara Planina
Mountains Petrohan Nova Zagora Banya
Panagyurski polyani
Geophilus rhodopensis Kaczmarek 1970
Western Rhodope Devin Strandzha Groudovo
Manastirski vuzvishenia Yambol Sredna Gora
Zajchi vrah
Henia angelovi Ribarov 1987
Sakhar hilly region Sakartsi

HIMANTARIIDAE
Thracophilus berovi Matic et Darabantu 1974
Western Rhodope Dobrostan

SCHENDYLIDAE
Brachyschendyla (s str) *varnensis* Kaczmarek
1969
Varna
Schendyla (s str) *delicatula* Kaczmarek, 1969
Zlatni pyasutsi
Schendyla (s str) *montana* balcanica Kaczmarek,
1969
Stara Planina Mountains vr Stoletov
Schendyla (s str) *walachica* rhodopensis
Kaczmarek 1969
Western Rhodope Asenovgradska krepost
Bachkovski manastir

LITHOBIIDAE
Eupolybothrus andreevi Matic 1964
Stara Planina Mountains Tserovo
Eupolybothrus ochraceus (Folkmanova 1936)
Stara Planina Mountains Sofia Konyavska
planina Osogovska planina, Sandanski Belasitsa
planina Rhodope Shoumen
Eupolybothrus valkanovi Kaczmarek 1873
Asenovgrad
Harpolithobius aseni Kaczmarek 1975
Asenovgrad
Harpolithobius banaticus rhodopensis Kaczmarek,
1975
Western Rhodope
Harpolithobius folkmanovae Kaczmarek 1975
Ropotamo, Bakadzishki vuzvisheniya, Primorsko
Strandzha Gramatikovo
Harpolithobius hemusi Kaczmarek 1975
Stara Planina Mountains Teteven
Lithobius (*Monotarsobius*) *bifidus* Matic, 1973
Bourgas Mladezhko
Lithobius (*Monotarsobius*) *jurinei* Matic et
Golemansky, 1965
Asenovgrad
Lithobius (*Monotarsobius*) *proximus* Matic et
Golemansky 1967
Western Rhodope Banite Velingrad
Lithobius (*Monotarsobius*) *strandzanicus* Ribarov
1987
Strandzha Koushevets

Appendix 21 Bulgarian Endemic Species of Myriapoda (Dr Gergin Blagoev) (continued)

Lithobius (*Monotarsobius*) *taschevi* Matic et Golemansky 1965
Western Rhodope Bachkovski manastir Velingrad Plovdiv Kosovo Strandzha Vizitsa Rila Borovets Stara Zagora Pazardzhik Lozenska planina Germanski manastir Strandzha Malko

Lithobius (*Monotarsobius*) *totevi* Kaczmarek 1975
Vitosha Dragalevtsi

Lithobius (*Monotarsobius*) *vizicae* Ribarov 1987
Strandzha Vizitsa, Kroushovets

Lithobius (*Monotarsobius*) *zelazovae* Kaczmarek 1975
Stara Planina Mountains Petrohan Belogradchik Kalofer Berkovitsa Kotel Bozhentsi Soumen Rila Borovets Western Rhodope Velingrad Devin Bedenski bani Eastern Rhodope Roudozem

Lithobius (s str) *balcanicus* Matic, 1973
Western Rhodope Smolyan Turnovo Sakhar hilly region

Lithobius (s str) *beschkovi* Matic et Golemansky 1967
Stara Planina Mountains Troyansko (Gradeshnitsa Golyama Zhelyazna)

Lithobius (s str) *bulgaricus* Verhoeff 1925
Eastern Stara Planina Mountains, Bakadzhishki vuzvishenia Yambol, Trakijska nizina Pirin Kostenets Western Rhodope, Strandzha South Black Sea coast

Lithobius (s str) *christovici* Matic et Golemansky 1964
Rhodope Bachkovski manastir Sadovo Asenovgrad

Lithobius (s str) *diapolisi* Ribarov 1987
Strandzha Yambol

Lithobius (s str) *electron* Verhoeff 1928
Western Rhodope

Lithobius (s str) *forficatus* biungulatus Matic et Golemansky, 1965
Asenovgrad

Lithobius (s str) *glacier* Verhoeff 1928
Osogovo Rouen

Lithobius (s str) *golemanskyi* Ribarov 1987
Yambol Strandzha Sredna Gora

Lithobius (s str) *maculipes* (Folkmanova 1936)
Strandzha Kyupriz

Lithobius (s str) *ogleduicus* Ribarov 1987
Strandzha Vizitsa Bakadzhishki vuzvishenia Vojnika

Lithobius (s str) *popovi* Matic 1973
Lovech Devetaki

Lithobius (s str) *rishovensis* Matic 1967
Stara Planina Mountains Gradestnitsa

Lithobius (s str) *thracicus* Matic et Golemansky 1967
Pazardzhik Ognyanovo

Lithobius (s str) *tiasnatensis* Matic 1973
Yambol Mramor

Lithobius (s str) *uniunguis* Matic et Golemansky, 1967
Western Rhodope Banite Pazardzhik Srebrino

DIPLOPODA

CALLIPODIDAE

Balkanopetalum armatum Verhoeff 1926
Western Stara Planina Mountains Cherepish Tserovo, Beledie han Zhelen Tserovo Cherepishki manastir, Bov

Balkanopetalum beskovi Strasser 1973
Western Rhodope Dobrostan

Balkanopetalum rhodopinum Verhoeff, 1937
Western Rhodope Pestera Dobrostan Chouren

Eurygyrus bulgaricus (Verhoeff, 1926)
Varna Evxinograd Belasitsa

DORYPETALIDAE

Dorypetalum bulgaricum Strasser 1966
Eastern Rhodope Ivajlovgrad Kostino

ANTHROLEUCOSOMATIDAE

Bulgaricus trianteevi Strasser 1960
Karloukovo

Bulgarosoma buresch Verhoeff 1926
Vratsa Ledenik caves near Vratsa

Bulgarosoma meridionale Tabacaru 1967
Western Rhodope Trigrad

Bulgarosoma rhodopinum Strasser, 1966
Western Rhodope Mostovo

Bulgarosoma superficiei Strasser 1975
Vitosha Alcko

Bulgarosoma tridentiferum (Gulicka, 1967)
Oryahovo

Prodicus albus Strasser 1960
Stara Planina Mountains Troyanski balkan, Cherni Osum

Prodicus delcevi Strasser 1973
Slavyanka Paril

Prodicus falcatus Gulicka 1967
Kotel Kipilovo

Prodicus lepenice Strasser 1975
Western Rhodope Velingrad

Stygiosoma berovi Gulicka 1967
Gotse Delchev

HAASEIDAE

Haasea vidinense (Strasser 1973)
Vidin Byala

MASTIGOPHOROPHYLLIDAE

Mastigophorophyllon bulgaricum bulgaricum Schubart, 1934
Rila Chamkouriya Borovets Asenovgrad Strandzha Malko Turnovo

Appendix 21 Bulgarian Endemic Species of Myriapoda (Dr Gergin Blagoev) (continued)

Mastigophorophyllon bulgaricum pirinicum
Gulicka 1967
Pirin Demyanitsa Bunderitsa

GLOMERIDAE
Glomeris vodnatensis Verhoeff, 1926
Stara Planina Mountains Tserovo Karloukovo Vratca, Iskursko defile Veliko Turnovo Lakatnik, Kotel, Bov, Gintsi, Vratsa, Zemenski prolom Skakavitsa, Sredna Gora

JULIDAE
Apfelbeckiella beroni staregai Strasser, 1973
Bourgas Mladezhko
Apfelbeckiella beroni Strasser 1966
Rhodope Mostovo Kroumovgrad Popsko
Apfelbeckiella bulgarica Verhoeff 1926
Strandzha Gramatikovo Bourgas Mladezhko Malko Turnovo
Apfelbeckiella golemanskyi Ceuca 1973
Western Rhodope Batak Smolyan Devin.*Apfelbeckiella trnovensis* deliormana Strasser 1966
Rouse Tabachka
Apfelbeckiella trnovensis rhodopiana Strasser, 1966
Eastern Rhodope Kurdzhali Gorna Snezhinka Ostrovitsa Western Rhodope Stoudenets, near vr Snezhanka, Gotse Delchev Dolno Drvanovo Pirin Bunderitsa
Apfelbeckiella trnovensis trnovensis (Verhoeff 1928)
Veliko Turnovo Arbanasi Sliven Shoumen Strandzha Kyupriz
Balkanophoenix borisi Verhoeff 1937
Stara Planina Mountains Lakatnik Western Rhodope Choukourska
Leptoiulus borisi Verhoeff 1926
Rila Borovets, Rilski manastir, Mousala Chadur tepe Vitosha Varna Pirin Kamenitsa Western Rhodope Beglika Sredna Gora Panagyurski kolonii Belasitsa, Petrich
Megaphyllum anatolicus denticulatus (Strasser, 1969)
Sozopol
Megaphyllum beroni (Strasser 1973)
Western Rhodope Trigrad
Megaphyllum glossulifer (Schubart, 1934)
Rila Mountains Mousala Grunchar
Megaphyllum rossicus strandschanus Verhoeff, 1937
Strandzha Mountains Michourin, Eastern Rhodope Mountains Kurdzhali
Mesoiulus bulgaricus Gulicka, 1967
Svilengrad Mezek
Typhloiulus bureschi Verhoeff, 1926
Stara Planina Mountains Lakatnik Tserovo Golyama Zhelyazna, Karloukovo Zhelen Gintsi Lipnitsa Vratsa Chiren Beli Izvor Vidin Dolni Lom
Typhloiulus georgievi Strasser 1962
Lovech Kurpachevo Kroushouna
Typhloiulus kotelensis Jawlowski 1938
Kotel Beli vodi Sredna Gora Panagyuriste
Typhloiulus longipes Strasser 1973
Vratsa, Chiren
Typhloiulus staregai Strasser, 1973
Vidin Salash
Xestoiulus pirinicus (Gulicka 1967)
Pirin Demyanitsa

POLYDESMIDAE
Brachydesmus cristofer Strasser 1966
Sofiya Bosnek Ourvich, Kyustendil Treklyansko
Brachydesmus dadayi brusenicus Gulicka 1967
Vratsa Brousen
Brachydesmus hercegowinensis confinis Strasser 1969
Sofiya Berende Izvor
Brachydesmus hercegowinensis reflexus Strasser, 1975
Sofiya Breze
Brachydesmus hercegowinensis trifidus Strasser 1973
Kyustendil Stradalovo
Brachydesmus radewi Verhoeff, 1926
Vratsa Dolna Beshevitsa
Brachydesmus tetevensis Strasser 1973
Stara Planina Mountains vr Vezhen
Polydesmus bureschi Verhoeff 1928
Veliko Turnovo
Polydesmus jawlowskii Strasser 1966
Rila Rilski manastir, Gotse Delchev Satovcha
Polydesmus planinensis Gulicka 1967
Stara Planina Mountains Rousalka
Polydesmus rhodopensis Gulicka 1967
Western Rhodope Hvojna Asenovgrad
Polydesmus zonkovi Verhoeff, 1937
Sliven, Pirin Bansko Rilski manastir

TRICHOPOLYDESMIDAE
Bacillidesmus bulgaricus bulgaricus Strasser, 1962
Mihajlovgrad Prevala, Vratsa Chiren, Vidin Dolni Lom Drouzhba Drashan

CHILOPODA
HIMANTARIIDAE
Bothriogaster signata graeca (Verhoeff, 1901)
Gotse Delchev Ognyavski bani
Thracophilus bulgaricus Verhoeff, 1926
Western Rhodope Bachkovo, Narechenski bani, Asenovgrad Panagyuriste

Appendix 21 Bulgarian Endemic Species of Myriapoda (Dr Gergin Blagoev) (continued)

LITHOBIIDAE
Lithobius (Monotarsobius) burzenlandicus wardaranus Verhoeff, 1937
Vitosha Western Rhodope Batak Velingrad Trigrad Pirin Bunderitsa
Lithobius (Monotarsobius) dobrogicus Matic 1962
Pazardzhik Srebrino Western Rhodope Srebrino

Lithobius (s str) *lakatnicensis* Verhoeff 1928
Stara Planina Mountains Lakatnik Bov Vrachanski balkan Dolno Ozirovo, Western Rhodope Pestera Dobrostan

ANTHROLEUCOSOMATIDAE
Prodicus bilselii Verhoeff, 1940
Shoumen

Appendix 22 Balkan Endemic Species of Myriapoda (Dr Gergin Blagoev)

DIPLOPODA
GLOMERIDAE
Glomeris balcanica Verhoeff 1906
Pirin Rozhen, Malko Turnovo, Haskovo, Slavyanka, Osogovo, Sakhar hilly region, Stara Planina Mountains Kalofer, Asenovgrad, Rhodope Kurdzhali, Zaburdo Shiroka luka Kyustendil Koznitsa, Rila Maljovitsa, Western Rhodope Tchepelare Mihalkovo, Sredna Gora, Rila Mousala, Stara Planina Mountains vr Botev Belasitsa

JULIDAE
Cylindroiulus (Crenatoiulus) vitosae Strasser, 1962
Vitosha Veliko Turnovo, Lyulin planina, Plovdiv Pesnopoj Ropotamo Western Rhodope Asenovgradska krepost, Varna Asparouhovo
Megaphyllum rhodopinus Verhoeff, 1928
Western Rhodope Batak Bachkovski manastir, Beglika Snezhanka Pestera Chepelare Yagodina Gotse Delchev Slashen Slavyanka Petrich Plovdiv Kosovo Koprivstitsa Pazardzhik Debrastitsa Panagyuriste

Serboiulus spelaeophilus Gulicka, 1967
Vidin Vurbovo, Replyana, Salash, Belotintsi Falkovets Oreshets Turgovishte Dolni Lom Berkovitsa, Belogradchik, Gorna Louka, Vladimirovo Mitrovtsi Stoubel Mihajlovgrad Prevala, Beli Mel Cherkaski, Iskursko defile gara Tompsun

POLYDESMIDAE
Polydesmus renschi Schubart, 1934
Rila Chamkouriya, Stara Planina Mountains Malka Brestnitsa, Karloukovo, Vidin Ribisha Iskurski prolom Tserovo, Sofiya, Stara Planina Mountains Iskrets, Vratsa, Chiren Pleven Deventsi Western Rhodope Kosovo, Strandzha Malko Turnovo, Mihajlovgrad Gorna Verenitsa Prevala, Ahtopol, Sredna Gora

Appendix 23 Rare Species of Myriapoda (Dr Gergin Blagoev)

CHILOPODA
GEOPHILIDAE
Geophilus electricus (Linnaeus 1758)
Varna
Geophilus proximus C L Koch, 1847
Stara Zagora

LITHOBIIDAE
Eupolybothrus leptopus Latzel 1880
Vitosha Mountain
Harpolithobius radui Matic, 1955
Shoumen
Lithobius (Monotarsobius) aeruginosus L Koch 1862
Shoumen

Lithobius (Monotarsobius) catascaphius Verhoeff 1937
Western Rhodope Mountains
Lithobius (Monotarsobius) pustularis Matic 1964
Strandzha Mountain

CRYPTOPIDAE
Cryptops parisi rhenanus Verhoeff, 1931
Rila Mountains
Lamyctes fulvicornis Meinert, 1868
Yambol

DIPLOPODA
GLOMERIDAE
Glomeris pustulata Latreille, 1803
Sredna Gora Mountains

Appendix 23 Rare Species of Myriapoda (Dr Gergin Blagoev) (continued)

POLYDESMIDAE
Brachydesmus perserensis Verhoeff 1932
Rila Mountains Rilski manastir
Brachydesmus polydesmoides Verhoeff 1895
Western Rhodope
Polydesmus mediterraneus valachicus Tabacaru & Negrea 1961
Lovech
Polydesmus rubellus Attems, 1902
Dobrich

PACHYIULIDAE
Pachyiulus varius (Fabricius 1781)
Cherven bryag
Strongylostoma jaqueti Verhoeff 1898
Varna

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NOTES

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Insects of Bulgaria, Part 1: Odonata, Ephemeroptera, Plecoptera, Homoptera (Auchenorrhyncha), Heteroptera, Coleoptera

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SUMMARY

The orders of insects described in this paper are some of the most ancient representatives of the class Insecta and among the most numerous families and species of the contemporary fauna Together they en compass 37% of the insect fauna in Bulgaria Scien tific research on them began in the last century and they have since been extensively studied This paper includes current information on the total number of the established families and species in the Bulgarian fauna the number of endemic, rare and relict species, and the degree to which each order has been investi gated in Bulgaria Although these insect groups have been thoroughly studied in faunistic terms there are areas of Bulgaria that have not been investigated enough and that should be subject to future research These areas are specified within this report

Special attention is paid to rare endemic and relict species The percentage of rare species is high est in Plecoptera (29%) and Odonata (26 6%) The percentage of endemic species is highest in Plecoptera (25%) and Ephemeroptera (11 8%) Heteroptera has the highest percentage of relict species (7 2%) Areas where the most unique communities occur are indi cated Most are in the high mountains along the Black Sea coast and in the southwestern part of Bul garia (mainly the southern Strouma River valley) For each order areas of special interest and environmental importance are indicated These are primarily refugia where large numbers of relict species of glacial origin or troglobionts are concentrated The sensitivity of the different orders to anthropogenic forces is discussed at length The most sensitive to such influences are al most all the Odonata and Plecoptera species as well as Coleopteran troglobionts Areas containing the most representative samples of biodiversity in the dif ferent orders also are indicated Most of these areas are located in the mountains mainly in the Rilas Pirins Vitosha and the Western Rhodopes

A great deal of concrete data are presented re garding existing threats to the survival of biotypes of the different orders The most endangered ecosystems are identified along with the regions where they are situated and the specific factors that threaten to de stroy or totally extinguish them Specific recommen dations for preserving the species composition of the listed orders are offered Based on concrete data on the presence of large number of endemic, rare and relict species proposals are made for new protected areas (national parks and reservations) It is also rec ommended that a red data book of Bulgarian inverte brate fauna, including insects, be developed and issued soon

A BRIEF HISTORY OF ENTOMOLOGICAL RESEARCH

Research on the insect orders described in this paper began at different times The first investigations date back to the beginning of the last century and were carried out by foreign zoologists Several expe ditions organized by the Hungarian zoologist Imre Frivaldszky in the first half of the last century exam ined different regions of Bulgaria The materials gathered on these expeditions enabled us to discover the first endemic species of the Bulgarian fauna – sev eral species in different families of Coleoptera (Many of these species – for example, *Carabus versucolor*, *Carabus cavernosus* *Cardiophorus hinkei* and *Dor cadion sturmi* – are still considered Bulgarian and Bal kan endemics) By the end of the last century many foreign zoologists and entomologists were visiting Bul garia Their interest focused mainly on the Coleop tera most of the entomology publications issued be fore the beginning of this century involved this order

The first investigations on Heteroptera date back to the end of the last century The first article written by the Hungarian Gena Horvath was published in 1890 At about the same time, research began on Odonata (the first publication was written by the Bul garian zoologist Georgy Hristovich in 1892) and on Ephemeroptera and Plecoptera (the first publication on the two orders was written by the Czech entomolo gist Frantishek Klapek in 1894) The investigations on Homoptera were the last to begin with the first publi cations written by the Bulgarian entomologists Nikola Nedelkov (1908) and Dimitar Yoakimov (1909)

At this point over 1500 monographs and scientific papers on the different insect orders have been pub lished For some of these orders (Odonata Plecop tera and Coleoptera), the publications have been written primarily by foreign authors mainly Germans and Czechs For the other orders most of the publi cations have been written by Bulgarians

The bibliography lists 263 of the most significant

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publications on the different orders They are divided among the orders as follows

Odonata	47	(Bulgarian 3, foreign 44)	
Ephemeroptera	25	(Bulgarian 15 foreign - 10)	
Plecoptera	38	(Bulgarian 11 foreign 27)	
Auchenorryncha	19	(Bulgarian 14 foreign - 5)	
Heteroptera	51	(Bulgarian 41 foreign 10)	
Coleoptera	83	(Bulgarian 51 foreign 32)	

Of the total of 263 publications 135 were written by Bulgarian authors and 128 by foreign scientists

It should be noted that, for some of the orders, and for some groups of families or separate families, monographs have been or are about to be issued in the *Fauna of Bulgaria* series Such systematic groups are Odonata Pentatomoidea Haliplidae Hygrobiidae Dytiscidae Gyrinidae Chrysomelidae Curculionidae Rhynchophora

The different groups have not been investigated to equal degrees (see next section) In general however, the species composition of these orders has been re searched in great detail when compared to the Bul garian fauna as a whole This is obvious from the fol lowing numbers

Odonata	10 families 29 genera and 64 species
Ephemeroptera	15 families 30 genera and 102 species
Plecoptera	7 families 22 genera and 96 species
Auchenorryncha	14 families and about 500 species
Heteroptera	39 families 373 genera and 1020 species
Coleoptera	79 families and 5370 species

The high level of species diversity in these orders can be very clearly illustrated by comparing the num ber of species in each in the Bulgarian fauna and in the Central European fauna The Ephemeroptera and Heteroptera orders have more species in Bulgaria than in Central Europe (in Central Europe they have 90 and 900 species respectively) For the other orders the Bulgarian fauna contain somewhat fewer species than the Central European fauna Coleoptera – 90% Odonata – 80% Plecoptera – 77% Auchenorrhyncha – 71% Future research will definitely increase these percentages since the real numbers of species in Bul garia are undoubtedly higher than those given above

MAJOR GAPS IN KNOWLEDGE

Most of the orders discussed in this paper are among the best investigated in the Bulgarian fauna (Table 1) This is true especially for taxonomic re search and to a large extent for faunistic research on the Heteroptera Odonata, and Plecoptera 96% of the probable Heteropteran species in Bulgaria and approximately 85% of the other two orders, are known The Ephemeroptera and Homoptera (Auchenorrhyncha) orders are not so well investi gated 73% of the probable species composition in the former suborder in the national fauna and 62% in the latter are known

The situation with the Coleoptera order is rather different For the order as a whole 67% of the prob- able total of species in Bulgaria are already known The different families, however are in different stages of investigation and knowledge The best investigated families are Carabidae, Haliplidae Dytiscidae Gy rinidae, Silphidae Cleridae Buprestidae Elateridae Coccinellidae Cerambycidae Chrysomelidae, and

Table 1

Order	Number in Bulgaria					Degree of study of the order in Bulgaria (%)
	Families	Species				
		Total	Endemic	Relict	Rare	
Odonata	10	64	-	1	17	85%
Ephemeroptera	15	102	12		19	73%
Plecoptera	7	96	24	-	28	85%
Homoptera (Auchenorryncha)	14	500	13	10	49	62%
Heteroptera	39	1020	31	73	92	96%
Coleoptera	79	5370	393	24	560	67%
Total	164	7152	473	108	765	

Curculionidae Between 90 and 95% of the actually occurring species in these families are known Known to a somewhat lesser degree (from 65 to 85%) are the species within the families Hydrophilidae Dryopidae Histeridae Cholevidae Dermestidae, Bruchidae, and Meloidae A third group includes those families that have been investigated to a still lesser but still quite satisfactory degree (about 50 to 60%) Helodidae, Cantharidae Anobiidae, Georysidae, Nitidulidae Tenebrionidae, and Ipidae Finally there is a sub stantial group of families that are still not so well in vestigated (under 50%) Pselaphidae Scydmaenidae Staphylinidae Eucnemidae Cucujidae, Cryptophagi dae Mycetophagidae Oedemeridae Anthicidae and some others

Almost all the families of the orders mentioned above – the exceptions are those on which mono graphs have been published in the *Fauna of Bulgaria* series – have not been studied or are poorly studied with respect to ecology and zoogeography Almost nothing has been done to protect these insects Only several Coleoptera species and their typical cave representatives (troglobionts from the Trechinae and Bathysciinae subfamilies) are protected by special leg islation A major gap is the absence of a "Red Data Book" for Bulgarian insects and other invertebrates Such a book should be published as soon as possible

ASSESSMENT OF CURRENT KNOWLEDGE

Areas Requiring Further Investigations

The territory of Bulgaria, which is characterized by extremely diverse relief – high mountains extensive plains and valleys long and deep river valleys a long seashore with dunes and beaches – has not been stud ied to an equal degree with respect to the entire insect fauna The orders have been insufficiently investi gated in the following areas

- **Odonata** the high mountain lakes, mainly in the Rila and Pirin Mountains, the wetlands near Sil istra, and the whole region of the eastern Rho dopes and northwestern Bulgaria
- **Ephemeroptera** the subalpine and alpine zones in the mountains
- **Plecoptera** some plain regions mainly the Da nubian plain and the Thracian lowland
- **Auchenorryncha** and **Heteroptera** Slavyanka Mountain where undoubtedly very interesting species will be found
- **Coleoptera** the Danubian Plain (particularly the Dobrudzha area) the Mesta valley and high parts of the western Rhodopes

Some mountain areas along the national borders with Serbia Macedonia Greece, and Turkey are poorly studied or have not been studied at all These are the mountains Chiprovska, Ruy Milevska Osogovska, Vlahina, Maleshevska, Ograzhden, Belasitsa, Slavyanka Stargach Sakhar and Strandzha as well as the regions of Znepole, Piyanec, and Gorna Arda

Rare Species

This category includes species and subspecies distributed mainly in a single locality or in several lo calities with small populations The percentage of species included in this category varies significantly among the different orders For the Plecoptera the percentage of rare species is 29 2%, for the Odonata – 26 6%, for the Ephemeroptera – 18 6% for the Cole optera – 10 4%, for the Auchenorrhyncha – 9 8% and for the Heteroptera – 9%

Odonata has 17 rare species, most of which are found along the southern Black Sea coast (7) on Vi tosha Mountain (5) in the southern part of the Strouma River valley (4), and on the northern Black Sea coast and in the western Rhodopes (3 each) This is a moderate level of rarity

Ephemeroptera has 19 rare species, primary re stricted to the western Rhodopes (3) the Rila Mountains the Pirin Mountains, the western Stara Planina and Strandzha Mountain (2 each) This is a low level of rarity

Plecoptera has 28 rare species, located primarily in the central Stara Planina Mountains (17), and the Rila and Vitosha Mountains (6 each) This is a moderate level of rarity

Auchenorryncha has 49 rare species They occur primarily on Vitosha Mountain (8), in the central Stara Planina Mountains (5) in the western Stara Planina and along the southern Black Sea coast (4 each) and in the Strouma Mesta zoogeographical regions (3 each) This is a low level of rarity

There are 92 rare species in the Heteroptera, most of which are found in the southern part of the Strouma River valley (33), the southern Black Sea coast (16), the northern Black Sea coast, Slavyanka and Strandzha Mountain (4 each) the Pirin Mountains and the western Rhodopes (3 each), the Rila Mountains the central Stara Planina Mountains and Bela sitsa Mountain (2 each), and Vitosha Mountain (1) This is a low level of rarity

Coleoptera has at least 560 rare species found predominantly in the southern Black Sea coast (81) the Strouma Mesta region (71) the western Rhodopes (49) the northern Black Sea coast (37) Vitosha Mountain (36) and Strandzha Mountain (19) Rare species are found to a considerably smaller extent on the Slavyanka and Belasitsa Mountains (7 each) This is a low level of rarity

The total number of rare species for all orders is at minimum, 765 (or 10 7% of all known species)

The areas with the greatest number of rare species are found in the southern part of the Strouma River valley from the town of Simitli to the national border (111) and along the southern Black Sea coast to Cape Emine (108) Rare species occur to a lesser degree number on Strandzha Mountain (25 species) and in the central and eastern Stara Planina Mountains (24 each) It is interesting to note that relatively few rare species occur in the highest Bulgarian mountains for example on Slavyanka Mountain (9) in the Rila Mountains (10) on Belasitsa Mountain (9) in the western Stara Planina (6) and in the Pirin Mountains (5) The is a low level of rare species occurrence

Endemic Species[1]

The endemic species and subspecies can be divided into two groups the Bulgarian and the Balkan endemics Some of the Bulgarian endemics are restricted to very small localities – a single cave for example or a group of neighboring caves Such is the case for species or subspecies from the genera *Phegomisetes* and *Duvalius* (Carabidae Coleoptera) and all the troglobiont species from Cholevidae (Coleoptera) Other Bulgarian endemics are widely distributed (e g , some species from the Ephemeroptera and the Coleoptera)

It is very likely that in the future Bulgarian endemics will be found in other Balkan Peninsula regions Thus it is possible to combine the Bulgarian and Balkan endemics into a single category – Balkan endemics Throughout this report we treat the endemics together in this manner

Some orders have moderate percentages of endemic species (Plecoptera – 25%, Ephemeroptera – 11 8% and Coleoptera – 7 3%) others have low percentages (Heteroptera – 3%) and Auchenorrhyncha – 2 6%) No endemic species have been found from Odonata

There are 12 endemic species in Ephemeroptera (6 Bulgarian and 6 Balkan) They have been found in the Pirin Mountains (5) in the Rila Mountains the western Rhodopes, Strandzha Mountain and the southern part of the Strouma River valley (3 each) on Vitosha Mountain and in the western Stara Planina Mountains (2 each) Most of them inhabit mountain streams No endemics have been found on Slavyanka or Belasitsa Mountain, but most likely some will be

Plecoptera has 24 endemic species (10 Bulgarian and 14 Balkan) They are found in the mountains the central Stara Planina (15) the Pirins (12) the Rila (11) the western Rhodopes (10) Vitosha (8) and Strandzha (6) As of yet, no endemic species have been found on Slavyanka or Belasitsa Mountains

Auchenorrhyncha has 13 endemic species (all are Bulgarian endemics) They occur on the southern Black Sea coast (3), in the western Rhodopes and Strandzha Mountain (2 each) on Vitosha Mountain and in the southern Strouma River valley (1 each) Interestingly, no endemics have yet been found in the mountains (Rila, Pirin Stara Planina Slavyanka and Belasitsa) We suspect that we will find endemic species in these areas as they are more carefully studied

Heteroptera the most extensively researched order has 31 endemic species (18 Bulgarian and 13 Balkan) They are most abundant in the southern part of the Strouma River valley (19 species) Heteropteran endemics are also found in the Pirins (4) the Rilas and central Stara Planina the southern Black Sea coast and Strandzha Mountain (3 each) Vitosha Mountain, the western Rhodopes Slavyanka Mountain, and the northern Black Sea coast (2 each) and Belasitsa (1) No endemic species have been found in the Danubian plain or Thracian lowland They are probably not present in these regions

Coleoptera contains the greatest number of endemic species and subspecies (393 260 Bulgarian and 133 Balkan) They occur predominantly in the Rila Mountains (96) the central Stara Planina and western Rhodopes (86 each), the Pirin Mountains (75) the southern Strouma and Mesta River valleys (68) the western Stara Planina (64) Vitosha Mountain (55) the southern Black Sea coast (51) and the northern Black Sea coast (25) Endemic species are also found in the mountains Slavyanka (20), Strandzha (18), and Belasitsa (14)

The total number of endemic species and subspecies for all orders is 473 (6 6% of all species) The areas with the greatest number of endemic species are the Rila Mountains (117) the western Rhodopes (107) the Pirin Mountains (103) and the central Stara Planina Mountains (102) It should be emphasized that in all these mountains (except the Rhodopes) national parks have already been created High numbers of endemics have also been discovered in the southern part of the Strouma River valley (95) the western Stara Planina (83) Vitosha Mountain (81), and the southern Black Sea coast (67) Endemic species occur to lesser degree on Strandzha Mountain (43) along the northern Black Sea coast (31) on Slavyanka Mountain (25) and on Belasitsa Mountain (16) This is a low level of endemism

The numbers of endemic and rare species in the different regions of Bulgaria are given in Table 2

Relict Species

Relict species have not been found in the orders Ephemeroptera and Plecoptera

One relict species has been established for the Odonata at Strandzha Mountain

The relict species of Auchenorrhyncha and Heteroptera are divided into categories according their area of origin tropical, mountain Mediterranean and

Table 2 Richness of endemic and rare species in different regions of Bulgaria

Territories (regions)	Endemics			Rare	All
	Bulgarian	Balkan	All		
Southern part of the Strouma River Valley	54	41	95	111	206
Southern Black Sea coast	36	31	67	108	175
Western Rhodopes	66	41	107	58	165
Vitosha	42	39	81	56	137
Rila	64	53	117	10	127
Central Stara Planina	62	40	102	24	126
Pirin	56	47	103	5	108
Western Stara Planina	54	29	83	6	89
Northern Black sea coast	18	13	31	47	78
Eastern Stara Planina	29	17	46	24	70
Strandzha	29	14	43	25	68
Eastern Rhodopes	16	24	40	14	54
Slavyanka	11	14	25	11	36
Belasitsa	6	10	16	9	25
Sredna Gora	12	7	19	4	23
Osogovo	3	8	11	3	14
Plana	3	2	5	7	12
Lyulin	3	5	8	3	11
Sakhar	5	6	11		11
Golo Bardo	2	5	7	3	10
Lozenska Planina	1	2	3	3	6
Ograzhden	2	1	3	3	6
Malashevska Planina	1	1	2	2	4
Ruy Planina	1	2	3	1	4
Verila				1	1
Vlachina Planina				1	1
Total number for all orders	307	166	473	765	

glacial Auchenorrhyncha has 10 relict species (2% of the species composition) all of which are glacial relicts They have been found at Vitosha Mountain (7) in the Rila Mountains in the western and central Stara Planina in the western Rhodopes and at Belasitsa (1 each)

Heteroptera has 73 relict species (7 2% of the species composition) The breakdown according to origin is glacial (59) mountain Mediterranean (11) and tropical (3) They occur on Vitosha Mountain (45) in the Rilas (43) the Pirins (32) the western Rhodopes (27) the western Stara Planina (13), the central Stara Planina (11) Slavyanka Mountain (6) Belasitsa and the southern part of the Strouma River valley (3 each) and the Thracian lowland and eastern Rhodopes (1 each)

There are 24 relict Coleoptera species all of which are endemics and of glacial origin As of now they have been found only in the following mountains the Rilas (18) Vitosha (14) Pirin (10) and the central Stara Planina and West Rhodopes (6 each)

The total number of relict species in all orders (not including endemics) is 108 (or 1 5% of all species) Areas with the greatest number of relict species

are Vitosha Mountain (66) the Rila Mountains (62) the Pirin Mountains (42), and the western Rhodopes (34) National parks exist in all of these areas except for the western Rhodopes Relict species exist to a lesser degree in other regions of our country in the central Stara Planina Mountains (18) in the western Stara Planina (14) on Slavyanka Mountain (6) on Belasitsa Mountain (4), in the southern part of the Strouma River valley (3) and on Strandzha Mountain (1)

Ecosystems and Unique Communities

Bulgaria is a country of varied relief and diverse climatic influences It is situated on the natural border between two continents and two completely different zoogeographical subregions (the Euro Siberian and Mediterranean) The unusual diversity of Bulgaria's insect fauna is due to this situation The topography climate and paleogeographical history during the Tertiary Quaternary period have been critical factors in creating and maintaining many unique ecosystems and communities

The unique ecosystems and communities for any particular order are of course located in different regions but some overlap This is quite natural since in different regions the identical climatic physiogeographic and paleogeographic indices have allowed for the differentiation of unique refugia and for the survival of such communities Many endemic and rare species as well as relict species of varied origin, have been retained in these communities The unique communities for each order have been found in the following areas

- For Odonata the most interesting communities are located along the Black Sea coast and in parts of southwest Bulgaria mainly the high mountain lakes of the Rila and Pirin Mountains Future studies will determine if such communities are located in Strandzha where a single relict species of this order is found

- For Ephemeroptera similar communities have been preserved mainly in the high mountains (Rila Pirin Vitosha and the western Rhodopes) and in the southern part of the Strouma River valley

- The unusual communities of endemic and rare Plecoptera species are located in the Rila, Pirin Vitosha and western Rhodope Mountains, in the high parts of the central Stara Planina Mountains, and at Strandzha Mountain

- Auchenorrhyncha also occur in unique communities but these have a smaller proportion of interesting species They are found in the high mountains (Vitosha Rila, Pirin central Stara Planina and western Rhodopes) but also in different regions along the Black Sea coast and in the southern Strouma River valley

- The Heteroptera have been well studied in communities located mainly in the Pirin Mountains and at Slavyanka Mountain where the fauna are best preserved Similar unique communities are also located in other high mountains (Rila Vitosha western Rhodopes Stara Planina) along the southern Black Sea coast and in the southern Strouma River valley
- Unique communities of Coleoptera the order with the greatest species richness and the most varied ecological niches, are distributed in almost all parts of Bulgaria The most remarkable are those of the high altitudes (the orophytic zone) of the Rila Pirin, and Vitosha Mountains, the xerothermic and calcareous zones of Slavyanka Mountain, the thermophylic refuges in the Strouma River valley the Black Sea coast and Strandzha Mountain

Table 3 lists the regions with unique communities according to the number of endemic rare and relict species in them

Ecologically Important Areas

The most ecologically important regions for the Odonata, Ephemeroptera and Plecoptera with aquatic larval phase are marshlands along the Danube River high mountain lakes of the Rila and Pirin Mountains some rivers of the Black Sea basin (Ropotamo Veleka Fakiyska, and Dyavolska) and some lakes along the southern Black Sea coast (Arkutino and Alepu)

For Auchenorrhyncha and Heteroptera the important regions are the southern part of the Strouma River valley (mainly around the town of Kresna and the "Rupite" site) the area surrounding the town of Petrich and the alpine zones of the Rila, Pirin, Vitosha, Slavyanka, and western Rhodope Mountains Other important areas are the forest steppes in northwestern Bulgaria and the Thracian lowland, the salty soils along the Black Sea coast and the sand dunes and oak forests at Strandzha Mountain

For the Coleoptera species vital areas are found mainly in the alpine zones of the Rila Pirin, Vitosha western Rhodope and Stara Planina Mountains (these are areas that support glacial relicts or species with the Arctic Alpine distribution) The occurrence of Coleopteran troglobionts (genera species, and sub species) should be noted They inhabit only karst caves or chasms and are both endemics and relicts Three troglobionts Cholevidae has 10 genera and 19 species of troglobionts All are located in the Stara Planina and Rhodopes (except for one species on Slavyanka Mountain)

Table 3

Territories with unique communities of endemic rare and relict species	Species				A%[1]
	Endemic	Rare	Relict	All	
Southern part of the Strouma River valley	95	111	3	209	15 5%
Vitosha	81	56	66	203	15 1%
Western Rhodopes	107	58	34	199	14 8%
Rila	117	10	62	189	14 0%
Southern Black Sea coast	67	108	0	175	13 0%
Pirin	103	5	42	150	11 1%
Central Stara Planina	102	24	18	144	10 7%
Western Stara Planina	83	6	14	103	7 7%
Northern Black Sea coast	31	47	0	78	5 8%
Strandzha	43	25	1	69	5 1%
Slavyanka	25	11	6	42	3 1%
Belasitsa	16	9	4	29	2 2%
Total number for all orders	473	765	108	134	

Notes [1] Percent of the total number of endemic rare and relict species

Sensitivity to Human Impacts

The species examined in this report exhibit varied degrees of sensitivity to specific anthropogenic factors We can classify them as high, moderate, or low in sensitivity

Almost all Odonata and Plecoptera species exhibit high sensitivity, the rest of the orders are moderately sensitive All troglobiont Coleoptera species show exceptionally high sensitivity The development of caves – including in some case electrification – and tourist impacts are pernicious for the whole cave fauna but especially for the troglobionts Often these types of human activities lead to complete destruction of the cave fauna

Representative Sites

For the various orders the most interesting representative areas are located in the following regions

- Odonata along the Black Sea coast, southwestern Bulgaria the high mountain lakes of the Rila and Pirin Mountains

  Ephemeroptera the Rila Pirin Vitosha western Rhodope and Strandzha Mountains

- Plecoptera the altitudinal zone over 1000 m above sea level in the high mountains, the whole of Strandzha Mountain where 47% of the species are endemic or rare

- Auchenorrhyncha the Strouma River valley south of the town of Kresna Slavyanka Mountain

- Heteroptera the Rila and Slavyanka Mountains

- Coleoptera the alpine zone of the high mountains the Slavyanka Belasitsa and Strandzha Mountains

HISTORIC, CURRENT, AND POTENTIAL THREATS

Every faunal species is subject to a variety of forces that threaten it with destruction or extinction In the past many of the species in the orders described here were partially or completely destroyed by either abiotic or anthropogenic factors, including drought, glaciation during the Quaternary the mass clearing of forests and various human constructions or agricultural activities The current threats to the survival of the respective biotas by anthropogenic factors are considerably greater than in the past The different orders are subject to different factors

- Odonata The most endangered species are found in the small streams near the Black Sea coast These streams are currently undergoing extensive alteration There is a real threat that at least 6 species will go extinct in this area

- Ephemeroptera The most threatened species are those whose larvae live in the middle or lower

course of the larger rivers Pollution of the water with different industrial or household wastes is the most significant threat in these areas The endemic mountain species are threatened by the increasing incidence of acid rain These and other factors have already caused seven species to go extinct Another 13 species are threatened with extinction

- Plecoptera The most endangered species are those of rivers running through plains where the total pollution load has severely depleted the fauna and driven species to extinction Some species in the Danube and the Marica Rivers have already been destroyed The fauna of the Iskar, Maritsa, and Yantra Rivers have been severely damaged or partially destroyed In general this group is among the most endangered by potential environmental changes

- Auchenorrhyncha and Heteroptera The fauna of the plains the mountain foothills (up to 1000-1200 m above sea level), and especially the sea shore dunes and salty soils along the Black Sea coast are the most endangered The most threatened river valley is that of the Strouma River which is among the most faunistically interesting At present 55 endemic relict, and rare species have been located in the Strouma valley a figure unmatched in the Bulgarian fauna

- Coleoptera The most endangered Coleopteran fauna are found in all the caves of the Stara Planina and western Rhodopes that are supplied with electricity and developed for tourism A considerable number of endemic relict species inhabit these caves The fauna of all the areas around the towns and the large industrial centers are also highly threatened

RECOMMENDATIONS

The survival of the species described in this paper requires both specific and general actions We recommend the following specific actions

- Odonata Stop the mass and uncontrolled draining of wetlands, the alteration of the small streams along the Black Sea coast, and the mass pollution of different waterways with industrial or household waste

- Ephemeroptera Stop household and industrial pollution of the rivers as well as their canalization or correction in construction works (for example, in building electric power stations, pumping stations and dams, or in the extraction of minerals) when they do not comply with environmental recommendations

- Plecoptera Strict control over future dam construction and other hydrotechnical activities in the high mountains A typical example is the expected implementation of the notorious Rila project which will transfer water from the basin of the Strouma River to the Maritsa Similar projects are extremely threatening to a considerable portion of the endemic rare and relict fauna of the high mountains

- Auchenorrhyncha and Heteroptera Reduce the main potential threats to the survival of the most interesting representatives of this fauna These threats include agricultural activity without environmental control and poorly planned industrial, urban and road construction projects Currently, construction projects proceed in regions with rich or unique (endemic rare and relict) fauna without even having an expert environmental assessment performed in advance

- Coleoptera Careful expert environmental assessment should be an absolute requirement before any future cave development or electrification goes forward, and before the caves are turned into tourist sites The cave fauna and troglobionts are the most severely threatened with partial or total extinction We should not forget that the Bulgarian cave fauna is unique in the world!

The following recommendations pertain to the protection of the fauna in all the orders

- Begin work immediately on the development and publication of a red data book for the invertebrate fauna including the insects of Bulgaria This is a pressing matter, as is evident from the fact that 473 endemic, 765 rare, and 108 relict species in the orders described in this paper have already been discovered

- Create new protected areas – national parks and reserves – in regions rich in endemic rare and relict species Such parks have already been created in the Vitosha Rila Pirin and Stara Planina (the "Vrachansky Balkan" park and the "Central Balkan" park) Mountains A biosphere reserve has been created at Slavyanka Mountain and several protected areas have been established in the western Rhodopes (e g , Mantaritsa Reserve) The number of endemic rare and relict species in the orders described in this paper that live in the protected areas in some of the mountains are

  Vitosha – 81 endemic 56 rare and 66 relict species 203 species altogether

  Rila – 117 endemic 10 rare, and 62 relict species,

189 species altogether

Central Stara Planina – 102 endemic 24 rare and 18 relict species, 144 species altogether

Slavyanka Mountain – 25 endemic 11 rare and 6 relict species 42 species altogether

With this data in mind more specific proposals to set up new protected areas or several national parks are absolutely justified These proposals are as follows

1 Create a national park in part of the western Rhodopes It should unite several of the already existing protected areas which were established almost exclusively for the protection of forests and plants The fact that 107 endemic 58 rare and 34 relict insects from the orders discussed (199 species altogether) have already been discovered in the western Rhodopes supports this proposal According to this criterion this area ranks first among all the Bulgarian mountains

2 Create a national park or at least several protected areas in the southern part of the Strouma River valley to be more precise in the vicinity of the town of Simitli near the border with Greece In this territory 95 endemic, 111 rare, and 3 relict species from the orders discussed (209 species altogether) have already been discovered According to this criterion this is the most important area in all of Bulgaria

3 Create new protected areas in the southern part of the Black Sea coast especially for the protection of the rare species inhabiting this region 67 endemic and 108 rare species (175 species altogether) have been discovered there, which ranks it fifth in Bulgaria

4 Unite or transform the several existing small protected areas on Strandzha Mountain into one more extensive national park 43 endemic 25 rare and 1 relict species (69 species altogether) have been discovered there Because this mountain has not been well studied with respect to entomology these figures will surely increase in the future

5 Continue and intensify investigations of the insect fauna of Slavyanka Mountain where 25 endemic, 11 rare and 6 relict species (42 species altogether) have been discovered The actual number of species is several times larger Determination of this number will be a prerequisite for the transformation of the existing protected area into a national park This is also valid for Belasitsa Mountain where only 16 endemic, 9 rare, and 4 relict species (29 species altogether) have been discovered At least one protected area should immediately be created there

Appendix 1 Rare Species of Odonata

Epallage fatime Charpentier
Yuzhno Chernomorsko kraybrezhie Strandzha Mt
Chalcolestes viridis (V Linden)
Iztochna Stara Planina Mt , Sofiyska kotlowina Kroupnishko Sandansko Petrichka kotlowina Yuzhno Chernomorsko kraybrezhie
Lestes macrostigma (Eversmann)
Yuzhno Chernomorsko kraybrezhie
Erythromma najas (Hansemann)
Zapadna & Iztochna Dounawska ravnina
Coenagrion hastulatum (Charpentier)
Vitosha Mt Zapadni Rhodopi Mt
Cercion lindeni (Selys)
Yuzhno Chernomorsko kraybrezhie
Aeschna subarctica (Walker)
Pirin Mt 2000 alt
Aeschna cyanea (Muller)
Sofiyska kotlowina Rila Mt , Zapadni Rhodopi Mt
Caliaeschna microstigma (Schneider)
Kroupnishko-Sandansko Petrichka kotlowina Severno & Yuzhno Chernomorsko kraybrezhie
Cordulegaster picta Selys
Yuzhno Chernomorsko kraybrezhie
Cordulegaster heros Theischinger
Kroupnishko Sandansko Petrichka kotlowina
Cordulegaster insignis charpentieri Kolenati
Severno & Yuzhno Chernomorsko kraybrezhie
Somatochlora metallica meridionalis Nielsen
Yuzhno Chernomorsko kraybrezhie
Somatochlora flavomaculata (V Linden)
Zapadni Rhodopi Mt
Libellula fulva Muller
Sofiyska kotlowina Trakiyska nizina Kroupnishko Sandansko Petrichka kotlovina
Orthetrum anceps (Shneider)
Severno Chernomorsko kraybrezhie
Leucorrhinia pectoralis (Charpentier)
Iztochna Dounavska ravnina Sofiyska kotlovina

Appendix 2 Relict Species of Odonata

Calopteryx virgo meridionalis Selys
Yuzhno Chernomorsko kraybrezhie Strandzha Mt

Appendix 3 Bulgarian Endemic Species of Ephemeroptera

HEPTAGENIIDAE
Iron yougoslavicus Samal 1939
Vitosha Mountain Sredna Stara Planina, Podbalkanski kotlovini Rila Mountain Pirin Mountain, Mestenska dolina
Rhithrogena braaschi Jacob, 1974
Pirin Mountain
Rhithrogena iridina (Kolenati 1860)
Rila Mountain, Pirin Mountain, Zapadna Stara Planina

LEPTOPHLEBIIDAE
Paraleptophlebia lacustris Ikon 1962
Iztochna Stara Planina Iztochen Predbalkan part Bakadzhiksko Burgaska, Strandzha Mountain, Yuzhno Chernomorsko kraybrezhie

EPHEMERELLIDAE
Ephemerella maculocaudata Ikon 1961
Krupnishko Sandansko Petrichka dolina Iztochni Rodopi
Ephemerella mucronata unicolorata (Ikon)
Soldan 1982
Krupnishko Sandansko Petrichka dolina

TAENIOPTERYGIDAE
Brachyptera bulgarica
Sofiyska kotlovina Vitosha Stara Planina Rila Zapadni Rhodopi Iztochni Rhodopi Strandzha (100 1700m)
Brachyptera helenica
Strandzha Mountain (300 400m)

Appendix 4 Balkan Endemic Species of Ephemeroptera

HEPTAGENIIDAE
Iron yougoslavicus Samal 1939
Vitosha Mountain Sredna Stara Planina Podbalkanski kotlovini, Rila Mountain Pirin Mountain, Mestenska dolina
Rhithrogena braaschi Jacob 1974
Pirin Mountain
Rhithrogena iridina (Kolenati, 1860)
Rila Mountain, Pirin Mountain Zapadna Stara Planina

LEPTOPHLEBIIDAE
Paraleptophlebia lacustris Ikon 1962
Iztochna Stara Planina Iztochen Predbalkan, part Bakadzhiksko Burgaska Strandzha Mountain, Yuzhno Chernomorsko kraybrezhie

EPHEMERELLIDAE
Ephemerella maculocaudata Ikon , 1961
Krupnishko Sandansko Petrichka dolina Iztochni Rodopi
Ephemerella mucronata unicolorata (Ikon)
Soldan 1982
Krupnishko Sandansko Petrichka dolina

TAENIOPTERYGIDAE
Brachyptera bulgarica
Sofiyska kotlovina, Vitosha Stara Planina, Rila, Zapadni Rhodopi Iztochni Rhodopi Strandzha (100 1700m)
Brachyptera helenica
Strandzha Mountain (300 400m)

Appendix 5 Rare Species of Ephemeroptera

Ameletus inopina Etn
Rila Mountain Borovets resort Pirin Mountain Argirovo and Gorno Breznishko Lakes
Metreletus balcanicus (Ulm)
Strandzha Mountain Fakiyska river Golyamo Boukovo v , Ropotamo river middle course, Topolovets river Gradets v
Ametropus Fragilis Alb b
Donau river 747 th , 704 th 497 th river km (now missing)
Baetis niger (L)
Stream within Dospat river basin

Baetis macani Kimm
Maritsa river Kostenets Novi Krichim, above Plovdiv Purvomay Preslavets v Lyubimets v
Baetis pentaphlebodes Ujh
Osum river Alexandrovo v
Baetis tracheatus Keff & Mach
Maritsa river below Plovdiv and above Dimitrovgrad

Appendix 5 Rare Species of Ephemeroptera (continued)

Centroptilum nana Bog
Strandzha Mountain stream near Varvara v
Centroptilum pulchrum Etn
Harmanliyska river Malevo v
Rhithrogena uridina (Kolenati)
Rila Mountain Baninska river (the Mesta river basin) Pirin Mountain Razlog Stara Planina Mountain Botounya river Vratsa
Rhithrogena sowai Puths
Rhodopi Mountain Zaburdo river Chepelare Stara planina Mountain Leva river Vratsa
Ecdyonurus subalpinus Klap
Maritsa river Belovo Dolna banya v
Ecdyonurus torrentis Kimm
Maritsa river Momina klisoura V Kostenets, Belovo
Heptagenia longicauda (Steph)
Maritsa river Purvomay Dimitrovgrad Kozhouh Mountain Petrich
Ephemerella mesoleuca (Brauer)
Maritsa river Svilengrad Toundzha river Elhovo Iskur river Gigen v
Neoephemera maxima (Joly)
Toundzha river Slivenski bani resort Yambol(now missing)
Brachycercus harrisella Curtis
Donau river Kozloduy Maritsa river Dimitrovgrad Harmanli (missing now)
Cercobrachis minutus (Tshern)
Donau river Svishtov Lakut island Tundzha river above Yambol (missing now)
Paraleptophlebia cincta (Retz)
Maritsa river Dimitrovgrad Zlatna Panega River Roumyantsevo v

Appendix 6 Bulgarian Endemic Species of Plecoptera

NEMOURIDAE
Nemoura braashi
Rila Pirin, Rhodopi Vitosha (600 1700m)
Nemoura bulgarica
Rila Pirin Rhodopi Stara Planina (1400 2100m)
Nemoura pirinensis
Rila, Pirin Vitosha Stara Planina (1200 2400m)
Protonemura beaumonti
Pirin Mountain Iztochna Stara Planina Strandzha Mountain (300 1500m)
Protonemura matthewi
Pirin Mountain (2200m)

LEUCTRIDAE
Leuctra balcanica
Vitosha (800 1400m)
Leuctra marani
Rila Pirin Vitosha Rhodopes (800 2300m)
Leuctra pseudohippopus
common in all high mountains of Bulgaria (800 1800m)

PERLODIDAE
Isoperla russevi
Sredna Stara Planina Mt (1800m)
Isoperla submontana
common in all high mountains (except of Vitosha) (500 1800m)

CHLOROPERLIDAE
Chloroperla kosarovi
common in all high mountains (500 2000m)
Chloroperla russevi
common in all high mountains (except of Vitosha) (1000 2000m)

Appendix 7 Balkan Endemic Species of Plecoptera

NEMOURIDAE
Nemoura braashi
Rila Pirin Rhodopi Vitosha (600 1700m)
Nemoura bulgarica
Rila Pirin Rhodopi Stara Planina (1400 2100m)
Nemoura pirinensis
Rila Pirin Vitosha, Stara Planina (1200 2400m)
Protonemura beaumonti
Pirin Mountain Iztochna Stara Planina Strandzha Mountain (300-1500m)
Protonemura matthewi
Pirin Mountain (2200m)

LEUCTRIDAE
Leuctra balcanica
Vitosha (800 1400m)
Leuctra marani
Rila Pirin Vitosha Rhodopes (800 2300m)
Leuctra pseudohippopus
common in all high mountains of Bulgaria (800 1800m)

PERLODIDAE
Isoperla russevi
Sredna Stara Planina Mt (1800m)

Appendix 7 Balkan Endemic Species of Plecoptera (continued)

Isoperla submontana
common in all high mountains (except of Vitosha) (500 1800m)

CHLOROPERLIDAE
Chloroperla kosarovi
common in all high mountains (500 2000m)
Chloroperla russevi
common in all high mountains (except of Vitosha) (1000 2000m)

Appendix 8 Rare Species of Plecoptera

Rhabdiopteryx alpina
Stara planina Kostina rivers, 1400 m
Rhabdiopteryx hamulata
Strandzha Mt, 100 300 m
Rhabdiopteryx navicula
Sredna Gora Stryama river 800 m
Rhabdiopteryx neglecta
Stara planina Botunya river 800 m
Taeniopteryx hubaulti
Stara planina Tshuprenska and Stakevska rivers 400 600 m
Amphinemura standfussi
Stara planina Tazha river, 400 m
Nemoura longicauda
Vitosha Rila Mts Vasov hut 1750 m
Nemoura marginata
Vitosha Mt, 800 m
Protonemura auberti
Vitosha 1800 m
Protonemura autumnalis
Stara planina Tsherni Osam river 1300 m
Protonemura brevistyla
Rila Mt Kostenets res 1000 m
Protonemura illiesi
Stara planina Kostina and Tundzha rivers 600 1600 m
Protonemura meyeri
Stara planina Kostina river 1400 m
Protonemura nitida
Vitosha, Pirin Banderitza river 1800 m
Leuctra bronislavi
Stara planina Tazha and Asenovska rivers, 500 800 m
Leuctra hirsuta
Vitosha, 1200 m
Leuctra prima
Vitosha 1200 m
Leuctra quadrimaculata
Stara planina Beli Vit Tundzha and Stara reka rivers 800 1000 m
Capnia nigra
Rila Iskar river
Bulgaroperla mirabilis
Stara planina Novoselska and Dvoynitza rivers Strandzha Mt (300 800 m)
Dictyogenus ventralis
Rila Mt Maritza river 800 m
Isogenus nubecula
Stara planina Beli Osam Troyan
Perlodes dispar
Stara planina Gradetz
Perla bipunctata
Stara planina Lom river
Perla illiesi
Stara planina Stara Reka Sliven
Chloroperla tripunctata
Centr Stara planina 500 1600 m
Siphonoperla burmeisteri
Rila Mt Iskar river 900 m
Siphonoperla torrentium
Stara planina Botunya, Tundzha and Kamtshiya rivers

Appendix 9 Endemic Species of Homoptera Auchenorrhyncha

Tachycixius viperinus Dlabola
Sredna Gora Mts
Oliarus iopotamus Dlabola
Kroupnishko Sandansko Petrichka kotlovina Yuzhno Chernomorsko kraybrezhie
Stiromeurysa vitoshaensis Dlabola
Vitosha Mt
Conomelus odryssius Dlabola
Trakiyska nizina
Delphacodes horwathi Joakimov
part Sakarsko Toundzhanska
Chlorita thracica Dlabola
Trakiyska nizina
Erythria selecta Horvath
Zapadni Rhodopi Mt
Arbanda strandjensis Bayrjamova
Strandzha Mt
Thamnotettix thrax Dlabola
Yuzhno Chernomorsko kraybrezhie
Opsius euxinus Dlabola
Yuzhno Chernomorsko kraybrezhie
Kazachstanicus autosicus Dlabola
part Bakadzhiksko Burgaska

Appendix 9 Endemic Species of Homoptera Auchenorrhyncha (continued)

Steptanus josifovi Dlabola
Podbalkanski kotlovini

Erythroneura unipunctata Dlabola
Podbalkanski kotlovini

Appendix 10 Rare Species of Homoptera Auchenorrhyncha

DELPHACIDAE
Delphacodes albifrons Fieber
Gabarevo by Stara Zagora Sofia
Javesella discolor Boh
Gabarevo by Stara Zagora Vitosha Mt
Javesella dubia (Kbm)
Centr Stara planina
Metropis flavipes Signoret
Sofia
Metropis inermis Wagner
Belasitsa Mt
Metropis mayri Fieber
"Karandila" by Sliven
Metropis ugamicus Mit
Ivaylovgrad
Chloriona clavata Dlabola
Gotse Delchev
Chloriona flaveola (Lindberg)
Gotse Delchev
Chloriona orientis Dlabola
Nesebur
Chloriona smaragdula (Stal)
Jambol
Stenocranus fuscovittatus (Stal)
Sofia
Kelisia ribauti Wagner
Kazanluk
Kelisia praecox Haupt
Sofia
Anakelisia fasciata (Kbm)
Sofia

CIXIDAE
Cixius cunicularis L
Plana Mt Lyulin Mt
Cixius simplex (H S)
Brestovets

CICADELLIDAE
Allygus maculatus Rib
West Stara planina Mt
Sorhoanus hypochlorus Fiber
West Stara planina Mt
Agallia antoniae Mel
West Stara planina Mt
Edwardsiana fructator Rib
Vitosha Mt
Edwardsiana lamellaris Rib
West Stara planina Mt Plana Mt

Ribautiana tenerrima H S
Centr Stara planina Plana Mt
Chlorita tesselata (Leth)
Simitli
Acrocephalus longiceps (Kbm)
Centr Stara planina
Parabocratus storai Lindberg
"Pobiti kamuni" by Varna
Handianus procerus (H S)
Pleven
Goniognathus bolivari Mel
Arven
Goniognathus brevis (H S)
Vitosha Mt
Jassargus flori Fieber
Elin Pelin by Sofia
Platimetropius filigranus (Scott)
Vinitsa
Phlogotettix cyclops (M R)
Arkutino
Adarrus geniculatus (Cer)
Vitosha Mt
Eupterix stachydearum (Hardy)
Vitosha Mt
Hardya anatolica Zach
Vitosha Mt
Flammigeroidia tiliae (Geoffr)
Karnobat
Yongia pandelei (Leth)
Karnobat
Ribautiana cruciata (Rib)
Karnobat
Eurhadiana loewi (Then)
Vitosha Mt
Doratura exilis Horvath
Vitosha Mt
Aglena ornata (H S)
Karnobat

ISSIDAE
Agalmatium bilobum (Fieber)
Gotse Delchev
Tachycixius viperinus Dlabola
Sredna Gora Mts
Issus muscaeformis Schr
Asenovgrad
Hysteropterum discolor Germ
Asenovgrad
Hysteropterum tauricum Kuzn
Kurdzhali

Appendix 10 Rare Species of Homoptera Auchenorrhyncha (continued)

Myiterodus imaculatus F
Batova by Varna

ACHILIDAE
Akotropis quercicola Linnavuori
Primorsko

Helicopterа marginicollis (Spin)
"Perla" by Primorsko

TETTIGOMERIDAE
Tettigometra laeta H S
Centr Stara planina

Appendix 11 Relict Species of Homoptera Auchenorrhyncha

GLACIAL RELICTS
Dicranotropis divergens (Kbm)
Rila Mt , Vitosha Mt
Dicranotropis becker Fieber
Vitosha Mt
Cromorphus borealis (J Sahlberg)
Vitosha Mt
Calligypona forcipata (Boh)
West & Centr Stara planina
Calligypona vicina J Sahlberg
Vitosha Mt
Calligypona pallens (Stal)
Rhodopi Mt
Ribautodelphax altaica Vilbaste
Belasitsa Mt
Arboridia ribauti (Oss)
Vitosha Mt
Jassargus cebennicus Rib
Vitosha Mt
Cixius granulatus Horvat
Vitosha Mt

Appendix 12 Endemic Species of Heteroptera

Velia saulii serbica Tamanini
Vitosha Mt Rila Mt Pirin Mt
Dicyphus (Brachycerocea) digitalidis Josifov
Rhodopi Rila Pirin Slavyanka & Belasitsa Mts
Dicyphus (Mesodicyphus) martinoi Josifov
Kroupnishko-Sandansko Petrichka kotlovina
Zapadni Rhodopi Mt
Calocoris (Closterotomus) princeps Reuter
Stara Planina Mt Plana Mt Strandzha Mt
Zapadni Rhodopi Mt , Kroupnishko-Sandansko Petrichka kotlovina
Phytocoris (Compsocerocoris) strymonensis Josifov
Kroupnishko Sandansko Petrichka kotlovina
Dichrooscytus bureschi Josifov
Kroupnishko Sandansko Petrichka kotlovina
Heterocordylus cytisi Josifov
Kroupnishko Sandansko Petrichka kotlovina
Orthotylus (Neopachylops) bureschi Josifov
Kroupnishko Sandansko Petrichka kotlovina
Orthotylus (Neopachylops) junipericola balcanicus Josifov
Kroupnishko Sandansko Petrichka kotlovina
Mecomma ambulans montanus Josifov
Rila Mt
Pilophorus dianae Josifov
Kroupnishko Sandansko Petrichka kotlovina
Ograzhden Mt
Campylomma novaki Wagner
Kroupnishko Sandansko Petrichka kotlovina
Criemnorhinus basalis Reuter
Kroupnishko Sandansko Petrichka kotlovina
Psallus (Apocremnus) betuleti montanus Josifov
Vitosha Mt
Psallus (Hylopsallus) pseudoquercus Josifov
Stara Planina Mt , Zapadni Rhodopi Mt Plana Mt Kroupnishko Sandansko Petrichka kotlovina
Psallus (Psallus) balcanicus Josifov
Stara Planina Mt Plana Mt , Strandzha Mt
Kroupnishko Sandansko Petrichka kotlovina
Psallus (Psallus) faniae Josifov
Yuzhno Chernomorsko kraybrezhie
Psallus (Psallus) milenae Josifov
Kroupnishko Sandansko-Petrichka kotlovina
Orthonotus pseudoponticus Josifov
Rhodopi & Pirin Mts
Compsidolon (Apsinthophylus) balcanicus Josifov
Pirin Mt
Adelphophylus balkanicus (Kormilev)
Kroupnishko Sandansko Petrichka kotlovina
Slavyanka Mt , Sofiyska kotlovina, Podbalkanski kotlovini
Placochilus seladonicus mediterraneus Josifov
Kroupnishko Sandansko Petrichka kotlovina
Paredrocoris seidenstucker Josifov
Kroupnishko Sandansko Petrichka kotlovina
Tupona linnavuori Wagner
Kroupnishko Sandansko Petrichka kotlovina
Isometopus longirostris Josifov
Kroupnishko Sandansko Petrichka kotlovina
Gampsocoris liliane Josifov
Kroupnishko Sandansko Petrichka kotlovina

Appendix 12 Endemic Species of Heteroptera (continued)

Plinthisus coracinus Horvath
Zapadna Stara Planina Mt
Plinthisus mehadiensis Horvath
Yuzhno Chernomorsko kraybrezhie
Ischnocoris bureschi Josifov
Kroupnishko Sandansko Petrichka kotlovina Severno Chernomorsko kraybrezhie Strandzha Mt
Aethus balcanicus Josifov
Yuzhno Chernomorsko kraybrezhie
Thyreocoris ochridanus Kormilev
Iztochna Dounavska ravnina

Appendix 13 Rare Species of Heteroptera

BELOSTOMATIDAE
Lethocerus partuelis (Stal)
SW Bulgaria (Petrich Sandanski)

VELIIDAE
Velia pelagonensis Hoberlandt
SW Bulgaria (Kresna)
Velia thadamatha Hoberlandt
SW Bulgaria (Kresna)

GERRIDAE
Gerris ventralis (Fieber)
SE Bulgaria (Strandzha Mt)

CRYPTOSTEMMATIDAE
Cryptostemma castaneovitreus Linnavuori
SE Bulgaria (Strandzha Mt)

MIRIDAE
Fulvius punctumalbum (Rossi)
Trakia (Ognjanovo), Petrich
Macrolophus glaucescens Fieber
Kalotina
Teratocoris antennatus (Boheman)
SE Bulgaria (Ropotamo)
Adelphocoris insignis Horvath
SW Bulgaria (Sandanski)
Calocoris reuteri Horvath
N Bulgaria (Gabrobo)
Orthops coccineus Horvath
SW Bulgaria (Belasitsa Mt)
Saundersiella moerens (Reuter)
Stara planina Mt near Kotel E Rhodopi near Dubevets
Brachynotocoris puncticornis Reuter
Sofia
Heterocordylus farinosus Horvath
Slavyanka Mt
Excentricoris planicornis (Herrich Schaffer)
Slavyanka Mt
Acronihinum conspersum Noualhier
SW Bulgaria (Kresna)
Systellonotus kirtschenkoi Poppius
SW Bulgaria (Kresna Petrich)
Omphalonotus quadriguttatus (Kirschbaum)
Rila Mt (Borovets)
Acrotelus caspicus (Reuter)
SW Bulgaria (Sandanski Petrich)
Plagiognathus flavipes Reuter
SW Bulgaria (Petrich)
Campyloma diversicornis Reuter
SW Bulgaria (Kresna)
Phoenicocoris modestus (Mayer Dur)
Pirin Mt (Popina luka)
Atractotomus marcoi Carapezza
SW Bulgaria (Kresna)
Psallus albicans (Kirschbaum)
Plana Mt
Psallus pardalis Seidenstucker
Plana Mt
Phylidea henschi (Reuter)
E Rhodopi Mt (Dubevets)
Conostethus angustus Wagner
Burgas
Conostethus venustus (Fieber)
Burgas
Auchenocrepis reuteri Jakovlev
SW Bulgaria (Petrich)
Tuponia piasina Fieber
SW Bulgaria (Petrich)

ANTHOCORIDAE
Temnostethus lunula Wagner
E Rhodopi Mt (Mesek near Krumovgrad)

REDUVIIDAE
Rhinocoris niger (Herrich Schaffer)
Kurilo
Sastrapada baerensprungi Stal
SW Bulgaria ("Rupite" near Petrich)

TINGIDAE
Acalypts hellenica Reuter
SW Bulgaria (Kresna)
Acalypts samaia (Puton)
Rhodopi Mt Pirin Mt
Kalama aethiops Horvath
Strandzha Mt

Appendix 13 Rare Species of Heteroptera (continued)

Galeatus decorus Jakovlev
SW Bulgaria (Petrich)
Galeatus affinis Herrich Schaffer
Nesebar
Tingis caucasica (Jakovlev)
Stara Zagora
Catoplatus distinctus Montandon
Marin tepe near Varna
Agramma blandula (Horvath)
Sandanski

SALDIDAE
Chartoscirta longirostris (Jakovlev)
Burgas
Saldula xanthochila (Fieber)
Varna Lake Struma river by Skakavitsa

LEPTOPODIDAE
Patapius spinosus (Rossi)
Harmanli
Enanotus lanosus (Dufour)
Harmanli

ARADIDAE
Aradus serbicus Horvath
W Stara planina
Aradus crosus Fallen
Rila Mt
Mezira tremulae (Germar)
Nesebar Kyustendil

BERYTIDAE
Metacanthus (Cardopostethus) annulosus (Fieber)
Varna
Metatropis rufescens (Herrich Schaffer)
W Stara planina
Gampsocoris enslini Seidenstucker)
SW Bulgaria (Petrich)

LYGAEIDAE
Lygaeosoma anatolicum Seidenstucker
Rupite" near Petrich
Lygaeosoma angulare Reuter
Kresna
Lygaeosoma sibiricum Seidenstucker
Slavyanka Mt (Ali botush)
Orsillus depressus Dallas
Razlog Kresna
Cymodema tabidum Spinola
Ropotamo
Ischnodemus caspicus Jakovlev
"Rupite" near Petrich
Henestaris cremeus Kiritschenko
Nesebar
Henestaris mioratus Horvath
Burgas
Tropidophlebia costalis (Herrich Schaffer)
Sandanski
Auchenodes joakimoffi Seidenstucker & Josifov
SW Bulgaria (Petrich)
Oxycarenus hyalinipennis (Costa)
Rupite" near Petrich
Stygnocoris similis Wagner
Melnik Petrich
Plinthisus mehadiensis Horvath
Nesebar
Eremocoris pellitus Seidenstucker
Petrich
Camptocera glaberrima (Walker)
Kresna
Proderus crassicornis Jakovlev
Kresna
Lethaeus cribratissimus (Stal)
Petrich Asenovgrad
Diomphalus hispidulus Fieber
Central Stara planina
Trapezonotus anorus (Flor)
Vitosha Mt
Megalonotus hirtulus Fieber
E Rhodopi Mt
Piezoscelis staphylinus (Rambur)
Belasitsa Mt
Lasiocoris anomalus (Kolenati)
Trakiya
Peritrechus rhomboidalis Puton
Zlatovruh by Plovdiv
Xanthochilus saturnius (Rossi)
North from Michurin
Raglius marimensis (Costa)
South from Primorsko
Pachybrachius fracticolis (Schilling)
"Rupite" by Petrich

COREIDAE
Haploprocta umbrina Jakovlev
Bachkovo
Haploprocta sulcicornis (Fabricius)
Strandzha Mt

ALYDIDAE
Megalotomus junceus (Scopoli)
Asenovgrad

RHOPALIDAE
Chorosoma gracile Josifov
"Pobiti Kamuni" by Varna

SCUTELLERIDAE
Odontoscelis hispidula Jakovlev
Buchino-Prohod
Odontoscelis oculatus Horvath
Sandanski

Appendix 13 Rare Species of Heteroptera (continued)

PENTATOMIDAE
Crypsinus angustatus (Barensprung)
Burgas
Stenodontus obtusus Mulsant & Rey
Slavyanka Mt (Ali botush)
Menacarus arenicola (Scholtz)
Primorsko
Sciocoris atticus Horvath
Pomorie
Rubiconia intermedia (Wolff)
Central Stara planina

Holcogaster congenitus Putshkov
Kresna

ACANTHOSOMATIDAE
Elasmucha fieberi (Jakovlev)
Pirin Mt

CYDNIDAE
Aethus pilosulus (Klug)
Ograzhden Mt
Geotomus brunnipennis Wagner
Pomorie

Appendix 14 Relict Species of Heteroptera

A) TROPICAL
Ochterus marginatus Latreille
Kurdzhali Gotse-Delchev Petrich
Anisops sardea Herrich-Schaffer
Plovdiv Lebnitsa by Sandanski
Mesovelia vittigera Horvath
Lebnitsa by Sandanski

B) MOUNTAIN MEDITERRANEAN
Alloeonotus egregius Fieber
Rila West Stara planina *Pachytomella parallela* (Meyer Dur)
West Stara planina
Dichrooscytus valesianus Fieber
Rhodopi Pirin Rila & Vitosha Mts
Macrotylus (s str) quadrilineatus (Schrank)
Stara planina & Vitosha Mts *Dimorphocoris fuscus* Joakimov
Stara planina Pirin Rila & Vitosha Mts
Criocoris nigripes Fieber
Slavyanka Mt
Compsidolon balcanicum Josifov
Pirin Mt
Acalypta finitima (Puton)
Rhodopi & Pirin Mts
Acalypta pulchra Stusak
Rila & Vitosha Mts
Eremocoris obscuratus Montandon
Vitosha Mt
Carpocoris melanocerus (Mulsant & Rey)
W and C Stara planina, Rhodopi Pirin Rila & Vitosha Mts

C) GLACIAL
Hesperocorixa sahlbergi (Fieber)
Rila Mt
Arctocorisa carinata (C Sahlberg)
Rila & Vitosha Mts

Arctocorisa germari (Fieber)
Rila Mt
Bryocoris pteridis (Fallen)
W and C Stara planina Rhodopi Slavyanka, Pirin Rila & Vitosha Mts
Dicyphus constrictus (Boheman)
Pirin Mt
Dicyphus pallidus (Herrich-Schaffer)
W and C Stara planina Rhodopi, Slavyanka Belasitsa Pirin Rila & Vitosha Mts
Stenodema holsatum (Fabricius)
W and C Stara planina, Rhodopi Slavyanka Belasitsa Pirin, Rila & Vitosha Mts
Phytocoris reuteri Saunders
Rila & Vitosha Mts
Calocoris alpestris (Meyer Dur)
Rila & Vitosha Mts
Calocoris sexguttatus (Fabricius)
Rila & Pirin Mts
Lygocoris contaminatus (Fallen)
West and Central Stara planina Rhodopi Pirin Rila & Vitosha Mts
Pinalitus rubricatus (Fallen)
Rhodopi Pirin Rila & Vitosha Mts
Orthocephalus brevis (Panzer)
Rhodopi
Excentricus planicornis (Herrich Schaffer)
Slavyanka Mt
Orthotylus obscurus Reuter
Central Stara planina
Orthotylus virescens (Douglas & Scott)
Rila & Pirin Mts
Globiceps dispar (Boheman)
Rhodopi Pirin Rila & Vitosha Mts
Globiceps flavomaculatus (Fabricius)
Rhodopi Pirin Rila & Vitosha Mts
Cremnocephalus albolineatus Reuter
Rodopi
Cremnocephalus alpestris Wagner
Rhodopi Pirin Rila & Vitosha Mts

Appendix 14 Relict Species of Heteroptera (continued)

C) GLACIAL (continued)
Hallodapus rufescens (Burm)
Vitosha
Parapsallus vitellinus (Scholtz)
Vitosha
Monosynamma bohemani (Meyer Dur)
Vitosha
Phoenicocoris modestus (Meyer Dur)
Pirin
Phoenicocoris obscurellus (Fallen)
Rila
Psallus fallenl Reuter
Vitosha
Psallus haematodes Gmellin
Vitosha
Placochilus seladonicus seladonicus Fallen
Pirin Rila & Vitosha Mts
Eurycolpus flaveolus (Stal)
Vitosha
Acompocoris alpinus Reuter
West and Central Stara planina Rhodopi Pirin
Rila & Vitosha Mts
Nabis brevis Scholtz
W and C Stara planina Rhodopi Pirin Rila &
Vitosha Mts
Nabis flavomarginatus (Scholtz)
Rhodopi Pirin Rila & Vitosha Mts
Nabis limbatus (Dahlbom)
Rhodopi Pirin, Rila & Vitosha Mts
Empicoris vagabundus (Linnaeus)
Rhodopi & Rila Mts
Rhinocoris annulatus (Linnaeus)
Rila & Vitosha Mts
Acalypta marginata (Wolff)
Rila & Vitosha Mts
Acalypta musci (Schyrank)
Rila
Salda litoralis litoralis (Linnaeus)
Rhodopi Pirin Rila & Vitosha Mts
Saldula orthochila (Fieber)
Rhodopi Pirin Rila & Vitosha Mts
Aradus betulinus Fallen
Rhodopi
Aradus erosus Fallen
Rila
Aradus truncatus Fieber
Central Stara planina
Aradus pallescens frigidus Kiritschenko
Pirin
Berytinus crassipes (Herrich Schaffer)
Rila
Lygaeosoma sibiricum Seidenstucker
Slavyanka Mt
Nysius thymi (Wolff)
Western Stara planina, Rhodopi, Pirin, Rila &
Vitosha Mts
Stygnocoris pygmaeus (R Sahlberg)
Rila & Vitosha Mts
Drymus sylvaticus (Fabricius)
Rila & Vitosha Mts
Gastrodes abietum Bergroth
Rhodopi Rila & Vitosha Mts
Trapezonotus desertus Seidenstucker
Rhodopi Pirin Rila & Vitosha Mts
Megalonotus antennatus (Schilling)
Vitosha
Ulmicola spinipes (Fallen)
Pirin Rila & Vitosha Mts
Eurygaster dilaticollis (Dohrn)
Western Stara planina Rhodopi, Belasitsa Pirin
Rila & Vitosha Mts
Sciocoris microphthalmus Flor
Rhodopi Pirin Rila & Vitosha Mts
Pitedia juniperina (Linnaeua)
Rhodopi Rila & Vitosha Mts
Picromerus bidens (Linnaeus)
Vitosha
Triolus luridus (Fabricius)
Vitosha
Elasmucha fieberi (Jakovlev)
Pirin
Canthophorus impressus (Horvath)
Pirin & Vitosha Mts

Appendix 15 Endemic Species of Coleoptera

CARABIDAE
Cicindela (Cicindela) hybrida rumelica Apfelbeck
1904
Black Sea coast
Carabus (Megodontus) violaceus azurescens
Dejean 1826
Stara planina Rila Vitosha
Carabus (Megodontus) violaceus bartoni Maran
1930
Pirin Slavyanka Belasitsa
Carabus (Morphocarabus) ullrichi rhilensis Kraatz
1876
Stara planina, Rila
Carabus (Morphocarabus) versicolor Frivaldsky
1835
Stara planina

Appendix 15 Endemic Species of Coleoptera (continued)

Carabus (Pachystus) cavernosus Frivaldsky, 1837
Stara planina Rila Vitosha Rhodopi Sredna gora Lyulin Slavyanka, Osogovo
Carabus (Procerus) sommeri bureschianus Breuning 1928
West Rhodopi
Cychrus semigranulosus balcanicus Hopffgarten 1881
Stara planina Rila Vitosha Rhodopi Sredna gora Lyulin , Osogovo, Belasitsa Pirin, Lozenska planina
Nebria (Alpeus) eugeniae K Daniel 1903
Rila
Nebria (Alpeus) rhilensis Frivaldsky 1879
Rila, Pirin Stara planina
Dyschirius (Dyschirius) simulator Muller 1922
Sandanski Petrich valley
Trechus demicapicus Moravec, 1986
Pirin
Trechus gulickai Lobl 1967
Pirin
Trechus kobingeri bulgaricus Pawlowski 1972
Lyulin Vitosha Osogovo Rila
Trechus matusmeae Pawlowski, 1972
West Rhodopi
Trechus merkli Pawlowski 1973
West Stara planina
Trechus obtusus thracicus Pawlowski, 1973
Sakar Bozkite cave, Strandzha
Trechus orphaeus Pawlowski 1973
Rila
Trechus pirinicus Pawlowski 1972
Pirin
Trechus priapus K Daniel 1902
Vitosha Stara planina Osogovo Rila Rhodopi
Trechus rambousekii Breit 1909
Rila
Trechus rhilensis Kaufmann 1884
Rila Vitosha
Trechus rhodopeus Jeannel 1921
Rila, Vitosha Pirin Belasitsa, Stara planina West Pernik
Trechus subnotatus Dejean 1831
Sofia Tryavna Pirin Rila West Rhodopi Rouse
Trechus szujeckii Pawlowski 1972
West Rhodopi
Pheggomisetes buresi Knirsch, 1923
West Stara planina
Pheggomisetes globiceps globiceps Buresch 1925
West Stara planina
Pheggomisetes globiceps breiti Mandl 1942
West Stara planina
Pheggomisetes globiceps cerovensis Gueorguiev 1964
West Stara planina
Pheggomisetes globiceps georgievi Z Karaman 1958
West Stara planina
Pheggomisetes globiceps ilandjievi Gueorguiev 1964
West Stara planina
Pheggomisetes globiceps karlukovensis Genest 1978
West Stara planina
Pheggomisetes globiceps lakatnicensis Jeannel, 1928
West Stara planina
Pheggomisetes globiceps mladenovi Gueorguiev 1964
West Stara planina
Pheggomisetes globiceps stoicevi Gueorguiev 1964
West Stara planina
Pheggomisetes radevi radevi Knirsch, 1924
West Stara planina
Pheggomisetes radevi ilcevi Knirsch 1924
West Stara planina
Pheggomisetes radevi tranteevi Gueorguiev, 1964
West Stara planina
Duvalius (Duvaliotes) beshkovi Coiffait 1970
Osogovo
Duvalius (Paraduvalius) balcanicus J Frivaldsky 1879
Stara planina
Duvalius (Paraduvalius) beroni Gueorguiev, 1971
West Stara planina
Duvalius (Paraduvalius) bulgaricus (Knirsch 1924)
Middle Stara planina
Duvalius (Paraduvalius) bureschi Jeannel, 1928
West Rhodopi
Duvalius (Paraduvalius) garevi Casale & Genest, 1991
Lovech
Duvalius (Paraduvalius) hannae Hurca, 1990
Middle Stara planina
Duvalius (Paraduvalius) karelhurkai Farkac 1990
West Rhodopi
Duvalius (Paraduvalius) kotelensis Genest 1978
East Stara planina
Duvalius (Paraduvalius) legrandi Genest, 1983
Veliko Turnovo
Duvalius (Paraduvalius) papasoffi Mandl, 1942
West Stara planina
Duvalius (Paraduvalius) pretneri Gueorguiev, 1971
West Stara planina
Duvalius (Paraduvalius) rajtchevi Genest & Juberthie 1983
West Rhodopi
Duvalius (Paraduvalius) regisborisi Buresch 1926
Middle Stara planina
Duvalius (Paraduvalius) zivkovi zivkovi (Knirsch, 1925)
West Stara planina

Duvalius (Paraduvalius) zivkovi deltsheri
Gueorguiev, 1965
West Stara planina
Tachys krueperi Apfelbeck 1904
Trakijska nizina Strandzha
Bembidion (Bembidionetolitzkya) rhodopense
Apfelbeck 1902
Stara planina Rila Pirin
Bembidion (Emphanes) nivulare Apfelbeck 1904
Black Sea coast
Bembidion (Peryphus) subcostatum javurkovae
Fassati 1944
Dunavska ravnina Predbalkan Stara planina, Podbalkan, Sofiya Vitosha Zemenska planina Rila Sandanski Petrich, Pirin, Belasitsa West Rhodopi, East Rhodopi Trakijska nizina, Black Sea coast
Bembidion (Philochthus) decoloi Apfelbeck 1911
South Black sea coast
Xenion ignitum (Kraatz 1875)
Stara planina Vitosha Sushtinska Sredna gora Rila Pirin West Rhodopi
Pterostichus (Aphaon) rhilensis kourili Maran 1933
Rila, Pirin West Rhodopi
Pterostichus (Aphaon) rhilensis vitosensis Maran 1933
Middle Stara planina Vitosha
Pterostichus (Haptoderus) vecors Tschitscherin 1897
Stara planina
Pterostichus (Melanius) melanarius bulgaricus
Lutshnik 1915
Rila Stara planina Sofia Razgrad, Kazanluk, West Rhodopi Pernik Sozopol Vitosha Bourgas Belasitsa
Pterostichus (Pterostichus) brucki Schaum 1859
Stara planina Sashtinska Sredna gora Vitosha Rila Rhodopi Sakar
Pterostichus (Pterostichus) merkli Frivaldsky 1879
Stara planina
Pterostichus (Rambousekiella) ledenikensis
Knirsch 1925
West Stara planina
Tapinopterus balcanicus balcanicus Ganglbauer 1892
Rila Stara planina Pirin West Rhodopi, Sredna gora
Tapinopterus balcanicus belasiciensis Maran 1933
Belasitsa
Tapinopterus balcanicus bureschi Maran 1933
Slavyanka
Tapinopterus bartoni Maran 1933
Rila West Rhodopi
Tapinopterus kaufmanni kalofirensis Maran 1933
Middle Stara planina Sredna gora, Vitosha, Plana

Appendix 15 Endemic Species of Coleoptera (continued)

Tapinopterus kaufmanni kulti Maran, 1933
Rila West Rhodopi
Tapinopterus kaufmanni winkleri Mandl 1936
West Stara planina
Molops alpestris centralis Mlynar, 1977
Vitosha
Molops alpestris rhilensis Apfelbeck 1904
Rila Pirin West Rhodopi
Molops alpestris kalofericus Mlynar 1977
Stara planina Sredna gora
Molops dilatatus dilatatus Chaudoir 1868
Rila West Rhodopi, Vitosha, Slavyanka, Belasitsa, Pirin Plovdiv
Molops dilatatus angulicollis J Muller 1936
Stara planina Strandzha Sredna gora
Molops doderoi hlisnikovskyi Mlynar 1977
Slavyanka
Molops piceus bulgaricus Maran 1938
Rila Stara planina Belasitsa Vitosha Kyustendil Sredna gora West Rhodopi
Molops rhodopensis rhodopensis Apfelbeck, 1904
Rila Pirin West Rhodopi
Molops rhodopensis kourili Maran, 1942
Pirin Gotse Delshev valley
Molops robustus parallelus Mlynar 1977
Sofia Lyulin Vitosha Golo Burdo Kyustendil
Molops rufipes belasicensis Mlynar 1977
Pirin Sandansko Petrich valley Belasitsa
Molops rufipes golobardensis Mlynar 1977
Golo Burdo
Molops rufipes klisurianus Apfelbeck 1902
Stara planina Milevska planina Kraishte
Agonum (Platynus) proximum Frivaldsky, 1879
Stara planina
Agonum (Platynus) serbicum Csiki 1904
Belasitsa
Calathus glabricollis Dejean 1828
East Dounavska ravnina
Laemostenus (Actenipus) plasoni (Reitter 1885)
Middle Stara planina Rila, Pirin West Rhodopi
Amara (Celia) messae Baliani, 1924
Middle Stara planina, Vitosha Rila Pirin
Amara (Celia) municipalis (Duftschmid 1812)
Rila Sredna gora East Rhodopi Razgrad Pirin Vitosha Stara planina Slavyanka
Zabrus (Peloi) balcanicus Heyden 1883
Stara planina Vitosha West Rhodopi Lyulin Sofia, Slive Rila East Rhodopi Sredna gora
Zabrus (Peloi) increassatus tuleschkovi Maran 1933
Sandanski Petrich valley
Zabrus (Peloi) rhodopensis Apfelbeck 1904
Rila Slavyanka Osogovo, Pirin East Rhodopi West Rhodopi Sliven
Acupalpus planicolis Schaum 1857
Sandanski Petrich valley South Black Sea coast

Harpalus (s str.) euchlorus Menetries 1836
North Black Sea coast
Harpalus (s str.) serdicanus Apfelbeck 1904
Vitosha
Singilis fuscipennis Schaum 1857
Sandanski Petrich valley
Microlestes apterus Holdhaus, 1904
Sandanski Petrich valley Black Sea coast
Parazuphium chevrolati laticolle Hurka, 1987
South Black Sea coast
Aptinus (s str.) merditanus orientalis Hurka 1988
Maleshevska planina

DYTISCIDAE
Agabus (Gaurodytes) bulgaricus Csiki 1943
Slavyanka
Agabus (Dichonectes) balcanicus Heinik 1955
Vitosha Pirin Bunderitsa, Slavyanka Rila
Borovets Stara planina Vrachanski balkan
Hydroporus (s str.) thracicus Guéorguiev 1966
Pazardzhik Ognyanovo
Hydroporus (Stenoporus) gueorguievi Wewalka 1975
Vitosha, Rila, West Rhodopi

HYDROPHILIDAE
Hydraena (s str.) bulgarica Breit 1916
Stara planina Tetevenski balkan
Hydraena (s str.) pachypteria Apfelbeck 1909
Vitosha, Strouma Krapets
Ochthebius granulatus albanicus Apfelbeck 1907
Vitosha
Ochthebius ponticus Jenistea 1956
Varna

CHOLEVIDAE
Balcanobius etropolensis Guéorguiev 1965
Stara planina Etropole (caves and precipices)
Bathyscia besucheti Giachino, 1991
Gotse Delchev Mousomishta (cave)
Bathyscia raitchevi Casale Giachino & Etonti 1990
West Rhodopi Trigrad
Beronia micevi Guéorguiev 1960
Belogradchik (caves)
Beroniella tetevensis Giachino & Guéorguiev 1990
Teteven (cave)
Beskovia bulgarica Guéorguiev, 1960
Stara planina Cherepish (cave)
Bureschiana drenskii Guéorguiev 1963
East Rhodopi Ostrovitsa (cave)
Genestiella gueorguievi Giachino 1992
Troyan Golyama Zheleznа
Hexaurus merkli (Frivaldszky 1879)
Stara planina Shipchenski balkan (cave)
Hexaurus paradisi Zerche 1990
Stara planina Raj (cave)
Hexaurus schipkaensis Zerche, 1990
Stara planina Shipka (cave)
Hexaurus similis (Frivaldszky, 1879)
Stara planina Shipchenski balkan (cave)
Netolitzkya jeanneli jeanneli Buresch 1924
Stara planina Dryanovski manastir (cave)
Netolitzkya jeanneli matroffi Jeannel, 1930
Arbanasi cave Kalougerova doupka
Netolitzkya maneki maneki J. Muller 1909
Tryavna (cave)
Netolitzkya maneki ilschewi Jeannel, 1924
Veliko Turnovo Belyakovets (cave)
Radevia hanusi Knirsch 1925
Vratsa cave Ledenika
Rhodopiola cavicola Guéorguiev 1960
West Rhodopi Dobrostan (cave)
Trianteeriella bulgarica Pretner 1958
Stara planina Teteven Malka Zhelyazna

STAPHYLINIDAE
Aleochara gridelli Bernhauer, 1936
Pirin
Alpinia uhligi Pace, 1987
Middle Stara planina
Amischa uhligi Pace, 1987
Middle Stara planina
Atheta atomaroides Brundin 1948
Rila
Atheta bulgarica Scheerpeltz 1944
Strouma valley Trakijska nizina
Atheta fuscicolor G. Benick 1943
Pirin
Atheta intermissa G. Benick 1969
Predbalkan Trakijska nizina
Atheta palata G. Benick 1970
Pirin
Atheta rumelie G. Benick 1969
Trakijska nizina
Atheta scintillans Scheerpeltz 1937
Stara planina Rozalito pole
Atheta subtilicornis G. Benick 1943
Rila
Atheta thrax Muona 1975
Rila
Coryphium balcanicum Zerche, 1990
Middle Stara planina
Deliphrosoma mandli (Scheerpeltz 1937)
Middle Stara planina
Deliphrosoma pirinense Zerche, 1991
Pirin
Falagria anatolica Fagel, 1969
Rhodopi
Geodromicus montenegrinus Bernhauer 1941
Pirin
Geodromicus robusticornis Bernhauer 1941
Rila

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Geodromicus schuberti Scheerpeltz 1937
Stara planina Botev Rozalito pole
Geostiba balcanica Zerche 1988
Middle Stara planina
Geostiba bulbifera Zerche 1988
Vitosha
Geostiba bulgarica Pace 1983
Rila
Leptusa rhilensis Pace, 1983
Vitosha Rila
Ocyusa ferdinandi coburgi Rambouseck, 1909
Rila Stara planina Botev
Ocyusa regis borisi Scheerpeltz, 1937
Stara planina Botev
Olophrum bulgaricum Scheerpeltz, 1929
North Bulgaria Middle Stara planina
Olophrum leonhardi Scheerpeltz, 1929
Rila Pirin
Omalium bulgaricum Zerche 1988
Pirin Rila West Rhodopi
Ophthalmoniphetodes behnei Zerche 1990
Vitosha
Ophthalmoniphetodes doeblerae Zerche, 1990
Rila
Ophthalmoniphetodes gracilis Zerche, 1990
Pirin
Ophthalmoniphetodes heidemariae Zerche, 1990
Pirin
Ophthalmoniphetodes illevi Zerche, 1990
Vitosha
Ophthalmoniphetodes longicornis Zerche 1990
Pirin
Ophthalmoniphetodes macrocephalus Zerche, 1990
Pirin
Ophthalmoniphetodes musalensis Zerche 1990
Rila
Ophthalmoniphetodes rhilensis Zerche 1990
Rila
Ophthalmoniphetodes uhligi Zerche 1990
Rila
Sipalia bulgarica Scheerpeltz 1951
Rila Trakijska nizina
Sipalia rhilensis Pace 1983
Vitosha, Rila
Stenus bosnicus Bernhauer 1909
Sandanski Petrich valley
Stenus heydeni L Benick, 1915
West Stara planina, Vitosha, Rila
Stenus hilfi L Benick 1915
Rila
Stenus nodipes Puthz 1971
Sofya Rila
Thinobius delicatulus bernhaueri Rambouseck, 1910
Trakijska nizina
Thinobius perpusillus Rambousek 1909
Trakijska nizina
Thinobius rambousekii Smetana 1959
Sofia Trakijska nizina
Xantholinus bulgaricus Coiffait 1972
Stara planina
Xantholinus varnensis Coiffait 1972
South Black Sea coast
Gabrius bulgaricus Coiffait 1971
West Rhodopi
Alapsodus bulgaricus Coiffait, 1971
Sofia
Quedius burechi Coiffait 1971
Vitosha
Quedius schipcanus Scheerpeltz 1937
Middle Stara planina
Quedius bulgaricus Scheerpeltz, 1937
Middle Stara planina
Quedius troglophilus Coiffait, 1969
West Stara planina
Quedius ponteuxinus Coiffait, 1970
South Black Sea coast
Quedius gueorguievi Coiffait 1967
West Stara planina Zaselc (Porojnata doupka)
Quedius rodopianus Coiffait 1971
West Rhodopi
Lobrathium bureschi Scheerpeltz 1937
Middle Stara planina
Lathrobium bulgaricum Raitschev 1987
Dounavska ravnina Dragichevi blata
Lathrobium leonardi Breit 1912
Rila
Medon coriaceum Coiffait 1969
Melnik
Medon bulgaricus Coiffait 1970
South Black Sea coast
Medon umbilicatus Coiffait, 1970
South Black Sea coast
Scopaeus ectypus Coiffait 1971
Dounavska ravnina
Scopaeus bulgaricus Coiffait 1971
South Black Sea coast
Astenus bulgaricus Coiffait, 1971
Vitosha
Lasteva albanica Bernhauer 1936
Middle Stara planina Rila, Pirin
Lasteva uhligi Zanetti 1984
Middle Stara planina

CANTHARIDAE
Cantharis bulgarica Svihla 1983
Sandanski Petrich valley, Pirin
Malthinus bulgaricus Svihla 1990
Sandanski
Malthodes serbotae macedonicus Svihla 1980
Rila

Appendix 15 Endemic Species of Coleoptera (continued)

ELATERIDAE
Zorochros kourili (Roubal 1936)
Kresna valley
Athous pfefferi Roubal 1932
Vitocha Rila Slavyanka
Athous hilfi Reitter 1812
Stara planina, Ograzhden Rila, Pirin
Athous monilicornis Schwarz 1897
Stara planina Vitocha Rila, Pirin Rhodopi
Ctenicera schneebergi (Roubal 1932)
Stara planina Rila Pirin
Haterumelater julianum Penev 1987
Sandanski-Petrich valley
Adrastus gurjevae Penev 1983
Malashevska planina Rila Rhodopi
Cardiophorus hinkei (Frivaldsky 1837)
Sliven South Black Sea coast
Cardiophorus marani Roubal 1936
Veliko Turnovo Sandanski Petrich valley West Rhodopi, Strandzha
Cardiophorus bureschi Roubal, 1936
West Rhodopi Trakijska nizina
Cardiophorus luciae (Laibner 1985)
Rila Sandanski Petrich valley East Rhodopi

BUPRESTIDAE
Acmaeoderella flavofasciata deorum (Obenberger, 1940)
Sandanski Petrich valley
Sphenoptera buresi Obenberger 1932
Pirin Sandanski Petrich valley
Sphenoptera sceptrifera Obenberger 1949
Pirin Sandanski-Petrich valley, South Black Sea coast
Anthaxia muehlei Niehuis, 1983
West Rhodopi
Anthaxia thessalica Brandl 1981
Pirin Sandanski Petrich valley Slavyanka West Rhodopi

HELODIDAE
Helodes bulgharensis Klausnitzer, 1980
Rila
Cyphon furcillatus Nyholm, 1948
Rila

NITIDULIDAE
Meligethes coerulescens Kraatz, 1858
Podbalkan

ENDOMYCHIDAE
Sphaerosoma csikii Apfelbeck 1916
Rila Vitosha
Sphaerosoma shardaghensis Apfelbeck 1916
Rila
Sphaerosoma sturanyi Apfelbeck 1909
Rila Vitosha Central Stara planina

COCCINELLIDAE
Hyperaspis minois Fursch 1985
Nesebur, Melnik

MELOIDAE
Mylabris (Corvina) confluens Reiche 1865
South Black Sea coast Bourgas Strandzha Malko Turnovo

MORDELLIDAE
Mordellistena (s str) longicornoides Ermisch, 1965
South Black Sea coast
Mordellistena (s str) olympica Ermisch 1965
South Black Sea coast
Mordellistena (Pseudomordellina) nigrocapillata Ermisch 1965
South Black Sea coast
Anaspis (Silaria) bernhauerl Roubal, 1910
Sliven
Anaspis (Larisia) mariae Roubal 1910
Pancharevo, Sliven
Anaspis (Larisia) rambouseki Roubal, 1910
Sliven

TENEBRIONIDAE
Pedinus oblongus Mulsant & Rey, 1853
Sandanki Petrich valley
Colpotus byzantinicus Waltl 1838
South Black Sea
Melanomon inermus Picka 1983
Riverside of Ropotamo
Laena heydeni Weise 1880
Vitosha Pirin Sandanski Petrich valley
Laena swarzi Reitter, 1885
Strandzha, South Black Sea coast
Laena graeca Weise, 1878
Ludogorsko plato South Black Sea coast
Laena apfelbecki Schuster, 1815
North Black sea coast
Cataphronetis reitteri Seidlitz, 1894
South Black Sea
Dichillus carinatus (Kuster 1884)
Sandanki Petrich valley
Idastrandiella allardi (Reitter, 1884)
Sandanki Petrich valley
Probaticus (Pelorinus) fuelei (Kuster, 1850)
Trakijska nizina
Probaticus (Pelorinus) maurus (Waltl 1838)
Trakijska nizina Sakar South Black Sea coast
Gunarus bulgaricus Medvedev et Angelov 1981
Sandanki Petrich valley Sakar

Appendix 15 Endemic Species of Coleoptera (continued)

Cylindronotus (Stenomax) steindachneri
Apfelbeck 1906
Trakijska nizina Sakar
Cylindronotus (Omeleis) intricatus (Allard, 1877)
Belasitsa

SCARABAEIDAE
Psammodius (s str) bulgaricus Menel 1982
South Black Sea coast
Psammodius (Leiopsammodius) strumae Chromy, 1983
Sandanski Petrich valley

CERAMBYCIDAE
Xylosteus bartoni Obenberger et Maran 1933
Rila
Brachyta balcanica Hampe 1870
Sofia, Sredna gora Sliven Trakijska nizina
Sakar South Black Sea coast
Vadonia imitatrix (Daniel 1898)
Razgrad
Vadonia moesiaca (Daniel 1891)
Vitosha, Sandanski-Petrich valley Slavyanka
Middle Stara planina Trakijska nizina, South
Black Sea coast
Saphanus ganglbauer Brancs 1886
Vitosha Lozen Middle Stara planina Rila Pirin
East Rhodopi
Chlorophorus nigripes Brulle 1832
South West Bulgaria Kresna gorge North East
Bulgaria Sindel
Dorcadion laevipunctatum Breuning 1944
South West Bulgaria
Dorcadion mincovae Heyrovsky 1962
Kresna valley
Dorcadion lineaticolle Kraatz 1873
South West Bulgaria
Dorcadion gallipolitanum Thomson 1867
Belasitsa
Dorcadion sturmi Frivaldsky, 1837
Sofia Konyavska planina Sredna gora Trakijska
nizina, Middle Rhodopi
Dorcadion borisi Heyrovsky, 1931
Osogovo Belasitsa
Dorcadion ljubetense Pic, 1909
Osogovo Rouen
Oxylia duponcheli (Brulle, 1832)
Trakijska nizina

CHRYSOMELIDAE
Smaragdina (Monrosia) graeca (Lefevre 1872)
Strelcha Dryanovski manastir Rabishko ezero
Ognjanovo, Maricostinovo Kresna valley, Sredna
gora Mejdenik, Strandzha Harmanli Rhodopi
Panickovo Varvara

Rhodopaca angelovi Gruev et Tomov, 1968
Middle Rhodopi Zdravec
Chrysolina (Colaphoptera) globosa reprehensa
Bechyne 1950
Germanski manastir Dragalevtsi Krustec, Sredna
gora Bogdan
Chrysolina (Colaphoptera) notiophila Bechyne
1952
Rila Borovets, Sredna gora Fenera Bogdan P
Deliradev
Oreina (Protorina) melanocephala schipkana
(Jakob, 1953)
Stara planina Shipka
Oreina (Romalorina) variabilis balkanica (Weise,
1883)
Rhodopi Rila Vitosha, Osogovo Stara planina
Oreina (s str) speciosissima drenskii (Gruev, 1974)
Pirin Bajovi doupki, Rila
Goniocteina (Goniomena) pallida reticulata
(Bechyne 1947)
Rhodopi Zdravets Stara planina Svoge,
Turnovo Rila Partizanska poljana, Musala,
Caira Vitosha Bojana, Aleko, Dragalevtsi, Pirin
Yane Sandanski
Luperus rhilensis Weise 1900
Rila Damga
Phyllotreta pontoaegeica Gruev, 1982
Bourgas
Aphthona parnassicola Heikertinger, 1944
Melnik Rozhenski manastir Sliven Karandila
Golo burdo, Strandzha Fakiya, East Rhodopi
Ardino Beli brezi
Longitarsus behnei Gruev 1989
Pirin Vihren Kabata
Longitarsus solaris Gruev, 1977
Slancev biyag
Orestia bulgarica Heikertinger 1910
Vitosha, Rila, Stara planina Sliven
Derocrepis (Aeschrocnemis) serbica rhilensis
Gruev 1974
Rila Yakoruda
Derocrepis (Aeschrocnemis) serbica rhodopensis
Gruev, 1973
Rhodopi Bachkovski manastir, Panickovo
Gulabovo Zdravets Rhodopski partizanin
Cudnite mostove, Michalkovo, Ardino
Ivailovgad Kroumovgrad
Derocrepis (Aeschrocnemis) serbica slavicus Gruev,
1979
Trun
Chaetocnema (s str) imitatrix Gruev, 1990
Vitosha
Psylliodes (s str) magnificus Gruev 1975
Strandzha Bolyarovo Achtopol Ropotamo
Cassida (s str) rufovirens rhilensis Weise, 1891
Rila, Stara planina

Appendix 15 Endemic Species of Coleoptera (continued)

BRUCHIDAE

Acanthoscelides tarnawskii Borowiec 1980
Rhodopi

CURCULIONIDAE

Apion (Exapion) hilfi Wagner 1912
Sandansko Petrich valley Pirin

Apion (Omphalapion) rhodopensis Angelov 1962
Trun, Simitli valley Pirin, West Rhodopi

Apion (Thymapion) ottonis Wagner 1914
North Black Sea coast

Apion (s str.) graecum Desbr. 1896
South Black Sea coast

Otiorhynchus (Arammichnus) curhorhynchoides curhorhynchoides Reitter 1912
Lyulin Vitosha, Rila Pirin

Otiorrhynchus (Arammichnus) curhorhynchoides hospes Apfelbeck 1932
Pirin

Otiorhynchus (Arammichnus) curhorhynchoides rhodopicola Apfelbeck 1932
West Rhodopi

Otiorhynchus (Arammichnus) gemellatus Stierlin 1875
West Rhodopi

Otiorhynchus (Arammichnus) parreyssi Stierlin 1861
Sredna gora Vitosha, Rila, Pirin West Rhodopi *Otiorhynchus (Arammichnus) zebei* Stierlin 1861
Podbalkan, Sredna gora Golo burdo Sandanski Petrich valley Slavyanka West Rhodopi

Otiorhynchus (Dorymerus) annulipes Apfelbeck, 1832
Vitosha, Black Sea coast

Otiorhynchus (Dorymerus) bosnicus Stierlin 1888
Pirin Rila

Otiorhynchus (Dorymerus) cavicentris Angelov 1973
Golo burdo Middle Rhodopi

Otiorhynchus (Dorymerus) demirkapensis Apfelbeck 1899
Middle Stara planina West Sredna gora Osogovo West Rhodopi Rila Pirin Strandzha

Otiorhynchus (Dorymerus) endriodu Angelov 1964
Pirin

Otiorhynchus (Dorymerus) ganglbauer Stierlin 1888
Belasitsa

Otiorhynchus (Dorymerus) inunctus Stierlin 1861
Vitosha Pirin West Rhodopi

Otiorhynchus (Dorymerus) joakimoffi Apfelbeck 1932
Pirin

Otiorhynchus (Dorymerus) rhambouseki Apfelbeck 1918
Stara planina

Otiorrhynchus (Dorymerus) sorbivorus Reitter 1913
Vitosha Rila West Rhodopi

Otiorrhynchus (Dorymerus) trigradus Angelov 1974
West Rhodopi

Otiorrhynchus (Dorymerus) verrucipes Apfelbeck 1898
South Black Sea coast

Otiorhynchus (Neotournieria) bureschi Apfelbeck, 1932
Middle Rhodopi North Black Sea coast Strandzha

Otiorrhynchus (s str.) bohemanni Stierlin 1877
Pirin West Rhodopi

Otiorrhynchus (s str.) cepelarus Angelov, 1974
West Rhodopi

Otiorrhynchus (s str.) elegantinus Angelov 1974
West Stara planina

Otiorrhynchus (s str.) lithanthracius hospitus Reitter, 1912
Rila

Otiorrhynchus (s str.) petryszaki Mazur 1983
Middle Stara planina

Otiorrhynchus (s str.) pirinus Angelov, 1974
Pirin

Otiorrhynchus (s str.) rhilensis Stierlin 1888
Middle Stara planina Rila Pirin West Rhodopi

Otiorrhynchus (s str.) splendidus Reitter 1913
Rila West Rhodopi

Otiorrhynchus (s str.) tournierioides Apfelbeck, 1932
Sliven

Otiorrhynchus (Tournieria) albidus Stierlin 1861
East Black Sea coast, Golo burdo Zemenska plaina Simitli valley Sandanski Petrich valley Pirin Rhodopi Slavyanka

Otiorrhynchus (Tournieria) gotzi Angelov 1964
Rila

Otiorrhynchus (Tournieria) juglandis Apfelbeck 1896
Pirin, Slavyanka, West Rhodopi, Trakijska nizina, Black Sea coast

Otiorrhynchus (Tournieria) ropotamus Angelov 1974
Trakijska nizina, South Black Sea coast, Strandzha

Otiorrhynchus (Tournieria) serdicanus Apfelbeck 1922
Vitosha Pirin West Rhodopi

Troglorhynchus beroni Angelov 1985
East Rhodopi cave Jukaya

Troglorhynchus gueorgievi Angelov 1985
Middle Stara planina cave Jalovitsa

Argoptochus bulgaricus Angelov 1987
Slavyanka planina

Argoptochus markovensis Angelov 1987
West Rhodopi East Rhodopi Trakijska nizina Sakar Black Sea coast Strandzha

Appendix 15 Endemic Species of Coleoptera (continued)

Argoptochus viridilimbatus (Apfelbeck, 1899)
Trun Rila
Mylacus bulgaricus Purkyne 1949
Middle Rhodopi Middle Stara planina.*Mylacus compactus* Angelov, 1973
Sandanski Petrich valley
Mylacus crinitoides Angelov 1973
Dobroudzha, Strandzha
Mylacus cylindrirostris Angelov 1973
Sandanski Petrich valley
Mylacus laevis Angelov 1973
Sofia
Mylacus montanus Angelov, 1973
Osogovo
Mylacus punctatus Angelov, 1973
South West Bulgaria
Mylacus pustulatus Seidlitz, 1868
Radomir valley, Lyulin, Plana, West Rhodopi East Rhodopi, Trakijska nizina
Omias taygetanus Purkyne 1949
Pirin, West Rhodopi
Omias crinitus Reitter 1906
Dounavska ravnina Black Sea coast, Strandzha
Urometopus peneva Behne, 1990
Dobroudzha
Rhinomias bulgaricus Angelov, 1990
West Rhodopi
Rhinomias dieckmanni Kostal 1988
Blask Sea coast
Metacinops rhinomacer Kraatz 1862
West Rhodopi
Phyllobius aetolicus Apfelbeck, 1915
Rila Pirin
Phyllobius bulgaricus Apfelbeck 1915
Sredna Gora, Rila, West Rhodopi
Phyllobius cupreoaureus Stierlin, 1861
East Rhodopi, South Blask Sea coast
Phyllobius fulvago Stevens, 1829
Trakijska nizina Black Sea coast
Phyllobius haberhaueri Apfelbeck 1915
Sliven
Phyllobius lateralis Reiche, 1857
Middle Stara planina, Sandansko-Petrich valley West Rhodopi, Trakijska nizina
Phyllobius pictus Stevens 1829
Kyustendil
Phyllobius pinicola Kiesenwetter 1864
West Stara planina Sandanski Petrich valley, Pirin, West Rhodopi
Phyllobius rhodopensis Apfelbeck, 1898
Vitosha, Sandanski-Petrich valley, Pirin
Phyllobius cupreoaureus Stierlin 1861
South Black Sea coast
Polydrosus (Eudipnus) coccifeae Kiesenwetter, 1864
Zemen, Sandanski Petrich valley Pirin, Slavyanka
Polydrosus (Eudipnus) sciaphiliformis Apfelbeck 1899
Vitosha Pirin Rila West Rhodopi
Polydrosus (Metadrosus) schwiegeri Reitter 1908
Golo burdo Dobruza
Polydrosus (Neodrosus) thalassinus Gyllenhal 1834
Sandanski Petrich valley Trakijska nizina Black Sea coast
Trachyphloeus alens Angelov 1980
Mesta valley West Rhodopi, Slavyanka Trakijska nizina
Trachyphloeus amplithorax Formanek, 1907
Dobroudzha
Trachyphloeus bosnicus Apfelbeck, 1898
Rila, Pirin, West Rhodopi
Trachyphloeus globipennis Reitter, 1894
Black Sea coast Strandzha
Trachyphloeus turcicus Seidlitz 1868
Kresna gorge Dobroudzha
Trachyphloeus ypsilon Seidlitz 1868
Trakijska nizina
Trachyphloeus suomalainenii Petryszak 1990
Pirin, West Rhodopi
Foucartia dieckmanni Angelov 1986
Dobroudzha Black Sea coast, Strandzha
Foucartia sacarensis Angelov 1987
Sakar
Brachysomus rumelicus Apfelbeck, 1899
Sliven
Tropiphorus caesius Frivaldsky, 1879
Stara planina Vitosha Rila Pirin West Rhodopi
Auchmerestes kiesenwetteri Kraatz 1862
West Rhodopi
Tanymecus bulgaricus Angelov 1990
Trakijska nizina
Cneorrhinus bulgaricus Formanek, 1912
North Black Sea coast
Larinus (s str) bulgaricus Vos, 1943
North Black Sea coast
Lixus (Ortholixus) bituberculatus Smreczynski, 1968
Sandanski Petrich valley, Trakijska nizina, Black Sea coast
Donus viescens (Petri 1901)
Sliven
Alophus kaufmanni Stierlin 1884
Middle Stara planina Rila, West Rhodopi.*Alophus rhodopensis* Reitter, 1912
Stara planina, Vitosha, Rila Simitli Pirin West Rhodopi
Plinthus sturmi bulgaricus Meregalli, 1985
Middle Stara planina, Rila Pirin West Rhodopi
Acalles ganglbauerii Solari, 1907
Middle Stara planina
Bagous bulgaricus Angelov 1989
Sofia Koumaritsa Trakijska nizina

Appendix 15 Endemic Species of Coleoptera (continued)

Pselactus bulgaricus Angelov 1959
Trakijska nizina
Ceuthorrhynchus (Hadroplontus) apfelbecki
Schultze 1897
North Black Sea coast
Ceuthorrhynchus (Oprohinus) cinnamomeus
Schultze, 1897
Sliven
Ceuthorrhynchus (s str) rhodopensis Dieckmann, 1969
West Stara planina West Rhodopi Trakijska nizina
Ceuthorrhynchus (s str) solarius Angelov 1971
South Black Sea coast
Ceuthorrhynchus (s str) karamani Muller 1921
Simitli
Sibinia abdominalis Tournier, 1873
East and Southwest Bulgaria
Gymnetron (Rhinusa) dieckmanni Behne 1988
Rila

Xenotychius dalmatinus Penecke 1922
Podbalkan West Rhodopi
Tychius exiguus Faust 1889
Gotse Delchev valley, Sakar South Black Sea coast
Tychius consputus Kiesenwetter, 1864
South Black Sea coast
Cionus griseopubens Wingelmuller 1914
Middle Stara planina, Rila, Sandanski Petrich valley Pirin
Nanophyes smreczynskii Dieckmann, 1963
Rila Sandanski Petrich valley Trakijska nizina Black Sea coast Strandzha
Mecinus bulgaricus Angelov 1971
Trakijska nizina
Miarus balcanicus Desbrochers 1893
Middle Stara planina East and Middle Rhodopi, Sakar Sandanski Petrich valley
Orchestes (Pseudorchestes) michalki (Dieckmann 1963)
West Stara planina, West Rhodopi

Appendix 16 Rare Species of Coleoptera

CARABIDAE
Cicindela (Taenidia) elegans stigmatophora
Fischer W 1825
Varna
C (Cephalota) turcica Schaum, 1859
East Rhodopi
Carabus (s str) menetriesi pacholei Sokolar 1911
Belasitsa Mt
C (Orinocarabus) linnei Panzer 1812
Pleven
Nebria (Eunebria) merkliana Apfelbeck 1904
Pirin Mt
Leistus (Pogonophorus) fulvibarbis Dejean 1826
Sandanski
Notiophilus danieli Reitter 1897
Ropotamo
Siagona europaea Dejean 1826
"Roupite" by Petrich
Dyschirius (s str) extensus Putzeus 1846
Pomorie
Dyschirius (s str) punctatus (Dejean 1825)
Sandanski
Apotomus testaceus Dejean 1825
Maslen nos
Polyderis brevicornis (Chaudoir 1846)
Sliven
Lymnastis galilaeus Motschulsky 1862
Shoumen
Asaphidion rossi (Schaum 1857)
Belasitsa Mt
Bembidion (Bracteon) foraminosum Sturm, 1825
Turnovo

B (Chrysobracteon) argenteolum Ahrens 1812
Sofia
B (Philochthus) escherichi Ganglbauer, 1897
Pomorie
B (Notaphocampa) niloticum Dejean, 1831
Ropotamo
B (Lopha) humerale Sturm 1825
Rila
B (Notaphus) obliquum Sturm, 1825
Nesebar
B (Nepha) menetriesi rettpenne Muller 1918
West Rhodopi
B (Peryphus) cordicolle Duval 1851
Sveti Vlas
Pogonus (s str) olivaceus Carret, 1903
Bourgas
P (Pogonidius) meridionalis Dejean 1828
Dobroudzha
Poecilus (s str) punctulatus (Schaller, 1783)
Dobrich
Pterostichus (Bothriopterus) quadrifoveolatus
Letzner 1852
Primorsko
P (Haptoderus) brevis (Duftschmid 1812)
Belasitsa
P (Haptoderus) properans Chaudoir 1868
Strandzha
P (Haptotapinus) crassiusculus Chaudoir 1868
Stara planina
P (Cophosus) cylindricus (Herbst, 1784)
Svishtov

Appendix 16 Rare Species of Coleoptera (continued)

Abax (s str.) parallelepipedus (Piller & Mitterpacher 1785)
Belogradchik
Agonum (s str.) burthleri Hopfgarten 1888
Sliven
A. (s str.) hypocrita (Apfelbeck, 1904)
Vitosha
A. (s str.) versutum Gyllenhal 1827
Sofia
A. (Europhilus) piceum (Linnaeus 1758)
Ropotamo
A. (Platynus) serbicum Csiki, 1904
Belasitsa
Calathus micropterus (Duftschmid, 1812)
Sofia
Taphoxenus gigas (Fischer W. 1823)
Kavarna
Amara (Zezea) concinna Zimmerman 1831
Primorsko
A. (Z.) tricuspidata pseudostrenua Kult 1946
Pomorie
Zabrus (s str.) ignavus Csiki 1907
West Rhodopi
Z. (Peloi) femoratus Dejean 1828
Stara planina
Z. (P.) graecus subtilis Schaum 1862
Kurdzhali
Anisodactylus pueli Schauberger 1933
Ahtopol
Loxoncus procerus (Schaum 1858)
Sozopol
Bradycellus (s str.) csikii Laszo 1912
Albena
B. (s str.) verbasci (Duftschmid 1812)
Lozenska planina
Ophonus (Incisophonus) incisus (Dejean, 1829)
Sandanski
Harpalus (Artebas) sturlini Poncy, 1901
Bourgas
H. (s str.) ampicollis Menetries 1848
Varvara
H. (s str.) calathoides Motschulsky 1844
Sveti Vlas
H. (s str.) subtruncatus Chaudoir 1846
Silistra
H. (Haploharpalus) hirtipes (Panzer 1797)
Rouse
Parophonus (s str.) dia Reitter 1900
Harmanli
Eucarterus sparsutus (Reitter 1898)
Nesebur
Dixus capito Serville 1821
Rouse
Badister (s str.) lacertosus Sturm, 1815
Dobrich
B. (Trimorphus) sodalis (Duftschmid 1812)
Sofia
B. (Baudia) dilatatus Chaudoir 1837
Sliven
Singilis (Phloeozetus) fuscipennis Schaum 1857
Kresna
Demetrias (s str.) monostigma Samouelle, 1819
Sandanski
Dromius (Manodromius) strigiceps Reitter 1905
Vitosha
D. (s str.) schneideri Crotch, 1870
Rila
Philorhizus quadrisignatus Dejean, 1825
Lozenska planina
Apristus reticulatus Schaum 1857
Sandanski
Microlestes schroederi Holdhaus 1912
Vasil Levski
M. seladon Holdhaus 1912
Pirin
Zuphium araxidis Khnozorian 1970
Sveti Vlas
Brachinus efflans Dejean & Boisduval 1829
Bourgas
B. incertus Brulle 1834
Bourgas
Aptinus merditanus orientalis Hurka 1988
Malashevska planina

HALIPLIDAE
Haliplus obliquus (Fabricius 1787)
Sofia

HYGROBIIDAE
Hygrobia tarda (Herbst 1779)
Sofia

DYTISCIDAE
Coelambus novemlineatus (Stephens 1828)
Rila
C. ennecagrammus (Ahrens 1833)
Varna
Hygrotus decoratus (Gyllenhal 1810)
Sofia
Hydroporus zimmermanni J. Muller, 1926
Sozopol
H. ferrugineus Stephens 1828
Sliven
Graptodytes varius (Aube, 1836)
Sofia
Deronectes moestus (Fairmaire 1858)
Pirin
Agabus (Gaurodytes) sturmi (Gyllenhal 1808)
West Rhodopi
A. (G.) pseudoneglectus Franciscolo 1972
Svilengrad

Appendix 16 Rare Species of Coleoptera (continued)

A (Agabinectes) didymus (Olivier, 1795)
West Rhodopi
Ilybius quadriguttatus (Boisduval 1835)
Varna
Rhantus (s str) suturellus (Harris 1828)
Batak
Rh (s str) latitans Sharp 1882
Vratsa
Rh (Melanodytes) pustulatus (Rossi, 1792)
Slavyanka
Meladema coriacea Castelnau 1834
Slavyanka
Acilius canaliculatus (Nicolai, 1822)
Sofia
Dytiscus semisulcatus Muller 1776
Varna

HYDROPHILIDAE
Hydrochus carinatus Germar 1824
Pirin
Helophorus (Empleurus) rufipes (Bosc 1791)
Lyulin
Anacaena globula (Paykul 1798)
Lyulin
Enochrus coarctatus (Gredler, 1863)
Rupite
E testaceus (Fabricius 1801)
Rupite
Cymbiodyta marginella (Fabricius 1792)
Rupite

HYDROSCAPHIDAE
Hydroscapha granulatum (Motschulsky 1885)
Kostenets

CATOPIDAE
Nargus wilkini (Spence 1815)
Rila
Catops nigrita Erichson 1837
Rila
C coarctatus Kellner 1846
West Rhodopi
C grandicollis Erichson 1837
Dobrich
Choleva oblonga Latreille 1807
Sveti Konstantin

STAPHILINIDAE
Oxytrus (Anotylus) pumilus Erichson 1837
Sliven
Eusphalerum (Abinotum) alpinum (Heer 1838)
Rila
Zyras (s str) collaris (Paykul 1800)
Skakavitsa
Z (Pella) limbata (Paykul, 1789)
Zemen
Z (P) lugens (Gravenhorst, 1802)
Zemen
Lesteva hansenii Lohse 1950
Rila
Stenus gracilipes Kraatz 1856
Rila
Quedius collaris Erichson 1839
Rila
Q cincticollis Kraatz, 1856
Rila
Tachyporus austriacus Luze 1901
Rila
Mycetoporus punctipennis Scriba 1868
Rila
M splendens (Marsham 1802)
Skakavitsa
Conosoma strigosoma J Sahlberg, 1911
Rila
Conosoma bipunctata (Gravenhorst, 1802)
Zemen
Gabrius suffragani Joy, 1913
Persina
Paragabrius micans (Gravenhorst, 1802)
Persina
P micantoides Lohse 1956
Persina
Heterothops quadripunctatula Gravenhorst 1802
Ograzhden
Raphirus boopoides Munster, 1922
Pirin
Sauridius obscuripes Coiffait, 1967
Vitosha
Lathrobium furcatum Czwalina, 1888
Persina
L levipenne Heer 1838
Persina
Lobratium meridionale Korge 1971
Vitosha
Geodrimicus nigrita (Muller 1821)
Pirin
Coiphium atratum Breit 1911
Kalofer
Ontholestes tessellatus (Fourcroy 1785)
Trovan
Nudobius lentus (Gravenhorst, 1806)
Vitosha
Philonthus nigriventris Thomson 1867
Razgrad
Ph corvinus Erichson 1837
Vitosha
Ph addendus Sharp 1867
Vitosha
Ph tenuicornis Mulsant & Rey 1835
Vitosha
Ph mannerheimi Fauvel 1868
Vitosha

Appendix 16 Rare Species of Coleoptera (continued)

Ph aculeatus Coiffait 1963
Vitosha
Ph marginatus (Stroen 1768)
Vitosha
Staphylinus dimidiaticornis Gemminger 1851
Vitosha
Pseudocypus fulvipennis Erichson, 1839
Sofia

DRYOPIDAE
Dryops subincanus (Kuwert, 1890)
Sliven
D nitidulus (Heer, 1851)
Sofia
Elmis rioloides (Kuwert 1890)
West Rhodopi
Riolus apfelbecki Ganglbauer 1904
Vitosha

ELATERIDAE
Selicus brunneus (Linnaeus 1758)
Vitosha
S subaeneus (Redtenbacher 1842)
Karlovo
Aplotarsus angustulus (Kiesenwetter 1858)
West Rhodopi
Stenagostus rufus (Degeer 1774)
Predela
Megapenthes lugens (Redtenbacher, 1842)
Varna
Agriotes nitidicollis Miller 1881
Melnik
A gallicus Boisduval 1835
Strandzha
A pallidulus (Illiger 1807)
Razgrad
A medvedevi Dolin 1960
Knezha
A modestus Kiesenwetter 1858
Vasiliko
Lacon querceus (Herbst 1784)
Belasitsa
Anostirus castaneus (Linnaeus 1758)
Rila
Ampedus ruficeps (Mulsant & Guillebeau, 1855)
Belasitsa
A ochropterus Germar, 1844
Sandanski
A nigroflavus (Goeze 1777)
Sandanski
A balteatus (Linnaeus 1758)
Bansko
A erythrogonus (Muller 1821)
Rila
Cardiophorus erichsoni Buysson, 1901
Plovdiv

Athous mutilatus Rosenhauer 1847
Pirin
A cavus (Germar, 1817)
Razgrad
A propinquus (Buysson 1889)
Sofia
Calambus bipustulatus (Linnaeus 1767)
Strandzha
Adrastus binaghi Leseigneur 1969
Harmanli

SILPHIDAE
Necrophorus nigricornis Faldermann 1835
West Rhodopi
Necrodes littoralis (Linnaeus 1758)
West Rhodopi
Thanatophilus dispar (Herbst, 1793)
Kavarna
Blitophaga opaca (Linnaeus 1758)
Sadovo
Silpha granulata Olivier 1790
Petrich

HISTERIDAE
Abraeus globosus Creutzer 1899
Eminska planina
Acritus nigricornis (Hoffmann 1803)
Primorsko
Bacanius soliman Marseul 1862
Kresna
Cylister oblongus (Fabricius 1792)
Vitosha
Dendrophilus punctatus (Herbst 1792)
Lozenska planina
Epierus italicus (Paykull, 1811)
Petrich
Epineuchinus caucasicola Bickhardt 1918
Arkutino
Exaesiopus grossipes (Marseul, 1855)
Luda Kamchiya
Gnathoncus nanuetensis Marseul 1868
Vratsa
Hister lugubris Truqui 1852
Petrich
H moerens Erichson 1834
Verila planina
H montenegrinus J Muller 1900
Bourgas
H teter Truqui 1852
Berkovitsa
Hypocacculus praecox (Erichson 1834)
Primorsko
H rufipes (Kugelann, 1792)
Luda Kamchiya
Hypocaccus speculum (Schmidt, 1884)
Petrich

Appendix 16 Rare Species of Coleoptera (continued)

Margarinotus meridarius (Hoffmann 1803)
Sofia
M striola C Sahlberg 1834
Stara Zagora
M stigmosus (Marseul, 1861)
Balchik
Onthophilus affinis (Redtenbacher 1849)
Pirin
Platylomalus complanatus (Panzer, 1792)
Varna
Plegaderus sanatus gobanzi J Muller, 1902
Slavyanka
P vulneratus (Panzer 1792)
Slavyanka
Spirinus algericus (Paykul 1811)
Pirin
S lautus Erichson, 1839
Sofia
S planiusculus Motschulsky 1849
Bourgas
S prasinus Erichson 1834
Petrich
S stussineri Reitter 1909
Pirin
S tenuistriatus sparsutus Solsky 1878
East Rhodopi
Tribalus minimus (Rossi 1790)
Luda Kamchiya

MELOIDAE
Cerosoma ephesica Reitter 1885
Harmanli

MORDELLIDAE
Mordellistena subepisternalis Ermisch 1965
Nesebur
M dvorakii Ermisch 1965
Nesebur
M pseudohirtipes Ermisch, 1965
Nesebur

NITIDULIDAE
Epuraea florea Reichson 1845
Svilengrad
Meligethes chloriocyaneus Jelinek & Audistio 1977
Vitosha
M hoffmanni Reitter 1871
Sozopol

CLERIDAE
Necrobia ruficollis (Fabricius 1775)
Elhovo
Denops albofasciatus (Charp 1825)
Sredna gora

COCCINELLIDAE
Scymnus (s str) inderiensis Mulsant, 1851
Central Stara planina
S (Pullus) silesianus Weise 1902
Sandanski
Epilachna argus (Geoffroy, 1762)
Vidin
Sidis tristiculus Weise 1885
West Stara planina
Hyperaspis femorata (Motschulsky, 1837)
West Stara planina

Chlocorus renipustulatus (Scriba 1891)
Plana planina
Coccinella hieroglyphica Linnaeus 1758
Vlahina planina
Nephus quadrimaculatus Herbst 1784
Slavyanka

SCARABAEIDAE
Copris umbilicatus Abeille 1901
West Rhodopi
Geotrupes impermedius Costa 1827
Vratsa
Aphodius (Agrilinus) constans Duftschmid 1805
Vratsa
Propomacerus bimucronatus Pallas, 1781
Primorsko
Polyphylla olivieri
Svilengrad

CERAMBYCIDAE
Obrium brunneum Fabricius 1792
Pirin
Molorchus kiesenwetteri Mulsant & Rey 1861
Central Stara planina
Semanotus undatus (Linnaeus 1758)
Chepelare
Clytus tropicus Panzer 1795
Strandzha
Chlorophorus nigripes Brulle, 1832
Kresna
Niphona picticornis Mulsant 1839
Kresna
Phytoecia argus (Frolich 1793)
Zemen
Rhopalopus spinicornis Abeille 1869
Strandzha
Rh hungaricus Herbst 1784
Central Stara planina

DERMESTIDAE
Dermestes olivieri Lepesme, 1939
Sredna gora

Appendix 16 Rare Species of Coleoptera (continued)

D sardous Kustei, 1846
Stara Zagora
D aurichalceus Kuster 1846
Pirin
Ctesias serra (Fabricius 1792)
Varna
Globicornis marginata (Paykul 1798)
Razgrad
Anthicus goliath Mulsant & Rey 1868
Sadovo

BRUCHIDAE
Bruchus lentis Frolich, 1799
Melnik
B sagnaticornis Gyllenhal, 1833
West Rhodopi
B venustus Fachiracus, 1839
Melnik Harmanli
Bruchidius cinerascens (Gyllenhal 1833)
Nesebur
B gilvus (Gyllenhal 1839)
Asenovgrad
B mordelloides (Baudi 1886)
Nesebur
B obscuripes (Gyllenhal, 1839)
Nesebur
B grandicornis (Blanchard, 1844)
Sozopol

BUPRESTIDAE
Acmaeodera edmundi Obenberger, 1935
Kresna
Acmaeoderella chrysanthemi (Chevrolat 1854)
Kresna Sandanski
A levantina (Obenberger 1934)
Kresna Sandanski
A subcyanea (Reitter 1880)
West Rhodopi
Capnodis porosa (Klug, 1829)
Sandanski
Dicerca moesta (Fabricius 1793)
Vidin (Topolovets)
Eurythyrea quercus (Herbst 1780)
Belasitsa
Anthaxia (s str) lucens Kuster 1852
Melnik
A (s str) hackeri Frivaldsky 1884
Kresna Arkoutino
A (Haplanthaxia) praeclara Mannerheim, 1837
Pirin
Sphenoptera (Chlostetha) substriata Krynicki 1834
Sandanski Kozhouh
S (Deudora) carceli Castelnau & Gory 1839
Sandanski
Meliboeus (Mexixes) acratus (Mulsant & Rey 1863)
Sandanski Kresna

Agrilus philipovi Alexeev 1965
Sandanski Melnik
Aphanisticus pygmaeus Lucas 1849
Sandanski
A elongatus Villa 1835
Varna Arkoutino
Habroloma nana (Paykul 1799)
Rila Vitosha
Trachys problematicus Obenberger 1916
Sandanski
Kisanthodia ariasi (Robert, 1858)
Sozopol, Arkoutino

TENEBRIONIDAE
Tentyria rotundata angulata Brulle, 1832
Kresna Melnik
Asida sabulosa banatica Frivaldszky 1865
Kresna
Pimela polita Solier 1836
Blagoevgrad
Blaps abreviata Menetries 1836
Plovdiv
B tibialis Reiche, 1857
Kavarna
B mullen Seidlitz 1894
Aytos
B reflexicollis Solier 1848
Nevrokop
Melanimon tibialis (Fabricius 1781)
Melnik
M inermis Piska 1983
Ropotamo
Oplocephala haemorrhoidalis (Fabricius 1787)
Stara planina
Neatusa picipes (Herbst 1797)
Plana planina
Cryphaeus cornutus (Fischer W 1823)
Dobrich
Probaticus obesus (Frivaldszky 1835)
Strandzha
P tarsatus (Kuster 1850)
Bourgas
Stenosis brentoides laeviventris (Desbrocher 1881)
Primorsko
Scaphidema metallicum (Fabricius, 1792)
Ropotamo
Metachsa azurea (Waltl 1838)
Ropotamo
Alphitophagus bifasciatus (Say 1823)
Kresna
Tribolium destructor Uyttenbogaard, 1933
Ropotamo
Hypophloeus longulus Gyllenhal, 1827
Strandzha
H fasciatus Fabricius 1790
Strandzha

Appendix 16 Rare Species of Coleoptera (continued)

Laena schwarzi Reitter 1885
Strandzha
L gangalbauer Reitter 1891
Harmanli
Eutagenia smyrnensis Solier 1838
Ropotamo
Dichillus carinatus Kuster 1848
Maleshevska planina
Elodonopirus armatus (Panzer, 1799)
Strandzha
Pentaphyllus chrysomeloides Rossi, 1892
Strandzha
Menephilus cylindricus (Herbst 1784)
Strandzha

CHRYSOMELIDAE
Donacia (s str) crassipes Fabricius 1775
Arkoutino
D (s str) semicuprea Panzer 1796
Sofia
D (s str) vulgaris Zschach 1788
Gara Ogiazhden
D (Donaciella) tomentosa Ahrens 1810
Sofia
Plateumaris braccata (Scopoli 1772)
Velingrad
Cryptocephalus gamma Herrich Schaeffer 1829
Bourgas
C flexuosa Krynicky 1834
Varna (Kranevo)
C biledjekensis Pic 1909
Harmanli
C quadripustulatus Gyllenhal 1813
West Rhodopi
C vittatus Fabricius, 1775
West Stara planina
C frontalis Marsham 1802
Vitosha
C querceti Suffrian 1848
Melnik
C planifrons Weise 1882
Sofia
Stylosomus flavus Marseul 1875
Blagoevgrad
Oomorphus concolor (Sturm 1807)
Trun
Pachnephorus canus Weise 1882
Primorsko
Chrysolina carpathica (Fuss, 1856)
Kalofer
Ch purpurascens (Germar 1822)
Stara planina
Ch grossa (Fabricius 1792)
Plovdiv
Chrysochloa intricata anderschi Duftschmid 1825
West Stara planina
Ch bifrons (Fabricius 1792)
Klisoura
Gonioctena rufipes (Degeer 1775)
West Rhodopi
G olivacea (Forster 1771)
Kalofer
Phyllobrotica elegans Kraatz 1866
Ahtopol
Luperus viridipennis Germar 1824
Rila
Euluperus xanthopus (Duftschmid, 1825)
Kalofer
Phyllotreta armoraciae (Koch 1803)
Varna
Ph christinae Heikertinger 1941
Vratsa
Ph exclamationis (Thunberg 1784)
Plovdiv
Ph schouchi Heikertinger 1941
Vratsa
Ph ganglbauer Heikertinger 1909
Nesebur
Ph judaea Pic 1901
Kranevo
Aphthona atrovirens (Forster 1849)
West Rhodopi
A bonvouloiri picipes Heikertinger 1912
Vlas
Longitarsus jakobeae (Waterhouse 1858)
Strandzha
L gracilis Kutschera 1864
Pirin
L longiseta Weise 1889
Stara planina
L fulgens (Foudras 1860)
Melnik
L fuscoaeneus Redtenbecher 1849
Simeonovgrad
L jailensis Heikertinger 1913
Strandzha
Altica pusilla Duftschmid 1825
Plovdiv
A corniolax Kral, 1969
Plovdiv
Hermaeophagus mercurialis (Fabricius 1792)
Rila
Sataphila olexai Kral 1964
Strandzha
Crepidodera sublaevis Motschulsky, 1859
West Rhodopi
C corpulenta Kutschera 1860
West Rhodopi
Chalcoides nitidula (Linnaeus 1758)
West Rhodopi
Minota obesa (Waltl, 1839)
West Stara planina

Mantura matheuwsi (Curtis 1833)
Vitosha
Chaetocnema major (Duval 1852)
Bourgas
Ch mannerheimi (Gyllenhal 1827)
Harmanli
Psylloides marcida (Illiger 1807)
Bourgas
P luteola (Muller 1776)
West Stara planina
P isatidis Heikertinger, 1912
West Stara planina
P reitteri Weise, 1888
Arkoutino
Dicladispa testacea (Linnaeus 1767)
Strandzha
Cassida ferruginea Goeze, 1777
Ahtopol

ANTHRIBIDAE
Tropideres (s str) albirostris (Herbst 1783)
Pirin
T (Rhaphitropis) pudens Gyllenhal 1833
Haskovo
T (Enedreutes) sepicola (Fabricius 1792)
Rila
T (E) curtirostris Mulsant & Rey, 1860
Ahtopol
T (E) bilineatus (Germar 1818)
West Rhodopi
Anthribus scapularis Gebler 1833
Golo burdo

RHINOMACERIDAE
Rhinomacer attelaboides Fabricius 1787
West Rhodopi
Pselaphorhynchites longipes (Thomson, 1888)
Plovdiv
Coenorhinus ruber (Fairmaire 1859)
Stara Zagora
Haplorhynchites pubescens (Fabricius, 1775)
East Stara planina

CURCULIONIDAE
Apion (Perapion) velatum Gestacker 1854
Vitosha
A (P) sedi Germar 1818
West Rhodopi
A (P) marchicum Herbst 1797
Varna
A (Ceratapion) cylindricolle Gyllenhal 1839
Varna
A (Metapion) breiti Wagner, 1910
Golo burdo
A (Catapion) seriatosetosulum Wencker 1864
Slavyanka
A (Protapion) filirostre Kirby, 1808
Radomir
A (s str) amethystinum Miller 1857
West Stara planina
A (Eutrichapion) spensei Kirby 1808
West Rhodopi
A buddebergi Sedel 1885
Pirin
A fallens Desbrochers 1895
Sandanski
A simile Kirby 1908
Vitosha
A samarense Faust, 1891
Pirin
A corsicum Desbrochers 1888
Sozopol
Liopholeus pupillatus Apfelbeck 1928
Central Stara planina
Otiorhynchus (Dodecastichus) mastix (Olivier, 1807)
Asenovgrad
O (s str) laevigatus (Fabricius 1792)
Vitosha
O (s str) politus Gyllenhal 1834
Vitosha
O (s str) dubius (Storm 1765)
Rila
O (s str) antennatus Stierlin 1861
West Rhodopi
O (s str) chrysomus Boheman 1843
West Stara planina
O (s str) hyngaricus Germar 1824
Varna
O (Dorymerus) peregrinus Stierlin 1861
Varna
O (D) simulans Stierlin, 1877
Ropotamo
O (D) scitus Gyllenhal 1843
Sliven
O (D) gemmatus (Scopoli 1763)
Asenovgrad
O (Tournieria) phreatus Reitter 1913
Sliven
O (T) fiater Stierlin 1861
Varna
O (Arammichus) chrysocomus Germar, 1824
Plovdiv
Stomodes rotundicollis Frivaldszky 1880
West Rhodopi
Peritelus sheroides Germar, 1824
Oryahovo
Ptochus porcellus Boheman, 1834
Varna
Mylacus globulus (Boheman 1843)
Kresna

Appendix 16 Rare Species of Coleoptera (continued)

Onoias mollinus Boheman 1834
Vitosha
Phyllobius viridaerus (Laicharting 1781)
Rila
Ph pedestris Schilsky, 1911
West Rhodopi
Ph contemptus Stevens 1829
Varna
Ph scutellaris Redtenbacher 1849
Golo burdo
Ph alpinus Stierlin, 1859
Rila
Ph paganettii Schilsky 1911
Sandanski
Ph cupreoaureus Stierlin, 1861
Ropotamo
Trachyphloeus ventricosus Germar 1824
Rila
Polydrosus (Metallites) marginatus Stephens 1831
Razgrad
P (Tylodrusus) impressifrons Gyllenhal, 1834
Blagoevgrad
P (T) flavipes (Degeer 1775)
Blagoevgrad
Barypeithes pellucidus Boheman 1834
Vitosha
Brachyderus incanus (Linnaeus 1758)
West Rhodopi
Brachysomus kubanensis Reitter 1888
Emine
Pseudoptochus auriohirtus (Seidlitz 1868)
Strandzha
Tropiphorus carinatus (Muller 1776)
West Rhodopi
Sitona gemellatus Gyllenhal 1834
Belasitsa
S costipennis Faust 1883
Ivaylovgrad
S puberulus Reitter, 1903
Ropotamo
Brachycerus junix Lichtenstein 1796
Pleven
Chlorophanus gibbosus (Paykul 1792)
Sofia
Pleurocleonus quadrivittatus (Zoubkoff 1829)
Varna
Conorrhynchus nigriventris (Pallas 1881)
West Rhodopi
Bothynoderes allicans Gyllenhal 1834
Razgrad
B vexatus Gyllenhal 1834
Pleven
Pseudocleonus graminis (Panzer 1789)
Petrich
Eustenopus villosus (Boheman, 1843)
Petrich

E hirtus (Waltl 1838)
Sandanski
Larinus maurus (Olivier 1807)
Sofia
L rusticanus Gyllenhal, 1836
Slavyanka
L centaureae (Olivier 1807)
Pirin
L australis Capiomont 1874
Petrich
L carinirostris Gyllenhal, 1836
Sandanski
Lixus scabricollis Boheman 1843
Rila
L bidens Camiomont 1874
Bourgas
L difficilis Capiomont 1874
Pleven
L acicularis Germar, 1824
Sofia
L lateralis (Panzer, 1793)
Nesebur
L cribricollis Boheman 1836
Sozopol
L punctiventris Boheman, 1836
Sozopol
Hypera zebra (Reitter 1896)
Primorsko
H rogenhoferi (Ferrari, 1866)
Pleven
H striata (Boheman 1834)
Pirin
H denominanda (Capiomont, 1868)
Chepelare
Curculio rubidus Gyllenhal 1836
Pirin
Donus intermedius (Boheman 1834)
Chepelare
Donus crinitus (Boheman 1834)
Vitosha

CURCULIONIDAE
Limobius mixtus (Boheman, 1834)
West Stara planina
Rhytidoderes plicatus (Olivier 1790)
Sofia
Liosoma oblongulum Boheman, 1842
Sveti Iliya
L cribrum (Gyllenhal 1834)
West Rhodopi
Anchonidium ulcerosum (Aube 1850)
Plovdiv
Myorrhinus albolineatus (Fabricius 1792)
Varna
Magdalis (s str) linearis Gyllenhal, 1827
West Rhodopi

Appendix 16 Rare Species of Coleoptera (continued)

M (Panopsis) fuscicornis Desbrochers 1870
Plovdiv
Anoplus roboris Suffrian, 1840
Rila
Bagous (s str) collignensis (Herbst 1797)
Varna
B (Abagous) glabrirostris (Herbst 1795)
Varna
B (A) robustus Brisout 1863
Strandzha
Rhyncolus elongatus Gyllenhal, 1827
Vitosha
Rh punctatulus Boheman, 1838
Plovdiv
Rh reflexus Boheman, 1838
Varna
Hexarthrum culinaris (Germar, 1824)
Varna
Rutidosoma globulus (Herbst 1795)
Plovdiv
Lytodactilus leucogaster (Marsham, 1802)
Silistra
Homorosoma validirostre (Gyllenhal, 1837)
Razgrad
Phrydiuchus speiseri (Schultze 1897)
Varna
Coeliodes ruber (Marsham 1802)
Sandanski
C cinctus (Geoffroy 1785)
Pazardzhik
C rubicundus (Herbst 1795)
Vitosha
Ceuthorhynchidius rufulus (Dufour 1851)
Sandanski
Ceuthorhynchus niyazii Hoffmann 1957
Varna
C nigrinus (Marsham, 1802)
Karlovo
C kraatzi Brisout 1869
Sofia
C symphyti Bedel 1885
Razgrad
C paszlavskyi Kuthy 1890
Osogovska planina
C arquatus (Herbst 1795)
Kamchiya
C italicus Brisout, 1869
Primorsko
C scribicollis Neresheimer, 1924
Strandzha
C obscurus Brisout, 1869
Sandanski
C faeculentus Gyllenhal 1837
Pirin
C inaffectatus Gyllenhal 1837
Novi Pazar

C plumbeus Brisout 1869
Sandanski
C similis Brisout 1869
Vitosha
C lukesi Tyl 1914
West Rhodopi
C barbareae Suffrian 1847
Primorsko
C canaliculatus Brisout 1869
Ropotamo
C viridanus Gyllenhal, 1837
Asenovgrad
C coerulescens Gyllenhal, 1837
Rilski manastir
C subpilosus Brisout, 1869
West Rhodopi
C radula Germar 1824
Nesebur
Baris rufa Boheman 1844
Varna
B morio Boheman 1844
Asenovgrad
B cuprirostris (Fabricius 1787)
Sofia
B spitzyi Hochhut, 1847
Nesebur
B semistriata (Boheman 1836)
Varna
Anthonomus (s str) bituberculatus Thomson 1868
Tryavna
A (s str) amygdali Hustache 1930
Sandanski
Brachonyx pineti (Paykul 1792)
West Rhodopi
Elleschus bipunctatus (Linnaeus 1758)
Vitosha
Sibinia sodalis Germar, 1824
Sredna gora
S potentialle Germar, 1824
Verila planina
Xenotychius africanus (Franz 1943)
West Stara planina
Tychius lineatulus Stephens 1831
West Rhodopi
T lateralis Penecke 1922
West Rhodopi
T sharpi Tournier 1873
Ropotamo
T consputus Kiesenwetter 1864
Nesebur
Camptorhynus simplex Seidlitz, 1867
Sandanski
Cionus schultzei Reitter 1904
Varna
C schoenherr Brisout, 1863
Varna

Appendix 16 Rare Species of Coleoptera (continued)

C nigritarsis Reitter, 1904
Rila
C longicollis montanus Wingelmuller 1914
Sandanski
Anoplus plantaris Thomson 1836
Vitosha
Nanophyes annulatus Agar, 1830
Pirin
N transversus Aube 1850
Sandanski
N sahlbergi Sahlberg 1834
Emine
Corimalia pallida (Olivier 1807)
Sandanski
C fausti Reitter 1890
Sandanski
Gymnetron vestitum (Germar 1821)
Sofia
G furcatum Desbrochers, 1893
Sandanski
G dieckmanni Behne 1988
Rila
Miarus monticola Petri, 1912
West Rhodopi
M distinctus Boheman 1845
Vitosha
Orchestes (s str) rufus (Schrank, 1781)
Kamchiya
O (s str) quedenfeldti Gerhard 1865
Ropotamo
O (s str) stibieckii (Smreczynski, 1957)
Rilski manastir
O (Alyctus) rusei (Herbst, 1795)
Vitosha
O (Pseudorchestes) ermischi (Dieckmann, 1958)
Asenovgrad
O (P) piatensis (Germar 1821)
Primorsko
Gasterocercus depressirostris (Fabricius 1792)
Vitosha
Acalloclates denticollis (Germar 1824)
Varna
Acalles camelus (Fabricius 1792)
Rilski manastir
A validus Hampe 1764
West Rhodopi
A ganglbauer Solari 1907
Kalofer
A balcanicus Solari, 1905
Nesebur
Trachodes hispidus (Linnaeus 1758)
Rila
Acentrus histrio (Falderman 1837)
Sandanski
Procas armillatus (Fabricius 1801)
Razgrad
Thryogenes festucae (Herbst, 1795)
Shabla

Th scirrhosus (Gyllenhal 1836)

Dorytomus (s str) tortrix (Linnaeus, 1761)
Sofia
D (s str) minutus (Gyllenhal, 1836)
Plovdiv
D (s str) puberulus (Boheman 1843)
Sandanski
Lepidonotaris petax (Sahlberg 1829)
Nesebur
Trachysoma alpinum Penecke 1894
Pirin
Ligryodes bischoffi Blatchley & Leng, 1916
Sofia
Orthochaetes (s str) setiger (Beck 1817)
Vitosha
Mecaspis nanus Gyllenhal 1834
Harmanli
Rhabdorrhynchus karelini Fahrs, 1842
Pernik
Parameira setosa Seidlitz, 1868
Nesebur
Amicromias breiti (Formaneck, 1909)
Kalofer
Rhynchaenus hungaricus Hajoss 1938
Emine
Rh pseudostygma Tempere 1983
Kalofer

IPIDAE
Eccoptogaster eichhoffi Reitter 1894
Kyustendil
E aceris Knotek, 1892
Tsoumerna
Phloeosinus bicolor Brulle 1832
Vitosha
Leperesinus orni Fuchs, 1906
Sofia
Dryocoetes hectographus Reotter 1913
West Rhodopi
D leonhardi Eggers 1912
Rila
Xyleborus monographus Fabricius, 1792
West Rhodopi
Pityophorus lichtensteini Ratzeberg, 1837
Pirin
Taphrorynchus ramicola Reitter 1894
Tsoumerna
Pityokteines voronzovi Jakobson, 1895
West Rhodopi
Orthotomicus robustus Knotek 1899
West Rhodopi
O suturalis Gyllenhal 1827
West Rhodopi
O longicollis Gyllenhal 1827
West Rhodopi

Appendix 17 Relict Species of Coleoptera

CARABIDAE
Nebria (Boreonebria) gyllenhali (Schonher 1806)
Rila Pirin
Bembidion (Testedium) bipunctatum nivale Heer 1841
Rila Pirin Stara planina Vitosha West & East Rhodopi
Amara (s str) nigricornis Thomson 1857
Rila Stara planina
A (Celia) erratica (Duftschmid 1812)
Rila, Pirin, Stara planina, Vitosha, West Rhodopi
A (Paracelia) quenseli (Schonher, 1806)
Rila Pirin, Stara planina

DYTISCIDAE
Coelambus novemlineatus (Stephens 1828)
Rila
Hydroporus tartaricus Le Conte, 1850
Rila Pirin Vitosha
Potamonectes griseostriatus (Degeer, 1774)
Rila, Pirin Vitosha
Oreodytes davisi Curtis 1831
Rila, Pirin Vitosha
Agabus (Gaurodytes) solieri (Aube 1836)
Rila Pirin Vitosha

HYDROPHILIDAE
Elophorus glacialis Villa 1833
Rila Pirin Stara planina Vitosha

STAPHYLINIDAE
Arpedium brachypterum Gravenhorst, 1802
Rila Vitosha
Anthophagus alpinus Fabricius 1792
Rila Vitosha

BUPRESTIDAE
Anthaxia tuerki Ganglbauer 1886
Sandanski Petrich valley South Black Sea coast

ELATERIDAE
Hypnoidus consobrinus (Mulsant & Guillebeau, 1808)
Rila

Ctenicera cuprea (Fabricius 1781)
Rila Pirin Stara planina Vitosha West Rhodopi
Liotrychus affinis (Paykul 1800)
Rila Vitosha

CERAMBICIDAE
Acmaeops septentrionalis Thomson 1866
Rila
Semanotus undatus (Linnaeus 1758)
West Rhodopi
Tragosoma depsarium (Linnaeus, 1767)
West Rhodopi

CHRYSOMELLIDAE
Asiorestia femorata (Gyllenhal 1813)
Vitosha

CURCULIONIDAE
Otiorhynchus morio Fabricius 1781
Vitosha
O dubius Strom, 1783
Rila Vitosha
O salicus Strom 1788
West Rhodopi
Himoiaciae (Koch 1803)
Varna
Ph christinae Heikertinger 1941
Vratsa
Ph exclamationis (Thunberg 1784)
Plovdiv
Ph scheuchi Heikertinger, 1941
Vratsa
Ph ganglbauer Heikertinger 1909
Nesebur
Ph judaea Pic 1901
Kranevo
Aphthona atroviens (Forster 1849)
West Rhodopi
A bomboulon picipes Heikertinger 1912
Vlas

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NOTES

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Insects of Bulgaria, Part 2. Blattodea, Mantodea, Isoptera, Orthoptera, Dermaptera, Embioptera, Megaloptera, Raphidioptera, Neuroptera, Mecoptera, Hymenoptera, Trichoptera, Lepidoptera, and Diptera

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SUMMARY

The orders described in this paper cover 54% (10 283 species) of the Bulgarian entomofauna The study of them began 160 years ago and a number of groups have been very well investigated (e g Neu roptera and Trichoptera) Hymenoptera and Diptera are the least investigated, the number of known spe cies in these orders is estimated at 28 to 33% of the actual total The least investigated geographic regions are the eastern Predbalkan Mountain some moun tains in the Kraishte Konyavo region the Plana Sashtinska Sredna Gora and Vlahina Mountains, the Maleshevska Planina Mountain, the Mesta River val ley and some parts of the Rhodopes

In terms of total species, the richest orders are Hymenoptera (4000) Lepidoptera (2860) and Dip tera (2800) Rare (793) endemic (271), and relict (42) taxa represent 10 7% of the species composition of the described insects The highest percentage of rare spe cies belong to the Neuroptera (27 4%) and Trichop tera (18 0%) Most of them are found in the Kresna gorge and the Sandanski Petrich valley (20 3%) and along the northern Black Sea coast (14 4%) The per centage of endemics is highest in Orthoptera (28 0%) and lowest in Diptera (1 0%) The endemics occur most frequently in the Pirin (21 8%) and Rila (20 7%) Mountains and in the Sandanski Petrich valley and the Kresna gorge (19 6%) The territories richest in rare endemic, and relict taxa are the Kresna gorge Sandanski Petrich valley, the Black Sea coast, the high parts of the Pirin and Rila Mountains the western Rhodopes and Vitosha Mountain

In this paper three territories of special environ mental importance are delineated (1) the high mountains (2) the middle course of the Strouma River and (3) the Black Sea coast The small isolated populations along the Black Sea coast which have de veloped under ecotone conditions and the relict communities of glacial origin in the mountains demon strate high sensitivity to anthropogenic influences The territories with the richest fauna are also defined the middle course of the Strouma River valley the north ern Black Sea coast and the Pirin Mountains The most threatened habitat types and their distribution for the different orders are described This paper includes recommendations for the conservation of the different insect groups and proposals for new protected natural territories in the Sandanski Petrich valley the Kresna gorge Belasitsa the Black Sea coast the Stara Plan ina the Rhodopes, and the Strandzha Mountain re gion This paper also stresses the need for a red data book on the invertebrates in Bulgaria and for invento ries of the invertebrates in the biosphere reserves

A BRIEF HISTORY OF ENTOMOLOGICAL RESEARCH

The first Bulgarian entomological studies were conducted 160 years ago (Frivaldsky 1833) Entomo logical investigations prior to the liberation of Bulgaria were carried out primarily by foreigners including Imre von Frivaldsky, Herman Loew, Josef Haber hauer Eduard Merkl Theobald Kruper, and Count Amedee Alleon After liberation a number of well known foreign specialists – August Forel Franz Kla palek, Viktor Apfelbeck Hans Rebel – as well as the first Bulgarian entomologists – Nikola Nedyalkov Dimitar Yoakimov, Porfiriy Bachmetjew, Andrey Markovich Hristo Pigulev – began their studies

With the establishment of the entomological sta tion at the Royal Scientific Institutes in 1905 and the Entomology Department at the Agricultural Research Institute in Sofia in 1909 Bulgarian entomology en tered a new stage These developments led to an up swing in entomological studies and an increasing num ber of publications on this subject In the *News of the Royal Natural Science Institutes in Sofia* (the publica tion with the best reputation in the natural sciences in Bulgaria between the two world wars) there were 52 publications on entomology exceeding the number of articles in all other subject areas The number of Bul garian entomologists increased rapidly after World War II and their investigations moved beyond the boundaries of Bulgaria Many internationally recog nized experts whose studies involved the fauna of different parts of the world began work at this time

The first studies of Orthopteroidea were pub lished at the end of the last century (Frey Gessner, 1892) Between the two world wars, two articles by Bulgarian authors were published one on Orthoptera (Drenovski 1929) and the other on Blattodea (Drenski 1939) In the same period the first article on the Bulgarian Embioptera appeared (Taborsky 1938) In the works of some authors (Klapalek 1895 Nedyal kov 1909) data on different insect groups including Orthoptera are presented After World War II many different studies of Orthoptera appeared (Buresh and Peshev 1955 1958, Peshev, 1959 1986, Andreeva, 1978 1982 Bey Bienco and Peshev, 1960, Popov and

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Ganev 1983) and the first catalogue of the Bulgarian Orthopteroidea was prepared for publication

The first studies of Neuropteroidea were con ducted by Klapalek (1895) and Nedyalkov (1909) Later the works of Navas (1929) and Buresh (1936) were published Popov (1967 1990) provided a thor ough study of the Bulgarian Neuroptera in his publi cations

Forel (1895) was working on the Bulgarian Hy menoptera (the Formicidae family) at the end of the last century Nedyalkov (1914) contributed to the thorough study of the whole order Investigations be tween the two world wars encompassed the Hymeno ptera parasites of the noxious insects (Chorbadzhiev 1924 1933) The studies of Pittioni on Apoidea (1938 1942) and the first works of Atanasov (1934 1938) on Formicidae and Apoidea were also published at this time After World War II many specialists went to work in this field Their research covers different groups Atanasov (1962 1976) – Apocrita, Kolarov (1977 1992) –Ichneumonidae Zaykov (1980 1983) and Balevski (1991) – Braconidae Pelov (1975 1991) – Proctotrupoidea Donev (1985 1990) – Mimaridae The pollinators in Apoidea were studied by Dochkova and Vassileva (1981 1991) However only Symphytaa was the subject of a generalized faunistic monograph (Vassilev 1978)

Klapalek (1894 1913) undertook the first studies of the Bulgarian Trichoptera Other authors who pub lished catalogues on the Bulgarian fauna also contrib uted to the investigation of this group (Georgiev and Beron 1962 1972) The thorough study of the Bulgar ian Trichoptera is associated with the publications of Kumanski (1968 1988) Hydrobiological studies of the Bulgarian rivers (Russev 1963 1990) also contributed our knowledge of this group Kumanski (1988) pub lished a generalized faunistic monograph on the Trichoptera in Bulgaria

Approximately 800 articles containing data about butterflies in Bulgaria are known to have been pub lished The first studies of Bulgarian butterflies were made by Frivaldsky (1837) Generalized monographs were written at the beginning of the century (Bachmetyev 1902 Rebel 1903) Drenovski (1927 and 1930) later developed a review of the butterfly fauna in the high Bulgarian mountains Buresh and Tuleshkov (1929 1943) issued a critical catalogue on the Macrolepidoptera in Bulgaria The recently pub lished catalogues of Ganev (1983 1986) provide an overview of the Bulgarian butterfly fauna A general ized faunistic work on the Rhopalocera has been pre pared for publication

The first studies of Bulgarian Diptera were made by Loew (1862 1863) Subsequently, investigations of different families (mainly involving taxa of economic importance) began Nedyalkov (1912) and Drenski (1930 1960) contributed to the study of the whole or der After World War II studies of the Diptera at the Black Sea coast (Beschovski 1966 1982), the synan thropic and synbovile flies (Lavchiev 1966 1990) and the water species (Tsvetkov, 1955, Kovachev 1969 1990 Michailova 1977 1990) began A number of re searchers who published catalogues on Bulgarian fauna contributed to the study of our Diptera, includ ing Valkanov (1957) on the flies of brackish waters and Georgiev and Beron (1962) on the troglophilian species Hydrobiological investigations in Bulgaria contributed to studies of the water Diptera (Caspers 1951, Valkanov, 1949, Kovachev, 1969 1990) Myce tophilidae (Bechev, 1988 1990), Cecidomyiidae (Dimitrova, 1989 1991) and Tachinidae (Houbenov, 1977 1992) were intensively investigated The species composition of a number of families is well studied but only one contemporary generalized monograph was published, on the Chloropidae family (Beshovski 1985)

The attached reference list of 293 titles includes publications selected according to the judgment of the respective authors According to contemporary under standing of the species in the different groups the best and most comprehensively studied are those for which monographs in the *Fauna of Bulgaria* series have been written Hymenoptera Symphyta (Vassilev, 1978), Trichoptera (Kumanski, 1985, 1988) and Dichoptera Chloropidae (Beschovski, 1985) The species in many groups that have not yet been monographed are nonetheless very well known including those in the Orthoptera and Neuroptera In some small orders – Blattodea Mantodea Isoptera Embioptera, Raphidioptera and Megaloptera –future investigations are unlikely to lead to substantial changes in species composition, since these have been very well studied

MAJOR GAPS IN KNOWLEDGE

The different insect groups have been investigated to varying degrees Least investigated are the orders Hymenoptera and Diptera in which the number of known species is estimated to be from 28 to 33% of the total Many families in these orders are almost completely unstudied With a few exceptions the studies of these groups have been faunistic or taxo nomic in nature The classifications of a number of Diptera families (Tabanidae, Syrphidae, and others) that were undertaken without reference to genital structures need to be revised The enormous species diversity of Hymenoptera and Diptera, the small num ber of researchers and the short term nature of con temporary investigations make realistic faunal analyses difficult It is difficult to define the exact number of genera because of the extensive nomenclature changes in some of the groups The classification of taxa as endemic, rare and relict should be regarded with some degree of uncertainty Of 80 Diptera families known in Bulgaria, only 16 are comparatively well studied of the rest 14 are somewhat better investi

gated than the other 50 The situation is similar with regard to the parasitic hymenoptera, since only Ich neumonidae Braconidae Proctotrupidae and Mimari dae have been intensively studied

Studies of the butterflies are considerably more complete it is estimated that 68% of the total species composition is known It is necessary however to re vise the number of subspecies of Papilionidea de scribed by Bulgarian scientists and to introduce a system of synonyms wherever it is needed In this way the large number of endemics in this group – a reflec tion mainly of the large number of subspecies of ques tionable rank – can be reduced The existing informa tion on Microlepodoptera is insufficient This group needs full faunistic investigations Although a large number of regional faunistic investigations exist al most all of them have been carried out in southern Bulgaria In northern Bulgaria by contrast the only studies are incomplete old fashioned works that date back to the beginning of the century

The notoriously negative role of the hemato phagous and synanthropic diptera the wide distribu tion of Diptera species and the lack of attractive forms have led to the impression that this group is in vulnerable to anthropogenic pressure As a result the problem of their conservation is not taken seriously enough In fact many Diptera members are adapted to specific microhabitats that are quite vulnerable to anthropogenic impacts

The state of insect protection in Bulgaria is ex tremely unsatisfactory Except for prohibitions on the collection of 12 attractive species of the Coleoptera and Lepidoptera orders (some of which are large in number) almost nothing has been done to protect in sects Two very substantial gaps are the lack of a red data book on the invertebrates in Bulgaria and the lack of inventories of the invertebrates in the bio sphere reserves

ASSESSMENT OF CURRENT KNOWLEDGE

Areas Requiring Further Investigations

Bulgaria's topography is diverse its territory em bracing both the Alpine Himalayan mountain system and the East European plain The proximity of the Mediterranean and the Black Sea the broad influence of the European continental land mass and the varied relief contribute to the formation of diverse climatic conditions The topography and the climate have de termined the characteristics and distribution of the soil vegetation and fauna The insect fauna of this complex biogeographical territory have not been stu died to an equal degree The different orders have been insufficiently investigated in the following areas

- *Orthopteroidea* the western parts of the Danu bian plain the Ludogorie, the Kraishteto and the Predbalkan valleys
- *Neuroptera* northern Bulgaria, Sredna Gora, and the Thracian lowland
- *Hymenoptera* for the Parasitica, Dobrudzha and northwestern Bulgaria for the Aculeata the Da nubian plain Strandzha Mountain most of the southern Black Sea coast, and some parts of the Stara Planina Rila Pirin and Rhodope Moun tains
- *Trichoptera* the Danubian plain the Kraishte Konyavo, and the Thracian lowland
- *Lepidoptera* the Danubian plain (Ludogorie and Dobrudzha), the Mesta River valley the Kraishte Konyavo part of the Prehodna region, and the southern parts of the Rhodopes and Strandzha Mountain Relatively under investigated are the eastern Stara Planina Moun tains and the Thracian lowland
- *Diptera* the western Danubian plain, Predbalkan, Sredna Gora the Thracian lowland and the Oso govo Belasitsa Mountain chain

The least investigated territories with respect to all orders are the eastern Predbalkan the middle Da nubian plain, some mountains of the Kraishte Konyavo part of the Prehodna region, Plana Sashtinska Sredna Gora, Vlahina and Malashevska Mountain the Mesta River valley, and some parts of the Rhodopes

Species Diversity (Table 1)

Three of the orders described in Table 1 are high in species diversity Hymenoptera – 4000 species (21% of the Bulgarian entomofauna's 19 000 species) Lepidoptera – 2860 species (15% of the Bulgarian entomofauna) and Diptera – 2800 species (14 7% of the Bulgarian entomofauna) As these orders are more fully studied the number of species is expected to increase Hymenoptera – about 12 000 species (30% of the fully investigated Bulgarian entomofauna which is estimated to include about 40 000 species) Lepidoptera – about 4200 species (10 5% of the fully investigated Bulgarian entomofauna) and Diptera – about 10 000 species (25% of the fully investigated Bulgarian entomofauna)

The tremendous species diversity in the Hy menoptera and Diptera the small number of research ers and the relatively limited extent of contemporary studies hamper the ability to classify taxa as rare en demic and relict Furthermore the actual faunistic di versity of these orders is still not known For these reasons this classification should be considered tenta tive and a degree of uncertainty assumed

The orders Orthoptera (207 species 1 1%) Neu roptera (113 species 0 6%) and Trichopter (250 spe cies 1 3%) are moderately rich in species They are the best investigated orders in Bulgaria

There is a small degree of species diversity (from 1 to 15 species) in the following orders Blattodea, Mantodea Isoptera Dermaptera Embioptera Mega loptera Raphidoptera and Mectoptera

A better sense of the diversity of the Bulgarian entomofauna can be gained by comparing it to that of Central Europe, especially if one considers the well in vestigated groups (Table 1) In a number of groups that are not described in this report species diversity is greater than that of Central Europe

Table 1 Species richness, degree of study, rare and endemic species of the examined Insecta groups

Orders	Species establ in Bulg	Possible sp Numb in Bulg	Degree of study (%)	Endemic	Rare	Relicts	Species establ in Cent Europe
Blattodea	15	20	75 0	1	2	0	12
Mantodea	4	5	80 0	0	1	0	1
Isoptera	2	2	100 0	0	1	0	1
Orthoptera	207	250	82 8	58	29	3	131
Dermpatera	7	15	46 6	0	3	0	7
Embioptera	1	2	50 0	0	1	0	0
Megaloptera	3	4	75 0	0	1	0	3
Raphidioptera	14	17	82 3	2	3	0	13
Neuroptera	113	120	94 2	1	31	1	114
Mecoptera	7	10	70 0	0	2	0	9
Hymenoptera	4 000	12 000	33 3	45	317	0	11 500
Trichoptera	250	260	96 1	33	47	1	300
Lepidoptera	2,860	4,200	68 1	103	136	37	3,200
Diptera	2 800	10 000	28 0	28	218	0	9,000
All	10,283	26,905	38 2	271	793	42	24,291

Rare Species (Tables 2 4 5)

This category includes taxa known from single habitats and represented by small populations The orders highest in the percentage of rare species are Neuroptera (27 4%) and Trichoptera (18 0%) Orthoptera is moderate in its percentage or rare species (14 0%), while the rest of the orders are low

There are 29 rare species in Orthoptera Most of them are found in the Sandanski Petrich valley (6 thermophilic species) the Rhodopes and at the Black Sea coast The percentage of rare species is almost evenly distributed at 12 13% each between the Ensifera and Caelifera suborders

The greatest number of rare species in the order Neuroptera which contains 31 rare species altogether, have been found in the eastern Stara Planina Mountains, in the Rila Mountains, and in the Strouma River valley This reflects the fact that most of these are dendrobionts and many are thermo and xerophilic in character The percentage of rare species is highest (50%) in the Coniopterygidae family about equal (19 21%) in the Chrysopidae and Hemerobiidae and a bit higher (22 31%) in families where thermophilous species predominate

The Hymenoptera include 317 rare species Most of these have been discovered in the Sandanski Petrich valley (58 species), the western Rhodopes (35 species) the Thracian lowland (33 species), Vitosha Mountain (35 species) the western Predbalkan (28 species) and the western Stara Planina Mountains (29 species) The percentages of rare species are high in the families Colletidae (60%) and Anthrophoridae (46%) moderate in Andrenidae (17%) and low in Chrysididae (7 5%) The members of the Aculeata suborder are mainly thermophilous species Consequently, about 80% of them inhabit

Table 2 Distribution of the endemic, rare, and relict species of Blattodea, Mantodea, Isoptera, Embioptera, Orthoptera, Dermaptera, Megaloptera, Raphidioptera, Neuroptera, Mecoptera, Hymenoptera, Trichoptera, Lepidoptera, and Diptera in Bulgaria

Territories	All	Endemic		Rare		Relict	
		#	%	#	%	#	%
Danubian plain		1	1		0 4		
Western	10	3	1 1	7	0 9		
Central	6	3	1 1	3	0 4		
Eastern	12	4	1 5	8	1 0		
Predbalkan	2			2	0 2		
Western	39	5	1 8	33	4 2	1	2 4
Central	12	1	0 4	11	1 4		
Stara Planina	19	8	2 9	10	1 3	1	2 4
Western	82	21	7 7	58	7 3	3	7 1
Central	66	26	9 6	27	3 4	13	30 9
Eastern	57	14	5 2	39	4 9	4	9 5
Prehodna geographical region							
Kraishte-Konyavo area	33	11	4 0	21	2 6	1	2 4
Sofia valley	31	7	2 6	24	3 0		
Lyulin	12	8	2 9	4	0 5		
Vitosha	109	29	10 7	61	7 7	19	45 2
Plana	6	2	0 7	4	0 5		
Podbalkan valleys	13	3	1 1	9	1 1	1	2 4
Sredna Gora	6	2	0 7	4	0 5		
Ichtimanska	10	4	1 5	6	0 7		
Sashtinska	5	3	1 1	2	0 2		
Sarnena	13			13	1 6		
Thracian lowland	52	10	3 7	42	5 3		
Sakhar Tundzha region	37	8	2 9	29	3 6		
Strandzha	43	14	5 2	27	3 4	2	4 8
Rila Rhodopes massif							
Osogovo Mountain	28	18	6 6			10	23 8
Vlachina Mountain	4	3	1 1	1	0 1		
Malashevska Planina	5	4	1 5	1	0 1		
Ograzhden	28	8	2 9	18	2 3		
Belasitsa	82	20	7 4	28	3 5	3	7 1
Rila	106	56	20 7	48	6 0	34	80 9
Pirin	121	59	21 8	33	4 1	29	69 0
Slavyanka	67	31	11 4	28	3 5	8	19 0
Central Strouma valley	215	53	19 6	161	20 3	1	2 4
Mesta valley	3	2	0 7	1	0 1		
Rhodopes	54	37	13 6	14	1 8	3	7 1
Western	108	23	8 5	74	9 3	11	26 2
Eastern	44	14	5 2	30	3 8		
Black Sea coast	8	4	1 5	4	0 5		
Northern	142	28	10 3	114	14 4		
Southern	120	22	8 1	97	12 2	1	2 4
Wide distribution up given altitude	6	5	1 8	1	01		
Total 1 106 10 7%	1106	271	24 5	793	71 7	42	3 8
Known in Bulgaria	10283		2 6		7 7		0 4

the lowlands and hills up to an altitude of 300 meters About 20% of the species mainly of the Apidae family (the *Bombus* and *Psithyrus* genera) have been found in the highlands (above 1 000 m)

Trichoptera contains 47 rare species most of them found in the Strandzha Mountain region (15 species) and in the Rhodopes (13 species)

The number of rare taxa in Lepidoptera is 136 About half (64) have been found in the Strouma River valley The territories with the greatest faunistic diversity are found in this valley the Kresna defile gorge the Sandanski Petrich valley, and the Kozhuch volcanic hill These sites are also among the best investigated Another region with high numbers of rare species is the Dobrudzha Black Sea coast where 24 rare taxa have been found The percentage of rare species in Lepidoptera (4 7%) is low

The number of rare species in the Diptera is 218 (7 8%) They are found mainly along the Black Sea coast – 78 species along the northern seacoast and 54 species along the southern seacoast A substantial number of rare dipteran species (20) has been found in the Kresna defile gorge and in the Sandanski Petrich valley

The total number of rare species in all the orders is 793 The total percentage of rare species in these orders is low – 7 7% of the total number of species known in Bulgaria (10 283) The areas with the highest number of such species are the Strouma River valley especially the Kresna defile gorge and the Sandanski Petrich valley (161 species) the northern and southern Black Sea coast (114 and 97 species respectively) the western Stara Planina Mountains (58 species) the eastern Stara Planina Mountains (39 species) and the Rila Mountains (48 species)

Endemic Species (Tables 2 and 3)[1]

The total number of endemic taxa in the described orders is 271 (2 6% of the total – a low level of endemism) They are divided into two categories – Bulgarian (local and regional) endemics and Balkan endemics (see Table 3) – and are unevenly distributed in the different orders

The total number of endemics in Orthoptera is 58 (14 0%) This can be considered a moderate level of endemism The difference in the percentage of endemic taxa in the two Orthoptera suborders is great 42% of the Ensifera are endemics as compared to 4% of Caelifera The high level of endemism in Ensifera (45% in the Tettigonidae and 63% in the Phaneropterinae subfamilies) reflects the presence of several genera experiencing an intensive process of species formation in the Balkan Peninsula The greatest number of endemics have been located in the Pirin Mountains (12) in the Kresna defile gorge and the Sandanski Petrich valley (11) in the Slavyanka Mountain region (10) and in Belasitsa and the Rila Mountains (9 species each) The endemic species in the high mountains are primarily restricted to mountain habitats while those in the low lands are primarily xerothermic

The level of endemism in Neuroptera is extremely low – only one species of the Neurorthidae family (a stenobiont with larvae inhabiting cold streams at an altitude of about 900 1000 m) The case with Blattodea (one endemic located on Vitosha Mountain) and Rapidioptera (2 endemics) is similar

The level of endemism in Hymenoptera is low 45 species (1 1%) Some newly described taxa in the parasitic Hymenoptera can be considered potential endemics The greatest number of endemic species – 14 species each – has been found in the Sandanski Petrich valley and in the Rhodopes

The level of endemism in Trichoptera is moderate 33 species (13 2%) Most of the species in this order inhabit clean oxygen rich waters so the endemics are concentrated in the mountains in the Rilas (16 species) Stara Planina (15) Rhodopes (14) and Pirins (12) Seventeen of the established endemics are typical for Bulgaria only while the rest (16) are also Balkan endemics

The level of endemism in Lepidoptera is low 103 species (3 6%) The territories with the most endemic species are the Rilas (34) the Pirins (36) the central Stara Planina (15 24), Vitosha Mountain (17) Slavyanka the Rhodopes the Sandanski Petrich valley and the Kresna defile gorge (23) In terms of specific sites the Kresna defile gorge ranks first in the number of endemic species (8) A considerable number of the endemic taxa are subspecies Forty five of the endemics located are typical for Bulgaria only The other 58 are also Balkan endemics

The level of endemism in Diptera is low 28 species (1 0%) This level will probably rise if several newly described taxa are determined to be endemics The highest number of endemic dipterans have been located on the northern and southern Black Sea coasts (10 species each) Of the 28 endemics 24 are typical only in Bulgaria The others are Balkan endemics

Of described groups the richest endemic areas are the Pirin Mountains (59) the Rila Mountains (56) the middle course of the Strouma River including the Kresna defile gorge and the Sandanski Petrich valley (53) the Rhodopes (about 50) Slavyanka (31), Vitosha Mountain (29) the northern Black Sea coast (28) and the central Stara Planina Mountains (26 taxa) The most active local centers of species formation are concentrated in several of these regions and their conservation is of special importance

Relict Species (Tables 2 4 5)

Relict species are described in several of the orders Two species in Orthoptera are glacial relicts while one species is probably a Tertiary petrobiont One glacial relict of the Hemerobiidae has been established in

Table 3 Distribution of the endemic taxa of the examined groups in Bulgaria

Territories	Bulgarian				Balkan	
	Local		Regional			
	#	%	#	%	#	%
Danubian plain			1	0 8		
Western					3	2 4
Central			1	0 8	2	1 6
Eastern	1	4 0	1	0 8	2	1 6
Predbalkan						
Western			2	1 7	3	2 4
Central					1	0 8
Stara Planina			4	3 4	4	3 1
Western			10	8 4	11	8 7
Central			11	9 2	15	11 8
Eastern	4	16 0	4	3 4	6	7 2
Prehodna geographical region						
Kraishte Konyavo area			1	0 8	10	7 7
Sofia valley	1	4 0	3	2 5	3	2 4
Lyulin			2	1 7	6	4 7
Vitosha			5	4 2	24	18 9
Plana					2	1 6
Podbalkan valleys			1	0 8	2	1 6
Sredna Gora			1	0 8	1	0 8
Ichtimanska			1	0 8	3	2 4
Sashtinska			1	0 8	2	1 6
Thracian lowland			2	1 7	8	6 3
Sakhar Tundzha region			2	1 7	6	4 7
Strandzha			6	5 0	8	6 3
Rila Rhodopes massif						
Osogovo Mountain			3	2 5	15	11 8
Vlachina Mountain			2	1 7	1	0 8
Malashevska Planina			1	0 8	3	2 4
Ograzhden			2	1 7	6	4 7
Belasitsa	2	8 0	4	3 4	14	11 0
Rila	5	20 0	19	15 9	32	25 2
Pirin	6	24 0	20	16 9	33	25 9
Slavyanka	2	8 0	6	5 0	23	18 1
Central Strouma valley	2	8 0	16	13 4	35	27 5
Mesta valley			1	0 8	1	0 8
Rhodopes	3	12 0	9	7 6	25	19 7
Western			12	10 1	11	8 7
Eastern			9	7 6	5	3 9
Black Sea coast			1	0 8	3	2 4
Northern	5	20 0	12	10 1	11	8 7
Southern			13	10 9	9	7 1
Wide distribution up given altitude					5	3 9
Total 271 2 6%	25	9 2	119	43 9	127	46 9

Table 4 Distribution of the endemic, rare, and relict insects of the Orthoptera, Neuroptera, and Hymenoptera in Bulgaria

Territories	Orthoptera			Neuroptera			Hymenoptera		
	A	B	C	A	B	C	A	B	C
Danubian plain									
Western	1				1			1	
Central	2							1	
Eastern	1				1				
Predbalkan									
Western	2				3			28	
Central								9	
Stara Planina	4						1	9	
Western	2	5			3		1	29	
Central	3		1	1			1	13	
Eastern	2	1	1		5		2	6	
Prehodna region									
Kraishte Konyavo area					1	1	1	7	
Sofia valley	1	3			1		1	5	
Lyulin	3							3	
Vitosha	5			1	1	1	1	35	
Plana					2				
Podbalkan valleys					1	1		2	
Sredna Gora	1							2	
Ichtimanska	1							5	
Sashtinska	1							2	
Sarnena								13	
Thracian lowland	4				2		1	33	
Sakhar Tundzha region	3	2						10	
Strandzha	6	2	1		4		1	3	
Rila Rhodopes massif									
Osogovo Mountain	3			1		1			
Vlachina Mountain	3								
Malashevska Plan	1								
Ograzhden	2	1							
Belasitsa	9				1			23	
Rila	9	3	1		5	1	1	19	
Pirin	12	2	1		2	1	1	6	
Slavyanka	10							12	
Cent Strouma Val valley	11	6			8		14	58	
Mesta valley	1						1		
Rhodopes	10	2		1		1	3	10	
Western	1	2			5		8	35	
Eastern	2	1					6	6	
Black Sea coast	2	1						3	
Northern	3	1			1		2	7	
Southern	1	4	1		2		3	14	
Total Number	58	29	3	1	31	1	45	317	0
(%)	28	14	1 4	0 9	27 4	0 9	1 1	7 9	0
Known in Bulgaria		207			113			4000	

Note A Endemic B Rare C Relict

Table 5 Distribution of the endemic, rare, and relict insects of the Trichoptera, Lepidoptera, and Diptera in Bulgaria

	Trichoptera			Lepidoptera			Diptera		
	A	B	C	A	B	C	A	B	C
Danubian plain				1					
Western		1		2	4				
Central				1	1			1	
Eastern		1		3	2			2	
Predbalkan								2	
Western				2	2	1			
Central				1	1				
Stara Planina	15	8				1			
Western	3	3		12	8	3	3	10	
Central	6	3		15	7	12		4	
Eastern	1	2		9	14	3		10	
Prehodna region									
Kraishte Konyavo area	1	1		9	10			1	
Sofia valley		4		4	3		1	8	
Lyulin				5	1				
Vitosha	9	1		174 2	8	18	1	16	
Plana				2				2	
Podbalkan valleys				3	3			3	
Sredna Gora				1				1	
Ichtimanska		1		3					
Sashtinska				2					
Thracian lowland				5	6				
Sakhar Tundzha	1			4	18				
Strandzha	5	15	1	4	3		1		
Rila Rhodopes massif									
Osogovo Mountain	2			12		9			
Vlachina Mountain					1				
Malashevska Plan	3	1							
Ograzhden				6	17				
Belasitsa	2			8	4	3			
Rila	16	3		34	7	31		9	
Pirin	12			36	15	27	1	8	
Slavyanka				21	12	8		4	
Cent Strouma Val	3	2		23	64	1	1	20	
Mesta valley		1							
Rhodopes	14	13		12	1	2			
Western	2	6		12	19	11		7	
Eastern		1		3	18		3	3	
Black Sea coast				2					
Northern		3		13	24		10	78	
Southern				8	17		10	54	
Distributed up given altitude	3			2					
Total Number	33	47	1	103	136	37	28	218	0
(%)	13 2	18 0	0 4	3 6	4 7	1 3	1 0	7 8	0
Known in Bulgaria		250			2860			2800	

Note A Endemic, B Race C Relict

Neuroptera One Tertiary relict in Trichoptera has been determined The number of relict species in Lepidoptera is larger (37) Most of these are found in the Rila Pirin Vitosha and in central Stara Planina Mountains (Table 2) Their concentration in the high mountains is due to their glacial origins The areas with the highest number of relicts are the Rila (34) Pirin (29), Vitosha (19) and central Stara Planina Mountains (13) Relicts are found in lower numbers (about 10 each) at Slavyankaand Osogovska Moun tains and in the western Rhodopes

Ecosystems and Unique Communities

The extreme variety of physiogeographic condi tions in Bulgaria and the historical development of its fauna are the main factors influencing the formation of its unique communities Some of these communities are refugia in which many rare endemic, and relict taxa of different origins are preserved

The separate orders of insects occur to varying degrees within different ecosystems and communities in Bulgaria Specific limited habitat types exist for Orthoptera and Neuroptera The high mountain meadows are of greatest importance less important are the mountain forests, glades and some biotopes of Mediterranean character (the Kresna defile gorge and a number of southern Black Sea coastal regions)

Some mountainous karst areas are important for the parasitic Hymenoptera while the regions of the Black Sea coast are important for a number of forest communities with well preserved fauna The following specific altitudinal zones above 800 m have been shown to contain a high number of Aculeata species the western Predbalkan the Sandanski Petrich valley the Thracian lowland and the southern Black Sea coast

As noted above most species in Trichoptera are adapted to clean oxygen rich waters which are found primarily in the mountains For this reason about 65% of the Trichoptera fauna is concentrated in re gions above 800 m The mountain communities in the Stara Planina Mountains in the Rila Pirin and Rho dope Mountains on Vitosha Mountain as well as oth ers in the watersheds of some lower mountains (Strandzha for example) are of special interest

The Lepidoptera are special for a number of rea sons Because a large number of experts have been working on butterflies over a period of many years and because of the high degree of Lepidopteran spe cies diversity this order has contributed to the discov ery of unique communities in almost all parts of the country The Kresna defile gorge and the Sandanski Petrich valley are characterized by high butterfly di versity, and have been well investigated The Stara Planina, Rila, Vitosha, Pirin Slavyanka and western Rhodope Mountains are inhabited by unique faunisti cally rich relict and refugium communities, in some of which active species formation processes are under way In addition to endemic rare and relict taxa these mountains also support a large number of species found nowhere else in Bulgaria There are several other regions with extremely interesting communities lakes (wherein the high degree of faunal diversity is due to the ecotone effect), the Dobrudzha Black Sea coast between the towns of Balchik and Shabla (steppe and Mediterranean communities) and the southern Black Sea coast between the towns of Ach topol and Rezovo

Several Diptera biotopes occurring only along the Black Sea coast are of special interest because specific halophilous and psammophilous community types are found there They are exposed however, to severe anthropogenic pressure and are extremely vulnerable

Especially valuable with respect to all the groups described are the communities richest in endemic rare and relict species (Table 2) Such communities can be found in the Kresna defile gorge, the Sandanski Petrich valley on the Black Sea coast and in the higher parts of the Pirin Rila Stara Planina Vitosha Belasitsa, and Slavyanka Mountains

Ecologically Important Areas

For the order Trichoptera the most ecologically important areas are those portions of the watersheds above 800 m altitude, the glacial lakes, as well as the upper courses of a number of the Strandzha Mountain rivers the Fakiiska Ropotamo Dyavolska, Karaa gatchka Veleka Silistar, and Rezovska

For the Orthoptera there are similar territories in the high parts of the Stara Planina the northern Pirins the western and central Rila the whole territory of Belasitsa and Slavyanka and different parts of the Rhodopes

For the parasitic Hymenoptera areas of special eco logical importance exist along the Black Sea coast where unusual halophilic and xerophilic communities are found, as well as in the karst regions of the western Rhodopes Important areas for the Aculeata are found in similar lo calities but in low altitudes – the Sandanski Petrich valley the southern Thracian lowland and the western Predbal kan (in the vicinity of Belogradchik)

With respect to the Lepidoptera there are two types of areas of special ecological importance (1) ar eas in the high mountains, where a number of boreal alpine arcto alpine and mountain elements and glacial relicts are concentrated, (2) areas in the lower eleva tions (e g , Kresna gorge the Sandanski Petrich valley the northern Black Sea coast) where Mediterranean and steppe elements are concentrated

Special areas for the Diptera are evenly distributed along the Black Sea coast where most of the endemic and rare representatives of the order are concentrated

Based on this overview three zones of special ecological importance can be delineated (1) areas in and between the highest parts of the mountains, (2)

the middle course of the Strouma River and (3) along the Black Sea coast

Sensitivity to Human Impacts

The described insect groups and the communities in which they exist demonstrate different degrees of sensitivity to different types of pollution and other an thropogenic environmental influences The small iso lated populations on the Black Sea coast which deve lop in highly specific ecotone conditions are particu larly sensitive They are connected with stagnant (freshwater and brackish) or semi stagnant basins which are sensitive to pollution At the same time they typically exist in psammophilic and halophilic communities that are extremely vulnerable to anthro pogenic influence These conditions involve primarily representatives of the Lepidoptera and Diptera

The populations in relict and refugium community types concentrated in the orophytic zone of the mountains are also distinguished by their high degree of sensitivity to anthropogenic impacts In these com munities the anthropogenic impact is not so obvious and often the number of the populations is larger Some Orthoptera and many Trichoptera and Lepido ptera play very important roles in these communities

The Orthoptera Hymenoptera and Lepidoptera that inhabit the valleys (Kresna gorge the Sandanski Petrich valley and the Thracian lowland) probably demonstrate a moderate level of sensitivity to anthro pogenic impacts However these territories are most seriously affected by the use of agricultural and indus trial chemicals to which insects are highly sensitive Almost all groups of insects demonstrate high sensitiv ity to combinations of anthropogenic influence as commonly found on the Black Sea coast in the Thra cian lowland and in the Sandanski Petrich valley

Possible Threats

With respect to Trichoptera the larvae of which are aquatic the threats are mainly pollution and the drainage or serious reduction of waters in the upper course of rivers as a result of the hydrotechnical con struction For the other groups the threats are similar and are due mainly due to destruction of the habitats of whole communities treatment with insecticides cultivation of improper flora species necessitating the use of insecticides, pasturing of cattle in the higher slopes of the mountains, building of ski slopes and the treatment of these slopes with chemicals installation of mercury lighting fixtures which are very attractive for night insects in regions with rich entomofauna

Representative Sites

For the various orders, the most interesting repre sentative areas are located in the following regions

Orthoptera and Neupteroidea Slavyanka Belasitsa (above 800 m) and Strandzha Mountains and the Black Sea coast between Sinemorets and Rezovo

Hymenoptera for Parasitica the forest communities of the Rhodopes for Aculeata, the Thracian lowland the Sandanski Petrich valley, and the southern Black Sea coast

Trichoptera the Strandzha Stara Planina, the Rho dopes Rila, and Vitosha Mountains

Lepidoptera the Kresna defile gorge Zemen gorge and the volcanic hill of Kozhuh

Diptera the Black Sea coast

The three regions with extremely rich entomo fauna in Bulgaria are the valley of the middle course of the Strouma River, the Pirin mountains and the northern Black Sea coast

HISTORIC, CURRENT, AND POTENTIAL THREATS

The formation of the contemporary fauna began in the Tertiary period and continued into the Quater nary During the Tertiary some relict species were able to survive in euxinous communities, concentrated mainly in the Tundzha Strandzha subregion During the Quaternary a large number of glacial relicts with boreal mountain and arcto alpine distribution survived throughout the high mountains

In the last 1000 years human influence has brought about the extinction of almost all the primary *Quercus* forest flora and a number of *Pinus* communi ties in the high parts of the mountains In the last few decades, the small number of steppe communities that survived in northeastern Bulgaria have also been ex tirpated Now the threats to the survival of the fauna are considerably more serious, and somewhat more specific to the different groups

With respect to the Trichoptera pollution of the rivers in the plains has reduced faunistic diversity (for example, in the Danube and Strouma river) and even totally destroyed it (for example in the Iskar from Sofia to Mezdra and the Maritsa below the town of Kritchim) The most threatened species are those whose larvae develop in the middle and lower courses of the rivers The Trichoptera are quite sensitive to changes in the aquatic environment and are extremely vulnerable to anthropogenic influences that are strongest in these regions – the alteration of river courses untreated industrial and household waste wa ters and so forth

As for the other insect groups the most threatened populations are those that inhabit the lowlands (the Sandanski Petrich valley the Thracian lowland) and the

Black Sea coast, where the anthropogenic influence is strongest The negative impact on Hymenoptera (Acu leata) in the regions of Stara Zagora Plovdiv Zlatitsa, Pirdop, Bourgas, Sofia, and the Vitosha Mountain has been demonstrated There are potential threats for the Lepidoptera in the region of the Kozhuch volcanic hill, where a resort has been planned, and in the region of Sinemorets as a result of unplanned resort development All activities associated with cultivation, enlargement of beaches and construction along the Black Sea coast are a real threat to the survival of the unique halophilic and psammophilic communities in which many Diptera dominate

RECOMMENDATIONS

The insect orders described need both specific and general recommendations for conservation Specific re commendations for the survival of the different groups are

Orthopteroidea and Neuropteroidea Halt the unplanned and uncontrolled use of chemicals in agriculture and forestry Cease entirely the use of chemicals in moun tain forest communities Require environmental con trols on activities in the mountain regions

Hymenoptera Prevent the unplanned use of chemicals on arable lands Conserve the small "islands" of unculti vated land in monoculture areas (around poles trees bushes etc) where plants important to insect survival grow This is an especially important factor for the sur vival and dispersal of a number of parasitic insects

Trichoptera Require environmental impact assessments of all the hydrotechnical activities in the mountains Control the waste treatment facilities in the mountain huts and hotels Reduce river pollution to a minimum Protect important natural areas

Lepidoptera Conduct studies of the regional fauna in northern Bulgaria Protect important natural areas Prepare red data books Bring a stop to the unplanned releases of pheasants and partridges which feed on the entire invertebrate fauna Select lighting fixtures with reduced ultraviolet radiation

Diptera Reduce to a minimum the destruction of the halophilic and psammophilic communities at the Black Sea coast Protect important natural areas

In most cases, the general recommendations for conservation concern all invertebrates For a long time the conservation of invertebrates has depended on the protection of forests and large vertebrates It was even assumed that it was sufficient to protect only the territo ries of importance to a few vertebrates Some of the recommendations offered below are important not only for the insects described in this paper but for many other organisms and community types

- Publish red registers' and a red data book on Bul garia's invertebrates

- Investigate the entomofauna in the protected areas and publish faunistic registers of the invertebrates living there This has not yet been done for any Bulgarian reserve

- Establish protected natural areas and expand ex isting areas in regions where the insect fauna richest in endemic, rare, relict and threatened taxa are concentrated Based on the data presented above, we propose the following changes and additions in the network of protected areas

  1 Increase the area included in the Tissata Reserve in the Sandanski Petrich valley Give the "Kozhucha" natural area the status of a reserve Establish a reserve that includes parts of all the plant zones of the Belasitsa Mountain The en largement of the protected territories in this re gion is very important It contains the largest number of endemic and rare species (about 215) and ranks first in Bulgaria in insect biodiversity

  2 Establish reserves at the Shabla and the Ezerets Lakes near the Black Sea coast in the area be tween the "Bolata" and the "Roussalka resorts in the area of "Beliya bryag" between the Bal chik tuzla and the town of Kavarna on the southern Black Sea coast, in the area around the firth of the Karaagach River and in the region between the Veleca and Rezovska Rivers The Black Sea coast is very vulnerable to constantly increasing anthropogenic pressures The com munities richest in endemic and rare taxa (142 on the northern and 120 on the southern Black Sea coast) are highly concentrated there and were protected until recently by the strict con trols along the borders

  3 Establish a national park in the western Stara Planina Mountains, and link this park to that which exists in the central part of the mountains Enlarge the system of protected areas in the eastern Stara Planina A considerable number of rare endemic, and relict taxa (220 altogether) are concentrated in the Stara Planina Mountains and many of them are found only there

  4 Establish a national park in the western Rhodopes that includes parts of the Dabrash, Mursalitsa and Chernatitsa Mountains The rich insect fauna of the Rhodopes, with 206 endemic, rare, and relict species, is relatively intact A special protected

territory should be established to the southwest of the Ivaylovgrad Dam in order to ensure the protection of a number of unique communities of Mediterranean character in the region

5 Enlarge the protected areas in the region of Strandzha Mountain, where a large number of Tertiary relict communities of euxinous type have been preserved Establish a national park on a part of Strandzha Mountain

Appendix 1 Bulgarian Endemic Species of Orthoptera and Neuroptera

ORTHOPTERA

ACRIDIDAE

Stenobothrus (Stenobothrus) bulgaricus Ramme 1933
Rhodopi mountain Hvoyna Chepelare

GRYLLIDAE

Diskoptila buresi Maran 1958
Aladzha manastir

Gryllomorpha dalmatina strumae Andreeva 1982
Blagoevgrad Melnik Kozhouh mtn

Tartarogryllus sandanski Andreeva, 1982
Petrich Marino pole

PAMPHAGIDAE

Paranocarodes chopardi Peshev 1965
E Rhodopi mtn, Pelevoun

TETTIGONIIDAE

Ephippiger ephippiger balcanicus Andreeva, 1985
N Bulgaria Stara planina

Ephippiger ephippiger varnensis Andreeva, 1985
Kavarna Balchik Pobiti kamani near Varna

Eupholidoptera beybienkoi Peshev, 1962
Loukovit, Ribaritsa

Eupholidoptera marani Peshev 1960
Rila mtn Bistritsa, Petrich

Isophya andreevae Peshev 1981
Kresnensko defile

Isophya bureschi Peshev 1959
Rila mtn Semkovo Youndola Pirin mtn Bansko

Isophya gulae Peshev, 1981
Elhovo Gorna and Dolna Topchiya

Isophya hospodai medimontana Nedelkov 1908
Lyoulin above Knyazhevo Lozenska mtn Germanski manastir

Isophya kisi Peshev 1981
Pirin mtn Popina luka, Papaz chair Slavyanka mtn

Isophya miksici Peshev 1985
W Stara planina mtn peak Kom Berkovitsa Vratsa

Isophya modesta longicaudata Ramme 1951
Dobroudzha Black Sea coast

Isophya petcovi Peshev, 1959
Central and East Rhodopi mtn and adjacent parts of Thracian lowland, Ahtopol

Isophya plevnensis Peshev, 1985
Loukovit, Pleven, Pavlikeni

Isophya pravdini adamovici Peshev, 1985
Sliven Sinite kamani

Isophya pravdini bazyluki Peshev 1985
Central Stara planina mtn peak Ambaritsa

Isophya parvdini pravdini Peshev, 1985
Central Stara planina mtn Troyan pass

Isophya rammei Peshev, 1981
Malko Turnovo

Isophya rhodopensis Ramme 1951
West and Central Rhodopi mtn

Pholidoptera aptera bulgarica Maran, 1952
Kresnensko defile, Pirin mtn, Strandzha mtn

Pholidoptera buresi Maran 1957
Pirin mtn, Popina luka

Pholidoptera hoberlandti Maran 1957
Rila mtn Rilski manastir

Poecilimon affinis medimontanus Peshev, 1980
Sredna gora mtn peak Bratiya

Poecilimon affinis rilensis Peshev, 1980
Rila mtn Rilski manastir, Parangalitsa

Poecilimon affinis ruenensis Peshev, 1980
Osogovo mtn peak Rouen

Poecilimon bulgaricus Andreeva 1980
Belasitsa mtn peak Kalabak

Poecilimon harzi Peshev, 1980
Pirin mtn

Poecilimon kisi Peshev 1980
Belasitsa mtn peak Kalabak

Poecilimon mistshenkoi marzani Peshev, 1980
Pirin mtn

Poecilimon mistshenkoi mistshenkoi Peshev, 1980
Pirin mtn

Poecilimon mistshenkoi tinkae Peshev, 1980
Belasitsa mtn peak Kalabak

Poecilimon mistshenkoi vlachinensis Peshev 1980
Vlachina mtn, Maleshevska mtn, Ograzhden mtn

Poecilimon peshevi Andreeva 1978
Vlachina mtn

RAPHIDOIOPTERA

RAPHIDIIDAE

Phaeostigma (Pontographidia) rhodopica Klapalek 1894
Rhodopi mtn Dobraluk Hvoyna

Appendix 2 Balkan Endemic Species of Orthoptera and Neuroptera

BLATTODEA

ECTOBIIDAE

Phyllodromica (Phyllodromica) carniolica Ramme 1913
Vitosha mtn Rila mtn

NEUROPTERA

NEURORTHIDAE

Neurorthus apatelios Aspck Aspck & Hlzel, 1977
Central Stara planina mtn, Vitosha mtn, Rhodopi mtn, Osogovo mtn

ORTHOPTERA

ACRIDIDAE

Chortippus (Chortippus) parallelus tenuis Brulle 1832
Malko Turnovo Bela Voda

PAMPHAGIDAE

Paranocaracris bulgaricus bulgaricus Ebner & Drenowski 1930
Strouma valley Pirin mtn Slavyanka mtn Strugach mtn, Mesta valley, Rhodopi mtn

RHAPHIDOPHORIDAE

Troglophilus neglectus vlasinensis Maran 1958
caves in West Stara planina mtn SW Bulgaria and Rhodopi mtn

TETTIGONIIDAE

Ancistrura nigrovittata Brunner van Wattenwyl 1878
Vitosha mtn, Belasitsa mtn Slavyanka mtn Rhodopi mtn, Eastern Stara planina mtn

Gampsocleis abbreviata Hermann 1874
Slavyanka mtn

Isophya hospodar hospodar Saussur 1898
Sofia Chirpan Eastern Rhodopi mtn, Sakar mtn Strandzha mtn

Isophya modestior modestior Brunner von Wattenwyl, 1882
Vitosha mtn, Western Stara planina mtn

Isophya obtusa Brunner von Wattenwyl 1882
Central Stara planina mtn peak Vezhen

Metrioptera (Broughtonia) arnoldi Ramme 1933
Stara planina mtn, Vitosha mtn Lyulin mtn Rila mtn Pirin mtn Rhodopi mtn

Metrioptera (Oreseliana) fedtschenkoi ambitiosa Uvarov 1924
Strouma valley Trhacian lowland Strandzha mtn Black Sea coast

Metrioptera (Vichetia) oblongicollis Brunner von Wattenwyl 1882
Stara planina mtn Pirin mtn Rhodopi mtn Strandzha mtn Osogovo mtn Slavyanka mtn, Sakar mtn, Black Sea coast

Pholidoptera aptera karnyi Ebner 1908
all Bulgarian high mountains

Pholidoptera macedonica Ramme 1928
Belasista mtn Slavyanka mtn

Pholidoptera rhodopensis Maran 1952
Rila mtn Kostenets

Platycleis (Modestana) ebneri ebneri Ramme 1926
Belasitsa mtn

Platycleis (Montana) macedonica Berland & Chopart, 1922
Strouma valley

Poecilimon elegans Brunner von Wattenwyl 1878
Central part of North Bulgaria Lyulin mtn, Vitosha mtn Rila mtn Rhodopi mtn Sredna gora mtn

Poecilimon macedonicus Ramme 1926
Southwest Bulgaria

Poecilimon orbelicus Pancic, 1883
Belasitsa mtn Slavyanka mtn Pirin mtn Rila mtn, Rhodopi mtn

Poecilimon zwicki Ramme 1939
Strouma valley Ograzhden mtn Belasitsa mtn Slavyanka mtn Pirin mtn Rhodopi mtn

Psorodonotus fieberi Frivaldszky, 1853
Stara planina mtn Osogovo mtn Vlachina mtn Pirin mtn Belasitsa mtn Rila mtn Rhodopi mtn

Saga campbelli gracilis Kis 1962
East Bulgaria

Saga rammei Kaltenbach 1965
Petrich, Slavyanka mtn Popovitsa near Plovdiv

RAPHIDIOPTERA

RAPHIDIIDAE

Phaeostigma (Phaeostigma) pilicollis Stein 1863
Stara planina mtn Strouma valley Belasitsa mtn Rila mtn Rhodopi mtn

Appendix 3 Rare Species of Orthoptera and Neuoptera

BLATTODEA
ECTOBIIDAE
Ectobius punctatissimus Ramme 1923
Strandzha mtn Gramatikovo

POLYPHAGIDAE
Polyphaga aegyptiaca Linnaeus 1758
Sandanski Kozhouh mtn

DERMAPTERA
CARCINOPHORIDAE
Anisolabis maritima Gene 1832
Sozopol

FORFICULIDAE
Anechura bipunctata Fabricius 1781
Asenovgrad
Apterygida media Hagenbach 1822
Zemen Skakavitsa

EMBIOPTERA
EMBIIDAE
Haploembia solieri Rambur 1842
Kresnensko defile Kozhouh mtn, Maslen nos

ISOPTERA
KALOTERMITIDAE
Kalotermes flavicollis Fabricius 1793
Records in Bulgaria uncertain

MANTODEA
MANTIDAE
Iris oratoria Linnaeus 1758
Petrich Harmanli Ivaylovgrad

MECOPTERA
BITTACIDAE
Bittacus tipularius Linnaeus 1758
Svishtov Varna Sredna gora mtn

BOREIDAE
Boreus westwoodi Hagen 1866
Vitosha mtn Sredets Rila mtn Saru gyol

MEGALOPTERA
SIALIDAE
Sialis nigripes Pictet 1865
Lovech Devetaki

NEUROPTERA
ASCALAPHIDAE
Delepiroctophylla australis Fabricius 1787
Ropotamo river

CHRYSOPIDAE
Chrysopa phyllochroma Wesmael 1841
Preslav Han Kroum Arkoutina, Strandzha mtn Katoun dere
Chryospa walkeri Mac Lachlan 1893
Rakovitsa near Koula, Rabisha
Nineta vittata Wesmael 1841
Stara planina mtn Petrohan, Vitosha mtn Zlatni mostove
Nothochrysa capitata Fabricius 1793
Rila mtn Borovets
Peyerimhoffina gracilis Sneider 1851
Rila mtn Borovets Western Rhodopi mtn Orfev

CONIOPTERYGIDAE
Aleuropteryx juniperi Ohm, 1968
Sliven Karandila, Rhodopi mtn Markovo
Aleuropteryx loewii Klapalek 1894
Western Stara planina mtn Eleshnitsa, Pirin mtn Predela
Aleuropteryx umbrata Zeleny, 1964
Belogradchik, Kresnensko defile
Coniopteryx (Coniopteryx) pygmaea Enderlein 1906
Kotel
Coniopteryx (Holoconiopteryx) haematica Mac Lachlan 1968
Sliven Karandila
Coniopteryx (Xeroconiopteryx) loipetsederi Aspck 1963
Primorsko
Conwentzia psociformis Curtis 1834
Kotel Plana mtn Kokalyanski manastir
Helicoconis aptera Messner 1965
Sandanski
Helicoconis lutea Wallengren 1871
Rila mtn Borovets Rhodopi mtn Smolyan
Hemisemidalis pallida Withycombe, 1924
Kresnensko defile
Parasemidalis fuscipennis Reuter, 1894
Rhodopi mtn Markovo

HEMEROBIIDAE
Hemerobius (Hemerobius) atrifrons Mac Lachlan 1868
Stara planina mtn Petrochan
Hemerobius (Hemerobius) schedli Hlzel 1970
Rila mtn Sitnyakovo Marishki chal
Hemerobius (Hemerobius) zernyi Esben Petersen 1935
Kresnensko defile
Psectra diptera Burmeister 1839
Zemen Skakavitsa

Appendix 3 Rare Species of Orthoptera and Neuoptera (continued)

Sympherobius (Niremberge) klapaleki Zeleni, 1963
Kotel Plana mtn Kokalyanski manastir
Rhodopit mtn Smolyanski ezera
Wesmaelius (Kimminsia) tjederi Kimmins, 1963
Pirin mtn Bunderitsa
Wesmaelius (Wesmaelius) quadrifasciatus Reuter, 1894
Rila mtn Borovets

MANTISPIDAE
Mantispa perla Pallas, 1772
Kresnensko defile Stara Zagora
Mantispa styriaca Podna, 1761
Sofia, Kresnensko defile Stara Zagora

MYRMELEONTIDAE
Delfimeus irroratus Olivier 1811
Belogradchik Kresnensko defile Sandanski
Myrmeleon (Myrmeleon) noacki Ohm 1965
Kresnensko defile, Strandzha mtn
Nedroledon anatolicus Navas 1914
Belasitsa mtn, Strandzha mtn peak Papia
Nicarinus poecilopterus Stein 1863
Karlovo

SISYRIDAE
Sisyra terminalis Curtis, 1854
Strandzha mtn Kovach

ORTHOPTERA
ACRIDIDAE
Chorthippus (Chorthippus) montanus Charpentier 1825
Western Stara planina mtn
Chorthippus (Glyptobothrus) vagans Eversmann 1848
Western Stara planina mtn Pursheviitsa
Dociostaurus (Dociostaurus) tartarus Uvarov, 1921
Petrich Marino pole
Dociostaurus (Stauronotulus) kraussi kraussi Ingenizkij 1897
Varna Pobiti kamani
Duroniella laticornis Krauss, 1909
Rhodopi mtn Popsko
Epacromius coerulipes Ivanov 1887
Sozopol
Epacromius tergestinus Charpentier 1825
Petrich
Pallasiella turcomana Fischer de Waldheim, 1833
Petrich Marino pole Pirinska Bistritsa river
Platypygius crassus Karny, 1907
Ropotamo river

CATANTOPIDAE
Miramella (Miramella) alpina collina Brunner von Wattenwyl 1882
Rila mtn Kostenets
Odontopodisma schmidti Fieber 1853
Western Stara planina mtn Rhodopi mtn Asenovgrad

GRYLLIDAE
Arachnocephalus vestitus Costa 1855
Varna, Pomorie Sozopol
Gryllus bimaculatus De Geer 1773
exact locality unknown
Modiocogryllus geticus Vasiliu, 1970
Melnik, Ropotamo river
Pteronemobius heydeni tartarus Saussure 1874
Ograzhden mtn Lebnitsa
Tartarogryllus burdigalensis Latreille 1804
Sofia Rhodopi mtn Bratsigovo, Krichim

TETTIGONIIDAE
Andreinimon nuptialis Karni 1918
Kresnensko defile, Petrich
Barbitistes constrictus Brunner von Wattenwyl, 1878
Rila mtn Sitnyakovo
Leptophyes discoidalis Frivaldszky, 1867
Kresnensko defile Berkovitsa Vratsa
Metrioptera (Broughtonia) domogledi Brunner von Wattenwyl 1882
Western Stara planina mtn
Pholidoptera brevipes Ramme 1939
Kotel, Zheravna Nesebur Orizare
Platycleis (Montana) stricta Zeller 1849
Sofia, Rial mtn peak Elenin vruh
Platycleis (Platycleis) falx Fabricius 1775
Rhodope mtn
Platycleis (Tesselana) orina Burr 1899
Sakar mtn
Platycleis (Tesselana) tesselata Charpentier, 1825
Sofia
Poecilimon affinis affinis Frivaldszky 1867
Western Stara planina mtn peak Kom, Sveti Nikolska planina
Poecilimon heinrichi Ramme 1951
Strandzha mtn Bela Voda, Kovach
Poecilimon miramae Ramme 1933
Strandzha mtn Bela Voda
Xya pfaendleri Harz 1970
Southwest Bulgaria, Rhodopi mtn

RAPHIDIOPTERA
INOCELLIIDAE
Parainocellia (Parainocellia) braueri Albarda, 1891
Rila mtn Rilski manastir Primorsko

Appendix 3 Rare Species of Orthoptera and Neuoptera (continued)

RAPHIDIIDAE
Phaeostigma (Pontoraphidia) setulosa setulosa
Aspck & Aspck, 1967
Sliven Karandila

Puncha ratzenburgi Brauer 1876
Rila mtn peak Popova shapka

Appendix 4 Relict Species of Orthoptera and Neruoptera

NEUROPETERA
HEMEROBIIDAE
Wesmaelius (Kimminsia) maladai Navas 1925
Vitosha mtn Osogovo mtn, Rila mtn, Rhodopi mtn, Karlovo, Radomir

ORTHOPTERA
ACRIDIDAE
Aeropedellus variegatus Fischer de Waldheim, 1846
Rila mtn, Pirin mtn

CATANTOPIDAE
Melanoplus frigidus Boheman, 1846
Stara planina mtn peak Botev Pirin mtn Kamenitsa Slavyanka mtn

PAMPHAGIDAE
Paranocarodes straubei straubei Fieber, 1853
Sliven Strandzha mtn, South Bulgarian Black Sea coast

Appendix 5 Bulgarian Endemic Species of Hymenoptera Parasitica

PARASITICA
BRACONIDAE
Angelovia elypsocubitalis Zaykov
Rhodopi mtn Dolno Loukovo hut Arda
Opius daghnoides Zaykov & Fischer
East Rhodopi mtn Konush
Opius plovdivensis Zaykov
Plovdiv
Opius rarus Zaykov
Rhodopi mtn Markovo
Symphya pappi Zaykov
Rhodopi mtn Peshtera Hrabrino

ICHNEUMONIDAE
Batakomacrus crassicaudatus Kolarov
Rhodopi mtn Batak Stoykite Hrabrino Asenovgrad
Cryptopimpla eleganta Kolarov
Rhodopi mtn hut Tshoudnite mostove
Misetus tyloidalis Kolarov
Strandzha mtn Malko Turnovo
Nothocremastus nigritulus (Kolarov)
Rhodopi mtn hut Tshoudnite mostove

MIMARIDAE
Anagrus vilis Donev
Primorsko
Erythmelus angelovi Donev
Asenovgrad Loukouvitsa
Ooctonus flaviventris Donev
Rhodopi mtn Pamporovo
Rhila bulgarica Donev
Rila mtn hut Bodrost

PROCTOTRUPOIDEA
Trissolcus argus Petrov
Rhodopi mtn peak Karandzhiluka
Trissolcus erectus Petrov
Rhodopi mtn Malevo
Trissolcus fuscus Petrov
Stara planina mtn hut Momina polyana
Trissolcus nigricans Petrov
Rhodopi mtn Boykovo
Trissolcus simplex Petrov
Stara planina mtn hut Dermenka

Appendix 6 Rare Species of Hymenoptera Parasitica

PARASITICA
ICHNEUMONIDAE
Boethus thoracicus (Giraud)
Rhodopi mtn Dolno Loukovo
Eclytus exornatus (Gravenhorst)
Rhodopi mtn Batak
Iseropus stercorator (Fabricius)
Rhodopi mtn Asenovgrad
Itoplectis curticauda (Kriechbaume
Stara planina mtn Peak Kom

Itoplectis melanocephala (Gravenhorst)
Sinemorets
Perithous albicinctus (Gravenhorst)
Rhodopi mtn Gorna Mesta
Piogaster pilosator (Aubert)
Rhodopi mtn Shiroka polyana
Theronia laevigata (Tschek)
Rhodopi mtn Velingrad

Appendix 7 Relict Species of Hymenoptera Parasitica

PARASITICA
ICHNEUMONIDAE
Cryptopimpla sordida (Hedvig)
Rhodopi mtn peak Prespa

Appendix 8 Bulgarian Endemic Species of Hymenoptera Aculeata

ACULEATA
ANDRENIDAE
Andrena bisulcata Morawitz
Sandanski
Andrena cinereophila Warncke
Ivaylovgrad Kobilino
Andrena combaela Warncke
Sandanski
Andrena combinata Christ
Kresna Sandanski
Andrena curvungula Thomson
Sandanski
Andrena floricola Eversmann
Sandanski
Andrena intermedia Thomson
Ivaylovgrad Kobilino

ANTHOPHORIDAE
Biastes emarginathus Schenck
Slanchev bryag
Parammobatodes minutus Mocsary
Sandanski

EUMENIDE
Alastor bulgaricus Atanassov
Marikostino

FORMICOIDEA
Camponotus samius Forel
Asenovgrad
Cardiocondyla stambuloffi Forel
Sliven Bourgas Michourin
Leptothorax bulgaricus Forel
Zemen
Proformica kobachidzei Arn
Vitosha mtn Bistritsa
Proformica pillosiscapus Dluss
Gotse Delchev Dolno Dryanovo

HALICTIDAE
Halictus xanthopus Kirby
Belogradchik
Sphecodes ferruginathus Hags
Sandanski

MASARIDAE
Ceramius bureschi Atanassov
Sofia Vrana

MEGACHILIDAE
Osmia bischoffi Atanassov
Varna Euxinograd
Pseudoanthidium reticulatum mocsary Fs
Sandanski

Appendix 9 Balkan Endemic Species of Hymenoptera Aculeata

ACULEATA
ANDRENIDAE
Andrena biggutata Friese
Sandanski Kozhouh mtn
Andrena cardalia Warncke
Sandanski
Andrena lamiana Warncke
Sandanski
Andrena simontornyella Noskiewicz
Berkovitsa

FORMICOIDEA
Leptothorax rottenbergi var balcanica Sants
Sandanski Kocherinovo

HALICTIDAE
Halictus frontalis Perez
Kroumovgrad

Appendix 10 Rare Species of Hymenoptera Aculeata

ACULEATA
ANDRENIDAE
Andrena aenei entris Moravitz
Sandanski Kroumovgrad
Andrena albopunctata Rossi
Belogradchik
Andrena bicarinata Mor
Vrushka chouka

Appendix 10 Rare Species of Hymenoptera Aculeata (continued)

Andrena chrysosceles Kirby
Belogradchik Vratsa
Andrena denticulata Kirby
Asenovgrad
Andrena dorsata Kirby
Belogradchik Sandanski
Andrena erberi Mor
Varna
Andrena erythrocnemis Moravitz
Ivaylovgrad Kobilino, Bourgas Granichar
Andrena figurata Mor
Lovech Kroushovitsa
Andrena fimbriata Brull
Harmanli
Andrena fulvago Christ
Belogradchik
Andrena gallica Schm
Rhodopi mtn Stoykite
Andrena gravida Imhoff
Zanozhene
Andrena lathyri Alfken
Belogradchik, Godech
Andrena minutula Kirby
Sandanski Chuprene
Andrena mucida Kriechb
Berkovitsa, Stara Zagora
Andrena nigriceps Kirby
Petrohan Rhodopi mtn Stoykite
Andrena nitida Miller
Vrushka chouka
Andrena ovatula K
Belogradchik Godech
Andrena polita Smith
Trigrad, Vratsa, Berkovitsa
Andrena symphyti Schmdkt
Berkovitsa
Andrena truncatilabris Mr
Godech Krushovitsa
Andrena tscheki Mor
Vrushka chouka
Andrena ventricosa Dours
Sandanski
Andrena vulpecula Kv
Golo burdo mtn
Andrena wilkella Kirby
Loukovitsko dere river, Elhovo

ANTHOPHORIDAE
Amegilla albigena Lep
Loukovitsko dere river Marikostino.*Amegilla garrula* Rossi
Petrich Sosopol Loukovitsko dere river
Amegilla ochroleuca Perez
Byala
Amegilla quadrifasciata Vill
Stara Zagora Zagore
Amegilla quadrimaculata Pans
Vitosha mtn Zheleznitsa
Anthophora agama Radosk
Belogradchik Vrushka chouka
Anthophora borealis Mor
Rhodopi mtn hut "V Kolarov"
Anthophora croceipes Mor
Asenovgrad
Anthophora dufourii Lep
Stara Zagora
Anthophora fulvitarsis Brulle
Kozhouh mtn
Anthophora monacha Er
Rhodopi mtn Shadiitsa hut 'Orfey "
Anthophora mucida Grib
Loukovitsko dere river
Anthophora podagra Lep
Godech
Anthophora robusta Klug
Loukovitsko dere river
Anthophora tarsata Spin
Belasitsa mtn
Anthophora testaceipes Mr
Yakorouda
Biastes emarginatus Schenck
Slunchev bryag
Biastes truncatus Nyl
Belasitsa mtn
Ceratina acuta Friese
Berkovitsa
Ceratina callosa Fabr
Kozhouh mtn
Epeoloides coecuticus F
Berkovitsa
Epeolus cruciger Panz
Elhovo
Epeolus schummeli Schiling
Sandanski
Eucera atteirima Friese
Loukovitsko dere river, Stara Zagora
Eucera caspica var perezi Mocs
peak Vedernik
Eucera dalmatica Lep
Belasitsa mtn Marikostino Kozhouh mtn
Eucera eucnemidea Dokrs
Vratsa
Eucera longicornis pillichii Alfk
Loukovitsko dere river Stara Zagora
Eucera nitidiventris Mocs
Berkovitsa, Petrich Kroushovitsa
Eucera numida Lep
Sandanski
Eucera seminuda Brulle
Belogradchik, Berkovitsa Godech
Eucera similis Lep
Pleven Stara Zagora
Eucera spectabilis Mocs
Belogradchik Kozhouh mtn

Appendix 10 Rare Species of Hymenoptera Aculeata (continued)

Eucera vittulata Nosk
Lovech Kroushovitsa
Melecta armata Pan
Vrushka chouka Harmanli
Melecta funeraria Sm
Belasitsa mtn Harmanli
Melecta luctuosa Scop
Stara Zagora Alibotoush mtn, Kurdzhali
Nomada basalis H Sch
Belogradchik Granitovo
Nomada kohli Schmd
Vrushka chouka
Nomada mocsaryi Schmied
Lovech Kroushovitsa
Nomada nobilis H Sch
Petrich Mitinovo, Loukovitsko dere river
Nomada pusilla lepeletieri Perez
peak Vedernik
Nomada sybarita Shmied
Lovech Kroushovitsa
Tetralonia armeniaca Mor
Loukovitsko dere river
Tetralonia dentata Kl
Vurtshets
Tetralonia graja Ev
Stara Zagora Elhovo Momchilgrad
Tetralonia lyncea Mocs
Stara Zagora
Tetralonia pollinosa Lep
Harmanliyska river
Tetralonia salicariae Lep
Belogradchik, Elhovo
Tetralonia scabiosae Lep
Klisoura monastery
Tetralonia tricincta Erichs
Kozhouh mtn, Petrich
Thyreus affinis F Mor
Michourin
Thyreus histrionicus Ill
Michourin *Triepeolus tristis* Smith
Slunchev bryag

APIDAE

Bombus alticola Kriechb
Rhodopi mtn, Rila mtn, Stara planina mtn peak Vezhen
Bombus armeniacus Rad
Sredna gora mtn Stara planina mtn Lyulin mtn
Bombus bureschi Pitt
Rhodopi mtn Smolyan
Bombus derhamellus var integer Lef
Alibotoush mtn
Bombus elegans Seidl
Alibotoush mtn Vitosha mtn Boyana
Bombus equestris F
Rila mtn, Vitosha mtn
Bombus gerstecker Mor
Rila mtn
Bombus hypnorum L
Etropole Vitosha mtn
Bombus jonellus K
Rhodopi mtn, Rila mtn
Bombus lapponicus hypsophilus Skor
Alibotoush mtn, Stara planina mtn
Bombus mastrucatus Gerst
Rhodopi mtn, Kostenets
Bombus muscorum F
Sredna gora, Stara planina mtn, Lyulin
Bombus niveatus Kriechb
Vitosha mtn
Bombus pomorum Pz
Alibotoush mtn Pirin mtn
Bombus pratorum tatranus Rad
Stara planina mtn Vitosha mtn, Alibotoush mtn
Bombus pyrenaeus Per
Vitosha mtn
Bombus sicheli Rad
Vitosha mtn hut "Aleko "
Bombus subterraneus L
Rila mtn, Vitosha mtn Alibotoush mtn
Bombus terrestris cryptarum Fabr
Marikostino
Bombus tristis Seidl
Vitosha mtn
Bombus vorticosus Gerst
Alibotoush mtn, Rhodopi mtn, Lyulin
Bombus zonatus Sm
Petrich Rhodopi mtn
Psithyrus barbutellus K
Stara planina mtn Troyan
Psithyrus bohemicus Seidl
Vitosha mtn Zlatni mostove
Psithyrus distinctus Per
Stara planina mtn Teteven, Troyan
Psithyrus maxillosus Klug
Stara planina mtn Beklemeto
Psithyrus meridionalis Rich
Stara planina mtn Teteven
Psithyrus rupestris F
Stara planina mtn peak Bratanitsa
Psithyrus sylvestris Lep
Stara planina mtn Kalofer Teteven peak Vezhen
Psithyrus vestalis Fourer
Zheravna

CHRYSIDIDAE

Chrysis fulgida L
Stara Zagora Loukovitsko dere river
Chrysis nitidula F
Karlovo
Chrysis pulchella Spin
Belogradchik
Chrysis sexdentata Christ
Harmanli

Appendix 10 Rare Species of Hymenoptera Aculeata (continued)

Hedychridium purpurescens var maculatum
Buysson
Asenovgrad
Hedychridium sculpturatum Hb
Sofia
Parnopes grandior var fasciata Mocs
Asenovgrad
Spinolia chalcites Mocs
Rakovishki monastery
Stilbum cyanurum var calens Spin
Bachkovski monastery

COLLETIDAE
Colletes anchusae Nosk
Vrushka chouka
Colletes cecrops Nosk
Sandanski
Colletes daviesanus crassus Warncke
Sandanski
Colletes eos Morise
Rhodopi mtn
Colletes hylaeiformis Eversmann
Harmanli Elhovo
Colletes maidli Nosk
Slunchev bryag, Sandanski
Colletes marginatus Sm
Belogradchik Granitovo
Colletes mlokossewiczi Radoszkovsky
Sandanski Godech
Colletes nasutus Smith
Petrich, Elhovo, Loukovitsko dere river
Colletes pallescens Nosk
Berkovitsa, Varshets
Colletes similis Schck
Berkovitsa Sandanski
Colletes succinctus L
Belogradchik
Prosopis euriscapa Frster
Sandanski Slunchev bryag
Prosopis gibba E Saund
Stara Zagora Zagore
Prosopis inevicornis Nylander
Slunchev bryag
Prosopis lineolata Schenck
Slunchev bryag
Prosopis polita Forster
Sandanski
Prosopis regnata Panzer
Sandanski

EUMENIDAE
Ancistrocerus parietinna L
Marikostino
Eumenes flavigularis Bl
Loukovitsko dere river
Eumenes papillarius Christ
Belogradchik
Eumenes pomiformis Rossi
Belasitsa mtn
Eumenes subpomiformis Rossi
Asenovgrad

FORMICOIDEA
Aphaenogaster gibbosa Latr
Petrich
Aphaenogaster subterranea Latr
Belasitsa mtn
Bothriomyrmex communista Sant
Petrich
Bothriomyrmex meridionalis Em
Petrich
Camponotus lateralis lateralis Olivier
Belasitsa mtn
Camponotus lateralis picea Leach
Belasitsa mtn, Malko Turnovo
Cataglyphis nodus Brulle
Svilengrad, Ognyanovo
Dolichoderus quadripunctatus Linne
Belasitsa mtn
Formica cunicularia glauca Ruzhky
Teteven, Chirpan, Loukovitsko dere river
Formica truncorum Fabr
Sandanski, Belogradchik Bleshnitsa
Formicoxenus nidulans Nyl
Belasitsa mtn
Leptothorax acervorum muscorum Nyl
Vitosha mtn
Leptothorax clypeatus Mayr
Obzor
Leptothorax tuberum clypeatus Mayr
Purvomaj
Leptothorax tuberum corticalis Schenck
Stroumeshnitsa river
Leptothorax tuberum unifasciatus Latr
Belasitsa mtn
Messor clivorum Ruzsky
Vitosha mtn Vratsa
Messor semirufus meridionalis Andre
Belsitsa mtn, Obzor Harmanli
Myrmecina graminicola Latr
Sandanski, Svilengrad
Myrmica sancta Karaw
Rila mtn, Kostenets
Myrmica scabrinodis sabuleti Meinert
Vitosha mtn
Myrmica scabrinodis scabrinodis Nylander
Belasitsa mtn
Myrmica scabrinodis schencki Emery
Blagoevgrad Mitinovo
Myrmica sulcinodis Nyl
Belasitsa mtn
Ponera coarctata Latr
Belasitsa mtn
Prenolepis nitens Mayr
Malko Turnovo

Appendix 10 Rare Species of Hymenoptera Aculeata (continued)

Stenamma westwoodi Westwood
Belasitsa mtn
Strongilognathus testaceus Schenck
Belasitsa mtn
Tapinoma erraticum nigerrimum Nyl
Kozhouh mtn
Tetramorium taurocaucasicum K
Primorsko

HALICTIDAE
Halictus biccallosus Mor
Golo burdo mtn
Halictus clypearis Schck
Lozenska mtn, Vitosha mtn
Halictus costullatus Kriechb
Kroushovitsa
Halictus damascens Per
Varna
Halictus kessleri Brams
Lovech
Halictus lativentris Schenck
Krichim, Rhodopi mtn
Halictus limbellus Mor
Belovo
Halictus linearis Schenck
Lovech Troyan Sliven
Halictus marginellus Schenck
Varna
Halictus pallens Brull
Krichim, Rhodopi mtn
Halictus patellatus Mor
Vitosha mtn Byalata voda
Halictus pollinosus Sichel
Rouse
Halictus pygmaeus Schenck
Belovo
Halictus semitectus Mor
Kroushovitsa
Halictus setulosus Strand
Golo burdo mtn
Halictus smeathmanellus K
Pirin mtn
Halictus subaurratus Rossi
Varna Sandanski
Halictus subfasciatus Imh
Kresna
Halictus truncaticollis Mor
Varna
Halictus trychopygus M
Belovo
Halictus tumulorum L
Golo burdo mtn Pancharevo Panagyurishte

MEGACHILIDAE
Anthidium pubescens Mor
Kozhouh mtn
Anthidium septemspinosum lep
Petrich, Belasitsa mtn
Chalicodoma muraria nestorea Brulle
Petrich Stara Zagora, Loukovitsko dere river
Chelostoma grande Nyl
Belogradchik
Chelostoma nigricorne Nyl
Berkovitsa
Coelioxys alata Forst
Belsitsa mtn Harmanli
Coelioxys brevis Eversmann
Pazardzhik Ognyanovo
Coelioxys conoidea Illig
Stara Zagora
Coelioxys forsteri Mor
Sandanski
Coelioxys quadridentata L
Godech
Hoplitis adunca Panz
Belogradchik, Vitosha mtn, Asenovgrad
Hoplitis anthocopoides Schenck
Rhodopi mtn hut "Orfey," Stoykite
Hoplitis claviventis Ths
Rhodopi mtn Trigrad Rozhen
Hoplitis spinulosa Kirby
Stara Zagora, Rhodopi mtn Trigrad
Hoplosmia loti Mor
Rhodopi mtn Trigrad
Megachile apicalis Spin
Kozhouh mtn
Megachile octosignata Nyl
Vrushka chouka
Megachile pilidens Alfk
Kozhouh mtn, Belasitsa mtn
Megachile pyrenaea Per
Panagyurishte
Osmia aurulenta Panz
Petrich
Osmia bicolor Schrenck
Kozhouh mtn
Osmia cerinthidis Mor
Petrohan
Osmia cristata Fonscol
Turia
Osmia dives Mocs
Belogradchik Chuprene
Osmia leucomelaena Kirby
Belogradchik Chuprene
Osmia notata Fabr
Pazardzhik Ognyanovo
Paraanthidiellum eximium Gir
Rhodopi mtn Rozhen
Paraanthidiellum lituratum Panz
Petrich
Paraanthidium interrumptum Fabr
Asenovgrad

POMPILIDAE
Batazonius lacerticida Pall
Stara Zagora Zagore
Cryptocheilus annulatus Rich
Svilengrad

Appendix 10 Rare Species of Hymenoptera Aculeata (continued)

Cryptocheilus ergerius Lep
Belsitsa mtn
Cryptocheilus versicolor Scop
Belasitsa mtn
Episyron rufipes L
Belasitsa mtn

SPHECIDEA
Astata armata Rossi
Harmanli
Astata minor Kohl
Stroumeshnitsa river
Astata pontica Pull
Elhovo
Bembecinus biarmatus Mocs
Asenovgrad Stara Zagora
Bembex integra Panz
Rila mtn, Vitosha mtn Varna
Bembex turca Dahlb
Varna
Cerceris dacica Schlett
Sofia Zagore
Cerceris interrupta Panz
Bachkovo Chaya river
Crabro albilabris Fabr
Asenovgrad Varna
Crabro cavifrons Toms
Rila mtn
Crabro fossorius L
Vitosha mtn Boyana
Crabro lituratus Panz
Sofia Pancharevo
Gorytes quinquecinctus F
Sandanski
Gorytes tauricus Rossi
Stroumeshnitsa river
Larra anathema Rossi
Stroumeshnitsa river
Oxybellus latro Oliv
Sofia
Philanthus coronatus F
Loukovitsko dere river Stara Zagora
Philanthus triangulum Fabr
Asenovgrad Elhovo
Psammophila alpina Kohl
Belasitsa mtn
Psammophila morawitzi Andre
Varna Obzor
Sphex aegyptius Lep
Pirin mtn
Sphex albisectus Lep et Serv
Loukovitsko dere river
Stizus hungaricus Friv
Varna

VESPIDAE
Polistes associus Kohl
Belogradchik, Asenovgrad

SYMPHYTA
ARGIDAE
Agre ciliaris Linne 1767
Panagyurishte
Arge dimidiata Fallen, 1808
Central Stara planina mtn
Arge rustica L
Marikostino
Arge simulatrix Konow, 1887
Blagoevgrad
Arge thoracica Spinola, 1808
Slavyanka mtn
Eumetalobus troglodytes Fabricius, 1787
Plovdiv
Acantholyda laricis Giraud 1861
Vitosha mtn

TENTHREDINIDAE
Athalia liberta Klug 1813
Vitosha mtn
Athalia lugens Klug, 1813
Rila mtn
Athalia maculata Mocsary, 1879
Kyustendil
Dolerus anthracinus Klug, 1814
Petrich
Dolerus brevicornis Zaddach, 1859
Stara planina mtn
Dolerus carbonarius Zaddach, 1859
Vitosha mtn
Dolerus ferrugatus Lepeletier, 1823
Vitosha mtn, Radomir
Dolerus liogaster Thomson 1871
Vitosha mtn, Radomir
Dolerus niger Linne 1767
Vitosha mtn
Dolerus sanguinicollis Klug 1814
Sliven
Macrophya albipuncta Fallen 1808
Sofia
Macrophya militaris Klug 1814
Slavyanka mtn
Macrophya parvula Konow 1884
Vitosha mtn
Macrophya sanguinolenta Gmelin 1790
Stara planina mtn
Macrophya teutona Panzer 1799
Central Stara planina mtn
Mesoneura opaca Fabricius 1775
Pazardzhik

Appendix 10 Rare Species of Hymenoptera Aculeata (continued)

Metallus gei Brischke 1883
Pirin mt
n.*Monophadnus monticola* Hartig 1837
Rila mtn Pirin mtn, Vitosha mtn
Monophadnus pallescnes Gmelin 1790
Vitosha mtn, Central Stara planina mtn
Nematinus bilineatus Klug 1819
Rila mtn
Pachynematus obductus Hartig, 1837
Rila mtn
Pareophora pruni Linne, 1758
Sofia
Rhadinoceraea micans Klug, 1814
Pirin mtn
Selandria (Emphytus) carpini Hartig, 1837
in whole country
Selandria (Empria) klugi Stephens, 1835
Sliven
Selandria frstenbergensis Konow 1855
Vitosha mtn
Selandria temporalis Thomson, 1871
Rila mtn
Tenthredo bipunctula Klug 1814
Sliven
Tenthredo campestris Linne, 1758
Stara planina mtn, Vitosha mtn
Tenthiredo colon Klug, 1814
Vitosha mtn, Rhodopi mtn Rila mtn
Tenthredo costata Klug, 1818
found in all parts of country
Tenthredo dachlii Klug, 1818
Vitosha mtn Stara planina mtn
Tenthredo frauenfeldi Giraud 1857
Vitosha mtn Rila mtn Lozenska mtn
Tenthredo marginella Fabricius 1793
Rhodopi mtn , Stara planina mtn
Tenthredo moniliata Klug, 1814
Pirin mtn, Slavyanka mtn
Tenthiredo olivacea Klug, 1814
Rila mtn
Tenthredo omissa Frster, 1844
Rila mtn
Tenthiredo rossii Panzer, 1805
Slavyanka mtn
Tenthredo semseyi Moscary 1883
Vitosha mtn
Tenthredo stecki Konow, 1888
Rhodopi mtn
Tenthredo vespa Retzius, 1783
Sandanski Black sea coast
Tenthredopsis coqueberti Klug, 1814
Blagoevgrad
Tenthredopsis friesei Konov 1884
Petrich, Rhodopi mtn
Tenthredopsis inornata Cameron 1881
Vitosha mtn
Tenthiredopsis nassata Linne, 1767
found in all part of country
Tenthredopsis parvula Konow 1890
Petrich, Lozenska mtn
Tenthredopsis stigma Fabricius 1798
found in all parts of country

Appendix 11 Bulgarian Endemic Species of Trichoptera

Chaetopteroides bulgaricus Kum
Rila mtn, Pirin mtn
Chionophylax mindszentyi bulgaricus Kum
Central Stara planina mtn
Chionophylax monteryla Bots
Rila mtn
Drusus balcanicus Kum
Central Stara planina mtn Vitosha mtn
Drusus bureschi Kum
Central & Eastern Stara planina mtn
Drusus discophoroides Kum
Belasitsa mtn
Drusus osogovicus Kum
Osogovska mtn
Drusus popovi Kum
Western Stara planina mtn
Psilopteryx schmidi Kum
Rila mtn, Pirin mtn
Rhyacophila braaschi Mal et Kum
Central Stara planina mtn Pirin mtn, Rhodopi mtn
Rhyacophila denticulifera Kum
Rila mtn, Rhodopi mtn Strandzha mtn
Rhyacophila joosti Mey
Central Stara planina mtn
Rhyacophila kownackiana Sz
Central Stara planina mtn
Rhyacophila pirinica Kum
Pirin mtn
Rhyacophila pseudotristis Kum
Rila mtn Pirin mtn, Rhodopi mtn Stara planina mtn
Synagapetus montanus Kum
Rila mtn Pirin mtn
Wormaldia bulgarica Nov
Rhodopi mtn, Rila mtn, Pirin mtn Belasitsa mtn

Appendix 12 Balkan Endemic Species of Trichoptera

Adicella balcanica Bots & Nov
Rhodopi mtn Stara planina mtn, Strouma valley
Agapetus slavorum Bots
Central Rhodopi mtn Maleshevska mtn
Annilella triloba Mar
Rila mtn, Pirin mtn, Western Stara planina mtn
Chaetopteroides maximus Kum
Vitosha mtn
Chaetopteryx stankovici Mar
all Bulgarian high mountains
Drusus discophorus Rad
Rila mtn Pirin mtn Vitosha mtn Rhodopi mtn
Hydropsyche mostarensis Klap
Kyustendil, Kresna
Hydroptila angulifera Kum
Rhodopi mtn, Maleshevska mtn
Limnephilus petri Mar
Rila mtn
Potamophylax borislavi Kum
Rhodopi mtn
Psilopteryx montanus Kum
Rila mtn, Vitosha mtn, Rhodopi mtn, Osogovo mtn
Rhyacophila brevifurcata Kum
Western Stara planina mtn
Rhyacophila loxias Schm
all Bulgarian mtn (700 2100 m)
Rhyacophila obtusa Klap
all Bulgarian mtn (300 1600 m)
Tinodes janssensi Jacqm
Strouma valley
Wormaldia juliani Kum
Strandzha mtn, Sakar mtn, Maleshevska mtn

Appendix 13 Rare Species of Trichoptera

Agapetus rectigonopoda
Eastern Stara planina mtn Strandzha mtn
Agrypnia pagetana Curt
Sofia
Allotrichia vilnensis Rac
Central Stara planina mtn
Anabolia furcata Brau
Strouma valley
Asynarchus lapponicus Zett
Rila mtn
Athripsodes albifrons L
Central Rhodopi mtn
Athripsodes aterrimus Steph
Sofia
Beraea tschundra Mal
Strandzha mtn
Brachycentrus subnubilus Curt
Varna
Ceraclea annulicornis Steph
Dulovo Pravda vill
Ceraclea fulva Ramb
Silistra
Ceraclea senilis Burm
Shabla lake
Chaetopterygopsis mclachlani Stein
Rila mtn Vitosha mtn
Chionophylax mindszentyi Schm
Central Stara planina mtn
Crunoecia monospina Bots
Western Rhodopi mtn
Diplectrona atra McL
Varna Batovska river
Glossosoma capitatum Mart
Strandzha mtn
Grammotaulius nitidus Muell
Western Stara planina mtn
Holocentropus stagnalis Albda
Losenska mtn
Hydropsyche botosaneanui Marink
Western Stara planina mtn
Hydropsyche sappho Mal
Strandzha mtn
Hydroptila ivisa Mal
Central Rhodopi mtn
Hydroptila vichtaspa Schm
Strandzha mtn, Maleshevska mtn
Limnephilus fuscicornis Ramb
Zemen
Limnephilus ignavus McL
Central Rhodopi mtn
Limnephilus incisus Curt
Kostinbrod
Limnephilus subcentralis Brau
Rhodopi mtn Batak lake
Lithax musaca Mal
Strandzha mtn
Micropterna hatatitla Mal
Eastern Rhodopi mtn
Oecetis tripunctata Fabr
Strandzha mtn Sakar
Orthotrichia melitta Mal
Strandzha mtn
Orthotrichia tragetti Mos
Strandzha mtn
Parachiona picicornis Pict
Rila mtn
Philopotamus achemenus Schm
Strandzha mtn
Phryganea ochrida Mal
Sofia
Plectrocnemia minima Klap
Central Stara planina mtn

Appendix 13 Rare Species of Trichoptera (continued)

Polycentropus irroratus Curt
Mesta valley
Potamophylax nigricornis Pict
Rhodopi mtn
Potamophylax rotundipennis Brau
Western Stara planina mtn
Rhyacophila laevis Pict
Central Rhodopi mtn
Setodes bulgaricus Kum
Strandzha mtn, Sakar mtn
Stactobiella risi Felb
Strandzha mtn
Synagapetus moselyi Ulm
Eastern Stara planina mtn
Tinodes raina Bots
Strouma valley
Tinodes rostocki McL
Stara planina mtn
Wormaldia balcanica Kum
Strandzha mtn
Wormaldia khourmai Schm
Strandzha mtn

Appendix 14 Relict Species of Trichoptera

Calamoceras illiesi Mal & Kum
Strandzha mtn

Appendix 15 Bulgarian Endemic Species of Lepidoptera

ARCTIIDAE
Chelis maculosa slivnoensis Rebel 1903
Sliven

COLEOPHORIDAE
Coleophora caliacriella Caradja 1931
Balchik

ELACHISTIDAE
Elachista laetella Rebel, 1930
Lyulin mtn

GELECHIIDAE
Depressaria tschorbadjiewi Rebel, 1916
Bourgas
Lita tachyptiella Rebel 1930
Bourgas
Megacriaspedus cerussatellus Rebel 1930
Slavyanka mtn
Megacraspedus incertellus Rebel 1930
Slavyanka mtn
Pleurota modestella Rebel 1916
Sliven
Teleia trifasciella Rebel, 1916
Sliven

GEOMETRIDAE
Agriopis beschkovi Ganev, 1987
Kresna
Aplocera derenaria von Mentzer 1981
Kresna Melnik
Archiearis puella mediterranea Ganev 1984
Kozhouh mtn
Glacies coracina bureschi Varga 1975
Pirin mtn
Gnophos glaucinarius perunii Varga 1975
Slavyanka mtn Pirin mtn Rila mtn Vitosha mtn Central & Western Rhodopi mtn, Central Stara planina mtn

NOCTUIDAE
Ammoconia senex wagneri Boursin, 1935
Sliven
Apamea maillardi oxygrapha Varga 1976
Central Stara planina mtn Vitosha mtn
Apamea zeta cyanochlora Varga 1976
Rila mtn Osogovo mtn Slavyanka mtn, Pirin mtn
Autophila asiatica argentea Caradja 1931
Balchik
Conisania renati meszarosi Varga & Ronkay, 1991
Kostinbrod
Dychagyris melanura albida Caradja, 1931
Balchik
Dychagyris renigera argentina Caradja 1931
Balchik
Euchalcia variabilis fuscolivacea Varga & Ronkay 1984
Rila mtn
Hypenodes nigritalis Ronkay 1984
Melnik
Syngrapha devergens rilaecacuminum Varga & Ronkay, 1982
Rila mtn
Yigoga flavina pretiosa Caradja 1931
Balchik

Appendix 15 Bulgarian Endemic Species of Lepidoptera (continued)

NOTODONTIDAE
Paradrymonia vittata bulgarica de Freina 1983
Bourgas Arkoutino Zlatni piasatsi Varna, Sakar mtn Strandzha mtn

NYMPHALIDAE
Boloria pales rilaensis Varga 1976
Rila mtn Pirin mtn
Erebia alberganus phorcys Freyer, 1836
Central Stara planina mtn
Erebia cassioides macedonica Buresch 1918
Pirin mtn, Rila mtn
Erebia epiphron infernalis Varga, 1971
Pirin mtn
Erebia orientalis Elwes 1900
Rila mtn Western & Central Strata planina mtn
Erebia ottomana bulgarica Drenowski 1930
Slavyanka mtn
Erebia ottomana bureschi Warren 1932
Pirin mtn
Erebia ottomana drenovskyi Barga 1977
Rhodopi mtn 1600 2000 m
Erebia pandrose ambicolorata Varga 1971
Rila mtn
Hypodrias cynthia drenovskyi Rber
Pirin mtn
Hypodrias cynthia leonhardi Fruhstorfer 1917
Rila mtn

PAPILIONIDAE
Anthocharis gruneri macedonica Buresh 1921
Slavyanka mtn Belasitsa mtn Kozhouh mtn
Parnassius apollo hermiston Fruhstorfer 1921
Stara planina mtn
Parnassius mnemosyne bulgarica Eisner, 1936
Cherni Lom river
Parnassius mnemosyne bureschi Bryk 1921
Slavyanka mtn
Parnassius mnemosyne cupido Bryk & Eisner, 1934
Belsitsa mtn
Parnassius mnemosyne dejotarus Fruhstorfer, 1916
Rila mtn
Parnassius mnemosyne drenowskyi Bryk & Eisner 1934
Varna
Pieris pseudorapae balkana Lorkovic, 1970
Rhodopi mtn

PSYCHIDAE
Reisseronia pusiella Rebel 1940
Pirin mtn

SESIIDAE
Sesia lanipes Lederer 1863
Central Stara planina mtn

TORTRICIDAE
Dichorampha rilana Drenowsky 1910
Rila mtn
Eucosma luciana caliacriana Caradja 1932
Balchik
Euxanthis drenowskyi Rebel, 1916
Rila mtn
Tortrix burgasiensis Rebel 1916
Bourgas

Appendix 16 Balkan Endemic Species of Lepidoptera

ARCTIIDAE
Ocnogyna parasita linaea Witt 1980
Sofia Vitosh mtn Lyulin mtn Kostenets Kresna Kozhouh mtn Zemen Bourgas, Varna Strandzha Western Sredna gora mtn Rhodopi mtn Kastakli reserve Sliwen Kazanluk Western Stara planina mtn
Parasemia plantaginis interrupta Schawerda 1910
Vitosha mtn Pirin mtn Osogovo mtn Western & Central Stara planina mtn

CTENUCHIDAE
Syntomis kruegeri marjana Stauder 1913
Sofia Vitosha mtn Slavyanka mtn Ograzhden mtn Strandzha mtn Rhodopi mtn Kresna Kozhouh mtn Petrich Stara Zagora Plovdiv Svilengrad Sliven Turnovo Varna Svishtov Iskurski prolom

GEOMETRIDAE
Colostigia aqueata herzegoviensis Rebel 1901
Pirin mtn
Gnophos certhiatus Rebel & Zerny 1931
Slavyanka mtn, Pirin mtn, Vitosha mtn
Idaea metohiensis Rebel 1900
Belasitsa mtn Slavyanka mtn Pirin mtn Central & Western Rhodopi mtn
Nebula nebulata prinica Reisser 1936
Slavyanka mtn, Pirin mtn, Rila mtn, Vitosha mtn

HEPIALIDAE
Triodia adriatica adriatica Osthelder 1931
Kresna Koshouh mtn

LEMONIIDAE
Lemonia taraxaci strigata Rebel 1910
Kresna, Kozhouh mtn

Appendix 16 Balkan Endemic Species of Lepidoptera (continued)

LYCAENIDAE

Agrodiaetus nephohiptamenos nephohiptamenos Broun & Coutsis 1978
Central Rhodopi mtn

Aricia allous macedonica Verity 1938
Vitosha mtn Rila mtn Pirin mtn Rhodopi mtn 1400 1600 m

Aricia eumedon rumeliensis (Eitschberger & Steiniger, 1975
Stara planina mtn, Sliven, Rila mtn, Vitosha mtn, Lozenska mtn, Pirin mtn, Slavyanka mtn, Rhodopi mtn Kastraklı Konyavska mtn Lyulin mtn

Lycaena candens leonhardi Fruhstorfer 1917
Western & Central Stara planina mtn, Osogovo mtn Vitosha mtn Rila mtn Rhodopi mtn 1100 1900 m Pirin mtn Belasitsa mtn

Lycaena virgaureae balcanicola Graves & Hemming, [1928]
Central Stara planina mtn, Rhodopi mtn up to 1600 m Rila mtn Western Sredna gora mtn Lozenska mtn, Plana mtn Kraishte, Osogovo mtn, Vitosha mtn Belasitsa mtn Ograzhden mtn, Slavyanka mtn Pirin mtn, Kresna

Maculinea alcon sevastos Rebel & Zerny, 1931
Pirin mtn Bunderitsa river

NOCTUIDAE

Agrochola rupicapra kresnaensis Ronkay & Meszaros 1982
Kresna, Kozhouh mtn

Agrochola thurneri Boursin 1953
Kresna Zemen Skakavitsa

Agrochola wolfschlaegeri Boursin 1953
Kresna Kozhouh mtn, Zemen, Sliven

Apamea michelii Varga 1976
Rila mtn Pirin mtn

Apamea rubrirena marginipicta Varga 1977
Vitosha mtn, Pirin mtn Rhodopi mtn Rila mtn Osogovo mtn, Central Stara planina mtn

Conistra ragusae macedonica Pinker 1956
Bourgas

Copiphana lunaki Boursin 1940
Kresna

Cryphia seladona burgeffi Draudt, 1931
Eastern Rhodopi mtn, Haskovo Susam, Sakar mtn Kresna Kozhouh mtn Osogovo mtn, Pirin mtn

Dasypolia templi vecchimontium Ronkay & Varga, 1985
Kresna Nesebur Vitosha mtn Belogradchik

Euxoa decora macedonica Thurner 1936
Slavyanka mtn, Pirin mtn, Central Rhodopi mtn

Euxoa vitta hercegovinensis Schawerda, 1938
Osogovo mtn Central Stara planina mtn

Hadena clara macedonica Boursin, 1959
Central Rhodopi mtn

Mythimna andereggii pseudocomma Rebel & Zerny, 1931
Slavyanka mtn, Rila mtn Pirin mtn Osogovo mtn Central Rhodopi mtn

Paradrina suscianja von Mentzer 1981
Kresna Kyustendil Stara planina mtn Etropolski manastir

Stranfussiana dalmata dalmata Staudinger, 1901
Slavyanka mtn

Stranfussiana lucernea ilirica Rebel & Zerny, 1931
Western Stara planina mtn, Rila mtn Belasitsa mtn, Slavyanka mtn

NYMPHALIDAE

Boloria graeca balcanica Rebel, 1903
Rila mtn Pirin mtn, Rhodopi mtn, Vitosha mtn

Erebia melas schawerdae Fruhstorfer 1918
Slavyanka mtn, Rila mtn Pirin mtn Central Stara planina mtn

Erebia oeme velutonia Fruhstorfer 1917
Osogovo mtn Western & Central Stara planina mtn, Pirin mtn, Rila mtn Western Rhodopi mtn

Erebia ottomana balcanica Rebel, 1913
Western & Central Stara planina mtn, Osogovo mtn, Rila mtn

Erebia pronoe fruhstorferi Warren 1933
Osogovo mtn, Vitosha mtn Central Stara planina mtn, Rila mtn

Erebia rhodopensis Nicholl, 1900
Rila mtn Pirin mtn, Central Stara planina mtn

Hipparchia volgensis delattini Kudrna, 1975
Vitosha mtn Kozhouh mtn Sandanski, Kresna, Varna Bourgas Pazardzhik Byaga

Melitaea arduina rhodopensis Freer, 1836
Northwest Bulgaria Vrusha chouka, Razgrad Sboryanovo Poda river

Pseudochazara anthelea amalhtea Frivaldsky 1845
Kresna Gradeshnitsa Sandanski

PAPILIONIDAE

Anthocharis cardamines hellas Hemming 1933
entire country up to 1700 m

Colias alfacariensis rumelica Reissinger, 1989
Asenovgrad, Bulgarian Macedonia (southwest Bulgaria)

Colias caucasica balcanica Rebel, 1901
Vitosha mtn Osogovo mtn Rila mtn Pirin mtn Central Rhodopi mtn

Euchloe ausonia graeca Verity 1908
Cherepishki manastir Rouse, Varna Balchik Central Rhodopi mtn Sliven, Svilengrad Sakar mtn Aytos, Bourgas, Vitosha mtn Lyulin mtn Sofia, Belasitsa mtn, Kozhouh mtn, Kresna, Zemen, Osogovo mtn, Ograzhden mtn

Appendix 16 Balkan Endemic Species of Lepidoptera (continued)

Gonepteryx cleopatra citrina Sheljuzhko, 1925
Rila mtn
Parnassius apollo rhodopensis Markovitsch, 1910
Ruy mtn, Osogovo mtn Rhodopi mtn, Rila mtn, Pirin mtn, Slavyanka mtn, Vitosha mtn, Plana mtn Lyulin mtn
Zerynthia cerisy ferdinandi Stichel, 1907
all Bulgaria

PSYCHIDAE
Eochorica balcanica Rebel 1919
Slavyanka mtn Ograzhden mtn, Strouma valley

Heliopsychidea graecella Milliere, 1867
Slavyanka mtn
Reisseronia nigrocilliella Rebel, 1934
Sandanski, Kresna

ZYGAENIDAE
Adscita albanica Naufock, 1926
Rila mtn

Appendix 17 Rare Species of Lepidoptera

ARCTIIDAE
Cymbalophora rivularis Menetries, 1832
Sakar mtn
Nudaria mundana Linnaeus 1761
Sliven
Pelosia obtusa Herrich Schaeffer [1848]
Kozhouh mtn Arkoutina, Schablensko ezero lake
Rhyparioides metelkanus Lederer, 1861
Shablensko ezero lake
Thumara senex Hbner [1808]
Kozhouh mtn

GEOMETRIDAE
Anticollix sparsata Treitschke 1828
Rila mtn
Apochima flabelaria Heeger
Ograzhden mtn, Kozhouh mtn
Baptria tibiale Esper 1791
Rila mtn Western Stara planina mtn
Comibaena nerearia Herrich Schaffer 1856
Slavyanka mtn, Kozhouh mtn Varvara, Sakar mtn Eastern Rhodopi mtn
Cyclophora pendularia Clerck 1759
Zemen, Kozhouh mtn Turnovo
Epirrita autumnata Borkhausen 1794
Rila mtn
Epirrita christyi Prout, 1906
Central Stara planina mtn
Epirrita declinans Staudinger 1880
Kozhouh mtn Kresna Sliven Pleven Varna Dulgopol Isperihovo Eastern Rhodopi mtn
Eumera regina Staudinger
Precolnitsa Zemen Vitosha mtn Eastern Rhodopi mtn
Eupithecia absinthiata Clerck 1759
Kresna Pirin mtn Sandanski Western Stara planina mtn Balchik
Eupithecia biornata Christoph 1867
Shablensko ezero lake

Eupithecia buxata Pinker, 1958
Kpithecia rena, Kozhouh mtn, Ograzhden mtn
Eudenticulata Treitschke, 1828
Balchik, Smirnenski
Eupithecia druentiata Dietze, 1901
Slavyanka mtn
Eupithecia extraversaria Herrich Schaeffer [1852]
Ograzhden mtn Sandanski Rhodopi mtn Martsiganitsa
Eupithecia goossensiata Mabille 1869
Rhodopi mtn Asenovgrad, Western Stara planina mtn
Eupithecia gratiosata Herrich Schaeffer, [1861]
Nesebar
Eupithecia irriguata Hbner [1813]
Ograzhden mtn
Eupithecia plumbeolata Haworth 1809
Sestrimo
Eupithecia selinata Herrich Schaeffer [1861]
Kozhouh mtn
Eupithecia silenata Assmann, [1849]
Vitosha mtn
Eupithecia tenuiata Hbner, [1813]
Central Stara planina mtn Western Rhodopi mtn
Eupithecia thurneriata Schtze 1958
Kozhouh mtn
Eupithecia variostrigata Alpheraky, 1878
Atanasovsko ezero lake Bourgas
Gypsochroa renitidata Hbner, [1813]
Vitosha mtn Central Rhodopi mtn
Hydriomena ruberata Freyer 1831
Pirin mtn
Idaea albitorquata Pngeler 1909
Ograzhden mtn Strouma valley
Idaea determinata Staudinger 1876
Ograzhden mtn, Kozhouh mtn Rila mtn
Idaea elongaria Rambur 1833
Ograzhden mtn Strouma valley

Appendix 17 Rare Species of Lepidoptera (continued)

Idaea macilentaria Herrich Schaeffer 1846
Pirin mtn
Idaea muricata Hufnagel 1767
Trivoditsi Sliven Plovdiv Kozhouh mtn
Dulgodeltsi Vulchedrum Vidin
Idaea soliaria Herrich Schaeffer 1851
Kresna Belasitsa mtn Sandanski
Idaea spissilimbaria Mabile, 1888
Vitosha mtn
Nebula senectaria Herrich Schaeffer, 1851
Ograzhden mtn, Kresna, Kozhouh mtn,
Sandanski, Pirin mtn
Nychiodes amigdalaria Herrich Schaeffer, [1848]
Sakar mtn, Sliven Kresna
Rheumaptera undulata Linnaeus, 1758
Rila mtn Pirin mtn Devin
Scopula ochroleucata Herrich Schaeffer, 1851
Kozhouh mtn
Sopula turbidaria Hbner 1819
Kozhouh mtn

HESPERIIDAE
Erynnis maloyi Boisduval 1834
Kresna Kozhouh mtn Ograzhden mtn
Gegenes nostrodamus Fabricius 1793
Kozhouli mtn, Sakar mtn
Muschampia tessellum Hbner 1803
Bourgas, Slavyanka mtn
Pyrgus cinarae Rambur, 1839
Kresna Rhodopi mtn Asenovgrad Sliven
Spialia phlomidis Herrich Schaeffer 1845
Kresna

LASIOCAMPIDAE
Lasiocampa eversmanni Eversmann 1843
Nesebar
Lasiocampa grandis Rogenhofer 1891
Gradeshka banya Svilengrad Varna, Nesebar,
cape Maslen nos Dulgopol Sliven, Trun
Poecilocampa alpina Frey & Wullschlegel 1874
Kostinbrod, Western Stara planina mtn Zemen
Trichiura verenae Witt 1981
Sakar mtn, Kresna Zemen Varna Rhodopi mtn

LYCAENIDAE
Agriades dardanus Freyer, 1844
Slavyanka mtn, Rhodopi mtn Chepelare
Heodes ottomanus Lefebvre 1830
Kresna Bourgas Marinka Gorno Ezerovo
Ahtopol, Strandzha mtn
Maculinea nausitous Bergstrsser 1779
Vitosha mtn, Lyulin mtn

LYMANTRIIDAE
Teia ericae intermedia Frivaldsky
Varna Balchik

NOCTUIDAE
Acronista alni Linnaeus 1767
Strandzha mtn Central Stara planina mtn
Acronista cuspis Hbner [1813]
Kozhouh mtn Strandzha mtn
Aedophron rhodites Eversmann 1851
Varna, Kresna
Agrochola deleta Staudinger, 1882
Sakar mtn, Eastern Rhodopi mtn
Agrochola osthelderi Boursin, 1951
Kresna
Amephana dalmatica Rebel 1919
Ograzhden mtn, Belasitsa mtn, Slavyanka mtn
Zemen, Kozhouh mtn, Sakar mtn
Amphipyra stix Herrich Schaeffer
Sakar mtn, Sinemorets Ograzhden mtn Kresna
Sandanski
Amphipyra tetra Fabricius, 1787
Ograzhden mtn Sakar mtn Varna
Antitype suda Geyer [1832]
Lakatnik
Apamea sicula Turati 1909
Bourgas Otmanli
Apaustis theophila Staudinger 1866
Kresna, Vlachina mtn Kozhouh mtn
Athetis lepigone Mchler, 1860
cape Schabla Balchik
Auchmis detersa Esper [1787]
Balchik Varna, Nesebar, Bourgas
Behounekia freyeri Frivaldskv 1835
Aytos Byalata river
Brachionycha syriaca Warren 1910
Hissar Sakar mtn Kresna Kozhouh mtn
Eastern Rhodopi mtn Sliven
Calophasia barthae F Wagner
Ograzhden mtn, Sakar mtn
Calophasia platyptera Esper [1788]
Sinemorets, Michourin Nesebar
Chersotis elegans Eversmann, 1837
Slavyanka mtn
Cleonymia opposita Lederer 1870
Kresna Sliven
Cryphia petrea Guenee 1852
Kresna
Cryphia tephrocharis Boursin 1953
Ograzhden mtn Strouma valley Rhodopi
Loukovitsa river, Obzor
Cucullia biornata Fischer von Waldheim, 1840
Varna
Dichonia pinkeri Kobes, 1793
Kresna
Discestra mendax Staudinger, 1879
Kozhouh mtn Dresna Melnik EasternRhodopi
mtn
Discestra stigmosa Christoph, 1887
Balchik Varna Nesebar, Bourgas Sozopol

Appendix 17 Rare Species of Lepidoptera (continued)

Diasteria caucasica Kolenati 1846
cape Sahbla, Karpets
Dryobotodes tenebrosa Esper, [1789]
Ograzhden mtn, Melnik Kozhouh mtn, Eastern Rhodopi mtn
Dysgonia torrida Guenee, 1852
Kresna
Enargia abluta Hbner, [1808]
Vidin Bynitsa
Eremodrina pertinax Staudinger 1879
Balchik Kresna
Eremodrina vicina Staudinger 1870
Kresna
Eublemma rosina Hbner, [1803]
Slavyanka mtn, Sliven
Euteliа adoratrix Staudinger 1892
Melnik
Euxoa agricola Boisduval 1829
Slavyanka mtn Central Stara planina mtn Rila mtn Blachik
Gortyna cervago Eversmann, 1844
Western Stara planina mtn
Hadena drenowskii Rebel, 1930
Slavyanka mtn Rila mtn
Hadena vulcanica urumovi Drenowski, 1931
Slavyanka mtn, Besaparian hills Rhodopi mtn, Pirin mtn
Haemerosia vasilinnei A Bang Haas, 1912
Yambol
Hypenodes orientalis Staudinger 1901
Primorsko
Janthinea frivaldshyi Duponchel 1835
Krichim, Kresna Ivaylovgrad
Lacanobia praedita Hbner [1813]
Balchik
Lacanobia splendens Hbner, [1808]
Rhodopi mtn Kastrakli
Leucania herrichi Herrich Schaeffer 1849
Eastern Rhodopi mtn
Lithophane lapidea Hbner, [1808]
Kresna Kozhouh mtn Zemen
Lithophane lederer Staudinger, 1892
Kresna Melnik
Macrochilo cribrumalis Hbner, 1793
Kozhouh mtn
Meganola gigantula Staudinger 1879
Kresna Melnik Sandanski
Miniotype leuconota Herrich Schaeffer
Sakar mtn Sliven Eastern Rhodopi mtn
Nola cristatula Hbner 1793
Balchik Sofia
Odice arcuinna Hbner 1790
Sakar mtn Rhodopi mtn Loukovitsa river Pazardzhik Sakar mtn
Orthosia schmidti Dioszeghy, 1935
Eastern Rhodopi mtn
Oxicestra geographica Fabricius 1787
Balchik Roussalka
Oxytripa orbiculosa Esper, [1799]
Balchik
Panthea coenobita Esper, 1785
Central Rhodopi mtn
Parexarnis fugax Treitschke, 1825
Vidin Boynitsa
Periphanes treitschkei Frivaldsky 1835
Nesebar, Sliven, Kresna, Kozhouh mtn
Plusia putnami Grote 1873
Central Rhodopi mtn
Polymixis xanthomista Hbner, [1819]
Lakatnik, Cherepish
Pseudozarba bipaetita Herrich Schaeffer, 1850
Kresna
Pyrois cinammomea Goeze, 1781
Kresna, Central Rhodopi mtn
Raparna conicephala Staudinger, 1870
Slavyanka mtn, Sandanski, Kresna
Spudaea pontica Kljutshko 1968
Kresna Ograzhden mtn Eastern Rhodopi mtn
Thysanoplusia orichalcea Fabricius 1775
Kresna
Valerietta bulgarica Drenowski, 1953
Vitosha mtn, Kresna
Xanthia cypreado Hampson, 1906
Rhodopi mtn, Sakar mtn, Kresna
Xylena lunifera Warren, 1910
Kresna Besaparian hills Lakatnik Belogradchik

NOTODONTIDAE
Paradrymonia vittata streckfussi Honrath, 1892
Ograzhden mtn Kresna, Zemen Kozhouh mtn Easter Rhodopi mtn
Peridea korbi Rebel 1918
Zemen
Rhegmatophila alpina osmana Friedel, 1967
Kresna, Rhodopi mtn Asenovgrad

NYMPHALIDAE
Coenonympha oedipus Fabricius, 1787
Bourgas Marinka
Hypodryas maturna Linnaeus, 1758
Razgrad
Lopinga achine Scopoli 1763
Razgrad Tsurkvino
Nymphalis vau-album [Denis & Schiffermiller] 1775
Sliven Sofia
Pararge climene Esper 1783
Sliven

PIERIDAE
Gonepteryx farinosa Zeller, 1847
Kozhouh mtn

Appendix 17 Rare Species of Lepidoptera (continued)

Pontia chloridice Hbner [1808 1813]
Belasitsa mtn Sliven Eastern Rhodopi mtn

SPHINGIDAE
Dolbina elegans steffensi Popescu Gorj 1971
Varvara Nesebar Arkoutina, Sakar mtn Eastern Rhodopi mtn

Hemaris croatica Esper 1779
Kresna, Sandanski Svilengrad, Kazanluk, Sliven Varna
Hyles nicea DePrunner 1798
Belasitsa mtn
Rethera komarovi drilon Rebel & Zerny 1931
Kresna, Slavyanka mtn Eastern Rhodopi mtn

Appendix 18 Relict Species of Lepidoptera

ARCTIIDAE
Arctia flavia Fuessly, 1779
Rila mtn

GEOMETRIDAE
Catascia dilucidaria [Denis& Schiffermller], 1775
Western Stara planina mtn, Rila mn, Pirin mtn
Entephria caesiata [Denis & Schiffermller] 1775
Rhodopi mtn Rila mtn, Vitosha mtn Pirin mtn
Entephria flavicinctata Hbner 1813
Pirin mtn Rila mtn
Entephria nobiliaria Herrich Schaeffer, 1852
Pirin mtn, Sandanski
Euphyia luctuata [Denis & Schiffermller], 1775
Rila mtn, Pirin mtn Belasitsa mtn Osogovo mtn, Vitosha mtn
Eupithecia fenestrata Milliere 1874
Rila mtn Pirin mtn Vitosha mtn Osogovo mtn
Gnophos obfuscatus [Denis & Schiffermller] 1775
Rila mtn Pirin mtn, Central Rhodopi mtn Vitosha mtn
Rheumaptera hastata Linnaeus 1758
Rila mtn Vitosha mtn
Venusia cambrica Curtis, 1839
Pirin mtn Rila mtn Central Stara planina mtn

HESPERIIDAE
Pyrgus cacaliae Rambur 1839
Pirin mtn Rila mtn Vitosha mtn Central Stara planina mtn

INCURVARIIDAE
Incurvaria velutella Zetterstedt 1840
Slavyanka mtn

LYCAENIDAE
Agrodiaetus damon [Denis & Schiffermller] 1775
Pirin mtn, Rila mtn

NOCTUIDAE
Agrotis fatidica Hbner, [1824]
Rila mtn
Apamea furva [Denis & Schiffermller], 1775
Rila mtn Slavyanka mtn, Osogovo mtn Stara planina mtn, Rhodopi mtn Vitosha mtn, Pirin mtn

Apamea remissa Hbner, [1809]
Rhodopi mtn, Belasitsa mtn, Pirin mtn, Vitosha mtn, Osogovo mtn
Chersotis andereggii Boisduval, 1832
Pirin mtn Gotse Delchev
Chersotis cuprea [Denis & Schiffermller] 1775
Slavyanka mtn, Stara planina mtn Rila mtn, Osogovo mtn Rhodopi mtn Vitosha mtn
Diarsia brunnea [Denis & Schiffermller] 1775
Osogovo mtn Stara planina mtn Vitosha mtn Pirin mtn, Rhodopi mtn Rila mtn
Diarsia mendica Fabricius 1775
Central Stara planina mtn Osogovo mtn Pirin mtn, Belasitsa mtn, Vitosha mtn Rila mtn, Rhodopi mtn
Discestra melanopa Thunberg 1791
Rila mtn Pirin mtn
Epipsilia grisescens Fabricius 1794
Osogovo mtn, Slavyanka mtn, Vitosha mtn, Rila mtn Pirin mtn Rhodopi mtn Rozhen Central Stara planina mtn
Hadena caesia bulgarica Boursin 1959
Pirin mtn Rila mtn Osogovo mtn Western & Central Stara planina mtn, Vitosha mtn Slavyanka mtn, Rhodopi mtn
Lycophotia porfirea [Denis & Schiffermller], 1775
Vitosha mtn Stara planina mtn Rila mtn, Pirin mtn
Mythimna impura Hbner [1808]
Vitosha mtn, Rhodopi mtn, Rila mtn
Photedes captiuncula Treitschke, 1825
Rhodopi mtn Rila mtn, Central Stara planina mtn Vitosha mtn, Pirin mtn
Syngrapha interrogationis Linnaeus, 1758
Pirin mtn, Rila mtn, Rhodopi mtn, Vitosha mtn Central Stara planina mtn
Xestia ashworthii candelarum Staudinger 1871
Osogovo mtn, Slavyanka mtn Central Stara planina mtn Pirin mtn Central Rhodopi mtn Kresna
Xestia speciosa Hbner [1813]
Central Stara planina mtn Pirin mtn, Rila mtn

Appendix 18 Relict Species of Lepidoptera (continued)

NOTODONTIDAE
Pheosia gnoma Fabricius, 1777
Rila mtn

NYMPHALIDAE
Boloria eunomia Esper 1799
Central Stara planina mtn
Boloria selene [Denis & Schiffermller], 1775
Rila mtn
Erebia gorge pirinica Buresch 1918
Pirin mtn, Rila mtn

PYRALIDAE
Asarta aethiopella Duponchel 1836
Rila mtn, Pirin mtn
Orenaja alpestralis Fabricius 1794
Rila mtn
Titanio phrygialis Hbner, 1796
Pirin mtn, Slavyanka mtn
Titanio schrankiana Hochenwarth, 1785
Rila mtn

Appendix 19 Bulgarian Endemic Species of Diptera

BRACHYCERA
ASILIDAE
Antipalpus reginae Moucha et Hradsky, 1966
Petrich
Dioctria bulgarica Hradsky, Moucha, 1964
Vitosha mtn
Eutolmus bureshi Hradsky Moucha 1964
Asenovgrad
Lasiopogon sofneri Hradsky Moucha, 1967
Asenovgrad

CHLOROPIDAE
Chlorops quercophilus Beschovski 1979
South Black sea coast
Dicraeus sabroskyi Beschovski 1977
Distr Sofia
Dicraeus valkanovi Beschovski 1982
Varna, Sozopol
Elachiptera submediterranea Beschovski 1980
Pirin Rhodopi Strandzha mtn

DOLICHOPODIDAE
Epithalassius stakelbergi Beschovski, 1966
Black sea coast

EMPIDIDAE
Empis rava Loew 1862
Varna
Hilara Psammophytophila Beschovski 1973
Black Sea coast
Empis nigerrima Loew, 1862
Varna

HYBOTIDAE
Chersodromyia bureschi Beschovski, 1973
Black sea coast
Chersodromyia milanchvalai Beschovski 1973
Shabla
Coenosia beschovskii Lavciev, 1970
Black sea coast

STRATTIOMYIDAE
Thauroera pontica Lindner 1936
Kamchiya

NEMATOCERA
CHIRONOMIDAE
Chironomus valkanovi Michailova 1974
Distr Pomorie, Bourgas
Glyptotendipes salinus Michailova, 1987
Lake Atanasovsko

MYCETOPHILIDAE
Acnemia vratzatica Bechev, 1985
Distr Vratsa
Anaclileia beshovskii Bechev, 1990
Balkan and Vitosha mtns
Ectrepesthoneura ledenikiensis Bechev, 1988
Distr Vratsa Ledenika cave
Mycetophila devioides Bechev, 1988
West Balkan
Sciophila zaitzevi Bechev 1988
West Balkan

KEROPLATIDAE
Macrorrhyncha veleve Bechev 1992
Strandzha mtn Sinemorets

Appendix 20 Balkan Endemic Species of Diptera

BRACHYCERA
ASILIDAE
Erax crassicouda Loew 1862
Varna
Neomochtherus granitis Tsacas 1963
Rhodopi Ivailovgrad

EMPIDIDAE
Empis nigerrima Loew 1862
Varna

SYRPHIDAE
Merodon chalybeatus Sack, 1913
Slavyanka mtn

Appendix 21 Rare Species of Diptera

BRACHYCERA
ACARTOPHTHALMIDAE
Acartophthalmus nigrinus Zetterstedt 1848
Kresnensko defile
Acartophthalmus pusio Frey 1828
Kresnensko defile

ANTHOMYIDAE
Paregle radicul Linnaeus 1761
Pirin mtn, Banderitsa
Pegomyia steini Hendel 1925
Rila mtn Engadina
Pycnoglossa cinerosa Zetterstedt, 1845
Rila mtn Engadina

ANTHOMYZIDAE
Anthomyza albimana Meigen, 1830
Distr Troyan
Anthomyza sordidella Zetterstedt, 1848
Distr Varna

ASILIDAE
Antipalpus sinuatus Loew, 1854
Eastern Rhodopi mtn
Cerdistus denticulatus Loew, 1849
Asenovgrad
Cyclosocerus platycerus Villeneuve 1913
Rhodopi Trigrad
Dasypogon melanopleurus Loew, 1869
Petrich
Neoitamus impudicus Gaerstaecker 1861
Petrich Bansko
Neomochtherus striatipes Loew 1849
Mezdra

AULACIGASTRIDAE
Aulacigaster leucopeza Meigen 1830
Distr Sofia

BOMBYLIIDAE
Bombyliosoma nigriceps Loew 1862
Varna
Bombylius floccosus Loew 1857
Sliven
Bombylius nubilus Mikan, 1796
Varna
Bombylius vulpinus Wiedemann in Meigen, 1820
Varna
Conophorus glaucescens Loew 1863
Sliven
Lomatia lateralis Meigen 1820
Vratsa
Toxophora maculata Rossi, 1790
Varna

CANACEIDAE
Canace salonitana Stroble 1900
Black sea coast

CHLOROPIDAE
Aphanotrigonum meigerei Duda 1933
Shabla, Dourankoulak
Chlorops anthracophagoideus Strobl, 1909
Distr Sofia
Chlorops gracilis Meigen 1830
Nesebur
Chlorops pallidiventrsi Duda 1933
Distr Dobrich
Coniosciniella zeterstedti Andersson, 1966
Pirdop
Cryptonevra tarsata Fallen 1820
Varna lake
Eurina ducalis Meigen, 1830
Petrich
Eurina lurida Costa 1885
Obrochishte
Homalura tarsata Meigen 1830
Varna lake
Lasiosina immaculata Becker 1912
Petrich
Lasiosina lindbergi Duda, 1933
Distr Kurdzhali
Meromyza hungarica Dely Draskovits 1978
Distr Bourgas
Meiomyza obtusa Peterfi, 1961
Plana mtn
Meromyza pluriseta Peterfi 1961
Pirdop

Appendix 21 Rare Species of Diptera (continued)

Oscinella pectoralis Becker, 1910
Nesebur
Oscinimorpha novaki Stroble 1893
Kresnensko defile
Platycephala umbraculata Fabricius, 1794
Dist Varna
Pseudopachychaeta pachycera Stroble 1902
Varna lake
Rhodesiella plumigera Meigen 1830
Lebnitsa
Siphonellopsis lacteibasis Stroble 1905
Varna
Specafron halophila Duda, 1933
Dourankoulak
Trichieurina pubescens Meigen, 1830
Distr Sofia

COELOPIDAE
Coelopa frigida Fabricius 1805
Black sea coast

CONOPIDAE
Conops elegans Meigen, 1824
Rhodopi Kostenets
Dalmannia marginata Meigen, 1824
Resovo
Melanosoma nigritarse Stroble, 1902
Lyulin mtn
Myopa polystigma Rondani, 1857
Varna
Occemyia melanopa Rondani 1857
Distr Petrich

DIASTATIDAE
Diastata fuscata Fallen, 1823
Klisoura

DOLICHOPODIDAE
Aphrosylus fuscipennis Stroble, 1909
Black sea coast
Aphrosylus piscator Lichtwardt 1902
Distr Varna
Campsicnemus curvipes Fallen, 1823
Nesebur
Dolichopus latelimbatus Macquart,
Sozopol
Dolichopus nigricornis Meigen 1824
Varna lake
Hydrophorus viridis Meigen 1824
Varna
Lamprochromus strobli Paranet 1925
Varna lake
Medetera glauca Loew 1869
Shabla
Microtes mediterraneus Becker 1919
Black sea coast

Sciopus glaucescens Loew 1856
Varna
Sciopus pallens Wiedemann 1830
Nesebur
Sciopus platypterus Fabricius 185
Shabla
Syntormon filiger Verrall, 1912
Bourgas
Syntormon spicatus Loew, 1857
Varna
Tachytrechus ripicola Loew 1857
Dourankoulak
Ziphandrium zetterstedti Parent 1925
Distr Pleven

EMPIDIDAE
Empis decora Meigen, 1822
Pancharevo
Empis haemi Loew, 1862
Vrana
Empis maculata Fabricius, 1786
Vrana

EPHYDRIDAE
Asmeringa inermis Becker, 1903
Distr Bourgas
Atissa limosina Becker, 1896
Distr Varna
Clanuneurum cimiciforme Haliday, 1855
Distr Varna
Discalssiopa lacteipennis Loew, 1862
Distr Varna
Ephydra attica Becker, 1896
Black sea coast
Ephydra buttata Loew 1860
Black sea coast
Ephydra riparia Fallen, 1813
Black sea coast
Hecamedoides glaucellus Syenhammer 1844
Rhodopi Podkova
Hydrellia pilitarsis Stenhammer, 1844
Varna lake
Notiphila venusta Loew 1856
Varna lake
Pelina nitens Loew 1873
Dourankoulak
Psilopa maritima Perris 1847
Varna lake
Schema acrosticalis Becker 1903
Varna Bourgas

HELCOMYZIDAE
Helcomyza mediterranea Loew, 1854
Black sea coast

Appendix 21 Rare Species of Diptera (continued)

HELOMYZIDAE
Acantholeria cinerariа Loew 1862
cave Zmeyuva dupka
Ecoptomera pallescens Meigen 1830
Reznjovete
Orbellia borisregis Czerny 1930
Rila mtn Saru gyol
Scoliocentra nigrinervis Wahlgren 1918
Rila mtn Saru gyol
Scoliocentra ventricosa Becker, 1907
caves Distr Veliko Turnovo
Tephroclamis halterata Meigen, 1830
cave Vaklite doupki

HYBOTIDAE
Chersodromyia curtipennis Collin, 1950
Black sea coast
Chersodromyia pontica Chvala, 1970
Black sea coast
Drapetis flavipes Macquart 1834
cave Haidoushka doupka

MUSCIDAE
Athericona varia Meigen 1826
Distr Bourgas
Coenosia ambulans Meigen, 1826
Varna lake
Coenosia humilis Meigen, 1826
Varna lake
Limnophora dinigrata Meigen
Rila mtn Youndola
Limnophora maritima Roder
Ropotamo
Limnophora obsignata Rondani
Ropotamo
Limnophora pollinifrons Stein, 1916
Black sea coast
Limnophora setinerva Stein, 1916
Distr Varna
Lispe caesia Meigen 1826
Distr Bourgas
Lispe flavicincta Loew, 1847
Distr Bourgas
Lispe litorea Fallen 1825
Distr Varna
Lispe loewi Ringdahl, 1922
Distr Brougas
Lispe longicollis Meigen 1826
Distr Bourgas
Lispe nana Macquart 1835
Black sea coast
Lispocephala erythrocera Robineau Desvoidy 1830
Dourankoulak

NEMESTRINIDAE
Neorhynchocephalus tauscheri Fischer 1812
Distr Sliven

PIPUNCULIDAE
Cephalosphaera furcatus Egger 1860
Vitosha mtn
Eudorylas zonatus Zetterstedt 1849
Petrich
Pipunculus campestris Latreille, 1805
Vitosha mtn
Pipunculus spinipes Meigen, 1830
Bachkovo
Tomosvaryella sylvatica Meigen 1824
Vitosha mtn

PLATYSTOMATIDAE
Platystoma lugubre Robineau Desvoidy, 1830
Kresnensko defile
Platystoma subfasciata Loew, 1862
Varna, Sliven

RHAGIONIDAE
Chrysopilus maerens Loew 1873
Rilski manastir
Rhagio maculatus macedonicus
Location not given
Rhagio cingulatus Loew, 1856
Rhodopi mtn
Rhagio maculipenis Loew 1854
Varna

SCIOMYZIDAE
Euthycera chaerophylli Fabricius 1798
Varna
Euthycera fumigata Scopoli 1763
Varna

SPHAEROCERIDAE
Kimosina ingisetosa Dahl 1909
Plana mtn
Minilimosina fungicola Haliday 1836
Distr Sofia
Opacifrons maculifrons Becker, 1907
Distr Varna Shabla
Opalimosina liliputana Rondani 1880
Distr Sofia
Telomerina flavipes Meigen 1830
Distr Mihailovgrad
Terrilimosina racovitzai Bezzi 1911
cave Roushova Gradeshnitsa

STRATTIOMYIDAE
Beris clavipes Loew 1767
Vitosha mtn

Appendix 21 Rare Species of Diptera (continued)

Eupachygaster tarsalis Zetterstedt 1842
Distr Sofia
Nemotelus bipunctatus Loew 1846
Rhopotamo, Bourgas
Nemotelus notatus Zetterstedt 1842
Sliven Primorsko
Odonthomyia annulata Meigen 1822
Varna
Oxycera trilineata Linnaeus 1767
Bourgas
Stratiomys longicornis Scopoli 1763
Central Rhodopi mtn

SYRPHIDAE
Callipiobola speciosa Rossi 1790
Varna
Cheilosia albipila Shiraki, 1838
Vitosha mtn
Cheilosia carbonaria Egger, 1860
Pirin
Cheilosia corecta Becker, 1894
Petrich Bouzloudzha
Cheilosia melanura Becker, 1894
Vitosha mtn
Cheilosia nigripes Meigen, 1892
Smolyan
Cheilosia pubera Zetterstedt 1838
Pirin
Cheilosia rufimana Becker 1894
Vitosha mtn, Pirin mtn
Chrysotoxum cisalpinum Rondani, 1845
Slavyanka mtn
Chrysotoxum parmense Rondani 1845
Resovo
Criorhina asilica Fallen, 1816
Vitosha mtn
Eristalis nigritarsis Macquart, 1834
Borovets
Eumerus argyropus Loew 1848
Petrich
Eumerus basalis Loew 1848
Bourgas
Eumerus olivaceus Loew, 1848
Vitosha mtn
Lathyrophthalmus quinquelineatus Fabricius, 1781
Kresnensko defile
Merodon natans Fabricius 1794
Petrich
Merodon pruni Rossi 1790
Bourgas
Merodon clunipes Sack 1913
Ropotamo
Merodon distinctus Palma, 1863
Slavyanka mtn
Merodon geniculatus Strobl, 1909
Bourgas
Merodon hamifer Sack 1913
Petrich
Merodon rufipes Sack 1913
Sliven
Merodon tener Sack, 1913
Slavyanka mtn
Merodon testaceus Sack 1913
Rila mtn Parangalitsa
Merodon velox Loew 1869
Tsarevo
Orthonevra fumipennis Loew 1843
Bourgas
Sphegina latifrons Egger, 1865
Vitosha mtn
Sphegina montana Becker, 1921
Rila mtn Borovets
Syritta flaviventris Macquart, 1842
Ropotamo Arkoutino
Syrphus friuliensis Van der Goot 1960
Vitosha mtn
Xanthogramma citrofasciatum DeGeer, 1776
Vitosha mtn
Xanthogramma laetum Fabricius, 1794
Slavyanka mtn

TABANIDAE
Chrysops hamatus Loew, 1858
Distr Sandanski
Hybomitra decora Loew, 1858
Distr Aitos
Tabanus fraseri Austen, 1925
Distr Varna
Thereoplectes tricolor Zeller 1842
Balkan Brousa

TACHINIDAE
Bathia jacentkovskyi Villeneuve, 1937
Sliven
Calozenillia tamara Portschinsky 1884
Arkoutino
Cylindromyia hermonensis Kugler, 1974
Melnik
Gonia zimini Mesnil, 1963
Ahtopol
Macquartia viridana Robineau Desvoidy 1863
Vitosha mtn
Minthodes picta Zetterstedt 1844
Vitosha mtn
Minthodes pictipennis Brauer & Bergenstamm 1889
Sliven
Petagnia subpetiolata Rondani 1859
Vitosha mtn
Phasia pandellei Dupuis 1954
Koula
Rhamphina pedemontana Meigen, 1824
Pirin mtn

Appendix 21 Rare Species of Diptera (continued)

Steleoneura czernyi Stein 1924
Blagoevgrad
Tachina corsicana Villeneuve 1931
Kresna

TEPHRITIDAE
Acidia cognata Wiedemann 1827
Rila mtn Riski monastir
Myopites inulaedysentericae Blot, 1827
Devnya
Myopites stylatus Fabricius, 1794
Black sea coast
Paracantella pavonina Portschinsky 1875
Zlatni pyasatsi
Tephritis cometa Loew, 1840
Black sea coast
Tephritis dilacerata Loew, 1846
Distr Varna
Tephritis ruralis Loew 1844
Distr Barna
Urophora algira Macquart, 1843
Distr Varna

TETHINIDAE
Rhicnoessa cinerea Loew 1862
Black sea coast
Tethina czernyi Hendel 1934
Dist Bourgas

THAEREVIDAE
Cionophora kollar Egger, 1854
Varna
Thereva spinulosa Loew, 1847
Varna
Thereva tuberculata Loew 1847
Varna

NEMATOCERA
CECIDOMYIIDAE
Ametrodiplosys auripes F Loew 1888
Drouzhba Kaliakra
Asphondylia geniste H Loew, 1850
Drouzhba Kaliakra

Bayeria salicariae Kieffer, 1888
Kamchia, Kaliakra
Giraudiella inclusa Fauenfeld, 1862
Drouzhba, Kaliakra
Wachtiella niebleri Rubsaamen, 1915
Drouzhba Kaliakra

CHIRONOMIDAE
Brillia modesta Meigen, 1830
Varna region
Chironomus obtusidens Goetghebuer, 1921
Distr Varna, Bourgas
Clunio ponticus Michailova, 1980
Black sea coast
Cryptocladopelma fridmanae Tshernovskij 1949
Smolyan lakes
Endochironomus impar Walker 1856
Smolyan lakes
Glyptotendipes caulicola Kieffer, 1913
Smolyan lakes

MYCETOPHILLIDAE
Monocentrota matilei Bechev 1989
West Balkan
Exechia furcata Lundstrom, 1911
cave Reznyovete
Exechia indecisa Walkner 1856
cave Reznyovete Mecha doupka
Exechia intersecta Meigen, 1818
cave Ledenika
Fungivora ornata Stephens, 1832
Goelmata mecha doupka
Messala saundersi Curtus 1836
cave Stargankovoto
Rhimosia gracillipes Dzedzicki 1909
cave Temnata doupka
Speolepta leptogaster Winnertz 1863
cave Mladenova doupka

THAUMELEIDAE
Orphnephila testacea Ruthe 1831
Vitosha mtn Dragalevtsi

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NOTES

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Diversity of Zooplankton and Zoobenthos in the Danube River, Its Tributaries, and Adjacent Water Bodies

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I THE DANUBE RIVER (BETWEEN THE 845th AND 375th KILOMETER), INCLUDING ISLANDS AND RIPARIAN MARSHES

Scientific research on the benthic fauna of the Bulgarian section of the Danube River began with the work of Wohlberedt (1911) and was continued by several other investigators (Haas, 1911 Buttner 1926 1928 Arndt, 1943, Drenski 1947) However, specialized studies of species composition and distribution, and environmental impacts on the development of the zoobenthos began only in 1956 Specialized research on the zooplankton began in 1958 Many studies on these topics have been published since (information on these publications is presented in the bibliography) In addition to these we have used the more general publications of Naidenow (1965, 1978 and 1984) for zooplankton and Russev (1967, 1987 and 1979) for zoobenthos

Zooplankton

One hundred and twenty four species of zooplankton occur along the Bulgarian back of the Danube River Two hundred and twelve species, chiefly Rotatoria are known for the riparian and island marshes The zooplankton community is dominated by the Rotatoria The Rotatoria *Brachionus calyciflorus* Pallas occurs year round, but constitutes 90% of the total biomass in the spring and autumn Crustacea are relatively more numerous in the summer

Protozoa

Only 17 taxa of Rhizopoda and Ciliata have been identified in zooplankton studies They occur only in sporadic mass incidents The most frequently occurring are representatives of the *Arcella Centropyxis Lesquereusia Vorticella* and *Zootamnium*

Rotatoria

One hundred and twenty three taxa have been established 58 in the Danube River the others in Danube's riparian and island marshes

Cladocera

Sixty eight species, including 9 forms and varieties have been established Thirty three are found in rivers 36 on islands and marshes, and 46 in low lying coastal wetlands Only 16 species are common to all three categories However, 26 species are shared by the islands and marshes

Copepoda

Thirty four species have been established Thirteen are found in rivers, 18 on islands, and 32 in riparian marshes Nine species are common to all three categories Seventeen species occur in both riparian and island marshes

Crustacea

The Danube has 44 species of Crustacea Thirty four species occur in marshes and on riparian islands while 78 species are found in riparian marshes and floodplains In other words, there are only half as many Crustacean species in the rivers as in the standing riparian water bodies This is the reverse of the ratio for the Rotatoria

Research over the years on the quantitative distribution of zooplankton along the Bulgarian Danube has revealed two basic patterns in its development a natural (undiked) and diked regime A non diked left bank and the absence of dams in the middle and lower stretches characterized the river until 1970 This was important in terms of the character of the plankton community, which is determined by the periodic or regular exchange of faunistic elements between the river and its adjacent water bodies

The zooplankton in the river consist almost entirely of Rotatoria species constituting on average 76% of the plankton numbers and 70% of the biomass Cladocera, whose mean biomass barely exceeds 4% of the total, is the least represented The Crustacea play a smaller role in the summer months while the Rotatoria never fall below 90% of the total biomass values in the autumn

Zooplankton distribution is uneven along the length of the river The highest indices occur in the Rousse region and the lowest in the river below Svishtov Distribution is also uneven across the river's width zooplankton being more prevalent towards the northern bank where the spacious marshes of Romania drain Zooplankton are most abundant in the autumn months (when over 95% of the annual quantities occur) followed by the spring The lowest quantities occur in the summer months In the autumn the mean biomass weight amounts to 2 8 g/m in the spring 0 12 g/m^3, and in the summer barely 0 009 g/m^3

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Under the natural hydrological regime the period of mass development of zooplankton does not coincide with the period when the main species that feed on them zooplankton – the Danubian fishes – hatch and grow After the construction of dikes and dams along the river the quantity of thelmatho heleoplankton Crustacea declined without however affecting the dominant Crustacea Rotatoria comprise 72% of the biomass although Cladocera can at times comprise up to 85% of the biomass

Over the course of a years numbers generally fluctuate between 134 000 specimen/m^3 and 13 000 specimen/m^3, while biomass may vary from 0 79 to 0 108 g/m The seasonal curve has an identical spring and autumn maximum and a very low autumn minimum Thus the changes in the zooplankton curve throughout the year, and the changing role of Crustacea plankton in building up zooplankton biomass show the transition from lotic to limnic conditions

As noted above zooplankton are relatively unevenly distributed along the width of the river Frequently the quantity of zooplankton along the Bulgarian bank is lower than it is along the Romanian bank Despite a reduction in the average annual flow after 1971 the conditions during the first half of the year favored the survival of the small fish, which are exceptionally planktonophagic in this period

From a biological point of view the river system under its natural hydrological regime should be seen as a dynamic unity consisting of the river, riparian marshes and marshes on river islands in which an exchange of aquatic organisms occurs The intensive rate of plankton development during the autumn months (when water levels rise in the river and marshes) can be explained by the presence of large quantities of plankton in the river After the barriers between the river and adjacent marshes are ruptured the concentration of plankton rapidly falls below that of the spring and summer, although hydrological conditions in the Bulgarian sector of the river may exhibit only small changes Research has shown that the standing water bodies along the river and on the islands play a considerable role in the normal biological cycle of the river and in particular in determining plankton density – a significant prerequisite in establishing a rationally managed fishery and maintaining water quality in the Danube

Studies of the Danube in the section between the 845th and 541st kilometer show that when the biomass level is at 0 1 g/m^3 zooplankton production amounts to 17 250 tons or 40% of the secondary productivity in this section This however represents only 6 2% of total biological productivity Under these conditions the river would produce 260 tons of fish – approximately 40% in the spring season 28% in the summer, and 35% in the autumn

Zoobenthos

A total of 305 zoobenthos species have been identified in the Bulgarian section of the Danube – 275 in the river itself and 94 in channels and marshes on the Bulgarian islands However a number of species that are more sensitive to changing conditions are now extinct The larvae of mayfly *Palingenia longicauda* which has long been extinct in the rivers of Western and Central Europe is a typical case In the Bulgarian Danube it was common up to the 1970s Today it is found only in the tributary system of the Tissa River Forty four species occur relatively frequently and 16 species are dominant The species composition can be broken down into the various groups as follows

Hydrozoa

So far only 3 species have been found in the Bulgarian sector of the Danube

Turbellaria

Five species among them *Dendrocoelum lacteum* (O F Mueller) have been found in the Danube They also occur in the channels of the islands in the Bulgarian Danube

Nemertini

The species *Prostoma graecense* Boehm has been found

Nematoda

Only two species of the Dorylaimidae family have been found

Nematomorpha

Only the species *Gordius aquaticus* L has been reported

Polychaeta

Two species (Caspian relicts) have been found

Oligochaeta

Forty six species have been found in the Bulgarian sector of the Danube

Hirudinea

Eleven species of leeches are known to inhabit this section of the Danube Five of these are also found in the marshes of the Bulgarian islands on the Danube

Gastropoda

Twenty eight species have been found in the Danube, and 15 in marshes and channels of the Bulgarian islands on the Danube

Lamellibranchia

Sixteen species have been found in the Danube, and 8 in the marshes and the channels of the Bulgarian islands on the Danube

Hydrachnellae

Only six species have been reported from marshes of the Bulgarian islands on the Danube

Decapoda

Only the Caspian relict *Astacus leptodactylus* Esch has been found

Mysidacea

Six species have been found in the Bulgarian section of the Danube *Limnomysis benedeti* Czern has also been established in the marshes on the Bulgarian islands along the Danube Two species of *Isopoda* have been found *Jaera sarsi* Valk is a Caspian relict

Amphipoda

Twenty three species have been found in the Danube while 4 have been found in marshes and channels of the Bulgarian islands on the Danube

Ephemeroptera

In the Bulgarian section of the Danube 22 species have been found 7 species are found in the marshes and channels of the Bulgarian islands along the Danube However many of them can no longer be found here

Plecoptera

Only three species have been reported here, and these were found during the first period of studies (1956 1961)

Odonata

Six species have been found in the Bulgarian Danube and 7 species in marshes and channels of Bulgarian islands on the Danube

Heteroptera

Ten species occur in Danube and 9 species in marshes and channels of the Bulgarian islands of the Danube

Coleoptera

Nineteen species have been found in the Danube River and 10 species in the marshes and channels of the Bulgarian islands on the Danube

Trichoptera

Seventeen species have been found in the Danube River but only one in the marshes and channels of the Bulgarian islands on the river

Diptera

In the Danube 55 species have been found Two species are found in marshes and channels of the islands of the Danube Two of them belong to the Simuliidae family, and 47 to the Chironomidae family

Bryozoa

Nine species have been found in the Danube River

The following groups of benthic invertebrates have not been studied in the Bulgarian section of the Danube Rhizopoda, Ciliata, Porifera, Tardigrada Hydracarina Ostracoda Harpacticoida, Cumacea Hydrozoa Turbellaria, Nematomorpha, and Nematoda the Diptera family has also been poorly studied

Studies of the zoobenthos communities in the Bulgarian Romanian section of the Danube throughout three seasons in 1964 showed that the mean biomass had fallen approximately 3 5 times when compared with data from 1958 This was observed in particular at the eastern end of the river section, and was attributed to the increasing influx of pollution from the tributaries and industrial towns situated along both banks of the river A gradual rise in the general biomass was detected for the 1970 1973 period and was attributed to the favorable influence of falling turbidity (i e lower rates of sedimentation due to a decrease in water borne silt) as a result of the commissioning of the Iron Gates power complex

These favorable impacts have continued, and even increased In October 1982 the zoobenthos species composition in two western parts of this section of the Danube – Novo selo (834th kilometer) and above Lom (747th km) – was comparable to that in the 1970 1973 period a finding supported by results in comparisons of carried sediments turbidity, and zoobenthos biomass over various periods However, the impact of the hydropower plant does not extend over the entire Bulgarian Romanian sector The tributaries from both sides of the Danube, despite an insignificant (10%) increase in water flow, carry substantially more sediments and insufficiently treated waste waters than in previous periods

The Danube was studied during a period of very low water (between 1998 7 and 2732 m^3/s) in October 1986 Fifteen groups and 89 taxa of invertebrates were found Sixty five were identified at the species level (species of the Chironomidae family have not been distinguished) The class Oligochaeta is represented by the highest number of taxa (42) followed by the order Amphipoda (12) the class Gastropoda (9) and the order Trichoptera (6) These figures are considerably lower than those given in general studies of species composition of the Danube River The latter reflect many years of research at many locations along the length of the river

In addition many species (in particular those in the orders Ephemeroptera and Plecoptera) have long been absent from the Bulgarian portion of the river

The groups that are found most often are the Diptera (chiefly Chironomidae and Bezzia) with a frequency (pF = 71 43%) followed by Amphipoda (pF = 68 64%) Oligochaeta (pF = 51 79%) Gastro poda (pF = 35 71%) Trichoptera (pF = 28 57%) Lamellibranchia (pF = 25 00%), Turbellaria (pF = 23 21%) Isopoda (pF = 19 64%), Nematoda (pF = 16 07%) Polychaeta (pF = 8 93) Odonata (pF = 7 14%), and Hydrozoa (pF = 5 36%) The most fre quently found species are *Corophium curvispinum* (pF = 30 36%), *Hydropsyche bulgaromanorum* and *Iso chaetides michaelseni* (pF = 26 79%) *Lithoglyphus naticoides* and *Dreissena polymorpha* (pF = 23 21%), *Pontogammarus obesus* (pF = 21 43%), *Pontogam marus sarsi* (pF = 19 64%) *Jaera sarsi sarsi* and *Dik erogammarus haemobaphes fluviatilis* (pF = 17 86%) *Propappus volki* (pF = 16 07%) etc Prevailing spe cies are *Corophium curvispinum* and *Pontogammarus sarsi* (DF = 17 86%) followed by *Hydropsyche bul garumanorum* (DF = 14 29%) *Isochaetides michael seni* (DF = 12 5%) *Propappus volki* (DF = 10 71%) *Lithoglyphus naticoides* (DF = 7 14%) and *Jaera sarsi sarsi Pontogammarus obesus Stenogammarus com presso similis*, and *Otamothrix moldaviensis* (DF = 5 36%) There are some species that appear infre quently in the biocenoses but when they do appear immediately become dominant and acquire a high "order of domination" (DT) ranking This is the case with the species *Dero obtusa Potamothrix hammonien sis* and *Stenogammarus compresso similis* (DT = 100%), *Pontogammarus sarsi* (DT= 90 94%), *Propap pus volki* (DT = 66 65%) *Corophium curvispinum* (DT = 58 83%) and *Hydropsyche bulgaromanorum* (DT = 53 34%)

With regard to density the representatives of Amphipoda are first – mainly Corophiidae (66 70%) followed by Oligochaeta (17 23%) Trichoptera (5 17%), and Chironomidae (2 91%) With regard to biomass, the most important groups are from the Gastropoda (79 90%) and Lamellibranchia (17 13%) If we ignore Mollusca (because of the weight of their shells), once again Amphipoda (57 47%), followed by Richoptera (26 73%) and Oligochaeta (8 98%) was the most significant as regards biomass

The structural parameters of the biocenoses re veal quite varied conditions in this section of the Da nube Thus the species diversity index is between 0 1 and 3 46 the general species diversity index, between 0 48 and 9 27, the equitability index between 0 16 and 0 97 and the dominance index between 0 13 and 0 89 Low values of these indices (and in the case of the dominance index high values) occur generally in parts of the Danube with large grain sand bottoms (with no silt traces) which are unfavorable for ani mals High values are found in areas with a dense lithofauna and (to a lesser degree) in pelorheophylic biocenoses Studies of the bottom of the Danube indi cate that the psamic biotope occupies 60% of this sec tion followed by gravels (27%) silts (5 5%) and psammic silts (7 27%)

Lithorheophilic zoocenoses are the most abun dant (in particular those of corofiumic silt) followed by eulythorheophilic zoocenoses The average gen eral density and biomass are higher than averages from the recent past Psammorheophilic zoocenoses have the lowest values with a total number of 1537 species per m and mean biomass of 0 9 g/m (molluscs have not been found) This biomass is about 4 times higher than the values from past years which we be lieve is due on the one hand to exceptionally low water quantities during the course of the studies, and on the other hand to lower sedimentation rates and the prob able enrichment of the bottom with organic substances – all of which create conditions for increases in the trophic base of the ecosystem

Ecological Problems

The impacts of pollution and dam construction are the main ecological problems of the Danube that have been studied by Bulgarian biologists In addition to generally employed saprobiologic methods to study the impacts of pollution methods of determining the self purification potential of the river through the use of biogenic aeration were also used together with some original criteria – percentage of habitation ratio between numbers and species composition of various zoobenthos groups ' and variation in bio mass "

Zoobenthos studies reflecting the state of the bottom of the river provide a more precise and valid assessment of total pollution and self purification characteristics as compared with studies conducted in other scientific disciplines Thus in the years 1956 1961 the Bulgarian Danube was oligosaprobic to oligo betamesosaprobic In the years 1964 1978 it was stable betamesosaprobic In the years 1982 1988 this stable state was interrupted with a certain ten dency towards alphamesosaprobia despite the excep tional autopurification potential of the great river (average water flow about 6 000 m^3) This has oc curred below the inflow from the tributaries and the larger cities on both banks of the river Autopurifica tion occurs over the course of about 1-5 km Immedi ately below Rousse however the benthos fauna has been destroyed over a stretch of 4 km while the zone of autopurification of the river (based on plankton studies) amounts to 15 km at a water temperature of 22 23° 23 km at 16 19° and 31 km at 7 8°

Pollution from the Arges which carries the effflu ent of Bucharest to the Danube results in a state of polysaprobia on the river with a ten fold decrease in the zoobenthos biomass In order to protect against

further pollution the Danube should be given the strict status of inland rivers under Bulgarian legislation which requires the treatment of industrial waste and effluent This can be done only after a tri lateral (or at least bi lateral) convention on the preservation of the Danube's water quality is agreed to by Bulgaria Romania and possibly Serbia The remaining countries of the Danube basin have not so far played a significant part in saprobic pollution of the Danube along its Bulgarian bank

Studies have shown that saprobic pollution from even large cities such as Vienna Bratislava and Budapest is self purified by the river at distances up to 40 km and the Iron Gates dams I and II contribute to the self purification of the Danube in the Bulgarian sector It would of course be useless to provide funds for treatment plants on the Bulgarian bank of the Danube if this is not matched by efforts in Romania and Serbia To ensure the appropriate development of such a convention it should be drawn up by the International Organization for the Study of the Danube as well as the former Comecom

II THE BULGARIAN TRIBUTARIES OF THE DANUBE RIVER

Various groups and species of invertebrates in the Bulgarian tributaries of the Danube have been studied by both Bulgarian and foreign specialists In some cases these studies have consisted of individual projects over selected sections of only the most commonly visited rivers such as the Iskar and its tributaries from Vitosha Mountain Later research has focused on the systematics of the groups For example Golemanski and Todorov (in print) report 33 species of Rhizopoda from the tributaries of the Beli Iskar

Studies of the Ciliata fauna in most of the Bulgarian tributaries of the Danube have been conducted over a longer period concentrating on species composition the influence of various ecological factors on them, and their significance as bioindicators (Detcheva 1971 1972 1974 1975 1975a 1975b 1979 1982 1983a 1983b 1991 in print) Ryanovska Vasileva (1949) reported 3 species of Hydrozoa for the Iskar and Vit More detailed studies of Oligochaeta from the Danubian tributaries have been conducted by Dimitrov (1972 and 1973) Uzunov (1976 and 1980) and Uzunov (1979) Buettner (1928) Petkov and Oshanova (1960) Drenski (1947) and Angelov (1959 and 1976) provided information on the distribution of some representatives of Gastropoda while the latter two also worked on Lamellibranchia

Other important studies include Valkanov (1938) on Isopoda Schaeterna (1923) on Amphipoda Boulgourkov (1961) on Decapoda Petrova (1971 and 1985) on Hydrachnellae Russev (1957 1960 1971 1977) Jacob and Braasch (1984) and Braasch et al (1985) on Ephemeroptera Rauser (1962 1965) Sowa (1970) Russev (1971) Braasch (1969, 1970, 1972), Braasch and Joost (1971a 1971b, 1975, 1976) on Plecoptera Beshovski (1965, 1967, and 1968) on Odonata, Gueorguiev (1957 1961 1962 1965 1971 1987) on Coleoptera, Klapalek (1895 and 1913) Navas (1929) and Popov (1981) on Neuroptera Josifov (1957) on Heteroptera Botosaneanu and Sykora (1963) Kumanski (1968a, 1968b 1969 1971a, 1971b, 1972, 1973a 1973b 1985 1988) on Trichoptera Gulichka (1961 and 1966) on Blephariceridae, Dimitrov (1962, 1966 1972 1973) on Chironomidae Konsulov and Paspalev (1925) Enderlein (1929) Kovatchev (1969, 1973a 1973b 1979) on the family Simuliidae Patev (1924) and Grancharova (1968a 1968b 1971) on the distribution of Bryozoa Hristovich (1892) Arndt (1943) and Kownacki and Kownacka (1973) reported data on the distribution of several groups of invertebrates but only in some locations in one or several rivers

Complex hydrochemical hydrofaunistic bioceno logical and saprobiological studies have been carried out over periods of several months and years in all the Bulgarian Danube tributaries and most of the results have been published Parts of the Lom River were studied by Russev et al (1991) of the Tsibritsa River by Russev and Janeva (1986) of the Ogosta River by Janeva (1991) of the Iskar River by Russev (1959 1968) Gardanov et al (1971) and Janeva and Russev (1989) on the Iskar tributaries from Vitosha Mountain by Russev (1961) on the Vit River by Russev (1977 1979a 1979b 1988), of the Osam River by Gardanov et al (1971) Russev (1977) and Russev et al (1984) of the Yantra River by Russev (1968) Russev and Janeva (in print) of the Rositsa River (a tributary of the Yantra) by Kovachev and Uzunov (1987) and parts of the Russenski Lom by Russev et al (1987 and 1988) Russev (1968 1970, 1975) contributed a general review of the saprobiological state of rivers in Bulgaria including some of the tributaries of the Danube

A total of 1610 taxa from 25 groups of benthic invertebrates have been established in the 13 tributaries of the Danube in Bulgaria

Protozoa

Rhizopoda have been studied only in several small streams of the Iskar drainage, 33 have been identified Ciliophora is represented in all tributaries by 224 taxa including the Gymnostomata (61) Vestibulifera (9) and Hypostomata (21) in Kinetofragmophora Hymenostomata (37) and Peritricha (20) in Oligohymenophora and Spirotricha (67) in Polyhymenophora Studies have looked at the frequency of some species in different rivers their distribution over various seasons and the influence of the major chemical parameters on distribution

Coelenterata

Hydrozoa

Four species have been found *Hydra circumcincta* is most common

Vermes

Turbellaria

Five species have been found

Nematomorpha

One unidentified specimen of the family Gordii dae was found in the Lom River

Nematoda

Many representatives of this group in the tribu taries of the Danube have not been identified

Oligochaeta

Ninety one species from 43 genera have been found A comparison of the characteristics of the Oli gochaeta fauna of the Danube (between the 845th km and the 375th km) and its Bulgarian tributaries has been carried out Analysis of the coefficient of faunis tic similarity (K%) has established that the Oligo chaeta fauna of the Bulgarian sector of the Danube differs substantially (mean K = 44 65) from that of its Bulgarian tributaries The similarity among the differ ent tributaries is considerable (K = 65% for the Vit and Yantra K = 74% for the Osam and Iskar etc), the mean value of K for the tributaries is 62 90% This is explained by the relative similarity of various ecological factors within the Bulgarian section of the Danube and by the presence of Ponto Caspian spe cies, the tributaries on the other hand, have been subject to considerable anthropogenic impacts leading to sharp variations in many ecological factors

Hirudinea

Of the 11 species that have been found *Cysto branchus fasciatus* (Koll) and *Piscicola geometra* (L) are rare Studies have also been conducted on the ecology of leeches and their significance as bioindica tors in Bulgarian rivers

Mollusca

Gastropoda

Thirty five species have been found Four of these – *Acroloxus lacustris* L *Amnicola steini* Mar tens *Myxas glutinosa* (Muell), and *Pseudamnicola sp* – are among the rare species in the Bulgarian tribu taries of the Danube The species *Fagotia acicularis* Fer *F esperi* Fer , *Lithoglyphus naticoides* Pfeif *Theodoxus transversalis* Pfeif and *Th danubialis* Pfeif came from the Danube

Lamellibranchia

Seventeen species have been found Because the sampling methodology has not always been suitable their representation in the tributaries of the Danube is probably larger

Arachnida

Hydracarina

Forty nine species have been found The number of species and their presence in the tributaries of the Danube are likely more extensive however as a great proportion of the gathered material has not been de termined

Crustacea

Isopoda

The species *Asellus aquaticus* L occurs almost everywhere where the degree of saprobic pollution is classified as Alphamesosaprobic

Amphipoda

A total of 7 species have been found Caspian relicts from the Danube have probably not penetrated the tributaries Indicator parameters of *Gammarus aiduus* Kar for establishing the saprobicity of rivers have now been determined and published

Decapoda

Three species are found commonly in the country However their presence in tributaries of the Danube is probably greater than previously determined, as the methodology used in sampling has been unsuitable

Insecta

Endemic relict, and rare species, as well as spe cies with aquatic forms during portions of their life cy cle, are discussed in the reports on insects

Ephemeroptera

Seventy seven species have been found Studies have examined aspects of their ecology and the signifi cance of mayflies as indicators

Plecoptera

Ninety four taxa have been found Their pres ence in the rivers Topolovets Voinishka Vidbol Ar char and Skomlya is likely much higher than currently known as these rivers have been insufficiently studied in their upper stretches

Odonata

Thirty-one species have been found mainly in the middle and lower stretches of the Danube tributaries

Coleoptera

One hundred eleven species have been found

Heteroptera

Twenty nine species have been found so far

Megaloptera

The species *Sialis lutaria* L has been found in pure deep silt

Trichoptera

One hundred thirty one species have been found so far in the tributaries of the Danube

Diptera

Three hundred twenty eight have been found These can be broken down according to the following families Blephariceridae (3) Tipulidae (3) Cylindrotomiidae (1) Limoniidae(8) Psychodidae (7), Dixidae (1) Culicidae (2), Simuliidae (60) Chironomidae (217) Thaumaleidae (1) Ceratopogonidae (3) Stratiomuidae (5) Tabanidae (2) Athericidae (2) Rhagionidae (1) Syrphidae (2) Empididae (2), Ephydridae (2), Muscidae (1), Sciomyzidae (1) With the exception of the families Simuliidae and Chironomidae identification has been carried only to the level of genera due to insufficient research and a lack of published literature The main aspects of the ecology of the Simuliidae family have been studied Comparison of the Simulid fauna in the various tributaries indicates that similarity is greatest among the rivers from the Stara Planina Mountains – the Vit Osam and Yantra The Simulid fauna of the Iskar which springs from the Rila Mountains, is more distinctive, as it includes species typical of the Boreo alpine complex well represented in the Rilas and less in the Stara Planina The degree of similarity between the tributaries and the Danube itself is inconsiderable for the reasons stated above

Tentaculata

Bryozoa

This group has been studied only in the Yantra River where 5 species have been found

Table 1 summarizes information on the provided distributions of the various groups of benthic invertebrate animals in the different tributaries of the Danube The northwestern tributaries of the Danube – the Topolovets Voinishka Vidbol Archar Skomlya and Tsibritsa Rivers – have been studied to a lesser degree As a result they are poorer in known species diversity Moreover the volume of water in these streams is much lower than in the other tributaries

Data on the number of species in the various groups of aquatic invertebrates pertains to research conducted throughout Bulgaria Today species composition is considerably poorer due to the increases in effluents and industrial wastewaters Thus studies carried out on the Yantra River in the periods 1964 1967 and 1987 1988 showed a considerable decline in species composition

The groups Porifera, Rotatoria, Gastrotricha, Nematoda, Tardigrada Ostracoda Harpacticoida, and Cumacea have not been studied at all in the Bulgarian tributaries of the Danube The groups Hydrozoa Turbellaria, Nematomorpha Hydracarina and Diptera (with the exception of the families Simuliidae and Chironomidae) have been insufficiently studied

Structural Characteristics of Benthos Zoocenoses

The species compositions of different rivers have been compared using a coefficient for species similarity (Soerensen 1948) Analyses of the structure of benthos zoocenoses have been carried out by determining the index of individual diversity (H) (Shannon and Weaver 1963) the general species diversity index (d) (Margaleff 1958) the domination index (c) (Simpson 1949) and the equitability index (e) (Pielou 1966) The number of species in 20 main benthos groups have been determined Analysis of composition and structure has been based on two main criteria the mean annual water volume and the degree of disruption of the zoocenoses due to anthropogenic impacts

Structural analysis of the biocenoses of the Bulgarian Danube tributaries brings out the following characteristic features (Janeva and Russev 1991) Table 2 presents the coefficient values for species similarity among the Danube tributaries In only two instances (between the Voinishka and Vidbol Rivers, and between the Ogosta and Rousenski Lom Rivers) are these values over 50% In most cases the similarity of species composition between the Vidbol, Voinishka Topolovets, Archar, Tsibritsa and Skomlya Rivers on the one hand and the Lom Osam Vit Ogosta Yantra and Iskar Rivers on the other varies between 35%-50% Exceptions are the lower levels of similarity between the rivers Vit and Rousenski Lom (30 24%) and Topolovets and Archar (21 58%) In general the differences in species composition between rivers from the two groups were greater, with coefficients varying between 25% and 47% Differences in species composition were most significant between the Vit and Tsibritsa Rivers (26 90%) the Yantra and Skomlya (21 20%) and the Iskar and Skomlya (18 75%) Differences in the volume of water in these rivers (resulting in variable current speeds) and in other ecological factors explains the differences between their species compositions

Analysis of the mean values of general and individual species diversity together with dominance (table 3) allows us to group the studied tributaries of the Danube into three groups Those in Group I (Voinishka Vidbol Archar and Lom) have species diversity values above 3 0 and dominance values under 0 20 The rivers in Group II – Skomlya, Tsibritsa

Ogosta and Vit – are moderate species diversity and dominance values within the intervals 2 97 2 65 and 0 27 0 23, in this group only the Vit has a lower domi nance value (0 20) The third groups includes the Iskar and Yantra Rivers which have the highest dominance indexes and the poorest levels of species diversity As far as evenness is concerned it is clear that the tributaries of the Danube have high equitabil ity indexes

These analyses lead to the following conclusions

- Most of the Bulgarian tributaries of the Danube (the Voinishka Archar, Skomlya, Lom, and Tsi britsa) are characterized by a rich and varied spe cies composition Their biocenoses are stable and successfully neutralize the negative effects of an thropogenic interference

- Most of the middle and lower stretches of the relatively large rivers (e g the Vit Yantra and Osam) are in an unfavorable position however much their upper stretches and tributary systems augment their species composition,

- The Iskar which receives the effluent of Sofia is in a comparatively unfavorable situation

The Saprobiological Status of the Danube Tribu taries in Bulgaria

The saprobiological status of the various tributar ies of the Danube in the period from 1956 to 1991 has been reported in many publications These have been discussed earlier and are listed in the bibliography The most recent data from the saprobiological studies are given in Table 4

Comparisons were drawn between the saprobi ological state of the 13 Danubian tributaries in the up per and lower courses of the rivers based on a study conducted from June 1984 to April 1989, and carried out by Russev and Janeva (1991) The content of dis solved oxygen oxidation and the ammonia group were studied using standard methods, and the saprobi ological index calculated after the method of saprobic valence described by Zelinka and Marvan (1961) and Rothschein (1962) Data for new bioindicators from Sladecek (1973) Russev et al (1976) Russev (1979) Janeva (1979) Uzunov (1979) and Kovachev (1979) were also used in these comparisons

The state of the tributaries in the foothills of the Stara Planina Mountains is relatively good ranging from xenosaprobic to oligosaprobic Thus, the sapro bic index of the Ogosta River at the town of Chiprovtsi in April 1985 was 71 91, of the Cherni Vit River above the village of Cherni Vit in April 1989 – 72 67, of the Cherni Osam River above the village of Cherni Osam in April 1989 – 81 58 and of the Yantra River above the village of Yabalka in May 1987 – 84 88 The posi tion of the Tsibritsa Archar and Iskar is similar (Table 4) For the remaining tributaries of the Da nube which are fed from springs arising on lower more even ground (e g the Skomlya and Beli Lom) or which have been studied in more remote locations in the mountains have saprobiological indexes within the beta mesosaprobic portion of the spectrum (42 59 56 67) The content of dissolved oxygen during the measurements varied between 8 00 and 13 28 mg/l Oxidation varied from 1 76 to 9 60 mg/l O the am monia group from 0 00 to 0 20 mg/l O These tribu taries although lower in water volume are clean since they do not run by larger settlements and industrial centers

Naturally, the tributaries of the Danube are con siderably more polluted just above the point where they join the Danube The most eastern of the tribu taries, as well as the Tsibritsa (with an average annual water flow of between 0 31 and 1 93 m^3/sec) have a SRs of between 39 95 and 55 19 (Beta alph ı meso saprobic to beta mesosaprobic) dissolved oxygen content values of between 8 8 and 15 04 mg/l oxida tion values between 1 50 and 12 0 mg/l O_2 and con centrations of the ammonia group of between 0 00 and 0 77 mg/l The remaining tributaries (with average annual flows of between 4 93 and 54 9 m_3/sec) have saprobiological indexes between 13 97 and 29 51 (polysaprobic and alpha mesosaprobic) dissolved oxygen content between 0 9 and 11 7 mg/l oxidation between 8 80 and 83 00 mg/l O_2 and concentrations of the ammonia group between 0 05 and 1 6 mg/l Their higher pollution load is due to the presence of large industrial settlements at Lom Miziya, Sofia Bozhu ritsa Byala Rousse and elsewhere In general how ever, pollution from the Bulgarian tributaries is rela tively slight, and concentrated along the Bulgarian riv erbank This reflects the fact that the Danube's water volume is more than 100 times greater than the largest of the Bulgarian tributaries (the Iskar)

III RESERVOIRS

Within the drainage area of the Bulgarian section of the Danube the reservoirs behind the Stamboliiski Dam, the Iskar Dam and the Pancharevo Dam have been studied The initial studies of temperature, oxy gen regime quantitative and qualitative composition of the zooplankton zoobenthos and ichthyofauna and the feeding of some fish species were performed by Dimitrov (1957 and 1960) The zooplankton of the man made lakes in Bulgarian was studied in depth by Naidenow (1962b 1969b 1972b, 1984 1987) and Naidenow and Baev (1987) The data for species composition for the various reservoirs can be summa rized as follows

Protozoa

Four species found in the reservoir at the Stam boliiski Dam

Rotatoria

Eight species at the Iskar Dam, and 36 in the

Stamboliiski Dam

Oligochaeta
Twelve species at the Stamboliiski Dam

Hirudinea
One species at the Stamboliiski Dam

Cladocera
Nine species at the Iskar Dam 4 species at the Pancharevo Dam and 15 at the Stamboliiski Dam

Copepoda
Eight species at the Iskar Dam and 6 species at the Stamboliiski Dam

Chironomidae
Twenty species at the Stamboliiski Dam

No other groups have been examined beyond these 7 groups of common aquatic invertebrates

Naidenow (1984) has compiled an original ty pology of the standing water bodies in Bulgaria Ac cording to him the quantitative development of the zooplankton is not always a suitable index for charac terizing the type of water body since its principal pa rameters vary within broad limits the qualitative composition and dominant complexes are generally more stable

Owing to their well expressed stages of evolution the classification of glacial lakes, falling into four classes requires precise measurement of their hydro logic and zooplanktonic characteristics Oligotrophic water bodies comprise the higher mountain glacial lakes and some dam lakes Glacial lakes in the third stage of development are usually oligo mesotrophic or alpha mesotrophic

Most of the man made lakes in Bulgaria are me sotrophic Contrary to natural lakes however they have never been in an oligotrophic state and few have reached advanced states of eutrophication Eutrophic standing water bodies include coastal wetlands mar shes and wetlands along the Danube warm water fish eries and some dam and micro dam reservoirs There are no dystrophic water bodies in Bulgaria landslide lakes in the Rhodope Mountains are the nearest in characteristics to these

Classification of freshwater basins is based not only on the presence of indicator species but on qualitative and quantitative relationships between taxonomic groups of zooplankton and changes in the structure of zoocenoses These are important consid erations in that they determine the ratio among the fine filtrators crude filtrators and predator organisms in the system

In the course of oligo eutrophic succession and parallel to the establishment of new biotopes and eco logical niches, there is an increase in the number of zooplankter species The level of species diversity reaches a maximum in late mesotrophy after a subse quent fall in eutrophy and in particular hypertrophy

IV LAKES

Devetashki Lakes

The Devetashki lakes are situated in the karstic Devetaki plateau, between the Osam and Rositsa riv ers The zooplankton were examined in Sinovishte, Dedevetz and Geranishte Lakes as well as several smaller lakes (Stublata, Dakova Bara, Shekerova Bara, Lewskova Bara, Bonchova Varpina Machkovetz Ruzhina Bara Starzhieva Bara, and Roupova Bara)

Twelve species of Rotatoria 15 species of Bran chiopoda and 6 species of Copepoda were found most of the species being common in Bulgaria Cope poda was represented by 2 species of Calanoida one of which (*Arctodiatomus wierzejskii*) was found on only one occasion The Cyclopoida are poorly represented with representatives of the subfamily Eucyclopinae being absent Among Branchiopoda all families (with the exception of Daphniidae) are represented by only 1 or 2 species Typically, representatives of these groups that are common in the Thracian and Danu bian plains are absent here

Many of the basins with abundant zooplankton have not been used as fisheries Stocking those that retain sufficient water year round with fish, followed by semi intensive feeding, could result in an annual yield of 25 50 kg fish per quarter acre (100 200 kg per acre) based on the existing trophic base Qualitative analysis of the seasonal dynamics of dominants (*Cyclops vicinus Acanthocyclops vernalis Daphnia pu lex*) indicates that conditions are favorable for stock ing as long as the titer of the plankton food base is maintained between 2 3 g per m^3 (Naidenow 1972)

Standing Water Bodies in the Ludogorie Region

A total of 93 water bodies were studied 14 of them seasonal This total also includes small natural water bodies artificial reservoirs micro dam lakes and waters collected behind dikes often with diame ters as small as 100 150 m and a depths between 0 5 and 2 5 m As they are supplied only by rains in the dry hot summers many of the shallower water bodies dry out completely

Within these pools, a total of 24 species of Rota toria 73 species of Crustacea (37 species of Cladocera and 24 species of Copepoda) and 6 species of Coleop tera were found In its composition structure and seasonal dynamics this fauna differs substantially from that found in the hydrobiocenoses of the interior of the country along the Black Sea coast and along the Da nubian banks

The most characteristic elements from a faunis tic zoogeographic perspective are *Lovenula alluaudi*

Alonopsis ambigua Daphnia ulomskyi and *Pleuroxus uncinatus* which do not occur elsewhere in the country *L alluaudi* is most common along the southern coasts of the Mediterranean but is also found in the countries of southern Europe and reaches the northernmost limits of its range in South Austria Hungary and the Danubian wetlands of Romania However its dominant role in the wetlands of Ludogorie has no parallel in the hydrofauna of other European countries *A ambigua* is a boreal element and its occurrence in the Ludogorie region has as yet no satisfactory logical explanation

Based on these observations, the hydrofaunistic complex of the Ludogorie clearly constitutes an unusual zoogeographic phenomenon Markedly southern species such as *Lovenula alluaudi Diaptomus minus Arctodiaptomus byzantinus, Arct kerkyrensis Daphnia simulis D ulomskyi* and *D atkinsoni* appear simultaneously with species typical for Central and even Northern Europe such as *Macrothrix hirsuticornis Alonopsis ambigua Eudiaptomus zachariasi* In the context of the neighboring well studied regions the Ludogorie region appears as an isolated oasis where a unique mixture of species from different zoogeographic regions situated far away from one another can be found The reason for the formation of such a specific hydrofauna cannot at present be given

In their studies of various small standing water bodies (ponds small marshes dendrothelms etc) researchers as early as the turn of the century included accounts of various types of aquatic invertebrates These studies are included in the bibliography However since the data is obsolete in terms of nomenclature and the existence of many of the small water bodies today is doubtful we have not summarized here the findings of these reports

V STIGOBIONTIC (UNDERGROUND) FAUNA OF BULGARIA

Bulgaria is one of the European countries whose stigobiontic (underground) fauna is comparatively well studied

The Protozoa are not well known in continental underground waters Foraminifera, which are found in wells in southeast Bulgaria in the proximity of the Black Sea are an exception Some authors report similar finds from underground waters in the deserts of Central Asia (Mikhalevich 1976) In all these cases perhaps we have an example of a marine organism from ancient seas that has adapted morphologically and physiologically to an underground manner of life Also, some epibiontic Protozoa of the genera *Podophrya, Tokophrya* and *Vorticella* are found on underground crustacea and the larval stages of underground Limnohalacaridae No special studies have been carried out on the latter in Bulgaria

Few groups of worms have penetrated into the underground waters Oligochaeta is only represented by *Haplotaxis bureschi* (Michaelsen) which occurs in the karst regions of the western Stara Planina The same species has been found in Yugoslavia and Romania

Despite serious speleological studies researchers have been unable to find the rare cave arachnelid *Troglochaetus beranekı* (known to occur in Central and Eastern Europe) nor *Marifugia cavatica* (known from Herzegovina)

Two Hirudinea species of the *Dina* genus have been found in caves in western Bulgaria (the western and central Stara Planina) They are rare species whose taxonomic status not clear They can probably be considered relict forms from the end of the Tertiary, but at this stage this remains a hypothesis

In Gastropoda 10 species and 1 subspecies, from 8 genera are known in Bulgaria 8 of which are endemics (73%) Compared with the karst of the Adriatic where Gastropoda are abundant Bulgaria has fewer species

The karst of the western Stara Planina appears to be the richest area for gastropod fauna with marked occurrence of endemics This may be due to the process of species formation after the end of the Tertiary when considerable changes occurred in the configurations of water basins in these lands

The basic components of the biocenoses in underground waters are stigobiontic crustacea and acarids The underground Ostracoda in Bulgaria are insufficiently studied Isolated reports come from southern and southeastern Bulgaria (Svetkov 1966 1972 Danielopol and Svetkov 1979, Danielopol 1980) Underground Ostracoda are typical for karstic and interstitial habitats Eight species are known in Bulgaria in 3 genera from 2 families Three of them (37%) are endemics According to Danielopol (1980) the representatives of the genus *Kowalevskiella* (which the author calls "living fossils') are ancient forms thermophilic relicts from the end of the Tertiary

The subclass Copepoda are typical with their great diversity in underground waters No underground forms from the Calanoida order are known in Bulgaria Bulgaria's underground waters are inhabited by 30 species (in 6 genera) from the Cyclopoida order 19 species are stigobionts 7 (36 8%) are endemic Because studies have been unevenly conducted it is not possible to indicate the territories in Bulgaria with the greatest numbers of endemic relict, and rare species Owing to the considerable extent of karst regions in the western Stara Planina, and the greater number of systematic studies that have been carried out there, this region appears to be the richest in species The most recently studied regions are the Danubian plain and Strandzha Mountain The genera *Speocyclops Acanthocyclops* and *Diacyclops* are the most specialized for an underground way of life

The Harpacticoida order is well studied in Bul

garia Typical for underground waters it has a marked degree of diversity and endemism Harpacticoida are more common in underground interstitial waters than Cyclopoida due most likely to their small dimensions Forty nine stigobiontic species falling into 10 genera are known in Bulgaria 21 of which are endemic (42 8%) All members of the *Parastenocaris* genus are found underground The genera *Elaphoidella Stygoelaphoidea* and *Nitocrella* also have many stigobiontic representatives The greatest numbers of endemic species are found in the regions of Dobrudzha Strandzha, the Rhodope Mountains, and the western Stara Planina Mountains

Within the large group Syncarida the Bathynellacea are well studied in Bulgaria They are among the most typical crustacean stigobionts having evolved over a long period in underground environments Seven species in three genera (*Bathynella Parabathynella* and *Hexabathynella*) are known Five (71%) are endemics Most of the endemics come from southern and southeastern Bulgaria due probably to the changes in the Black Sea and Aegean basins towards the end of the Tertiary They inhabit mainly the interstitial water but also occur in karst waters

In the order Amphipoda stigobiontic representatives from the genera *Bogidiella Ingolfiella* and *Niphargus* are known and occur throughout Bulgaria The first two genera are represented in Bulgaria by one species and (unlike *Niphargus*) are not sufficiently studied The genus *Niphargus* is represented by 7 endemic species

The representatives of the Cirolanidae family in Bulgaria are rare endemic and relict forms Two species have been found and one subspecies of the genus *Sphaeromides* (100% endemism) The representatives of *Sphaeromides* have been described and are known only from caves in the western and central Stara Planina As in other instances noted above they originated in a period of species formation that occurred toward the end of the Tertiary and in the early Quarternary in the western Stara Planina

The stigobiontic Asellota are well represented in the Balkan Peninsula Three Bulgarian endemic species from 2 genera have been found (100% endemism) The genus *Protelsonia* is found in caves in the western Stara Planina while the genus *Balkanostenasellus* is known from only one location – the karst springs near Assenovgrad

Broadly represented are the microisopoda of the Parasellidae family They belong to one genus (*Microcharon*) with 8 species 6 of which (75%) are endemics They inhabit mainly phreatic waters (wells) interstitial waters of river terraces and (to a lesser extent) karst waters

The Microcerberidae is another family of typical stigobionts of ancient origin Two endemic species from one genus are known

Only one endemic genus and species of terrestrial Isopoda (Genus Oniscidea, *Bureschia bulgarica* Verhoeff) has been described, from a cave near Polaten in the Teteven Region of the central Stara Planina This is an amphibic species and its inclusion in the underground fauna is disputed Nevertheless, there are many species (in particular some soil acarids) that are potential stigobionts and indicate the course of stigobiontic evolution

Aquatic acarids constitute a group of taxonomic categories that are not directly interrelated Stigothrombiidae Hydrachnellae, and Halacaridae About 130 species 56 of them stigobionts, have been found in the underground waters in Bulgaria Eight of the stigobionts (14 3%) are endemics

The Stigothrombiidae family was created to include the first Thrombiidae acarids found in underground waters Many representatives of the Thrombiidae inhabit the wet areas between the subsoil and underground waters representing different degrees of adaptation to the aquatic environment (Petrova, 1984) The species *Stygothrombium racovitzai* Mot et Tan is rare for Bulgaria

In the group Hydrachnellae, the endemic relict genus and species *Momonisia phreatica* Petrova is of special interest (Petrova 1974) It belongs to the ancient Momoniidae family which has 4 other genera Most of the representatives of this family are tropical land forms living underground in moderate regions We consider *Momonisia phreatica* a relict endemic form a successor of the tropical fauna that inhabited Strandzha prior to the Tertiary (Petrova 1984) The unique genus and species has been found only in a limited area of phreatic waters of the terrace of the Mladezhka River on Strandzha Mountain

In the Halacaridae freshwater group, 10 species have been found in Bulgaria (as compared to 5 species in Romania and 4 in Yugoslavia) *Soldanellonyx visurgis* Viets was until its discovery in Bulgaria known only in Germany (Petrova, 1975) Also of particular interest is the discovery of the northern species *Limnohalacarus wackeri* (Walt) in Bulgaria Its southernmost occurrence up until its discovery in our country was in the high mountain lakes of Switzerland While it is a surface dwelling in Switzerland it was found as an underground species with one single location (in wells at Gorni Chiflik in the Belogradchik Region) in northwestern Bulgaria

Halacarellus is a marine psammobiontic genus found in the underground continental waters of Bulgaria It too is of special interest with 3 species in Bulgaria – *H capuzinus* (Lohm) *H subterraneus* Schutz and *H phreaticus* Petrova (the *Halacaridii* of underground continental waters in Bulgaria thus total 13) The 3 species of genus *Halacarellus* in Bulgaria are a phenomenon from a genetic or ecological point of view The first two species are known as psammobionts from the Atlantic Ocean, the Baltic Sea the North Sea and the Black Sea In Bulgaria they be

came established not only in the mesopsammal zone but in underground continental waters along the Black Sea coast at a considerable distance from the sea A new species – *H phreaticus* Petrova – was also described from fresh water sources springs, wells and phreatic waters of river terraces 20 30 km from the estuary zone (Petrova 1972)

The question is why these halacarid species of the *Halacarellus* genus known from Boreal European and the Boreo Atlantic zone of North America are found outside of these areas only along the western Black Sea coastline in Bulgaria) and penetrate the continental phreatic waters The resolution of the question must involve the geological history of the Black Sea basin – in particular the Mio pleocene period when the Bulgarian Black Sea coast took shape Probably these ecologically pre adapted forms (i e , mesopsammic and brackish) were part of a fauna that survived from the time when the present day river valleys in their lower and even middle stretches were bays of the Neogene sea basins

There can be seen in many groups of soil acarids (e g Thrombidiformes Oribatei Mesostygmata) a transition towards a semi aquatic and aquatic way of life The same tendency has been found in representatives of the astygmatic acarids which belong to the genus *Schwiebea* (Angelkova and Petrova 1986) In this case we are referring to *Schwiebea barbei* Cooreman described from caves in France and found repeatedly in underground waters in Bulgaria (e g the Yambol Elhovo valley the Sofia Plain Strandzha Mountain) in all of its life stages (larval nymph and adult) This is also the case with five other species of the same genus that have been found in deep lying underground waters from the metro system of Vienna (Angelkova and Petrova 1986) We believe that all these species show pre adaptive and adaptive mechanisms for breaking away from the underground water medium and reaching the stigallum

From this discussion the following brief conclusions regarding the stigobiontic fauna can be drawn

- A specific endemic fauna formed as a result of changes that occurred toward the end of the Tertiary in the region of the western Stara Planina Mountains Strandzha Mountain the Black Sea coast and Thrace
- The stigobiontic fauna of northern Bulgaria is much poorer in species composition than that of western Bulgaria, which can be explained by the long period of time that the Misian plate was covered by the sea
- The occurrence of endemic and relict species is related to microevolutionary species formation processes within defined strictly localized micro regions
- A marked degree of diversity, and active processes of species formation related to this diversity is typical for neostigobionts of the Harpacticoida Cyclopoida and Microisopoda of the family Microparasellidae of the genus *Atractides*, and of the aquatic acarid family Hydrobatidae

The information in the Bulgarian literature on relict endemic and rare species of freshwater fauna are scant Hence the data in the attached appendixes lists and tables should be considered incomplete

Table 1 Distribution of invertebrate fauna groups in the Bulgarian Tributaries of the Danube River

Invertebrate Fauna Groups	Total	Topolovets	Voynishka	Vidbol	Aichar	Skomlya	Lom	Tsibritsa	Ogosta	Iskur	Vit	Osum	Yantra	Roussenski Lom
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PROTOZOA														
Rhizopoda	33									33				
Ciliophora	0													
Kinetofragmophora														
Gymnostomata	61	4	7	5	3	7	10	2	19	27	12	26	20	27
Vestibulifera	9						2		3	4	5	4	3	5
Hypostomata	21	1	2			1	2	1	7	8	6	9	7	7
Olygohymenophora														
Hymenostomata	37	11	6	10	5	9	19	6	19	6	15	25	1	20
Peritricha	20	1	3	1		2	7	1	6	14	6	8	5	10
Polyhymenophora														
Spirotricha	67	9	6	8	6	5	14	7	20	33	28	35	23	30
COELENTERATA														
Hydrozoa	4		1	1	1	1	1	1		4	1	2	2	
VERMES														
Turbellaria	5	1			1	1	2		5	5	3	3	3	1
Nematomorpha	1						1							
Nematoda	1	1		1	1		1		1	1	1	1	1	1
Oligochaeta	91	18	18	18	14	14	26	14	33	48	60	45	57	27
Hirudinea	11	1	1	2	3		4	2	2	7	7	6	8	3
Gastropoda	35	1	5	3	4	2	6	6	8	25	20	16	22	14
Lamellibranchia	17	2	1		1	2	2	1	1	8	7	5	11	5
ARACHNIDA														
Hydracarina	49		4		1		2		10	4	31	6	14	1
CRUSTACEA														
Isopoda	2	1	1				1	1	2	1	1	2	2	1
Amphipoda	7	2	3	1	1	1	5	1	4	5	4	2	4	4
Decapoda	3							1	1	1	2		2	
INSECTA														
Ephemeroptera	77	18	27	21	17	9	46	24	40	53	56	50	61	19
Plecoptera	94		2	1	1	1	17	1	31	63	51	51	27	3
Odonata	31	3	4	5	6	6	9	8	8	14	7	15	17	7
Coleoptera	111	5	7	4	3	4	12	10	16	79	14	30	27	15
Heteroptera	29	6	7	4	2	1	8	13	5	6	6	11	14	6
Megalaoptera	2									1	1		2	
Trichoptera	131	8	8	6	7	6	28	8	24	80	47	48	47	4
DIPTERA														
Blephariceridae	3						2		1	3	2	2	1	
Tipulidae	3	2	2	1	1	1	2	2	2	2	2	2	3	2

Table 1 Distribution of invertebrate fauna groups in the Bulgarian Tributaries of the Danube River (continued)

Invertebrate Fauna Groups	Total	Topo lovets	Voy nish-ka	Vid bol	Ar char	Skom lya	Lom	Tsi britsa	Og osta	Iskur	Vit	Osum	Yan tra	Rouss enski Lom
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cylindrotomiidae	1							1						
Limoniidae	8	1	2	1	1	2	5	3	4	5	6	6	7	
Psychodidae	7	1	1	1			1	1		6	1	4	4	2
Dixidae	1									1		1	1	
Culicidae	2	1	1				1	1	1	1	1	1	2	1
Simuliidae	60	3	3	5	3	3	9	4	20	46	26	26	24	6
Chironomidae	217	1	3	1	7	3	73	20	51	81	120	63	66	22
Thaumaleidae	1									1				
Ceratopogonidae	3	1	1	1	1	1	2	2	3	3	2	3	1	2
Stratiomyidae	5					1	1			1	2	5	5	
Tabanidae	2	2	2		2	1	2	1	1	2	2	2	2	1
Athericidae	2	1		2			1		1	1	1	2	1	1
Rhagionidae	1												1	
Syrphidae	2								1	2			1	1
Empididae	2									1	1			
Ephydridae	2						1						1	
Muscidae	1									1	1	1	1	
Sciomyzidae	1											1		
Indet	1	1	1				1	1	1	1	1	1	1	1
Bryozoa	5								1	1			5	
Total	1610	107	129	103	92	84	326	144	352	709	559	520	527	249

Table 2 Similarity of Species in the Bulgarian Tributaries of the Danube River (Sorensen, 1948)

River	Archar	Vidbol	Voy nishka	Tsi britsa	Topo lovets	Skom lya	Rouss enski Lom	Lom	Osum	Ogosta	Yantra	Iskur
Archar												
Vidbol	46 15											
Voynishka	42 52	55,21										
Tsibritsa	30 85	42 35	43 08									
Topolovets	21 58	39 46	45 35	44 69								
Skomlya	37 93	43,55	36 24	35 90	39,10							
Roussenski Lom	33 72	38,89	39,02	39 38	41 27	31,32						
Lom	35 29	33 33	38,40	32 89	36,86	30 71	36,92					
Osum	44,09	40 38	41,18	37 46	36,94	35,18	34 97	46,98				
Vit	30,77	31,29	32 60	26 90	27 72	27,86	30 24	38,82	43 34			
Ogosta	30 10	35 51	41 00	32 30	34 98	30 00	39 53	50 33	37 99	41,06		
Yantra	24 79	29 20	35 05	29 74	28,49	21 20	36 59	48 74	45 68	46,11	45 22	
Iskur	37 35	37 98	31,16	30,23	32,79	18,75	40 74	39 58	42,58	34 57	45,04	34,95

Table 3 Structural Parameters of the Bulgarian Tributaries of the Danube River (Janeva and Russev, 1991)

Danubian tributary	Mean water quantity of many years m^3/c	H	d	c	e
Vidbol	0 31	2 0 4 5 3 28	8,28 14 9 11,02	0 06 0 45 0 20	0 45 0 87 0 71
Archar	0 31	1 9 3 8 3,05	6 54 11 3 9,17	0 10 0 47 0,22	0,47 0 82 0,68
Skomlya		2,0 3,7 2 78	5,63 10 6 7 96	0,12 0,39 0 23	0,46 0,80 0 64
Voynishka	0 80	1 3 4 6 3 14	4 27 19 3 9 99	0 07 0 58 0 21	0 41 0 86 0,73
Topolovets	1 69	0 16 3 4 2 01	1 84 12 2 7 45	0 17 0,96 0 46	0 06 0 72 0,48
Tsibritsa	1 93	1,9 3,65 2,76	5,72 11 04 8,41	0 12 0,49 0 27	0,47 0,82 0,66
Lom	9,46	1 5 4 6 3 74	4 4 21 9 15 12	0 05-0 48 0 15	0 40 0 92 0,74
Vit	13 1	0 63 4 44 2 97	0 18 5 69 3 34	0 06 0 85 0 20	0 20 0 90 0 63
Ogosta	19 6	1,3 3 9 2 65	3,68 16 9 7,72	0 10 0 69 0,26	0,31 0 96 0,70
Yantra	40 1	0 10 4 2 2 08	1 16 12 8 4 80	0 08 0,73 0 38	0 1 0 87 0 61
Iskur	54 9	0 72 4 0 1,96	0 47 12 9 4,04	0 09 0,75 0,35	0 36 0 99 0 66

Table 4

Danubian tributary	Length km	Catchment area km²	Mean water quantity of many years km /S	Upper course					Lower course above outfall				
				Last year and month of research	O mg/l	Oxidation mg/l	NH^+_4	S R	Last year and month of research	O mg/l	Oxidation mg/l	NH^+_4	S R
Topolovets	68	583	1 69	10 1986	10 24	3 20	0 20	49 19	10 1986	10 72	2 24	0 24	39 95
Voynishka	60	277	0 80	10 1986	8 00	3 44	0 16	54,65	10 1986	8,8	11 6	0 2	45 85
Vidbol	62	330		04 1986				52 88	10 1986	11,04	2 40	0,77	48,75
Archar	59 4	365	0 31	10 1986	13 28	1 76	0 09	69 93	10 1986	15 04	12 0	0 12	46 84
Skomlya	41 6	162 8		10 1986	9 6	4 32	0 12	42 59	10 1986	10 72	2 88	0 2	55,19
Lom	92 5	1140	9 46	10 1986	9 6	2 64	0,14	47 77	10 1986	0 9	83 00	1 6	23 74
Tsibritsa	87,5	934	1,93	06 1984				56,67	06 1986	12,9	1,50	0,0	53,40
Ogosta	144 1	4231	19 60	04 1985	10 50	9,60	0,23	71 91	04 1985	5,2	2,60	0,75	29,51
Iskur	368 0	8646	54 9	04 1985	10,60	2 48	0 23	68 36	10 1986	8 48	8 80	0,16	29 29
Vit	188	3225	13 1	04 1989	9 58			72,67	10 1987				13 97
Osum	314 0	2824	12 5	04 1989	9 58			81 58	10 1988	11 7			23,21
Yantra	285,5	7862	40 1	05 1987	10 08	0 96	0 00	84 38	08 1987	10 22	12,00	1 14	26,00
Roussenski Lom	196 9	2947	4,93	06 1984	9,60	7 49	0,21	47 17	06 1987	8 1	16 00	0,05	32,92

Appendix 1 Caspian Relicts in the Bulgarian Portion of the Danube River and Its Tributaries

TURBELLARIA
Otoplana antipa An dei Lan – Danube River
Palaeodendrocoelum romanodanubialis Codr – Danube River

OLIGOCHAETA
Potamothrix grimmi (Hr) – Danube River

POLYCHAETA
Hypania invalida (Grube) – Danube River
Manayunkia caspica Annenkova – Danube River

GASTROPODA
Theodoxus danubialis (C Pfeiffer) – Danube Ogosta Iskar Zlatna Panega, Vit Osam Yantra, Rossitsa, Roussenski Lom Rivers
Lithoglyphus naticoides (Pfeif) – Danube, Vit Yantra Rossitsa Roussenski Lom Beli Lom Rivers
Micromelania lincta Mil
Clessiniola variabilis Eichw
Fagotia acicularis (Fer) – Danube Ogosta Iskar Zlatna Panega Vit, Yantra Rossitsa, Roussenski Lom Rivers
Fagotia esperi (Fer) – Iskar, Vit Ossam Yantra, Roussenski Lom Rivers

LAMELLIBRANCHIA
Dreissena polymorpha Pall – Danube and Topolovets Rivers

DECAPODA
Astacus leptodactilus Esch – Danube and Vit Rivers

MYSIDACEA
Limnomys benedeni Czern – Danube River

Appendix 1 Caspian Relicts in the Bulgarian Portion of the Danube River and Its Tributaries (continued)

Paramysis lacustris Czern – Danube River
P setosa Czern – Danube River
P (Metamysis) *ullskyi* Czern – Danube River
Mesomysis intermedia Czern – Danube River
M kowalewskyi Czern – Danube River

AMPHIPODA
Dikerogammarus haemobaphes fluviatilis Mart – Danube River
D villosus (Sow) – Danube River
D villosus bispinosus Mart – Danube River
Pontogammarus abreviatus (Sars) – Danube River
P crassus Gr – Danube River
P maeoticus Sow – Danube River
P obesus (Sars) – Danube River
P robustoides Gr – Danube River
P robustoides aestuarius Derj – Danube River
Stenogammarus compressosimilis Car – Danube River
Chaetogammarus ischnus Steb – Danube River
Ch placidus Sars – Danube River
Ch trichiatus Mart – Danube River
Ch warpachowskyi Sars – Danube River
Corophium curvispinum (Sars) – Danube River
C maeoticum Sov – Danube River
C robustum Sars – Danube River

Appendix 2 Relict Species of Underground Fauna

OLIGOCHAETA
Haplotaxis bureschi (Michaelsen) – cave in the western Stara Planina Mountains Bulgaria Yugoslavia

OSTRACODA
Kowalevskiella bulgarica Danielopol – wells interstitial habitats Bulgaria
K cvetkovi (Danielopol) – wells, springs in southern Bulgaria

ISOPODA
CIROLANIDAE
Sphaeromides bureschi Strouhal – cave near Iskrets karstic spring Opitsvet western Stara Planina Mountains
Sph bureschi serbica Pljakic – karstic spring Gradishte Bulgarian border, western Stara Planina Mountains
Sph polatemi Angelov – Polaten cave, central Stara Planina Mountains

ONISCIDEA
Bureschia bulgarica Verhoeff – Temnata dupka cave western Stara Planina Mountains

MICROCERBERIDAE
Microcerberus phreaticus Svetkov – wells near Elhovo
M stygius harmanliensis Svetkov – wells, Harmanli

ASELLOTA
Balkanostenasellus rumelicus Svetkov – springs near Asenovgrad
Protelsonia bureschi (Racovitsa) – cave near Kalotina western Stara Planina Mountains
P lakatnicensis (Buresch & Gueorguiev) – Temnata dupka cave, Lakatnik western Stara Planina Mountains

ACARI HYDRACHNELLAE
Kawamuracarus wardaricolus Viets – Southern Europe
Phreatohydracarus mosticus Motas & Tanasachi – Bulgaria Rumania
Momonisia phreatica Petrova – interstitial habitats Mladezhka River Strandzha Mountain

Appendix 3 Bulgarian Endemic Species

MOLLUSCA
Belgrandiella bulgarica Angelov – Polaten cave western Stara Planina Mountains
B pusilla Angelov – Lakatnik cave western Stara Planina Mountains
Pontobelgrandiella nitida (Angelov) – Polaten cave western Stara Planina Mountains
Cavernisa zaschevi Angelov – Iskrets cave western Stara Planina
Hauffenia lucidulus Angelov – wells near Varna
Iglica acicularis Angelov – Iskrets cave western Stara Planina
Insignia macrostomata (Angelov) – Polaten cave western Stara Planina Mountains
Saxurinator copiosus (Angelov) – Lakatnik cave, western Stara Planina Mountains
S bureši (Wagner) – Temnata dupka and Lakatnik caves western Stara Planina Mountains
Plagigeyeria gladilini procerulus (Angelov)

Appendix 3 Bulgarian Endemic Species (continued)

OSTRACODA

Mixtacandona elegans Danielopol & Svetkov – spring at Zvezdets southeast Bulgaria

Kowalevskiella bulgarica Danielopol – Bulgaria

K cvetkovi (Danielopol) – Bulgaria

CYCLOPOIDA

Acanthocyclops (A) *balcanicus* Naidenow & Pandurski – Gradezhnitsa cave region of Teteven western Stara Planina Mountains

Cyclops bohateri ponoriensis Naidenow & Pandurski Ponor cave western Stara Planina Mountains

Diacyclops fontinalis Naidenow – Bulgaria

D haemusi Naidenow & Pandurski – Ponor cave western Stara Planina

D chappuisi Naidenow & Pandurski – Zemen cave

Speocyclops rhodopensis Pandurski – cave near Gela village Rhodope Mountain

HARPACTICOIDA

Bryocamptus petkovski Apostolov – Strandzha Mountain

Elaphoidella angelovi Michailova – Rhodopes Mountain Elhovo

E borutski Michailova – Dobrudzha

E cvetkovi Michailova – southern Bulgaria

E gracilis serrulata Damian & Botosaneanu – Ropotamo River

E karamani latifurcata Apostolov – well, Rousse

E valkanovi Bassamakov – Sofia Dobrudzha

E cavernicola Apostolov – cave near Karloukovo

E balkanica Apostolov – cave in Michaylovgrad region western Stara Planina Mountains

E pandurskyi Apostolov – Bosnek cave Vitosha Mountain

Stygoelaphoidella bulgarica Apostolov – cave in Vratsa region western Stara Planina Mountains

St elegans Apostolov – Ponor cave

St michailovae (Bassamakov) – Pirin Mountains

St stygia Apostolov – Glozhene and Lipnitsa caves, western Stara Planina Mountains

St subterranea Apostolov – wells Pleven

Maracnobiotus bulbiseta Bassamakov & Apostolov Yagodinska cave, Rhodopes Mountains, Lakatnik cave, western Stara Planina Mountains

M parainsignipes Apostolov – karstic springs Iskrets western Stara Planina

Nitocra stygia Apostolov – Dobrudzha Strandzha Mountain

Nitocrella spinulosa Apostolov – Sredna Gora Mountains

N stygia Apostolov – Dobrudzha

N tonsa Michailova-Neikova – Strandzha Mountain western Stara Planina Mountains

SYNCARIDA

BATHYNELLACEA

Hexabathynella herbica (Svetkov & Petrova) – wells Harmanli spring at Bachkovo Monastery interstitial habitats Maritsa River

H breviappendiculata (Svetkov) – well Lyubimets village region of Haskovo

H longiappendiculata (Svetkov) – well Bochkovo village region of Asenovgrad

H mwesternica (Svetkov) – interstitial habitats Mesterna River, region of Gotse Delchev

H tenera (Svetkov) – Koroundzha spring near Sozopol

AMPHIPODA

Gammarus frater (Karaman & Pinkster) – spring by Asenovgrad Chervenata skala by Bachkovski Monastery, district of Plovdiv

G pulex cognominis Karaman & Pinkster – Devetashka cave district of Lovech

G shablensis (Carausu) Shabla Lake district of Varna

Niphargus ablaskiri gueorguievi St & G Karaman 35 localities district of Lovech

N bureschi (Fage) – 48 localities, western and central Stara Planina Mountains

N cepelarensis St & G Karaman – Sbirkova cave Chepelare, springs by Chepelare and Pamporovo resort Rhodope Mountains

N kochianus meliticensis Andreev & Dancau – spring by Sokolovo village district of Lovech

N pancic valkanovi St & G Karaman – springs Vitosha Mountain

N tauri pecarensis St & G Karaman – caves by Belogradchik, district of Michaylovgra

N toplicensis Andreev – springs by Musomishte village district of Sofia

ISOPODA

CIROLANIDAE

Sphaeromides boureschi Strouhal – caves near Iskrets karstik spring near Opitsvet western Stara Planina Mountains

Sph boureschi serbica Pljakic – karstic spring Gradishte near Bulgarian border, western Stara Planina

Sph polatini Angelov – Polaten cave central Stara Planina Mountains

Asellota

Balkanostenasellus rumelicus Svetkov – springs near Asenovgrad, southern Bulgaria

Protelsonia bureschi (Racovitza) – caves near Kalotina Bulgarian border western Stara Planina Mountains

Appendix 3 Bulgarian Endemic Species (continued)

Pr lakatnicensis (Buresch & Gueorguiev) – Temnata dupka cave Lakatnik western Stara Planina

ASELLOTA JANIROIDEA
Microcharon apolloniacus Svetkov – Koroundzha spring near Sozopol
M bureschi Svetkov – wells, region of Sofia
M curidices Svetkov – wells Harmanli interstitial habitats, Maritsa River
M orphei Svetkov – springs near Elhovo
M phlegetonis Svetkov – wells Sevlievo, Rousse Devnya spring
M thracicus Svetkov – wells springs, interstitial habitats in Thrace

MICROCERBERIDAE
Microcerberus phreaticus Svetkov – wells near Elhovo
M stygius harmanliensis Svetkov – wells Harmanli

ONISCIDAE
Bureschia bulgarica Verhoeff – Temnata dupka cave western Stara Planina Mountains

ACARI HALACARIDAE
Soldanellonyx chappuisi thracicus Petrova – wells, Lyubimets region of Haskovo
Porolohmannella cvetkovi Petrova – springs wells in northern and southern Bulgaria
P curvimandibulata Petrova – well Polsko Kosovo near Rousse
Halacarellus phreaticus Petrova – Koroundzha spring near Sozopol spring Daskotna, near Aytos

ACARI HYDRACHNELLAE
Atractides asticae Petrova – interstitial habitats Veleka and Mladezhka Rivers Strandzha Mountain
A longiporus Petrova – interstitial habitats Veleka River Strandzha Mountain
Axonopsis orghidani Petrova – interstitial habitats, Veleka River Strandzha Mountain
A bureschi Petrova – interstitial habitats, Veleka River Strandzha Mountain
Momonisia phreatica Petrova – interstitial habitats Mladezhka River Strandzha Mountain
Mideopsis motasi Petrova – wells in northern and southern Bulgaria

Appendix 4 Balkan Endemic Species

HIRUDINEA
Dina (D) absoloni Johanson – western Stara Planina Mountains Yugoslavia Bulgaria
Dina (D) lineata arndti Augener – western Stara Planina Mountains, Yugoslavia Bulgaria

OSTRACODA
Pseudocandona spelaea Klie – wells Stara Zagora Bulgaria caves in Greece
Ps putcana Klie – wells near Skopie Macedonia interstitial habitats Mesterna River in Bulgaria

HARPACTICOIDA
Elaphoidella fonticola Chappuis – Nish Yugoslavia karstic spring Trun western Bulgaria
E karamani karamani Chappuis – wells Peloponese, Greece, wells interstitial habitats Vardar Macedonia wells near the Iskar River
E necessaria Kiefer – wells Dobrudzha karstic spring, Trun Bulgaria wells near Skopie Macedonia
E tenera Chappuis – wells, Skopie, Macedonia, karstic spring at Bankya, near Sofia, Bulgaria

ISOPODA
CIROLANIDAE
Sphaeromides bureschi Strouhal – caves in western Stara Planina Mountains Bulgaria, Zaribrod, Yugoslavia

JANIRIDAE
Microcharon major Karaman – interstitial habitats Vardar, Macedonia interstitial habitats Mesterna River

Appendix 5 Rare Species

ROTATORIA
Brachionus quadratus var *tridentatus* Sernov – Danube River
Notholca longispina Kellec – Danube River

CLADOCERA
Alonella nana (Baird) – Ludogorie
Alonopsis ambigua Lilljeborg – Ludogorie
Chydorus globosus Baird – Ludogorie
Daphnia atkinsoni Baird – Ludogorie
D obtusa Kurz – Ludogorie
D similis Clans – Ludogorie
D ulomskiy Lilljeborg – Ludogorie
Donhevedia crassa King – Ludogorie
Latonopsis australis – Danube River
Pleuroxus striatus Schoedler – Danube River
Pl uncinatus Baird – Ludogorie
Polyphemus pediculus (L) – Danube River
Simocephalus serrulatus (Koch) – Ludogorie

COPEPODA
Acanthocyclops bicuspidatus odessanus (Schmankewie) – Ludogorie
Eudiaptomus gracilis (Sars) – Ludogorie
E zachariasi (Poppe) – Ludogorie
Lovenula alluaudi (Guerne & Richard) – Ludogorie
Macrocyclops distinctus (Richard) – Danube River
Mesocyclops orthonoides (Sars) – Danube River
Microcyclops bicolor (Sars) – Danube River

M planus (Gurney) – Danube River
M varicans rubellus (Lilljeborg) – Danube River

MOLLUSCA GASTROPODA
Anisus spirorbis (Linnaeus) – Boyansko blato Sofia, Danube River near Lom
A vortex (Linnaeus) – Plovdiv Devnenski izvori Varna Danube River Krivina
Gyraulus albus (Mueller) – Plovdiv Danube River near Svishtov, Gyurgevo Oltenitsa
G laevis (Adler) – Danube River at Rouse
Planorbis carinatus Mueller – Plovdiv, near the Maritsa River, Danube River

LAMELLIBRANCHIA
Pseudanodonta complanata (Rossmaessler) – Danube River near Lom Svishtov, Gebedzhensko blato Srebarna
Pisidium milium Held – Sofia Boyansko blato Sofiysko pole
P nitidum Jenyns – Opitsvet Sofia
P obtusale (Pfeiffer) – Sofiysko pole Samokov Mala cherkva
P subtruncatum (Malm) – Maritsa River near Samokovsko, Besden Sofia
P bulgaricum Odhner – Vitosha Mountain
P moitessierianum (Paladilhe) – Danube River Archar
P supinum Schmidt – Maslen nos, Danube River Rouse

Appendix 6 Rare Species of Underground Aquatic Fauna

OLIGOCHAETA
Haplotaxis bureschi (Michaelsen) – cave in western Stara Planina Mountains

HIRUDINEA
Dina (D) absoloni Johanson – western Stara Planina Mountains Yugoslavia Bulgaria Macedonia
D (D) lineata arndti Angener – western Stara Planina Mountains Bulgaria Macedonia

MOLLUSCA
Belgrandiella bulgarica Angelov – Platen cave western Stara Planina Mountains
B pusilla Angelov – Lakatnik cave western Stara Planina Mountains
Pontobelgrandiella nitida (Angelov) – Polaten cave western Stara Planina Mountains
Caverniisa zaschevi Angelov – Iskrets cave, western Stara Planina Mountains
Haufenia lucidulus Angelov – wells near Varna
Iglica acicularis Angelov – Iskrets cave, western Stara Planina Mountains

Insignia macrostomata Angelov – Polaten cave western Stara Planina Mountains
Saxirinator copiosus (Angelov) – Temnata dupka and Lakatnik caves western Stara Planina Mountains
Plagigeyeria gladilini procerulus Angelov

OSTRACODA
Pseudocandona puteana (Klie) – well Banican village region of Gotse Delchev
Ps spelaea (Klie) – spring Stara Zagora
Mixtacandona lyovuschkini (Rudjakov) – spring Melnitsa village region of Elhovo

CYCLOPOIDA
Acanthocyclops (A) propinquus (Plesa) – Bosnek cave, Vitosha Mountain
Cyclops bohateri ponorensis Naidenow & Pandurski – Ponor cave western Stara Planina Mountains
Eucyclops subterraneus intermedius Damjan) – Bosnek cave Vitosha Mountain cave in Rhodope Mountains

Appendix 6 Rare Species of Underground Aquatic Fauna (continued)

Speocyclops demetiensis demetiensis (Scourfield) – cave in region of Pleven

ISOPODA

CIROLANIDAE

Sphaeromides buresch Strouhal – cave near Iskrets k irstic spring Opitsvet western Stara Planina Mountains

Sph polaten Angelov – Polaten cave central Stara Planina Mountains

MICROCERBERIDAE

Microcerberus phreaticus Svetkov – wells near Elhovo

ONISCIDAE

Buresch bulgarica Verhoeff – Temnata dupka cave western Stara Planina Mountains

ACARI

LIMNOHALACARIDAE

Limnohalacarus wackeri (Walt) – wells Gorni Chiflik village region of Belogradchik northwestern Bulgaria

HYDRACHNEI LAE

Momonisia phreatica Petrova – interstitial habit its Mladezhka River Strandzha Mountain

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Aquatic Ecosystems of the Aegean and Black Sea Basins

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SUMMARY

This report deals with the biological diversity of the aquatic ecosystems in the Aegean and Black Sea basins For each river basin – including the running waters standing waters, and groundwater – biological diversity is discussed at three levels species cenotic (community) and ecosystem The main sources of information were academic scientific journals and other publications as well as several additional sources, such as the BIOMONITOR Information System The bibliography contains a total of 334 titles of background papers

In this century, there have been three main approaches to the study of the biodiversity of aquatic ecosystems – faunistic cenotic and applied These approaches have been grounded in their main subject area rather than in the time period per se

The total aquatic invertebrate species richness in the watersheds under review was determined to be 2240 species and subspecies from 49 systematic groups The number of recorded species tended to reflect the size of the river basins Thus, the total number of species recorded for the largest river basin that of the Maritsa (watershed area of 21,100 km^2) was 1263 as opposed to 275 species for the basin of the Veleka River (995 km) These figures were based on analyses of cenotic and habitat/ecosystem diversity within selected river basins

The inclusion of coastal water bodies in this review essentially diversified the list of species present by bringing in numerous oligo and/or euryhaline representatives Several groups, however, seemed to be insufficiently studied in accordance with the *Limnofauna Europea* when compared with the situation in neighboring countries

The level of rarity among the species present was discussed in the context of the environmental health of the habitats/ecosystems Emphasis is placed on the high level of endemism within phreatic (groundwater) habitats in contrast with the surface waters both running and standing which were affected to a much greater degree by human activities

Concerning cenotic diversity, there was found to be a discrepancy in the levels of exploration of the various communities within the provinces under review Thus 1153 species were established for natural rivers and streams but only 8 for artificial channels The main information about standing water bodies both natural and man made, concerned the zooplankton community rather than the zoobenthos Data on meyobenthos periphyton and other communities was insufficient or totally lacking Ecosystem diversity was insufficiently studied with respect to various habitat types, especially those of human origin (e g rice fields fish ponds smaller reservoirs and cooling basins) The unique properties and high fragility of the coastal and glacial lakes, among the ecosystems under review are also emphasized Some regions of special importance along the Black Sea coast and in the high mountains are outlined

The real and potential threats and dangers to biodiversity in the aquatic environments of the provinces under review include different types of water pollution hydrotechnical constructions, global climatic changes and the transboundary/regional transport of pollutants by means of atmospheric processes These threats are discussed in detail

It can be concluded that species diversity within both the watersheds under review was well studied, in contrast to cenotic and ecosystem diversity Although up to date information is lacking in certain areas, there are no poorly known river basins (i e "blank spots') requiring initial studies of their biodiversity Nevertheless many ecosystems require inventory of their species and cenotic diversity especially with respect to the on going processes of environmental changes resulting from human activities Several paradoxes are described in assessing our knowledge of the biodiversity of the aquatic ecosystems of the Black Sea and Aegean watersheds

INTRODUCTION

Several basic principles have been followed in developing this report on the biological diversity of the Bulgaria s freshwater ecosystems

The basin (or watershed) approach was adopted as a basic organizing principle at two levels The first includes the catchment areas of both the Aegean and Black Seas The second takes in individual river basins including the rivers lakes (both natural and artificial) and groundwaters The divisions of the main basins followed that used in the National Monitoring Network codification of the Ministry of Environment (MOE) (See Appendix 1) Several smaller rivers in the Black Sea province that lacked their own code were placed into a single group Some brackish and

hyperhaline coastal water bodies without outflow were also included in this group since they are fed by fresh groundwater flow

The biological diversity of the different basins was discussed at three levels

- Species level diversity the species content of the ecosystems under review as indicated by the richness of recorded taxa from various systematic groups The systematic groups followed the classification in *Limnofauna Europea* (1978) and the principal contributions in the issues of the *Fauna Bulgarica*

- Cenotic level diversity the specific biotic communities and organism assemblages within the ecosystems under study

- Ecosystem level diversity the typological variety of running and standing (both natural and artificial) water bodies as well as groundwaters and some temporary water bodies (thelms) (See Appendix 2)

By mutual agreement among the participants in the National Biological Diversity Conservation Strategy workshop, the "green" components of the ecosystems (phytoplankton periphyton and vascular plants) are discussed in other reports prepared by the botanists Similarly the insect fauna are reviewed separately in the reports on terrestrial invertebrate fauna Data regarding larval stages and several amphibious insects are only summarized here Thus this report mainly concerns the primarily aquatic invertebrate fauna

The basic resources for information were academic publications from both Bulgaria and other countries such as scientific journals special publications monographs and so forth The reports and proceedings of congresses conferences symposia, and other scientific meetings were intentionally avoided on the presumption that the most important information had already been published in respected scientific journals Unpublished data, expert consultations and annual reports (such as those commissioned by the MOE) were also used, but are not listed in the bibliography An additional important source was the data base of the BIOMONITOR Information System which has been developed and maintained by the author and collaborators since 1987 This system provides data on species richness and diversity and on the water biological sufficiency (wbs) and quality of the rivers It includes information from over 400 monitoring sites, as assessed by standardized methods using biotic and cenotic indices/parameters of the macrozoobenthic community

More than 330 articles are listed in the bibliography It is the personal judgement of the authors that this represents about 75% of the definitive contributions in this field Most of the entries (254) refer to articles found in 18 Bulgarian journals while 80 titles were published in 43 international or foreign journals At present a total of 58 Bulgarian authors have published 285 articles (243 within Bulgaria and 42 abroad) while 34 foreign authors have contributed 49 articles (11 in Bulgarian journals and 38 in foreign journals)

HISTORICAL BACKGROUND

Three basic periods or directions can be identified in the history of research on the biodiversity of fresh water and brackish water ecosystems These periods are linked together and it is quite difficult to separate them in time Each is well grounded in its main area of focus (see Table 1)

The "Faunistic Period" began at the start of the current century and has continued up to the present It has focused on providing data about species richness and the location and distribution of aquatic fauna by means of taxonomic systematic, caryological and other specific methods The approach in these studies has been largely determined by systematic groups and units rather than the typology of communities or ecosystems Intensive faunistic studies have been carried out over the last 30 years in several regions of Bulgaria, including the Thracian lowland (BAS, 1964, 1965 1966) the Black Sea coastal lakes and estuaries (BAS 1967) the Rhodope Mountains (BAS, 1975) and the lower part of the Strouma River (BAS 1990) After the publication of several faunistic catalogues (e g Valkanov 1954 Valkanov and Marinov 1959 Svetkov and Marinov 1986 Naidenov 1986, 1988 Marinov and Golemanski 1989) prominent summaries of the studied groups appeared in the issues of the *Fauna Bulgarica* At present there are 4 volumes concerning species richness and diversity of the groups Polychaeta (Marinov 1977) Trichoptera (Kumanski 1985b 1988) and Coleoptera Hydracanthares (Guerguiev 1987) in Bulgaria

The 'Cenotic Period" has developed parallel to faunistic period especially over the last twenty years The main subject of research in this area is the variety and abundance of specific species assemblages and communities in various kinds of habitats and ecosystems both natural and man made These studies have focused on the dynamics of quantified community parameters that reflect environmental factors including those of human origin (e g water pollution, eutrophication hydro technical constructions) The numerous contributions in this area have provided information about the dynamics of species composition density biomass, productivity and structural organization and the ecological/ environmental tolerances of the zoobenthos zooplankton periphyton and phreatic fauna as living components of running, standing and underground water bodies

The 'Applied Period" has arisen in the last twenty years, but it is based on work in the previous periods

and other areas of focus These studies focus on eco logical assessment of the state of the environment and the health of the processes within aquatic ecosystems based on knowledge about biological/species diversity ecological tolerances and specific features of the re spective organisms and communities Two "sub directions' can be identified The first has ad dressed problems of productivity or in general trophic potential and capacity mainly of standing wa ter bodies (both natural and artificial) by studying the zooplankton and zoobenthos communities The sec ond examines water quality and assesses environ mental impacts, mainly in running and underground waters through bioindication and structural analysis using the river macrozoobenthos and phreatic fauna Thus this period has provided many contributions to the assessment and management of water quality fish productivity self purification processes and so forth

CURRENT STATE OF KNOWLEDGE

For many reasons, we can regard our knowledge of biological diversity within the aquatic ecosystems of the Black Sea and Aegean catchment area as well ad vanced Many of the systematic groups have been completely elaborated, and it is unlikely that new faunistic discoveries will be made The main types of communities and ecosystems have also been well studied There are few if any regions where biological diversity has not been studied to some degree Fur thermore much of the research has concentrated on regions and objects of special zoogeographical, eco nomic and/or environmental interest It has thus been possible to conclude that the biological diversity of both the Aegean and Black Sea provinces is suffi ciently studied

At the same time however there have been and still are well founded doubts about the validity of these conclusions due to several unresolved paradoxes In general they reflect problems with the temporal and spatial scaling of our knowledge of biodiversity in the aquatic ecosystems in these provinces

The paradox of the *cumulative number* of entries in the faunistic lists originates in the practice of adding every newly found species to the historical list No system of long term monitoring has been in place to ensure that a given species in the fauna especially those included at an early point are truly present Thus species diversity may seem greater than it actu ally is

The paradox of *data incompatibility* originates in the practical impossibility of studying simultaneously and entirely all systematic groups communities and/or ecosystems Many changes sometimes radi cal can happen in the environment and in the biota between periods of investigation Thus comparisons between any two objects or places must take into ac count the time factor

The paradox of *discrete knowledge* originates in the fact that biological diversity has been studied group by group or object by object Consequently there has been much data about particular groups or objects but little or no data for all groups of species and all objects under investigation Thus the mental picture of biological diversity has been limited and perhaps even invalid in each concrete case

The paradox of *ecological ignorance* originates in the neglect of environmental changes due to human activities both past and present There have been nu merous and essential alterations in the general eco logical situation, so that many habitats and aquatic ecosystems no longer exist or living conditions have so shifted that there is no reason to expect further findings of numerous species especially of sensitive rare or endemic species But many species from these areas are still found in the lists of the Bulgarian limnofauna Thus, the depiction of biological diversity in the aquatic ecosystems of the provinces under re view seems to be approximate rather than definitive

For these reasons discussions of the distribution of species have been based strictly on published facts rather than on an accurate understanding of their ac tual or potential distribution

SPECIES DIVERSITY AND RICHNESS

The total number of recorded species and lower taxa within the range of the areas reviewed was de termined to be 2240 (Table 2) A margin of error of about ± 20% should be assumed due to the lack of long term taxonomic reviews the new faunistic contri butions and/or the presence of newly described spe cies This percentage was calculated on the basis of the average proportion of invalid names (synonyms species of dubious taxonomic status newly revised or "lumped species, etc) for several sufficiently elabo rated groups of hydrobionts

For example up to the present 136 species names have been recorded for aquatic Oligochaeta from riv erine and lacustrine macrozoobenthos in Bulgaria After updating their taxonomic status and distribution only 106 species (46 genera from 8 families) were ac tually represented in the species list of the Bulgarian limnofauna (after Uzunov and Kapustina in press) Two hundred and thirty eight species of caddisfly (Trichoptera) including 2 subspecies, are now estab lished for Bulgaria recently however 207 names that were used in the past have been shown to be invalid (after Kumanski, 1985b 1988) Among the aquatic beetles (Coleoptera Hydracanthares) 30 species names are no longer used in descriptions of the 139 species established for the Bulgarian limnofauna (after Guerguiev 1987)

Within the total species list, the relative propor tions of the different systematic groups varied The groups most represented seemed to be Protozoa (15 5% of the total number of recorded species) lar vae of the insects from the Diptera Chironomidae (9%), Trichoptera (7 6%) Coleoptera (6 6%) Cope poda (8 2%), rotifers (7 3%) etc

Because brackish and hyperhaline coastal lakes and the estuarine portions of the Black Sea tributaries

were taken into account in this review the list was essentially diversified through the inclusion of marine and brackish representatives Thus all the recorded species from Phlyllopoda Branchiopoda Cirripedia Anizopoda and many representatives from Hydrozoa Turbellaria Nemertini Polychaeta Gastropoda Bivalvia Amphipoda Isopoda and other groups were oligo or euryhaline hydrobionts

In comparing data from the Bulgarian literature with the information in the *Limnofauna Europaea* some groups – Nematoda Rotatoria Gastrotricha Tardigrada many Diptera families etc – seemed to be practically unknown their presence in neighboring countries indicates that they are probably more abundant in the Bulgarian aquatic fauna Due to the shortage or absence of specialists able to delineate the whole range of the systematic group there is insufficient knowledge about many inhabitants of both running and standing waters

Species diversity in the river basins under study seemed to be highest in the larger basins those of the Maritsa (1263 recorded species from 40 systematic groups) the Tundzha (662/35), and the Arda (604/31) (Table 2) This could be interpreted as a reflection of the greater number and types of habitats and ecosystems along the vertical gradient from high mountains to the lowlands There was almost a direct correlation between the number of recorded species and the surface area of the river basins under review (Figure 1)

Rare Species

The topic of rare species should be discussed based on analysis that takes into account their dependence on specific habitats their frequency their density and other characteristics Several species from the European Red Data List (Appendix 3) including *H medicinalis* (Hirudinea) *A astacus* (Crustacea Decapoda) *G flavipes* and *O cecilia* (Odonata) were common in the basins under study Their populations have not yet been damaged in contrast to those of *S nitida* (Gastropoda) and *U crassus* (Bivalvia) for which this is no recent evidence of their actual existence in the zoobenthos due to environmental changes in the localities where they were last recorded

Endemism

The level of endemism among the hydrobionts of open water bodies (both running and standing) was, in general lower than that of the phreatic fauna (see Appendix 4) Most of those included in the list are representatives of the fauna of underground waters (e g caves springs wells) There are only a few exceptions (e g *G shablensis H thracicus*) Within the Bulgarian phreatic fauna relatively high levels of endemism were established for Gastropoda (73% endemics) Ostracoda (37%) Copepoda Cyclopoida (36 8%) and Harpacticoida (42 8%) Syncarida (71%) Isopoda Asellota (75%) and Hydracarina (14 3%) (Information about endemism among the insect orders is presented within the relevant reports by mutual agreement of the authors)

A great portion of the phreatic Bulgarian and Balkan endemics are also relict forms In addition there are two main groups of relicts Pontic-caspian relicts which are distributed mainly in the coastal brackish water bodies (lakes and estuaries) and glacial relicts in the high mountains lakes (Appendix 5)

GAPS IN KNOWLEDGE

The data in Table 2 are sufficient to conclude that the level of exploration of the river basins under review was relatively satisfactory There is no reason to think that wholly unknown territories exist within the two provinces

There is however a problem involving the proper correlation between the level of exploration of the various systematic groups and the various types of habitats/ecosystems It can be seen in Table 3 for example that among running water habitats, 1153 species were established for natural rivers and streams but only 8 for artificial channels Sufficient information is lacking for several types of man made water bodies (rice fields cooling reservoirs deposition basins) for all types of temporary water bodies, for the waters of caves and so forth

Table 4 provides data concerning the level of exploration of species diversity in various habitats within the river basins under review It should, of course be remembered that the brackish and/or hyperhaline lakes occur only along the Black Sea coast and the glacial lakes only in the high mountains of the Aegean catchment area Nevertheless a comparison of the number of recorded species seems to indicate that the dam lakes (reservoirs) of the Black Sea basin have not been sufficiently investigated Other insufficiently studied groups and habitats include the riverine hydrobionts, native lowland lakes and underground aquatic fauna

Because the degree of study of species diversity within individual river basins was uneven the conclusions about the current state of knowledge of biodiversity at the watershed scale should be considered approximate For example studies of the standing water bodies within the largest river basin (the Maritsa) contain published data on only several reservoirs (Batak Pzhasatchnik Rozov kladenets) and fish ponds near the town of Plovdiv (after Dimitrov 1960b 1962, 1967 1969b Lvudskanova, 1967, 1969b, 1972b 1975 Naidenov 1964a 1964b etc) There are no data for such large reservoirs as Belmeken Topolnitsa Domlyan Trakiets and Tserkoski or for many of the smaller artificial water bodies

The lack of data about species diversity within the full range of aquatic habitats is compounded by the

lack of professionals sufficiently qualified to research the entire spectrum of hydrobiont taxonomic groups

CENOTIC DIVERSITY

In contrast to the large body of information about species diversity there is little data on the diversity of specific species assemblages or communities within the river basins under review There is much information about riverine macrozoobenthos but little about the lacustrine The basic data about standing water bodies (both natural and man made) concerns the zooplankton community and to a much lesser degree the benthic community Except for one study of the Ropotamo River (after Svetkov and Gruncharova 1976 Gruncharova 1977) no further investigations of the periphyton community in the country have been conducted Little data has been published about the meyobenthos or hyporeic communities as a whole A general conclusion can thus be drawn that cenotic diversity has not been so well studied as has species diversity

ECOSYSTEM DIVERSITY

In preparing this report it was difficult to review the entire diversity of ecosystem types and especially the habitats they contain For this reason only those for which some published information exists have been emphasized The number of recorded species as presented in Table 4 provides data about the level or degree of analysis for the different ecosystems (both natural and artificial) in the watersheds under review It is evident that species diversity of entire groups of ecosystems/habitats are insufficiently known

The coastal brackish and hyperhaline water bodies as well as the estuaries of the Black Sea tributaries are considered unique habitats/ecosystems due to the high species diversity of the communities they contain Unfortunately there is no recently published information about larger lakes such as Durankulak Shabla, Varna Beloslav Vaya and Mandra The hydrobiological characteristics of several smaller coastal lakes and wetlands – Shabla Tauk Liman Tuzla Stamoplo Arcutino Alepu etc – have not been studied for decades Meanwhile environmental changes due to human activities have strongly damaged their biological diversity

For example the biota of the largest coastal lake – Varna Beloslav – was studied in the 1930s (Valkanov 1934 1936) and later in 1964 1966 (Beshovski 1964 Marinov 1966 Kaneva–Abadjieva and Marinov 1967 Kaneva Abadjieva 1972) In the years that followed the lake was completely transformed by a channel with a large harbor for ocean liners and merchant ships Many industrial enterprises mainly chemical and power plants were built around its shore As a consequence of these numerous and profound anthropogenic transformations in the lake there is no further reason to regard it as a natural water body To cite one particular effect, the population of *Astacus leptodactylis* – the main invertebrate hydrobiont of economic interest – has been fully destroyed As concerns species and cenotic diversity there exist only a few unpublished studies of the effects of pollution from the tributary Provadizhska River on the dynamics of the zooplankton community

Many of the lakes and estuaries listed above are associated with wetlands of national and international importance They lie along the Via Pontica, and serve as migratory stopover points and wintering locations for waterfowl and other birds

REAL AND POTENTIAL THREATS TO BIODIVERSITY

The many human activities that could or do present real threats to the biological diversity within Bulgaria's aquatic ecosystems are summarized here

Pollution

Pollution from both point and non point sources, constitutes one of the most serious dangers to the species diversity of aquatic ecosystems Furthermore the changes in cenotic diversity, up to and including the complete elimination of certain communities alter the functions, and hence the stability, of ecosystems

The effects of pollution depend directly on the type and extent of the pollutants Pollutants can be divided into several categories

1 Saprogenic pollution

Loading with biodegradable organic matter or *saprogenic pollution* causes alterations in species composition The more sensitive species are replaced by more tolerant species in all communities while the species structure in general is simplified In lotic systems the relative share of zoobenthos and periphyton in the cenoses increases In lentic systems the zooplankton also increase The deposition of organic matter in standing water bodies can in some cases cause the zoobenthos to be eliminated Increasing eutrophication, and thus secondary saprobization are the main features of aquatic ecosystems that are receiving high levels of biodegradable organic matter

The Mesta River provides a well studied example The Mesta was heavily affected by organic pollutants of industrial origin (mainly tarboard paper and yeast production) More than 200 invertebrate taxa had been recorded for the zoobenthos Changes consequently occurred in both species composition and the structure of the bottom community The dominant tubificid species (Oligochaeta), for instance, changed as follows *Rhyacodrilus coccineus* dominated up

stream the source of the pollution while *Tubifex tubifex Pasmmoryctides albicola* and *Psammoryctides barbatus* dominated at three sites downstream of the source) The mean number of species was more or less equal (24 28 per m^2) but the Shannon Weaver index of species diversity varied between 3 353 for the first (unpolluted) site and 2 663 for the most affected site After the pollution was eliminated species diver sity was restored (after Kovachev 1977 1984 Kovachev and Uzunov, 1986, Uzunov and Zheleza rov in press Uzunov and Molle, in press Kovachev and Uzunov unpub data)

2 Inert pollution

Loading with suspended materials or *inert pollu tion* affects both the composition of the community and species richness The species structure of the communities becomes rather distorted In cases where the damage from suspended materials is strong, peri phyton (in lotic systems) might be eliminated, while in lentic systems the zooplankton might be inhibited Deposition and the elimination of suspended materials could stimulate the bottom dwelling benthos and the zooplankton

The Strouma River is an example of a stream that was heavily polluted by suspended materials of indus trial origin (coal cement powder, etc) At sites im mediately below the sources of the pollutants the mean number of species present in the macrozooben thos was less than 15% that of upstream sites Two hundred and ten kilometers downstream the mean number of species was still only half that of the up stream sites despite the fact that the level of the sus pended materials had fallen more than 95% After the inert pollutants were eliminated (1974 1975) the processes of recovery led to an increase in species richness the number of known species in the river rising to 263 as compared to 132 for the previous, heavily polluted period (after Kovachev and Uzunov 1977 Kovachev et al 1979 Islam et al 1985 Uzunov and Kovachev 1987)

3 Toxic pollution

Loading with toxic materials, or *toxic pollution* involves substances of various type and origin – heavy metals oil products organic substances such as pesti cides detergents and antibiotics etc – and can dam age biodiversity profoundly The acute impacts can include the complete elimination of aquatic biota while chronic impacts can include essential damage to populations and species Communities can be de stroyed or their structural organization distorted, as only a very few tolerant species are able to survive

The upper stretch of the Arda River was among the many water bodies affected by toxic pollution re ceiving heavy metals from the mining and processing enterprises in the region No zoobenthos or periphy ton were found for years along a 60 kilometer stretch of river downstream from the sources of the pollution After these sources were eliminated (1990) the river entered the initial stages of recovery and the macro zoobenthos began to reestablish themselves (after Russev 1959 1964 Kovachev and Uzunov unpub Uzunov unpub)

4 Thermal pollution

The heating of waters or *thermal pollution* is an example of a threat to the aquatic biota that is not well studied in this country Several foreign studies have demonstrated the effects of alterations in water tem perature on species composition in the communities as the most sensitive species are replaced by the most tolerant or eurythermic species An important aspect of thermal pollution is its intensifying effect on cenotic processes The reproductive capacity of various populations is exhausted due to rapid turnover and alterations in life stages

5 Mixed pollution

Aquatic organisms and systems are commonly ex posed to various combinations of pollutants, or *mixed pollution* Depending on the mix species composition species richness and community structure can vary with sensitivity along the route of the affected river As a rule species diversity is lower than at sites that are free of impacts Mixed pollution can permanently affect aquatic communities by exhausting their adap tive capacity and so transforming the biota

The Maritsa River provides an example of the effects of mixed pollution Over the last several dec ades the Maritsa has been strongly affected by urban development and industrialization in its basin Its bottom communities have been affected by the in creasing impacts of various pollutants Many stretches were subject to saprobic inert and/or toxic pollution Factor analysis (VARIMAX rotation) of data from 1976 1977 revealed that the most important factor determining species diversity and the structural or ganization of the macrozoobenthos was inert pollution (38% of total dispersion) followed by toxic (24%) and saprobic (22%) pollution The invertebrate commu nities have lost 76 species recorded before 1955, and another 76 species after 1963 During the period 1976 1977 a total of 219 taxa were recorded for the macrozoobenthos of the Maritsa in 1987, only 98 were found At several sites the macrozoobenthos were completely absent for one or more seasons in 1987 and some taxonomic groups were not repre sented in samples at all (after Russev, 1966, 1968, Russev et al 1981 Uzunov 1981, Uzunov et al 1981 Uzunov and Kovachev 1985 Kovachev, 1989, Uzunov et al , 1991 etc)

Hydrotechnical Projects

Hydrotechnical construction and other hydrologi cal engineering works can also cause essential changes in and damage to, the biological diversity of the

aquatic ecosystems under review In fact however this aspect was not well represented in the available references on the freshwater ecology of the country Thus the following comments are based on some general considerations

1 Drainage

The draining of marshes and other wetlands in general causes elimination of the aquatic ecosystems as a whole no species, no communities no biodiversity Many wetlands and shallow water bodies have been completely lost especially along the Maritsa and Tundzha Rivers and the Black Sea coast

2 Changes in riverbeds

The straightening diking embankment and walling of riverbeds can also bring about radical changes in species and cenotic diversity as the regulatory functions within the ecosystems are redistributed from the benthic to the periphyton community The natural flows of the rivers are redirected within artificial channels

3 Water withdrawals

The withdraw of waters affects primarily the species diversity of the benthic communities in streams and rivers Depending on the type of construction it can result in the loss of species or populations whose life cycles are linked to high waves or floods during the spring and (in cases where all water is withdrawn) the advance of secondary succession in downstream areas

4 Dams

The storing of river waters behind dams entails a radical change in ecosystem typology, as running waters are transformed into a standing waters This results in a redistribution of the ecosystem regulatory functions from benthic to planktonic communities At the species level the rheophilic hydrobionts are replaced by limnobionts Despite numerous references to the hydrobiology and ecology of reservoirs in the scientific literature no actual assessments have been made of the losses and benefits of such an exchange

Other Threats

Aquatic ecosystems face at least two other major potential threats neither of which has been studied with respect to their possible effects on biological diversity in Bulgaria

The trans boundary and regional transport of air pollutants can result in damage to species diversity through acid rain and/or through the deposition of harmful substances in water bodies, on soils, and eventually in the groundwaters Although no visible changes in cenotic and ecosystem diversity may take place substantial negative impacts on both community structure and ecosystem function can be expected

Global climate change and especially global warming might result in the loss of endemic species, as well as the more sensitive stenobiotic species and populations (in both surface and ground waters) as environmental parameters shift beyond their ecological tolerances

Appendix 1 Codification of the River Basins Under Review
(according with the National Monitoring Network)

Black Sea Catchment Province

[30] 025 Batova River basin
[30] 026 Devnenska River basin
[30] 027 Provadizhska River basin
[30] 028 Kamchia River basin
[30] 040 Ajtoska River basin
[30] 047 Ropotamo River basin
[30] 055 Veleka River basin
[30] 100 River basins of the smaller Black Sea tributaries
[30] 101 Basins of the coastal lakes lacking their own outflow

Aegean Sea Catchment Province

[30] 059 Tundzha River basin
[30] 060 Maritsa River basin
[30] 061 Arda River basin
[30] 064 Mesta River basin
[30] 065 Strouma River basin

Note Only the numbers after the brackets are used in the text and tables

Appendix 2 Codification of the Habitats/Ecosystems Under Review

Running Waters (Lotic Systems)

1A Rivers, streams and brooks
1B Artificial channels

Stagnant Waters (Lentic Systems)

2A1 Lowland lakes
2A2 Glacial mountain lakes
2A3 Brackish coastal lakes
2A4 Hyperhaline coastal lakes
2A5 Bogs, marshes, and other wetlands

2B1 Artificial lakes and reservoirs
2B2 Fish ponds
2B3 Rice fields
2B4 Cooling reservoirs
2B5 Deposition basins

Underground Waters (Phreatic Systems)

3A1 Water bodies in caves
3A2 Hyporheic habitats
3A3 Springs

3B1 Waters from well shafts and test pits

Temporary Water Bodies (Thelms)

4A1 Lithothelms
4A2 Phytothelms
4A3 Dendrothelms
4A4 Puddles and other temporary water bodies

Appendix 3 Excerpts from the European Red Data List of Globally Threatened Animals and Plants

IUCN Global Status E – Endangered V – Vulnerable I – Indeterminate * – Taxa known to be threatened but currently under review by IUCN (Source UN E/ECE/1249 NY 1991)

INVERTEBRATES

HIRUDINEA
Hirudo medicinalis I

GASTROPODA
Segmentina nitida V

CRUSTACEA DECAPODA
Astacus astacus V

ODONATA
Coenagrion mercuriale V
Ophiogomphus cecilia E
Gomphus flavipes I
Brachytron pratense I
Leucorrhinia pectoralis *

COLEOPTERA
Graphoderus bilineatus V

Appendix 4 List of the Bulgarian (BGE) and Balkan (BLE) Endemic Hydrobionts in the Provinces Under Review

HIRUDINEA
Dina absoloni Johans BLE
Dina lineata aindti Aug BLE

MOLLUSCA
Hauffenia lucidulus Ang BGE

OSTRACODA
Mixtacandona elegans Dan el & C et BGE
Pseudocandona spelaea Klie BLE
Pseudocandona puteana Klie BLE

COPEPODA
Hemidiaptomus thracicus Sch BGE

CYCLOPOIDA
Diacyclops schappuisi Naid & Pand BGE
Speocyclops rhodopensis Pand BGE

HARPACTICOIDA
Bryocamptus petkovski Apost BGE
Elaphoidella angelovi Mich BGE
Elaphoidella boiutzki Mich BGE
Elaphoidella cvetkiovi Mich BGE
Elaphoidella gracilis serrulata Dam & Bot BGE
Elaphoidella necessaria Kief BLE
Elaphoidella valkanovi Bass BGE
Elaphoidella pandurskyi Apost BGE
Stigoelaphoidella michailovae Bass BGE

Appendix 4 List of the Bulgarian (BGE) and Balkan (BLE) Endemic Hydrobionts in the Provinces Under Review* (continued)

HARPACTICOIDA (continued)

Maraenobiotus bulbiseta Bass & Apost	BGE
Nitocra stygia Apost	BGE
Nitocrella spinulosa Apost	BGE
Nitocrella stygia Apost	BGE
Nitocrella tonsa Mich	BGE

SYNCARIDA

Hexabathynella hebrica Cv & Petr	BGE
Hexabathynella brevappendiculata Cv	BGE
Hexabathynella longiappendiculata Cv	BGE
Hexabathynella nestica Cv	BGE
Hexabathynella tenera Cv	BGE

AMPHIPODA

Gammarus frater Kar & Pink	BGE
Gammarus shablensis Car	BGE
Niphargus cepelarensis St & Kar	BGE
Niphargus toplicensis Andreev	BGE

ISOPODA

Balkanostenasellus rumelicus Cv	BGE
Microcharon apolloniacus Cv	BGE
Microcharon euridices Cv	BGE
Microcharon major Kar	BLE
Microcharon phlegetonis Cv	BGE
Microcharon thracicus Cv	BGE
Microceberus phreaticus Cv	BGE
Microceberus styguis harmanliensis Cv	BGE

ACARI HALACARIDAE

Soldanellonyx chappuisi thracicus Petr	BGE
Porolohmannella cvetkovi Petr	BGE
Halacarellus phreaticus Petr	BGE

ACARI HYDRACHNELLAE

Atractides asticae Petr	BGE
Atractides longiporus Petr	BGE
Axonopsis orghidani Petr	BGE
Axonopsis boureschi Petr	BGE
Momonisia phreatica Petr	BGE
Mideopsis motasi Petr	BGE

* Note Information about endemic insect species from aquatic habitats/ecosystems is presented in separate reports in this volume

Table 1 Thematic Development of Scientific Literature (334 titles) on the Biodiversity of the Black Sea and Aegean Sea Basins During the Twentieth Century

Period	1900	1901–1910	1911–1920	1921–1930	1931–1940	1941–1950	1951–1960	1961–1970	1971–1980	1981–1990	1991
Faunistic	1	5	6	19	11	4	18	55	54	35	7
Cenotic					2		9	18	29	25	
Applied							6	5	10	14	1
Total	1	5	6	19	13	4	33	78	93	74	8

Table 2 Number of Recorded Species in the River Basins of Bulgaria (see Appendix 1 for codification of the river basins)

Systematic Groups	Black Sea Province									Aegean Province					Total
	025	026	027	028	040	047	055	100	101	059	060	061	064	065	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Rhizopoda			14	5	2	4		11	11		17	96	78		147
Ciliata	13	13	59	40	49	25	14	29	33	77	146	33	13	23	200
Porifera			1	1						1	5				5
Hydrozoa			12	3	2	9	1	9		1	2			2	14
Bryozoa			3	5	2	12	1	6		1	6				14
Turbellaria		3	15	3	2	5	2	12	3	3	10	4	2	5	29
Nemertini		1	2												2
Nematomorpha	1							1			1				3
Nematoda			6	2	3		1	5	3		1				9
Rotatoria			36	6	20	7	2	39	24	52	99	21	9	10	164
Gastrotricha								1							1
Polychaeta			14	1	2	8	1	5	1						22
Oligochaeta	1	3	16	22	8	13	6	17	27	47	54	27	59	50	70
Hirudinea		2	7	5	1		1	5	2	10	14	6	3	11	17
Gastropoda	1	4	28	9	2	8	4	15		22	37	11	5	11	57
Bivalva	1	1	7	2		7	1	7	1	6	11	3	1	1	23
Tardigrada						1									1
Hydracarina			4	8		8	75	13	20	8	61	26	5	8	124
Conchostraca											1				1
Phyllopoda									1						1
Ostracoda			32	3	2	7	4	19	30	3	42	8	8	2	64
Cladocera	1	1	22	4	13	28	19	42	24	41	70	30	27	13	108
Copepoda	5	2	46	8	17	37	22	41	59	44	101	20	14	21	183
Branchiopoda									2						2
Syncarida						2	2	3		2	5		2	1	7

Table 2 Number of Recorded Species in the River Basins of Bulgaria (continued)

Systematic Groups	Black Sea Province									Aegean Province					Total
	025	026	027	028	040	047	055	100	101	059	060	061	064	065	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mysicadea			4		1	2	1	3	1						5
Cirripedia			1		2	1		1							2
Amphipoda	2		20	9	5	9	4	15	18	8	14	12	3	8	41
Isopoda	1		4	2	3	4	3	8	2	6	11	3	4	4	17
Anizopoda						1		1							1
Decapoda	1	2	11	4	2	7	2	7	1	4	5		2	4	14
Ephemeroptera	14	7	16	58	1	29	45	46		66	89	58	37	55	90
Plecoptera				4		2	4	11		17	31	15	13	21	42
Odonata	10	55	14	22	2	7	13	51	9	27	30	23	15	25	58
Heteroptera	4		3	6		4	2	12		24	42	14	3	8	42
Trichoptera	5		10	9	3	1	19	9		38	85	71	35	70	170
Coleoptera	1		5	12	3	2	4	17		32	84	24	7	19	148
Megaloptera	1			1						1	1	1		1	1
Lepidoptera									1		1				2
Diptera															
Athericidae							2			2	2	1	2	2	2
Iepharicerdae								1		1	5	2	2	2	6
Ceratopogonidae			2		1	1		2		2	2	2	1	1	4
Chironomidae	3		46	18	14	14	5	34	23	85	98	57	19	127	201
Culicidae	15		9	16	1	12	7	18	6	5	15	5	1	4	35
Dixidae										1	2	1		1	2
Limoniidae							1	1		5	4	2	4	6	7
Muscidae						1	1			1	1	2			2
Simuliidae	2		2	9		2	4	6		13	46	20	36	41	64
Varia			3	6	1	5	2	3		7	14	6	4	10	18
TOTAL	80	40	474	303	164	282	275	526	302	662	1263	604	384	567	2240

Table 3 Number of Recorded Species in the Various Habitats in Bulgaria

Systematic Groups	1A	1B	2A1	2A2	2A3	2A4	2A5	2B1	2B2	2B3	2B4	2B5	3A1	3A2	3A3	3B1	4A1	4A2	4A3	4A4	Total
Rhizopoda			54	75	5		95	5	2					18	11						147
Ciliata	164		12	5	17	4	15	30	3	12											200
Porifera	2					1	1				1										5
Hydrozoa	7				8	4	4	1													14
Bryozoa	12				13	2	2	1	2												14
Turbellaria	10	1	1		15	4	3	1							7						29
Nemertini		1									1	1			1						2
Nematomorpha	1				1		1														3
Nematoda	1				5		4							2							9
Rotatoria	1		49		57	3	53	54	22					1	9					3	164
Gastrotricha					1																1
Polychaeta	6				20	4	2														22
Oligochaeta	63			6	31		3	12					2	6		7					70
Hirudinea	14				3		9	5		1	4										17
Gastropoda	27		7		17	3	26	2	1		3				6					1	57
Bivalva	12				8	3	9	1							1						23
Tardigrada	1									1											1
Hydracarina	39		6		7	3	30	1	14	6	1			9	13	37				4	124
Conchostraca	1																				1
Phyllopoda						1															1
Ostracoda	1	1		5	33	5	30		9			1			11	3				9	64
Cladocera	10		35	27	46	3	60	46	20		1				1	1			1	23	108
Copepoda	19	3	21	12	55	19	62	29	15	2		2	13	28	49	21	1	1	3	30	183
Branchiopoda						2															2
Syncardia														2	5	3					7
Mysidacea					5		2														5
Cirripedia					2	1															2

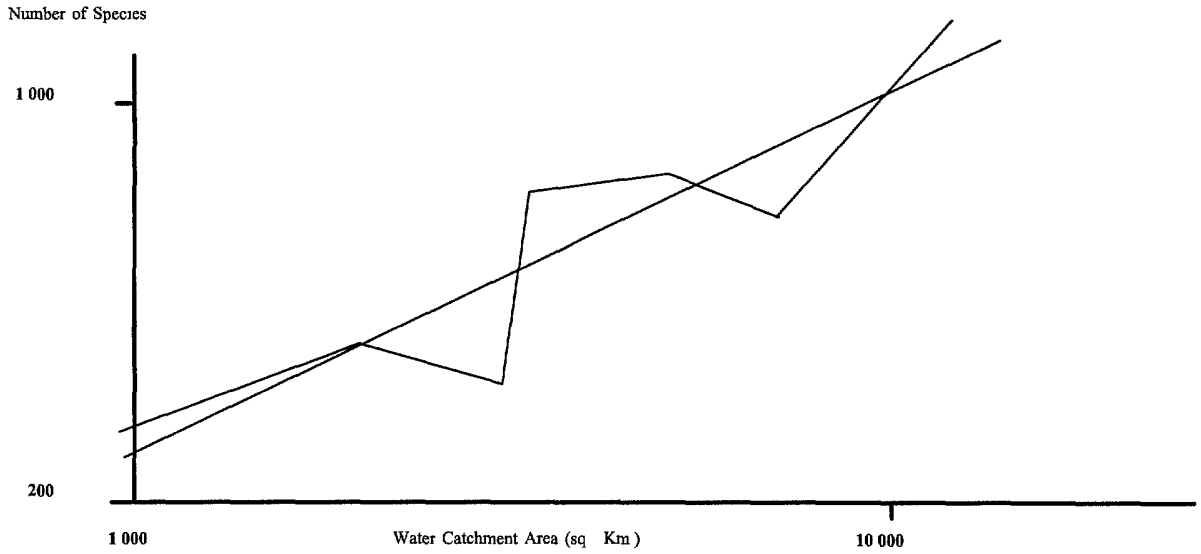
Table 3 Number of Recorded Species in the Various Habitats in Bulgaria (continued)

Systematic Groups	1A	1B	2A1	2A2	2A3	2A4	2A5	2B1	2B2	2B3	2B4	2B5	3A1	3A2	3A3	3B1	4A1	4A2	4A3	4A4	Total
Amphipoda	15		1		24	7	3	2					2	3	5	2					41
Isopoda	3				5	3	1							6	11	4					17
Anizopoda					1																1
Decapoda	5				10	6	3	1													14
Ephemeroptera	90		6		2		1	5	4												90
Plecoptera	42																				42
Odonata	34	1	11	4	2	1	33	4	4			1								15	58
Heteroptera	36		9		4		1	5	4												42
Trichoptera	86	1	4	15	17	3	48	7	4	1			8		9		1	2		5	148
Coleoptera	162		19		2		9	2													170
Megaloptera	1																				1
Lepidoptera	2																				2
Diptera																					
Athericidae	2																				2
Blepharicerdae	6																				6
Ceratopogonidae	2				2																2
Chironomidae	178				34	2	30	19	25											2	201
Culicidae	8						17		1	1					4		3		5	17	35
Dixidae	1																				2
Limoniidae	7																				7
Muscidae	2																				2
Simuliidae	64																				64
Varia	16					2	1														18
Total	1153	8	235	149	452	86	544	233	130	14	11	5	15	75	144	78	6	3	9	109	2240

Table 4 Number of Species from River Basins Under Review in Various Habitats and Ecosystems (see Appendix 1 for codification of the river basins)

Habitats and Ecosystems		Black Sea Province									Aegean Province				
		025	026	027	028	040	047	055	100	101	059	060	061	064	065
Rivers streams and brooks	1A	60	25	128	216	77	154	167	201	17	486	722	356	162	475
Artificial channels	1B			1					3		1	1			
Lowland lakes	A1	3	2	3	5	2	6	6	7	1	6	113	178	14	11
Glacial mountain	2A2											3	1	120	26
Brackish coastal	2A3	1	1	253	35	78	115	21	231	153					
Hyperhaline coastal lakes	2A4			50	3	9	13		22	17					
Bogs marches and marshlands	2A5	18	8	191	45	12	62	46	105	97	76	150	103	15	30
Artificial lakes and reservoirs	2B1	17	15	18	17	16	19	19	21	16	70	181	45	33	19
Fish ponds	2B2			3	4	3	3	2		3	2	120	2	1	1
Rice fields	2B3				2	2	2	2				9			4
Cooling reservoirs	2B4										1	10			
Deposition basins	2B5	2		2	2	2	3	4			1	2			
Water bodies in	3A1	1	1	1	1						4	9	10		2
Hyperheic habitats	3A2	1	1	1	3	1	1	3	1	17	27	47	3	2	6
Springs	3A3	2	9	68	8	2	6	7	16	46	15	68	12	12	19
Water from well shafts and test pits	3B1	2	2	3	3	2	9	46	6	2	29	21	4	7	6
Lihothelms	4A1	1	1	1	1		1		1	1		2	1	1	1
Phytothelms	4A2				2		2		3			2			
Dendrothelms	4A3	3		4	7	2	5	3	4		1				
Puddles and other temporary water bodies	4A4	4	1	13	18	1	23	23	38	10	28	32	4	1	10

Figure 1 Total Number of Species in the Water Catchment Areas of Basins Covered by this Survey



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Biological Diversity of the Black Sea Zoobenthos and Zooplankton

Asen Konsulov and Tsenka Konsulova

INTRODUCTION

The Black Sea is a unique body of water Its nar row connection with the world's oceans through the Bosphorus and its thermal and density related stratifi cation which for most of the year account for a quasi homogeneous structure of the water mass produce unique ecological conditions These special conditions explain, to a large degree, the increasing level of inter est in its biota and its characteristic diversity

The hydrological and hydrochemical peculiarities of the Black Sea together with its restricted vertical water interchange allow poisonous hydrogen sulphide gas to form and persist beneath the 150 meter isobath Consequently, most of the flora and fauna occupy only the uppermost 130 140 meters of the water mass, or 13% of the volume of the whole sea And among its other peculiarities the Black Sea ranks first among the world s threatened water basins

The large high water rivers that flow into the Black Sea carry enormous quantities of eutrophicants such as nitrogen and phosphorous compounds (as well as other point and non point source pollutants) at certain times of the year stimulating vigorous growth of phytoplankton and zooplankton This in turn causes so called secondary eutrophication within the water mass Because phyto and zooplankton are or ganisms with short life cycles and an ability to repro duce rapidly it is not uncommon for their remains to accumulate in considerable quantities Falling to the sea bottom or remaining within the thermal layer this detritus consumes oxygen as it decays, preventing both vegetation and pelagic or benthic sea fauna from de veloping

SECTION I ZOOPLANKTON

As an ecological category zooplankton comprise that portion of the planktonic fauna which constantly or temporarily inhabit the whole water mass or part of it Because the zooplankton act as important links in the complex trophic chains of pelagic biocenoses they have for a long time been the subject of considerable research

Systematics and Ecology

Zooplankton in the Black Sea along the Bulgarian coast include representatives of the following types Protozoa, Coelenterata, Nemathelminthes, Annelides Mollusca Arthropoda, Chaetognata and Chordata Knowledge of the species diversity within each of these basic systematic groups has been acquired mainly since 1952 In the years up until 1969 all zooplankton typical for the Bulgarian coastal waters were identified and described except for the class In fusoria (Russev et al 1959 Dimoff 1960 1963 1964 1966) A list of the zooplankton characteristic of this area again excepting Infusoria was compiled by Kon sulov (1976) In 1990, a full list of the zooplankton including Infusoria was published (Konsulov 1991) (See Appendix 1 Section I)

The species composition quantitative growth biomass and production of zooplankton play impor tant functions in the process of energy transfer be tween the sea surface and bottom The different states under which energy exchange manifests itself depend upon the character of the biotic and abiotic influences These factors are extremely variable in the waters of the Bulgarian Black Sea coast due to the shallowness of water mass along much of the coast This is why in cidental changes within the hydrological regime of the Bulgarian waters can cause development deviations in whole groups of organisms and partial or complete changes in species composition For the same reasons, eutrophication and its consequences have an impor tant impact on the waters beyond the estuaries of the large rivers a large proportion of which occur along our coast

In keeping with requirements for the preservation and reproduction of benthic organisms as well as the development of marine cultures the role of those zoo plankton known as larvaton' (mesoplankton) deserves special consideration Black Sea coastal waters are vis ited by a variety of valuable fish species during the dif ferent seasons – sprat anchovy blue fish Danube her ring belted bonito etc The juvenile forms of all these objects of passive and active Black Sea fishing are

planktonofagous while sprat and anchovy in all phases of their development form large schools and feed on zooplankton Thus it is obviously exceptionally im portant to know and preserve the trophic potential of the waters in general and certain species of zooplank ton in particular

Species Richness

In terms of species richness the Black Sea zooplankton in general can be considered relatively high, but in groups such as the Ctenophora it is low The presence of rare zooplankter species is also low One rarity is the *Pontella mediterranea*

Thermal Variation

The zooplankton of the Bulgarian Black Sea coast can by separated into thermophilic eurythermic, and cold water species In spring summer and autumn, with the structure of the water mass quasi homogene ous in the surface layers down to 25 m Cladoceran thermofiles are most often identified (*Penilia avirostris Pleopis polyphemoides P tergestina Podon intermedius P Leuckarti Evadue spinifera E nordmani*) followed by thermophilic and eurythermic Copepoda (*Centropages kroyeri Acartia clausi Paracalanus par vus* etc) Dominant in the zone under the thermal boundary are eurythermic and cold habitat forms (*A clasi Pseudocalanus elongatus Calanus helgolandicus, Oithona similis Sagitta setosa* and *Pleurobrachia rho dopis*)

The qualitative composition and quantitative de velopment of the bottom larvaton portion of the zooplankton (medioplankton) play a particularly im portant role in maintaining the species diversity of the benthos This group is represented by *Lamellibran chia veliger Gastropoda veliger Cirripedia nauplius Cirripedia cyprus Polychaeta larvae* etc (See Appen dix 1 Section I)

Seasonal Variation

The species composition and population dynamics of zooplankton have distinct seasonal characteristics This becomes obvious looking at Tables 1 4 which show the average multi year data for the composition and structure of zooplankton in the Black Sea in front of the Bulgarian coast (i e Capes Kaliakra, Ghalata Emine and Masslen Nos) These data are derived from both coastal waters and the open sea (Konsulov 1991)

As regards the winter biomass of zooplankton the richest region turns out to be the area 15 miles east of Cape Emine (Scheme I) bordering on the north and south of the 6 0° C isotherm curve Analysis of the av erage annual spring biomass of zooplankton shows that it is at its highest in the coastal waters of the Ghalata Cape (72 58 mg/m^3) and considerably lower in front of the Cape of Emine (35 39 mg/m^3) Biomass values for the open sea rank first in the region of the Ghalata Cape second along the Emine Cape and third and fourth respectively in the regions in front of Capes Masslen Nos and Kaliakra

During the summer surveys of the state of zooplankton along north to south transects have shown that higher biomass values are found in those coastal regions where the 8° C isotherm curve lies furthest from the coast This is due to the relationship between the location of isotherm curves and zooplankton structure (which bears upon their devel opment and biomass values) Analysis of the state and development of zooplankton along the Bulgarian Black Sea coast in summer show that the species com position includes representatives of the thermophilic eurythermic, and cold habitat complex (Konsulov, 1976) Growth in the thermophile complex is most substantial in surface, coastal water regions in eu rythermic species in the intermediate horizons and of the cold habitat complex below the 50 meter isobath curve in the open sea (Konsulov 1988, 1990, 1991) The species diversity of the thermophilic Cladoceran fauna is influenced by the presence of adjacent shallow sea shelf grounds where the laying and hibernation of eggs takes place at the end of summer and beginning of autumn

The distinctive autumn zooplankton in the Bul garian Black Sea coast includes all the summer zooplankters (except for *C Kroyeri*) but in lower quantities (see Table 4) This fact accounts for the lower average value of biomass (36 13 mg/m^3) com pared to that of summer (102 11 mg/m^3) The largest biomass quantities are those of *O minuta* (819 ind/m^3) *A clausi* (272 ind/m) and *P parvus* (218 ind/m^3) species that are found in coastal areas above the 10 0 C° isotherm curve The benthos larvaton in coastal waters in autumn is composed of *Cirripedia nauplius, Gastropoda veliger Lamellibranchia veliger* and Polychaeta larvae The highest average value of autumn biomass is located in the coastal waters of the Ghalata Cape (78 17 mg/m^3) whereas the lowest is to the south of the Cape of Masslen Nos (16 76 mg/m^3)

Susceptibility to Human Activities

As an ecological group the zooplankton are very sensitive to certain human activities High speed ship propellers are lethal to them transforming them into dead tissue and stimulating processes related to secon dary eutrophication Contact with oil is also lethal to zooplankton Exceptionally dangerous for macro and mesoplankton as well as for benthos larvaton is trawler fishing in the shallow shelf zone Trawling forms solid masses of Copepoda zooplankters in the bottom horizons causing considerable concentration of sprat along them This is the reason trawler fishing is conducted along the bottom leading to the move

ment of fine silt upwards from the soft ground The latter has lethal effects on mesoplankton and the sedimentation that follows in turn covers the hiber nating eggs of a number of the Cladoceran and Cope pod representatives This explains the large decline in the number of *P avirostris* (by 4 5 times) over the last decade The same applies to *P tergestina* and *C Kroy eri* This type of fishing also causes radioactive sub stances to move upwards and circulate (Konsulov 1991)

The growth and distribution of the invasive Ctenophora *Mnemia maccradyi* (Mayer, 1990) has in the last 4 5 years become particular important in terms of the stability of the Black Sea plankton community This plankter reaches 14 cms in size and preys upon mesozooplankton of all groups as well as the eggs and larvae of pelagic fish In the coastal waters during the summer months the density of this species reaches as much as 285 individuals per cubic meter and in adja cent to sea lakes (Varna Lake) exceeds 450 ind/m^3 (Konsulov 1986) The invasion of this species in the Black Sea and its massive increase are due to the high degree of eutrophication in the coastal waters As a result *M maccradyi* is seriously endangering species diversity among the zooplankton Another conse quence of advanced eutrophication in the coastal wa ters is the massive growth of *Noctiluca scintilans* which feeds on large quantities of pelagic and benthic larvaton heavily influencing in turn the community s population structure and biological diversity

Because of their feeding habits and reproductive characteristics the abovementioned zooplankters are taking an active part in the process of de eutrophication Their life cycle however is short and following death they fall to the sea floor where their decay causes the oxygen level to decrease This in turn causes conditions for the reproduction of the benthic fauna including bottom dwelling species of fish to deteriorate

Summary

Studies of the species diversity structure and growth of zooplankton in the Bulgarian Black Sea coast (Rozhdestvensky 1979 1986 Konsulov, 1976, 1986) show that

1 Changes within the species diversity and structure of zooplankton are greatest in the near coastal zone and are determined by the considerable an nual amplitude of the changes in the temperature of the water mass
2 Low winter temperatures reaching the shallow sea shelf bed are the main reason for the poor hiber nation and death of eggs of thermophilic Clado cerans and Copepods (Konsulov 1987) Another important reason for mortality among the better part of the population of these groups is bottom trawler fishing for sprat Fine sediments are lifted up by this type of fishing after which they fall back to the bottom covering the eggs of fish, mussels, and planktonic Crustacea
3 Zooplankton species diversity is also endangered by the invasion of the Ctenophora species *Mne mia maccradyi*, which was found only infrequently until recently

SECTION II ZOOBENTHOS

Brief History of Research

The history of research on the zoobenthos of the Bulgarian Black Sea coast can be divided into four pe riods The first begins with the early faunistic studies and lasts until the founding of the Marine Biological Station in the town of Varna in 1932 Chichoff (1912) in this period prepared a list of 249 animal species in cluding vertebrates that he had identified Paspalev (1933) together with Russian and Rumanian re searchers who had visited the Bulgarian coast pub lished data on the distribution of some of the zooben thic organisms of the Bulgarian coast

The second period begins with the establishment of the biological station in 1932 and ends in 1954 with the setting up of an advanced scientific research insti tute The results of the systematic and intensive re search activities from this period, mainly in the area of faunistics, have been published in 19 volumes belong ing to the Marine Biological Station ("Arbeiten aus der Biologischen Meersstation in Stalin (Bulgarien)") Most of these studies are devoted to the species com position of the fauna, as a foundation for carrying out community level research and for clarifying the trophic resources for fish in the sea and adjacent ba sins

Deserving of special recognition in this respect is Valkanoff director of the station from 1942 to 1964 whose work on whole ecological groups laid the foun dation for research on benthos cenology and the faunistic characteristics of zoobenthos (Valkanoff, 1935 1938 1953) Work in these areas was also en riched in this period by research work carried out by foreign scientists who worked for certain periods at the station (Klie 1937 Caspers, 1951 Czapic, 1952) Based on expeditions carried out by the Sozopol Ichtyological Station Netchaev et al (1938) provided information on the characteristics and distribution of the black mussel (*Mutilus galloprovincialis* Lam) along the Bulgarian Black Sea coast in relation to its exploi tation by people for food

The third period from 1954 to 1989 begins with the founding of the Scientific and Research Institute of Fishery (Institute Central de Recherche Scientifique de la Pisculture et de Pecherie Varna) The name was later changed to the Research Institute of Fisher ies and Oceanography, and then to the Institute of Fisheries (as it is called today) During this period a number of authors have provided qualitative and

quantitative information on the composition of the Protozoa (Valkanov 1970, Golemansky 1974 Det scheva 1983), Nematoda (Stoykov 1978 Uzunov 1977) Polychaeta, Archiannelida, Ostracoda (Marinov 1977 1990) Harpacticoida (Marinov 1971, Apostolov et al 1988) Halacarida (Petrova 1972) Malacostraca Mollusca (Kaneva Abadjieva 1960 1965, Bulgurkov 1968 1973) and Turbellaria (Konsulova 1978)

The faunistic data collected was first summarized in the "Catalogue of Bulgarian Black Sea Fauna" (Valkanov 1955) followed by two additions in 1964 (Valkanov et al) and 1989 (Marinov et al) Bio cenologic research, as a rule, has followed basic faunistic research, although in a number of cases (and more so in later periods) it has been carried out si multaneously Particularly important was research conducted in the years 1954 1957 This work made it possible to define for the first time the distribution of macrozoobenthos along the Bulgarian Black Sea coast (except for the 5 meter deep coastal zone), covering taxonomic composition and quantitative estimation from both a spatial and an ecological perspective (Kaneva Abadjeva et al 1960 1966)

During this period the trophic significance for fish of the zoobenthos was also pointed out (Kaneva Abadjieva et al , 1960 Karapetkova 1962), as was the negative effect of zoobenthos on underwa ter equipment and structures (Kaneva Abadjieva et al , 1965) The qualitative and quantitative composition of miobenthos and microbenthos were studied along with the macrozoobenthos (Marinov, 1978 Golemansky 1974 Detscheva 1983) The first report on important changes within zoobenthos communities, issued some 15 years ago described the invasion and climatic ad aptation of new immigrants to the Bulgarian Black Sea coast (Svetkov 1986) The decline in populations of the black mussel *Mytilus galloprovincialis* (Kaneva Abadjieva et al , 1976, Marinov, 1978) was also reported at about this time, stimulating work on the biological basis of mussel cultivation on the Black Sea coast (Konsulova 1985)

The fourth stage in research began with the founding of the Marine Biology and Ecology Depart ment within the Institute of Oceanology of the Bul garian Academy of Sciences in 1989 It focuses its re search on the species diversity and community struc ture of zoobenthos in the largely unknown near shore coastal zone Much of its work involves analysis of critical changes within the bottom zoocenoses as a consequence of the massive die off of more sensitive species during periodic summer hypoxia and investi gations of the mechanisms behind the lethal eutrophi cation process (Konsulova 1991, Konsulova et al 1991) The Institute of Fishery also continues to con duct research on the zoobenthos of the Bulgarian coastal shelf updating information and analyzing changes in quantitative and qualitative composition and zoocenoses distribution over the last 30 years

Current Assessment

Zoobenthos species composition is relatively well studied in the Bulgarian part of the Black Sea The latest data (Marinov 1990) indicate that a total of 1370 zoobenthos species occur These belong to 12 groups Protozoa Porifera Coelenterata Plathelminthes, Nemathelminthes Nemertini Anne lida, Arthropoda Mollusca Tentaculata, Echinoder mata and Chordata The arthropoda with 492 repre sentatives, are richest in species diversity out of which the largest number of species is represented by Har pacticoida (204) Next come the worms as a whole out of 338 species, 102 are Polychaeta and 109 Nematoda (See Table 5 and Appendix 2) Since there are still groups that are not well known – the Protozoa Oligochaeta Turbellaria etc – it can be as sumed that the number of zoobenthos species is in fact still larger

In terms of biotic communities three zones can be differentiated – the supralittoral mediolittoral and sublittoral – and these can be subdivided into 12 zoocenoses where the species composition and quali tative values of the benthos have been studied The greatest species diversity can be observed in the sand sublittoral zoocenoses (142 species) and the rock litto ral (123 spp) followed by Mytilus sludge zoocenoses (90 spp), Phaseolina sludge (60 spp), and coastal sludge (with 47 and 42 spp in two subcenoses)

Supralittoral Zone

This community is represented equally along the northern and southern Bulgarian coast Three zoocenoses can be differentiated, based on substrata characteristics rock supralittoral, sand rock supralit toral and dislodged algae Because of the specific en vironmental conditions within the supralittoral the or ganisms within this zone are quite diverse They in clude several species adapted to lasting dryness (often found several meters above sea level) such as *Littorina neritoides Chthamalus stellatus*, *Ligia italica* Talitri dae as well as freshwater and terrestrial animals (primarily larval and adult forms of insects) (Beshovsky, 1964 1975) *Orchestia bottae* (Amphipoda) a species especially typical of the sand rock littoral has been extensively studied Its av erage density is 2032 ind/m^3 its normal habitat being the underside of stones or dislodged algae and other vegetation (Stoykov 1975)

Mediolittoral Zone

1 Rock mediolittoral zoocenosis

This community is well represented along the whole coast except for the southern part Mass growth of algae especially of the green algae (Enteromorpha) is specific to this zone *Patella pon tica* (Gastropoda) which attaches itself to rocks is the

most characteristic inhabitant of this community and occurs only here Other characteristic species include representatives of the *Balanus* and *Chthamalus* (Cirripedia) *Pachygrapsus marmoratus* (the biggest Black Sea crab) and *Eriphia verrucosa* (Decapoda) (Marinov 1990) According to unpublished data (precise studies are lacking) the populations of *E ver rucosa* have greatly declined over the last 5 6 years

2 Sand mediolittoral zoocenosis

Macrozoobenthos species are not abundant here The dominant species are *Mesodesma cornea* (Lamellibranchia) and *Ophelia bicornis* (Polychaeta) The maximal density recorded for the former species is 9800 ind/m^3 and for the latter 2000 ind/m^3 Other species are scarce and occur as lone individuals
The species diversity of the miobenthos in this com munity and in subsoil beach waters is greater although the list of species is still incomplete due to insufficient faunistic studies of certain groups (Turbellaria Oligo chaeta Nematoda etc) The groups with the highest number of the 72 known miobenthos species are Har pacticoida (29 species) Polychaeta (9), Turbellaria and Halacaridae (7 species each) The average den sity of the miobenthos varies from 14 552 to 74 000 ind/m^3 in certain regions with Harpacticoidae and Oligochaeta most abundant
The microbenthos in the subsoil beach waters has been researched in great detail As a result, the so called Testacea taxon (Protozoa) was differentiated Over 70 species most of which are obligate psammo bionts, have been classified as members of the Testa cea In terms of their sea/land distribution the micro benthos have been found most abundantly in the beach zone within a distance of 1 to 12 km from the sea (Golemansky 1974, Valkanov 1970)
The benthos Infusoria (238 species) include a large number of Protozoan species inhabiting the coastal sand bottom subsoil beach waters and sand water The distribution of 139 species in different littoral bi otopes has been studied to ascertain their relationship to abiotic environmental factors It has been demon strated that the size of sand grains affects their distri bution with the largest numbers recorded on beaches with relatively large grains of sand Most frequently observed are representatives of the Kinetofragmo phora Polyhymenophora and Oligohymenophora Some species occur in all biotopes (e g *Cyclidium elongatum*) whereas others (*Protocruzia adchaerens Plagiocampa marina Euplotes trisucatus*) occur only in certain biotopes (Detscheva 1980 1983)

Sublittoral Zone

1 Cystoseira dependent zoocenosis

This community begins at a depth of 0 5 1 m and extends 15 20 meters deep Its development depends upon the availability of the brown algae *Cystoseira barbata* With 111 identified species, this zoocenosis is the richest in species diversity The taxa with the larg est number of species are the Crustacea (68) Poly chaeta (21) and Mollusca (7) Quantitative seasonal tests show that density and biomass are at their highest in the spring and summer, reaching a maximum of 212,668 ind/m^3 and 58 5 mg/m^3 per kg of sea weeds re spectively These indices are lowest at a depth of 1 m and highest at 3 m (Kaneva Abadjieva et al , 1977)

2 Rock sublittoral zoocenosis

According to seasonal research on the qualitative and quantitative composition of the macrozoobenthos in this zoocenosis at a depth of 1 to 8 meters in the Bay of Varna the species composition comprises 123 species with an average density of 105 ind/m^3 Domi nating the communities are the Crustacea (40 species and 47 5% of the density), Mollusca (36 species 32 2%) and Polychaeta (31 species 17 3%) The av erage values of species diversity (d1 of Margaleff, 1987) range between 5 2 in the winter and 6 0 in the summer After the summer bloom period of 1989, two negative changes in bottom waters due to oxygen de pletion were observed the total density increased by 2 5 times and species diversity fell sharply from 7 4 to 3 06, reflecting a five fold reduction in Crustacea spe cies The highest death rate has been recorded among the free living *Decapoda Upogebia pusilla* and *Macropipus holsatus* (Konsulova, 1991)

3 Sand sublittoral zoocenosis

This community occurs in the sublittoral zone below 5 meters One hundred and forty two macro benthos species have been identified here a high de gree of species diversity Prevalent in the total are Polychaeta (59), Crustacea (43) and Mollusca (30) The significance of each group across the profile of the zoocenosis differs depending on its density and bio mass In terms of density the Polychaeta play the leading role whereas the Mollusca are most significant in terms of biomass Applying the density index (square root of density and biomass), Mollusca are definitely dominant Five subcenoses have been iden tified in this zoocenosis

according to the composition and characteristics of the bottom (Table 6) Comparative analysis shows that the *A ornatus* + *Modiola adriatica* + *Venus gallina* sub cenosis is richest in species while the *Corbulomya maeotica* + *Nerine cirratulus* + *Cumopsis goodsiri* sub cenosis which is the highest in density, is poorest in this respect *C maeotica* + *D divaricata* + *V gallina* has the highest level of biomass due to the leading role of Mollusca within it (Kaneva Abadjeva et al 1966 Marinov 1990)

Three new Mollusca species for this zoocenosis have been identified along the Bulgarian coast *Mya arenaria* (1977), *Cunearca corne* (1984) (Lamellibranchia), and *Rapana thomasiana* (Gastropoda) (1956) This zoocenosis should include the Cocketrice bank a unique structure in the north eastern part of the Bay of Bourgas The unusual loca tion of the bank's crest its configuration (the highest part is 16 2 m deep with compact sections in some zones), and relatively strong streams in its eastern part create favorable conditions not only for species typical of the sand zoocenosis but also for species such as *M galloprovincialis* that are typical of the rock sublittoral cenosis Species diversity (d1) is high and in certain sections ranges between 8 1 and 10 2 A total of 64 macrozoobenthos species, belonging to 11 classes oc cur in this community Almost equally represented are Crustacea (24) and Polychaeta (23) with 16 Mollusca species The average density and biomass exceed by ten times the maximum found in the sand bottom cenosis (Table 6) Massive quantities of zoobenthic larvae of bottom fish have been identified here which indisputably makes the zoobenthos of this bank unique In recent years various economic organiza tions have become interested in taking sand from this natural deposit for construction purposes It is abso lutely imperative that measures be adopted to prevent such exploitation of the Cocketrice bank and to secure its future as a protected area (Konsulova, 1991)

4 Coastal sludge zoocenosis

This community is located from 15 20 m to 30 40 m deep and is most pronounced along the northern coast Depending on the quantities of *Melina palmata* (Polychaeta) it is divided into two subcenoses one in which *M palamata* is dominant and the other with very little *M palmata* The former subcenosis com prises 2/3 of the whole zoocenosis Its species diversity and average density are higher, and its biomass twice that of the latter Polychaeta and Mollusca are more significant and Crustacea are represented more mod estly Generally speaking this type of zoocenosis is scarce along the Bulgarian coast (Table 6) (Marinov, 1990)

5 Mytilus sludge zoocenosis

The width and distance from shore vary within this zoocenosis Its depth ranges from 13 m to a maximum of 80 m Species composition is very rich It contains a total of 90 macrozoobenthos species with Polychaeta prevailing (30) followed by Crustacea (26) and Mollusca (24) However only 14 species occur regularly Although it gives its name to the zooceno sis *M galloprovincialis* is not one of these species This is due to its spotty distribution which makes it difficult to obtain realistic information using the bot tom scraping method of observation The average density of the macrozoobenthos is 666 ind/m^3 In the northern region the density is considerably lower never exceeding 630 ind/m^3 and to the south it falls abruptly below these values Whereas in the northern region Polychaeta and Mollusca (*M subtruncata*) are the dominant groups Polychaeta (*Aricidea claudiae*) is dominant in the southern region Average biomass amounts to 134 4 g/m^3 This zoocenosis is considered one of the richest in species among zoocenoses that are high in biomass but as noted above results from bottom scraping tests are not reliable due to the spotty distribution of *M galloprovincialis* (Marinov 1990)

6 Phaseolina sludge zoocenosis

This zoocenosis occurs in a wide zone in northern coastal waters (as compared to the southern coast) It extends from 63 m to 184 m beneath the surface Fifty five macrozoobenthos species have been re corded among which Crustacea (19) Polychaeta (16) and Mollusca (10) are most prevalent Eight species occur most frequently, among which *Modiola phaseo lina* is conspicuous The greatest species diversity in this zone is found at depths of up to 100 m Below 148 m only five species have been identified The average density of 853 ind/m^3 and average biomass of 44 0 g/m^3 are represented chiefly by *M phaseolina* (Marinov, 1990)

Miobenthos in the Sublittoral Zones

The sand and sludge miobenthos from 5 m to 150 m are dominated by Polychaeta Harpticoida, and es pecially Nematoda This category of living organisms is divided into eumiobenthos (species whose adult forms do not exceed 1 mm in length) and pseu domiobenthos (juvenile forms of macrobenthos or ganisms) Polychaeta are represented by 42 species some of which are pseudo miobenthic forms Forty two species of Harpacticoida have been identified all of which are eumiobenthos Among the Nematoda the most typical species are

Axonolaimus ponticus Terschelingia longicaudata and *Viscosia glabra* The average total number of repre sentatives from these groups is 164,152 ind/m^3, of which 77 5% are Nematoda (Marinov 1978 1980)

Zoobenthos in the Bay of Varna, Varna Lake, and Beloslav

Careful research undertaken in the Bay of Varna ten years ago identified five basic zoocenoses with 65 macrozoobenthos species Polychaeata occur in the highest densities with *Spio filicornis* the most preva lent species (Marinov 1990) Two new species have also been identified – *Mya arenaria* and *Cunearca cornea* (Lamellibranchia) The latter is more abundant

The latest seasonal studies have recorded 105 species Most numerous are Polychaeta (38) Crusta cea (30) and Mollusca (25) The "amphioxus sand" zoocenosis, located in the furthest part of the lake, rates highest on the Shannon Weaver diversity index The "melina" type of sludge rates lowest The summer season turns out to be the most critical time of the year for bottom communities with the lowest H index (2 1) This is due to the periodic progression of summer hy poxia since 1986 and the distinct decrease in species diversity This phenomenon occurs chiefly at the ex pense of the Crustacea species In 1991, a massive die off of *Upogebia pusilla* and *Callianassa pestai* was recorded typical for the *U pusilla* zoocenosis Human activities have had their greatest impact on the ben thos communities of the sludge bottom in the southern and central parts of the bay, near Varna Lake These communities are significantly affected by eutrophica tion (Konsulova 1992)

Forty five macrozoobenthos species and groups have been identified in Varna Lake, of which 14 are Polychaeta 12 Crustacea, and 12 Mollusca Worms predominate in the species composition at all seasons Two critical zones in which living benthic organisms are absent year round occur in industrial areas in the western and eastern parts of the lake The general species diversity for almost all of the other stations is exceptionally low – 0 2 to 1 Two zones of relatively diverse benthos communities (H=1 65) can be traced at a maximal distance from the critical zones Only 7 species of macrozoobenthos organisms have been identified in the Beloslav Lake (which is connected by a canal to Varna Lake) 2 Polychaeta 3 Crustacea and Oligochaeta and Chironomidae larvae

In general the heavily degraded zoobenthos communities in the Varna region can be placed into two categories those that are totally devoid of living organisms and those that support zoocenoses consist ing of only a single species The status of the commu nities tends to improve the further they are from the basic polluting source i e the Devnzha Chemical Works The increase in species diversity however, is very limited (0 05) (Konsulova, 1992)

Zoobenthos in the Bay of Bourgas

Eighty five species have been identified in the Bay of Bourgas, including 33 Polychaeta, 23 Mollusca and 23 Crustacea Seven zoocenoses have been identified based on the characteristics of the bottom sur face and the most prominent species occurring there Two species not reported in previous studies have been identified *Cunearca cornea* and *Mya arenaria* Although it has only recently appeared in the Black Sea, *C cornea* has become a substantial component in bottom sand and sludge zoocenoses, causing signifi cant changes within them The abundance of this spe cies in the Bay of Bourgas has resulted in the rapid formation of a new high biomass zoocenosis (Table 7) (Marinov et al , 1989, Svetkov et al , 1986)

State of the Mussel Resources

Mytilus galloprovincialis is the most popular type of mussel in the Bulgarian part of the Black Sea It is found in the open sea between 35 40 m and 60 65 m Two characteristics make this a particularly important species First its filtering capacity is the greatest of any mollusk in the Black Sea It feeds on enormous quantities of plankton and detritus and thus contrib utes to the process of deeutrophication Second it transforms the planktonic mass into protein food suit able for human consumption, and thus represents a biological resource of economic significance

Comparisons with studies performed in 1938 (Netschaeff et al) and 1967 (Kaneva Abadjieva et al) reveal that by 1978 (Marinov), the natural mussel re sources had declined considerably This occurred de spite a gradual decrease in catch and, eventually, the total cessation of harvesting after 1973 The causes of this decline were increased predatory pressure from the exotic species *Rapana thomasiana* mass death and destruction of mussel fields as a result of eutrophica tion and hypoxia in bottom waters and trawler fishing in the coastal waters The relationship of *M galloprovincialis* and *R. thomasiana* in the northern part of the Bulgarian shelf seems to have stabilized It is believed that by 1984 the predator prey relationship reached "a stage of dynamic equilibrium The decrease in predator pressure with depth results in the progressive restoration of mussel stocks' (Konsulova 1992)

The export of *Rapana thomasiana* has become more economically important for Bulgaria during the last 2 3 years They are gathered manually using diving equipment to reach the bottom along the entire Bulgarian coast At present no data are available on the status and population of *Rapana thomasiana* and the impact of these activities

M galloprovincialis is cultivated on artificial sub strata is to obtain high quality protein food rich in vi tamins for people This comes at the expense of the pelagic plankton, thus diminishing their negative role

in contributing to bottom hypoxia in post bloom peri ods Mussels on the artificial substrata are endangered not only by predation from *R thomasiana*, but by hy poxia An attendant phenomenon is the formation of mixed cenoses in which a number of additional spe cies accompany the basic species This in turn im proves the conditions for reproduction and contributes to the restoration and stabilizing of the zoobenthos in the areas of cultivation (Konsulova 1990, 1985) Five groups (Plathelminthes Nemathelminthes, Annelida Arthropoda Mollusca) develop in large quantities within these artificial zoocenoses with Crustacea and Polychaeta dominating at an average density of 90,221 and 68,440 individuals per linear meter respectively

Mussel culture is presently most active in the re gion of Sozopol with a harvest of 150 tons per year In the last several years attempts have been made to establish private mussel farms but official statistics on their total production have not yet been presented

Harmful Zoobenthos Communities

Several species whose mode of living entails at taching themselves to underwater structures are able to thrive on virtually any kind of substrata This has always been considered a negative phenomenon as far as human activities are concerned, and has long been a subject of research The periods of proliferation of *Balanus improvisus*, *Mytilus galloprovincialis* and *Mer cierella enigmatica* have been studied on a monthly and seasonal basis From April through September, the biomass of these species is much higher (20,055 54 g/m^3) than during the period of October through March when it is exceptionally low (528 2 g/m^3) An nual rates of growth can reach as high as 84 kg/m^3 (Kaneva Abadjieva et al 1977)

SECTION III SUMMARY AND CONCLUSIONS

This paper summarizes the state of knowledge on the benthic and planktonic fauna of the Bulgarian Black Sea It includes full lists of the zooplankton and zoobenthos species of the shallow Black Sea shelf The micropelagic fauna is relatively unknown From this review several key conclusions can be drawn

- The zoocenosis of the rock sublittoral zone is one of the richest in species but has been studied only along the northern coast The southern coast re mains unknown
- The Cystoseira dependent zoocenosis is very rich in species diversity As its development depends upon the availability of the brown algae *Cystoseira barbata* research should aim at identifying the distribution of this species which is unknown at present
- The construction of control structures in the near coastal zone has resulted in a number of negative processes in terms of species diversity
- The effect of the predatory *Rapana thomasiana* on the natural mussel fields was considered to be totally destructive until two years ago Since 1990 this species has been extensively used in the food industry This suggests the need for more thor ough research on its resource base and distribu tion Further research is also imperative due to its effect on the black mussel and the general struc ture of bottom zoocenoses
- In comparison with the world's oceans the species richness of the Black Sea zoobenthos can be characterized as average
- The sections of the sea that are of greatest eco logical importance are those on the border of the 10 15 meter isobath curve as well as others marked on the Map 1 These areas are also the most sensitive to certain human activities, par ticularly trawler fishing and construction along the coast (including the building of control structures and piers) These human activities pose the major threat to the biodiversity of the shallow shelf To gether with the historically aggravated presence of hydrogen sulfide in waters below 150 m they de fine the necessity of urgent protection and resto ration activities

SECTION IV RECOMMENDATIONS

To protect the biodiversity of the Black Sea along the Bulgarian coast, the following actions are neces sary

1. Trawler fishing should be prohibited
2. Sea construction projects that have not been for mulated using available ecological expertise or with assessments by marine experts should be prohibited
3. Biofilter systems using artificially implanted bot tom cenoses should be introduced
4. Sea areas that serve as important sources for benthos, plankton, and larvaton should be de clared protected areas as necessary

Table 1 Average Composition and Structure of Zooplankton of the Black Sea Coast for Winter (1970 1988) (All figures per m^3)

A - Coastal region B - Open sea

Composition	Kalıakra Cape		Ghalata Cape		Emine Cape		Masslen Nos Cape	
	A	B	A	B	A	B	A	B
Noctiluca scintillans	1982	2520	2034	2840	3128	2968	2863	3165
Synchaeta vorax	1071	2140	965	2132	1097	2314	1407	2918
Acartia clausi	150	107	117	101	79	92	77	91
Acartia copepodit	118	189	105	165	94	131	59	132
Acartia nauplius	63	123	38	113	40	119	31	133
Pseudocalanus elongatus	203	103	195	142	151	167	147	138
Pseudocalanus copepodit	168	241	158	238	164	112	137	139
Pseudocalanus nauplius	94	521	103	490	119	81	83	111
Paracalanus parvus	162	148	174	157	133	98	159	97
Paracalanus copepodit	142	191	143	208	139	167	159	141
Calanus helgolandicus	4	7	2	6	3	10	1	11
Calanus copepodit	17	39	14	42	8	34	5	28
Calanus nauplius		92		101	2	68	6	46
Oithona minuta	268	239	266	218	158	142	169	117
Oithona munita copepodit	321	368	241	356	251	283	132	156
Oithona similis	152	180	144	156	112	146	117	131
Cirripedia nauplius	208	60	178	58	146	28	174	21
Polychaeta larvae	4	2	3	2	7	1	6	4
Lamellibranchia veliger	133	120	147	131	132	48	182	26
Gastropoda veliger	28	11	16	19	23	19	21	7
Sagitta setosa	3	14	2	11	3	18	4	16
Aurelia aurita ephyra	1	1	1	1	1	1	1	1
Pleurobrachia rhodopis	1	1	1	1	1	1	1	1
Oicopleura dioica	93	126	34	162	87	106	74	142

Table 2 Average Composition and Structure of Zooplankton of the Black Sea Coast for Spring (1970 1988) (All figures per m³)

A Coastal region B Open sea

Composition	Kaliakra Cape		Ghalata Cape		Emine Cape		Masslen Nos Cape	
	A	B	A	B	A	B	A	B
Noctiluca scintillans	27055	1972	21130	12184	18201	11960	42392	10843
Synchaeta vorax	303	319	438	215	386	316	196	284
Podon polyphemoides	564	70	598	47	407	87	298	52
Podon leucarti	50	14	215	14	70	3	141	29
Centropages kroyeri	1		2		45		3	
Acartia clausi	494	93	912	128	202	117	502	334
Acartia copepodit	162	140	253	95	95	99	582	285
Acartia nauplius	171	78	120	76	70	22	485	268
Pseudocalanus elongatus	112	130	47	454	7	250	286	130
Pseudocalanus copepodit	370	215	57	252	12	51	140	200
Pseudocalanus nauplius	284	105	8	213	30	42	143	203
Paracalanus copepodit	125	44	121	148	130	88	206	81
Calanus helgolandicus	1	6		8		12		3
Calanus nauplius		32		66		70		38
Calanus ova	31	96		31		31		46
Oithona minuta	160	39	68	170	167	154	361	123
Oithona similis	79	85	62	670	200	195	39	97
Copepoda nauplius	31	65	21	14	30	17	96	26
Cirripedia nauplius	86	3	98	9	144	12	193	16
Polychaeta larvae	80	3	78		50	3	154	10
Lamellibranchia veliger	238	33	174	141	67	10	364	49
Gastropoda veliger	80132	41	176	53	97	61	112	36
Sagitta setosa	1	3		1		1	1	11
Aurelia aurita ephyra	1	1	1	1	1	1	1	1
Pleurobrachia rhodopis	1	1	1	2	1	1	1	1
Oicopleura dioica	170	88	43	200	90	64	321	89

Table 3 Average Composition and Structure of Zooplankton of the Black Sea Coast for Summer (1970 1988) (All figures per m³)

A Coastal region B Open sea

Composition	Kalıakra Cape		Ghalata Cape		Emine Cape		Masslen Nos Cape	
	A	B	A	B	A	B	A	B
Noctiluca scintillans	23853	14017	28413	13243	18640	12320	24940	14386
Synchaeta vorax	109	268	49	196	116	98	98	84
Podon polyphemoides	214	163	767	326	158	35	175	107
Podon leucarti	81	34	436	74	63	3	71	63
Penilia avirostris	114	61	2044	137	484	180	487	126
Evadne nordmani	97	18	372	13	43	18	32	11
Evadne spinifera	86	31	191	21	91	98	84	49
Evadne tergestina	28	15	264	24	43	103	37	18
Centropages kroyeri	66		236		83		91	
Centropages copepodit	39		319		73		66	
Centropages nauplius	71		486		111		92	
Acartia clausi	803	486	2388	989	850	188	981	965
Acartia copepodit	875	579	24776	1218	789	164	843	938
Acartia nauplius	1482	682	3911	1891	385	21	365	1152
Pseudocalanus elongatus	57	135		91	31	62		83
Pseudocalanus copepodit	112	165		121	48	124		112
Pseudocalanus nauplius	134	119		170	112	43		164
Paracalanus parvus	69	39	275	113	96	165	178	101
Calanus helgolandicus		4		3		2		2
Calanus nauplius		7		16		2		12
Calanus ova		11		28		12		24
Oithona minuta	640	218	2813	897	792	500	596	518
Oithona similis	66	158		79		87		84
Decapoda mysis	1		26		1		6	
Copepoda nauplius	69	43	211	73	106	82	115	81
Cirripedia nauplius	137	92	498	224	181	7	186	78
Polychaeta larvae	48	16	384	87	198	51	199	73
Lamellibranchia veliger	178	57	943	196	344	35	361	178
Gastropoda veliger	116	78	131	97	96	97	149	117
Sagitta setosa	1	2		1		2	1	1
Aurelia aurita ephyra		1		1		1		1
Pleurobrachia rhodopis		1		1		1		1
Oicopleura dioica	112	78	316	116	104	51	114	101

Table 4 Average Composition and Structure of Zooplankton of the Black Sea Coast for Autumn (1970 1988) (All figures per m³)

A - Coastal region B Open sea

Composition	Kaliakra Cape		Ghalata Cape		Emine Cape		Masslen Nos Cape	
	A	B	A	B	A	B	A	B
Noctiluca scintillans	21364	11072	32114	14396	12189	10797	22631	19730
Synchaeta vorax	31	26	43	11	98	112	49	39
Podon polyphemoides	106	14	198	29	83	28	106	16
Podon leucarti	62	7	93	11	67	36	69	14
Penilia avirostris	217	24	436	39	187	28	181	22
Evadne nordmani	13		47		19	5	21	2
Evadne spinifera	19		39		11	9	16	8
Evadne tergestina	14		70	3	29	6	36	5
Acartia clausi	256	212	416	249	179	138	238	122
Acartia copepodit	468	54	672	130	298	168	341	126
Acartia nauplius	748	38	913	159	665	465	674	275
Pseudocalanus elongatus	16	116		113	11	85	16	78
Pseudocalanus copepodit	28	181		197	24	184	2*	131
Pseudocalanus nauplius	49	120		133	31	173	37	163
Paracalanus parvus	267	121	364	94	118	98	126	102
Calanus helgolandicus	3	7		6	1	3	1	2
Calanus nauplius	14	28		18	3	17	2	14
Calanus ova	7	31		27		24		21
Oithona minuta	1019	68	1640	124	302	218	316	133
Oithona similis	32	130		113	26	78	14	65
Decapoda mysis	3		18					
Copepoda nauplius	68	19	78	24	29	20	27	14
Cirripedia nauplius	125	14	328	168	129	93	144	23
Polychaeta larvae	53	3	1119	14	54	10	72	8
Lamellibranchia veliger	181	21	369	307	121	93	148	43
Gastropoda veliger	98	31	131	43	103	19	117	36
Sagitta setosa	9	2		1	1	1	1	1
Aurelia aurita ephyra	1	1	1	1	1	1	1	1
Pleurobrachia rhodopis	1	1		1	1	1	1	1
Oicopleura dioica	221	68	368	78	153	93	157	53

Table 5 Number of Benthic Organisms in the Bulgarian Part of the Black Sea (after Marinov, 1990)

Group	Number	Group	Number	Group	Number
Testacea	90	Oligochaeta	21	Tardigrada	5
Foramanifera	43	Harpacticoida	204	Colembola	4
Infusoria	2338	Cirripedia	5	Diptera Brachicera	13
Porifera	22	Ostracoda	74	Diptera Nematocera	15
Coelenterata	28	Mysidacea	11	Loricata	2
Turbellaria	25	Cumacea	13	Gastropoda	43
Nematoda	109	Isopoda	22	Lamellibranchia	46
Nemertini	26	Anisopoda	4	Bryozoa	13
Kinorhyncha	3	Amphipoda	62	Phoronidea	1
Gastrotricha	13	Decapoda	30	Kamptozoa	2
Rotatoria	32	Halacaridae	27	Echinodermata	5
Polychaeta	102	Hydrachnellae	1	Ascidiacea	6
Archiannelida	6	Pantopoda	2	Branchiostomidae	1

Table 6 Characteristics of Separate Zoocenoses in the Soft Sublittoral Bottom (after Marinov, 1990)

Zoocenoses and Subcenoses	Number of Species	Average density ind/m^2	Average biomass g/m^2
1 Sand bottom total	142	1474	134 4
a) subcenosis of clean sand	98	934	86 7
b) A ornata + M adriatica + G minima	105	1804	140 3
c) C maeotica + D divaricata + V gallina	61	1994	279 9
d) Br lanceolatum + St kefersteini + O limacina	83	1549	56 7
e) C maeotica + N cirratulus + C goodsiri	42	2576	30 0
2 Cocketrice bank	64	28353	2720 8
3 Coastal sludge			
a) subcenoses with M palmata prevailing	47	564	75 3
b) subcenoses with very little M palmata	42	256	40 9
4 Mytilus sludge	90	666	134 3
5 Phaseolina sludge	55	853	44 0

Table 7 Characteristics of Bourgas Bay Zoocenoses (after Marinov et al , 1989)

Zoocenoses	Number of species	Average density ind/m²	Average biomass g/m²
Melinna plamata	47	817	118 5
Venus gallina	42	975	510 5
Venus Melinna	41	1035	140 8
Mactra subtruncata	36	1018	266 4
Melina Mactra	23	816	170 8
Cunearca cornea	43	2365	1176 4
Amphioxus sand	50	3459	384 7

Appendix 1 Composition of the Zooplankton Along the Bulgarian Black Sea Coast

PROTOZOA
Noctiluca scintillans Suriray 1846
Leprotintinnus pellucidus (Cleve, 1899)
Tintinnidium mucicola (Claparede et Lachmann, 1858)
Tintinnopsis campanula Ehrenberg, 1848
T campanula var *butclii* Jorgensen, 1924
T meunieri Kofoid et Campbell 1929
T lobincoi Daday, 1886
T minuta Wailes 1925
T baltica Brandt, 1896
T parvula Jorgensen, 1912
T tubulosa Levander, 1900
T subacuta Jorgensen 1899
T beroidea Entz, 1884
T karajacens Brandt, 1908
T cylindrica Daday 1886
T davidovi Daday, 1886
Stenostemella ventricos (Cl et L , 1858)
S rivalis Meunier, 1910
Coxliella helix Brandt, 1907
C decipiens Jorg , 1924
C annulata Daday 1885
C undulatospiralis Dolgopolskaja 1940
Metacylis mediterranea Mereschkovskyi, 1881
Helicostomella subulata Jorgensen 1924
Favella ehrenbergi (Clap et Lach 1858)

COELENTERATA
Coryne tubulosa (M Sars 1835)
Rathkea octopunctata (M Sars 1835)
Hydractinia carnea (M Sars, 1846)
Moerisia maeotica (Ostroumow, 1896)
Obelia longissima (Pallas, 1766)
Aurelia aurita (Lesueur, 1758)
Rhizostoma pulmo (Macri, 1778)

CTENOPHORA
Pleurobrachia rhodopis Chun, 1880
Mnemia maccradyi (Mayer, 1900)

NEMATHELMINTHES
Synchaeta vorax Rousselet 1902
S neapolitana Rousselet 1902
S pontica Rodwald Rudescu, 1960
S pectinata Ehrb , 1893
Keratella cochlearis (Gosse 1851)

ANNELIDA
Polychaeta larvae

ARTHROPODA
Penilia avirostris Dana 1849
Pleopis polyphemoides (Leucart, 1859)
P tergestina (Claus 1877)
Podon intermedius Lilljeborg, 1853
P leuckarti (G O Sars 1862)
Evadne spinifera P E Muller 1868
E nordmani Loven, 1836
Anomalocera patersoni Templeton 1837
Pontella mediterranea Claus 1863
Labidocera brunescens Czernjavsky 1868
Calanus helgolandicus Claus, 1863
Calanipeda aquae dulcis (Kriczagin 1873)
Paracalanus parvus (Claus 1863)
Pseudocalanus elongatus (Boeck 1872)
Acartia clausi Giesbrecht 1889
Oithona minuta (Kricz, 1873)
O similis Claus, 1863
Cyclops vicinus Uljan 1875
C strenuus Fich 1851
Monstrilla grandis Giesbr 1892
Mesopodopsis slabberi (Van Beneden 1861)
Paramysis pontica Bacescu, 1940
Decapoda zoea

MOLLUSCA
Gastropoda veliger
Lamellibranchia veliger

CHORDATA
Sagitta setosa Muller 1847
Oikopleura dioica Fol, 1872

VERTEBRATA
Pisces ova
Pisces larvae

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990)

PROTOZOA
Common Testacea from the Bulgarian Section of the Black Sea

Psammonobiotus communis Gol
Pseudocorithion acutus (Wailes Valkanov, 1973)
P wailesi Gol
Centropyxionella arenaria Valk
C gibbula Valk
Paiamphitrema pontica Valk
Alepiella tricornuta Gol
Amphorellopsis elegans Gol
Pomoriella valkanovi Gol
Chardezia caudata Gol
Corithionella acola Gol
Lagenidiopsis valkanovi Gol
Messemvriella fillosa Gol
Vampirella peritrichophaga Valk
Raphidiophrysopsis sessilis Valk
Leptogromia operculata Valk
Euglyphinopsis pontica Valk

FORAMINIFERA
Lagenidae Shultze
Lagena apicula Reuss
L pseudogludosa Buchner
L simplex Buchner
L laevigata Reuss
L aequilabialis Buchner
Hauerina bradii Cushman
Ammomassilina alveliniformis Millet
Trilocularena circulare Herro Allen

Litoulidae Lamarck
Discamina falax Lacroix
Litoula nautiloides Brady
Ammobaculet ponticus Michalevich
Bulbobaculites mync Loeblich

Buliminidae Jones
Bolivia punctata d'Orbigny

Nonionidae Schultze
Cribroelphidium martcobi Bogdanovitch
C depressulum Walker et Jacob
C bartleti Cushman
Elphidium ponticum Dolgopolskaja et Pauli
E macellum Fichtel et Moll
E incertum Wiliamson
E polyanum (d'Orbigny)
Parellina thalba Loeblich Tappan

Miliolidae Ehrenberg
Milimina rugosa Mikhalevitch
M subrotunda Maontagu
Siphonaperta macbeathi Vella
Dentostomina bermudiana Carman
Massilina secans d'Orbigny
Milliamina gronlandica Cushman
Quiqueloculina pseudoseminula Mikhalevitch

Rotaliidae Ehrenberg
Rotalia perlucida Hern Allen et Earland
R soldanii d'Orbigny
R beccari Linne
R calcar d'Orbigny
Discorbis vilardeboana d'Orbigny
Discorbis sp

Ophthalmidiidae Cushman
Wisnerella auriculata Egger

Verneuliinidae Cushman
Egerella scabra Williamson

Ammodiscidae Reuss
Ammodiscus gulmarensis Hoglund
A intermedis Hoglund
Glamaspira glomerata Hoglund
Lituotuba nautiloides Brady

Trochamminidae Schwager
Trochamina intermedius Rumbler
T labiosa Hoglund

Textulariidae Ehrenberg
Textularia deltoidea Reuss

PORIFERA
Halichona aqueductus O Schm
H densa (Bow)
H grossa Schm
H implexa (Schm)
H pallida Bwn
H cinerea (Grandt)
H tubulifera Swartsch
H flaverscen (Tops)
Cliona vastifica Hancock
Dysidea fragilis (Mont)
Halichonissa limbata (Mont)
Halichondria panicea (Pall)
Grella garcilis (Swartsch)
Lesodendronyx dactionoides (Cart)
Micale syrinx (O Schm)
Microciona cleistochela (Tops)
Suberites prototypus (Swartsch)
Halichonissa digitata Sch
Suberites carnosus (Johnst)
Sycon ciliatum (Fabr)
Tedania nigrescens (O Schm)
Petrosia dura (Schm)

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

COELENTERATA
Aglaophenia pluma Lamoureux
Blackfordia virginica Mayer
Bougainvillia ramosa v Ben
B megas Kinne
Campanularia integriformis Mark
C volubilis var *urceolata* Clark
C johnstoni (Ald)
Campanulina laceta (John)
C repens A
Cladonema radiatum Duj
Corymorpha nutans Steenst
Coryne tubulosa (M Sars)
Eudendrium ramosum (L)
Obelia loveni (Allman)
O angulata (Hincks)
O gelatinosa(Pallas)
O longissima (Pallas)
Cordylophora caspia (Pallas)
Moerisia maeotica (Ostr)
Odessia maeotica Paspaleff
Pontia ostoumovi Paspaleff
Thaumantias maeotica (Ostr)
Plumularia halecioides Alder
Protohydra leuekarti Greef
Hydractinia carnea M Sars
Rathkea octopunctata M Sars
Sertularella polyzonias Grey

Scyphozoa
Lucernaria campanula Lamoureux

Anthozoa
Actinia aequina (L)
Actinothoe clavata (Ilmoni)
Pachycerianthus solitarius (Rapp)

PLATHELMINTHES

TURBELLARIA
Acirorhinchus reprobatus Greef
Archilina endostyla Ax
Archotoplana holotricha Ax
Baltoplana valkanovi Ax
Coelogynopora biarmata Steinbock
Convoluta fulvomaculata Ax
C hypparchia Perej
Coelogynopora tenuiformis Karling
Dendrocoelum lacteum (O F M)
Gyrator hermaphroditus Ehr
Leptoplana tremellaris Ehr
Monocelis longipes Duj
Otocellis rubropunctata (O Schm)
Otoplana bosporana Ax
O subterranea Ax
Parotoplanella progermaria Ax
Polycistis minuta Ulj
P negeli Knollner
Postbursoplana fibulata Ax
P pontica Ax
Prosthiostoma sophunculus D Ch
Pseudomonocelis ophiocephala O Schm
Rogneda polyrabdata Ax
Stycoplana taurica Jak
Triporoplana synsiphonioides Ax

NEMATHELMINTHES

NEMATODA
Anoplostoma viviparus (Bast)
Anicoma acuminata (Eberth)
Axonolaimus ponticus (Fil)
A setosus (Fil)
Bathylaimus assimilis (de Man)
B filipjevi Stoykov
Chromadora quadrilinea (Fil)
Ch bioculata M Schulz
Ch criocophana (Fil)
Bathylaimus cobbi Fil
Camacolaimus pontolittoralis Uzunov
Ceramonema anulata Fil
Chromadorita demaniana Fil
Ch leuekarti (de Man)
Chromadora sabulicola Fil
Ch cricophana Fil
Ch poecilosomoides Fil
Chromasrpirina pontica Fil
Comesoma stenocephalum Fil
Choanolaimus psammophilum Reiman
Cyatholaimus demani Fil
C coecus Bastian
Desmoscolex bacescui Pal et Endr
D eurycricus Fil
D laevis Kreis
Desmodora pontica Fil
D similis Algen
Diplogaster rivalis Leid
Dorylaimus filipjevi Gerlach
D otmanliensis Uzunov
Dolicholaimus benepapilosus Schulz
D nudus Stekch
D platonovae Stoykov
Epsilonema postulatum ponticum Stoykov
Enoploides sawelevi Fil
E amphioxi Fil
E alexandrae Uzunov
E cirratus Fil
E brevis Fil
Enoplus schulzi Gerlach
E euxinus Fil
E littoralis Fil
E maeoticus Fil

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

NEMATODA (continued)
Enoploides hirsutus Fil
Enoplolaimus dubius Fil
E conicus Fil
Ethmolaimus multipapilatus Par
Euyrostomina assimilis (de Man)
E ornata Eberth
Nudora steineri Fil
Nemanema filiformis Fil
Halalaimus ponticus Fil
Halichoanolaimus filicauda Fil
H clavicauda Fil
Hipodontolaimus balticus Schneider
H ponticus Fil
H filicauda Fil
Monhystera filiformis Bast
M collaris Fil
M parva Fil
M rotundicaudata Fil
Metachromadora macroutera Fil
M arearia Stoykov
M cystoseirae Fil
Monopostia costata Bast
Leptosomatum bacillatum Eberth
L punctatum Eberth
Leptosomatides euxina Fil
Linmaeus filiformis Fil
Oncholaimus campilocercoides Conick et Steckh
O conicauda Fil
O brevicaudata Fil
O dujardini de Man
Oncholaimellus mediterraneus Stekhoven
Onyx perfectus Cood
Oxystomina clavicauda Fil
O elongata Butsch
Parancholaimus zernovi Fil
Paralinchomaeus ostearum Fil
Paracanthonchus coecus Bast
Polygastrophora hexabulba Fil
Pontonema zernovi Fil
Quadricoma loricata Fil
Q steineri Fil
Rhabdites marina Butsch
Rhabdodemania pontica Plat
Sabatieria abissalis Fil
S vulgaris de Man
S cupida Breslau et Steckh
Spilophorella euxina Fil
Sphaerolaimus macrocirculus Fil
Sph ostreae Fil
Spirina sabulicola Fil
S zosterae Fil
Symplocostoma tenuicolae (Eberth)
S longicollae Bast
S ponticum Fil
Syringolaimus caspersi Gerlach
Theristus oxycercus (de Man)
Th littoralis Fil
Th longicaudata Fil
Tershellingia longicaudata de Man
T pontica Fil
T antonovi Fil
Trilobus gracilis Bast
Tripyloides marinus (Butsch)
Viscosia cobbi Fil
V minorb Bast
V glabra Fil

KINORHYNCHA
Echinoderes agigens Bacescu
Centroderes spinosus (Reinchardt)
Pycnophies ponticus (Reinchardt)
P kielensis Zelinka

GASTROTRICHA
Acanthodsys aculeatus Remane
Aspidiophorus mediterraneus Remane
Chaetonotus decipiens Remane
Ch maximus Ehrenberg
Ch pleurocanthus Remane
Ch similis Zelinka
Dendrodasys ponticus Valkanov
Heterolepidoderma marinum Remane
Macrodasys africanus var *ponticus* Valkanov
Turbanella cornuta Remane
T pontica Valkanov
Xenotrichula beauchampi Levi
X pygmaea Remane

ROTATORIA
Cephalodella auriculata (O F M)
C catellina (Muller)
Colurella adriatica Ehr
C colurus Ehr
C marinovi Althaus
C monodactylus Althaus
Dicranophorus bulgaricus Althaus
Diglena coenura Ehr
Encentrum arenarium Althaus
E psammophilus Althaus
E striatum Althaus
E marinum Dij
E valkanovi Althaus
Lecane althausi Rudescu
Lepadella ovalis (Muller)
L pontica Althaus
Monostyla lamellaris Daday
M cornuta O F M
Oecystus sp
Phyllodina cirina Ehr
Ph roseola Ehr
Proales halophila Remane

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

ROTATORIA (continued)
P commutata Althaus
P similis Beuachamp
P reinchardt (Ehr)
Pterodina clypeata (Ehr)
Rotaria cotrina (Ehr)
R notatoria (Pall)
Rotifer vulgaris Schrank
Testudinella patina (Herm)
T obscura Althaus
Halodigma tecusa Harr et Mayer

NEMERTINI
Amphiporus bioculatus Mc Inthosh
A lactifloreus (Johnston)
A pulcher (John)
Carinina heterostoma G I Muller
Cephalothrix sp (aff arenaria Hylb)
C bioculatus (Oerst)
C linearis(Rathke)
C rufifrons (John)
Cerebratulus marginatus (Reiner)
C ventrosulcatus (Burger)
Emplectonema gracilis (John)
Lineus bilineatus (Reiner)
L lacteus (Mont)
L geniculatus (Chiaje)
L ruber O F M
Micrura fasciolata (Ehren)
Ototyphlonemertes antipai G I Muller
Pontolineus arenarius G I Muller et D Scripcariu
Prostomatella vermicola (Quatrf)
Pussilineus gabriellae Gorrea
Tetrastemma bacescui G I Muller
T candida (O F M)
T coronatum (Quartf)
T longissimum Bulger
T melanocephalum (John)
Zygonemertes maslowskyi (Czern)

ANNELIDA

POLYCHAETA
Common species

Phyllodoce tuberculata Bobr
Grubea clavata (Clap)
Sphaerosyllis bulbosa South
Nereis zonata Malmgr
Neanthes succinea Leuck
Platynereis dumerilii (Aud et M)
Nerine cirratulus (D Ch)
Spio filicornis O F M
Polydora ciliata (Johnst)
Prionospio cirrifera Wiren
Aricidea claudiae Mc Intosh
Capitomastus minimus (Langerh)
Melinna palmata Gr
Terebellides stroemi Sars
Fabricia sabella (Ehr)
Nephthys hombergii (Aud et M Edw)
Ophelia bicornis Cav
Phyllodoce mucosa Oerst
Nephthys cirrosa Ehlers
Mercierella enigmatica Fauvel
Spirorbis pusilla Rathke
Nereis diversicolor O F M

ARCHIANNELIDA
Protodrilus flavocapitatus (Uljanin)
Nerilla antennata Schmidt
Saccocirrus papillocercus Bobrezky
Polygordius neapolitanus ponticus Zalensky
Trilobodrilus heideri Remane
Dinophilus gyrociliatus Schmidt

OLIGOCHAETA
Actedrilus monospermathecus Knollner
Aelosoma hemprichi Ehr
Chaetogaster cristalinus Veid
Enchitreus albidus Henle
Marionina achaeta (Hager)
M elongata (Leuckart)
M spicula (Leuckart)
M subterranea (Knollner)
Nais communis Piguet
N elinguis O F M
N pardalis Piguet
Homochaeta naidina Bretscher
Limnodrilus hofmeisteri (Clap)
L udekeminus Clap
Paranais littoralis (Muller)
Peloscolex benederi (D'Udek)
P swirenkoi (Jak)
Psamoryctes albicola (Michaelis)
Stylaria lacustris (L)
Rhizodrilus ponticus Hrabe
Tubifex euxinus (Hrabe)

ARTHROPODA

HARPACTICOIDA
Longipediidae
Canuellidae
Ectinosomatidae
D'Arcythompsoniidae
Tachidiidae
Harpacticidae
Tisbidae
Porcellidiidae
Peltidiidae
Tegastidae

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

HARPACTICOIDA (continued)
Thalestridae
Parastenheliidae
Diosaccidae
Metidae
Ameiridae
Paramesochridae
Tetragonicipitidae
Canthocamptidae
Cylindropsyllidae
Parastenocaridae
Cletodidae
Laophontidae
Ancorabolidae
Latiremidae

CIRRIPEDIA
Balanus improvisus Darw
Balanus eburneus Gould
Chthamalus stellatus (Poli)
Chthamalus depressus (Poli)
Verruca spingleri Darw

OSTRACODA
Darwinula stevensoni Br & Rob
Paracypris polyta G O S
Candonaneglecta Baird
C levanderi Hirschm
Candonopsis kingslei (Br & Rob)
Cyprinotus salinus (Br)
Eucypris inflata (G O S)
Cypridopsis aculeatus (Costa)
C newtoni Br & Rob
C vidua (O F M)
Potamocypris steueri Klie
Pontocythere bacescoi (Caraion)
P tschernjavskii Dub
Cyprideis torosa (Jones)
C littoralis Br
Microcytherura nigrescen G W M
M fulvoides Dub
Leptocythere relicta Sshorn
Cytheridea acuminata (Bosq)
Leptocythere devexa Schorn
L macallena (Br & Rob)
L nitida Schorn
L mediterranea (G W M)
L diffusa (G W M)
L striatocostata (Schw)
L quinquetuberculata (Schw)
L lopatica (Schorn)
L multipunctata (Seguenza)
Carinocythereis arinata (Roemer)
Cytheieis rubra pontica Dub
Hemicytheie sicula Br
Limnocytheie inopinata (Baird)
Aurila duboskyi Schorn
Cytheroma variabilis (G W M)
C karadagiensis Dub
C marinovi Schorn
Pontocytheroma arenaria Marinov
Loxoconcha bulgarica Caraion
L pontica Klie
L rhomboidea (Fisher)
L eliptica Brady
L granulata G O S
L aestuarii Marinov
L nana Marinov
L pennatus Schornikov
Microloxoconcha marinovi Schornikov
Paracytheridea pauli Dub
Hemicytherura bulgarica (Klie)
Pseudocytherura pontica Dub
Levocytherura pontica (Marinov)
L remanei (Marinov)
Semicytherura calamitica Schorn
S euxinica (Caraion)
S virgata Schornikov
Xestoleberis decipiens G W M
X aurantiaca (Baird)
X cornelii Carion
Microcythere varnensis Marinov
M longiantennata Marinov
Parvocythere hartmanni Marinov
Bythocythere turgida G O S
Sclerochilus gewemulleri Dub
S dubowskyi Marinov
Cytherois cepa Klie
C valkanovi Klie
C pseudovitera pseudovitera Dub
C messambriensis Marinov
C carcinitica Marinov
C pontica Marinov
Paradoxostoma intermedia G W M
P pontica Klie
P simile G W M
P convexum Schornikov
P quttatum Schornikov

MYSIDACEA
Seriella jaltensis Czern
Gastrosaccus sanctus (Van Beneden)
Leptomysis sardica pontica (Czern)
Hemimysis anomala G O S
H lamornae pontica (Czern)
Diamysis bahirensis meczikowi (Czern)
Limnomysis benedeni Czern
Mesopodopsis slabberi (V Beneden)
Paramysis kroyeri (Czern)
P agigensis Bacescu
P pontica Bacescu

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

CUMACEA
Bodotria arenosa Goods
Cumella limicola G O S
Iphinoe maeotica Sovinsky
I tenella G O S
I elisae Bac
Nannastacus euxinicus Bac
Pseudocuma ciliata G O S
P longicornis pontica Bac
Cumopsisi goodsiri (Beneden)
Cumella pygmaea euxinica Bac
Eudorella truncatula (Bate)

ISOPODA
Limnoria tuberculata Sowinsky
Eurydice rakovitzai Bacesco
E pontica Czern
E dollfusi Monard
E valkanovi Bacesco
E spinigera Hansen
Livoneca taurica Czern
Sphaeroma serratum (Fabr)
Sph pulchellum (Collassi)
Naessa bidentata (Adams)
Idotea baltica basteri Audouin
Synisoma capito (Rathke)
Tylos ponticus Grebnitzky
Jaera sarsi Valkanov
J hopeana Costa
J noidmani (Rathke)
Ligia italica Fabr
Gnathia oxyurae (Lilljeborg)
Pseudione diogeni Popov
Anisarthrus pelseneeri (Giard)
Bopyrus squillarum (Latr)
Miconiscus sp

ANISOPODA
Apseudopsis ostroumowi
Heterotanais gurney
Leptochelia savignyi
Tanais cavolini

AMPHIPODA
Orchomene humilis Bate
Ampelisca diadema A Costa
Bathyporeya guilliamssoniana (Bate)
Stenothoe monoculoides (Mont)
Perioculodes longimanus B et West
Synchelidium maculatum (Stebbin)
Monoculoides gibbosus Chevreux
Apherusa bispinosa (Bate)
Nototropis guttatus (A Costa)
Gammarus locusta L
Gammarus marinus Leach
G olivi M Edw
Pontogammarus maeoticus (Sovw)
P abreviatus borceai Car
Gammarellus carinatus Rathke
Iphigenella andrusowii G O S
I sablensis Carausu
Megaluropus agilis Hoeck
Melita palmata Mont
Cardiophilus baeri G O S
Chaetogammarus ischnus (Stebbing)
Ch major Carausu
Dikerogammarus haemobaphes (Eichw)
D fluviatilis A Martin
D villosus (Sow)
Pontigammarus robustoides (Grim)
Dexamine spinosa (Mont)
Orchestia gammarella (Pallas)
O montagui Audouin
O bottae M Edw
Thalorchestia deshayesii (Aud)
Th brito Stebbin
Talitrus saltator (Mont)
Hyale perieri (Lucas)
H pontica Rathke
H prevostii (M Edw)
Microdeutopus gryllotalpa A Costa
M stationis Delle Valle
M damnoniensis (Bate)
M anomalus (Rathke)
Coiemapus versicualtus (Bate)
Microprotopus longimanus Chevreux
Megamphopus cornutus Norm
Biancolina cuniculus (Stebbing)
Leptocheirus pilosus Zaddach
Grubia crassicornis (A Costa)
Pleonexes gammaroides Bate
Amphithoe vaillanti Leach
Corophium bonelli (M Edw)
C crassicorne Brus
C curvispinum G O S
C runcicorne Delle Valle
C volutator (Pallas)
Jassa ocia (Bate)
Erichthonius difformis (M Edw)
Syphonocoetes dellavallei Stebbing
Phthisica marina Slabber
Pseudoprotella phasma (Mont)
Caprella acanthifera Leach
C ferox (Czern)
C mitis Mayer
C danilewskii Czern

DECAPODA
Hyppolite longirostris (Czern)
Athanas nitescens Leach
Alpheus dentipes Guerin
Palaemon elegans Rathke

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

DECAPODA (continued)
P serratus (Pennant)
P adspersuss Rathke
Crangon crangon (L)
Pontophilus trispinosus Hailston
P fasciatus (Risso)
Homarus gammarus (L)
Processa edulis (Risso)
Astacus leptodactylus Eisch
Upogebia pusilla (Petanga)
Clibanarius erythrupus Latreille
Diogenes pugilator (Roux)
Macropipus holsatus Fabr
M depurator (L)
Pilumnus hirtellus (L)
Callinectes sapidus (Rathbus)
Eriphia verrucosa Forsc
Xantho poressa (Olivi)
Rhithropanopeus harrisii (Gould)
Brachynotus sexdentatus Risso
Pachygrapsus marmoratus (Fabr)
Pisidia longimana Risso
Portumnus latipes (Pennant)
Carcinus mediteraneus Czern
Macropipus arcuatus (Leach)
Macropodia longirostris (Fabr)

HALACARIDAE
Rhombognathus magnirostris (Tr)
Rh magnirostris ponticus Motas et Soarec
Rh notops (Gosse)
Rh pascens (Lohman)
Halacarellus bastert (John)
H hexacanthus Viets
H capuzinus (Lohm)
H phreaticus Petrova
H subterraneus Schulz
H marcandrei Monniot
H procerus Viets
Copidognathus fabricii (Lohm)
C brachystomus Viets
C mucronatus Viets
C brevirostris Viets
C magnipalpus serratisetus Viets
C magnipalpus ponticus Viets
C extensus Viets
C rhodostigma (Gosse)
C ponteuxinus Viets
C ponteuxinus pectiniger Motas et Soarec
C tabelio (Troues)
C tectiporus Viets
Copidognathopsis oculatus (Hodge)
C gracillipes (Troues)
C gracillipes quadrocostata (Tr)
Agaue chevreuxi (Tr)
Agauopsis brevipalpus (Troues)
A brevipalpus ponticus Chichkoff
A brevipalpus marinovi Petrova
Actacarus pygmaeus Schulz
Lomanella falcata (Hodge)
Acarochelopodia delamarei Angelier

HYDRACHNELLAE
Pontarachna valkanovi

PANTPODA
Callipalene phantoma
Tanystylum conirostre

TARDIGRADA
Batilipes mirus Richters
Helechiniscus guiteli Richters
Echiniscoides sigismundi (M Schultze)
Stygarctus bradypus Schultze
Hypsibius stenostomus Richters

INSECTA

COLLEMBOLA
Onychiurus fimata Gisin
Archisotoma besselsi (Pacard)
Friesea acuminata Denis
Seira ferrari Parona

DIPTERA

DIPTERA BRACHYCERA
Aphrosilus furcipennis Str
Aph venator Loew
Aph piscator Lichrwardt
Canace salonitana Strobl
Ephydra athica Becker
Eph bivitata Loew
Fucomya frigida F
Malacomya sciomyzona Halid
Hecamede albicans Maeig
Leptocera brachystoma Czern
Fucelia tergina Zetterstedt
Tetina griseola V d Vulp
Tetina cinerea Loew

DIPTERA NEMATOCERA
*Chironomus salinarius*Kieff
Ch plumosus (L)
Ch halophilus Kieff
Polypedilum gr nubeculosum Mg
P pharao Kieff
Tanytarsus halochloris Edw
Crocotopis silvestris Fabr
C ornatus Mg
C algarum Kieff
C varians (Staeger)

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

DIPTERA NEMATOCERA (continued)
C vitripennis Mg
Smittia duplicata Strenzke
Thalassomya frauenfeldi Chin
Clunio ponticus Haliday
Rheocricotopus foveata Edw

MOLLUSCA

LORICATA
Lepidochiton cinerea(L)
Middendorffia caprearum (Scachi)

GASTROPODA
Patella pontica Mil
Gibbula divaricata (L)
C albida pontica Mil
Phasianella pontica Mil
Theodoxus pallasii L
Th pilidei Mil
Litorina neritoides (L)
Hydrobia ventrosa (Montagu)
Lithoglyphus naticoides Pf
Rissoa splendida Eichw
R venusta Philippi
R euxina Mil
Micromelania lincta Mil
Adeorbis subcarinatus (Mont)
Coecum trachea (Mont)
C tenue Mil
Cerithium ponticum Mil
Bittium reticulatum &
Cerithiopsis tuberculatus (Mont)
Scalaria communis (Lam)
Eulima incurva (Renier)
Turbonilla delicata Mont
Partenina costulata Mil
Odostomia rissoiformis Mil
Eulimella pointelli de Follin
Calyptraea chinesis (L)
Trophonopsis breviatus Jeffr
Nassa reticulata (L)
Cyclonassa neritea (L)
C kamischiensis (Chenu)
C brussinae Andr
Raphitoma fuscatum (Deshay)
Mangelia pontica Mil
Retusa truncatula opima Mil
Cylichnina variabilis Mil
C ovoides Mil
Alexia myosotis (Drap)
Rapana thomasiana Grosse
Limapontia capitata (O F M)
Microchedyle tyrtovi (Kow)
Pseudovermes paradoxa Perej
Styliger bellulus
Embletonia pulchra Ald

LAMELLIBRANCHIA
Cunearca cornea (Reeve)
Modioala adriatica Lam
M phaseolina (Phil)
Mytilus galloprovincialis Lam
Mytilaster lineatus pontica Mil
M monterosatoi Dautz
Pecten ponticus B D D
Ostrea taurica Krinz
O sublamellosa Mil
Dreissena polymorpha (Pallas)
D distincta Andr
Divaricella divaricata (L)
Loripes lacteus (L)
Cardium edule (L)
C simile (Mil)
C exiguum Gmelin
C paucicostatum (Sowerby)
Monodacna colorata Eichw
Adacna plicata relicta Mil
Gouldia minima (Mont)
Meretrix rudis Poli
Venus gallina L
Tapes rugatus B D D
T lineatus Mil
T discrepans Mil
T proclivus Mil
Irus irus (L)
Petricola lithophaga (Retz)
Mesodesma cornea Poli
Mactra subtruncata var *triangula* Ren
Donax julianae Andr
D venustus Poli
Syndesmya alba Wood
S fragilis (Risso)
S ovata (Philippi)
Gastrana fragilis L
Tellina exigua Poli
T fabula propinqua Mil
T donacina L
Solen vagina L
Mya arenaria L
Corbulomya maeotica Mil
Pholas dactylus L
Teredo navalis L
Barnea candida pontica Mil
Thracia papyracea (Poli)

TENTACULATA

Appendix 2 Composition of the Zoobenthos Along the Bulgarian Black Sea Coast (after Marinov, 1990) (continued)

BRYOZOA
Bowervankia imbricata (Adams)
B gracilis (Leydy)
B caudata (Hincks)
Victorella pavida S Kent
Conopeum reticulum Harner
Conopeus seurati (Cann)
Electra pilosa (L)
E zostericola (Nordm)
E crustulenta (Pallas)
E pontica Granch
Membranipora tenuis Desor
Schisoporella linearis Hassall
Lepralia pallassiana Moll

PHORONIDEA
Phornois euxinicola S Long

ENTOPROCTA
Barenia benedeni
Urnatella gracilis

ECHINODERMATA
Stereoderma kirschberi (Heller)
Leptosynapta inchaerens (O Mller)
Ostergrenia thomsoni (Herapath)
O digitata (Montagu)
Amphiura stepanovi Dijakonov

CHORDATA

ASCIDIACEA
Ascidiella aspersa Mll
Ciona intestinalis L
Botrylus schlosseri Sav
Eugyra adriatica Drasche
Ctenicella appendiculata (Heller)
Molgula euprocta Drasche

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Freshwater Fish of Bulgaria

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SUMMARY

The contemporary Bulgarian ichthyofauna consists of 207 species and subspecies, 122 of which inhabit fresh and brackish waters – rivers, wetlands and natural and man made lakes In this report species diversity is discussed according to the watershed and type of water basin

I The Danube River Watershed

The fish of the Bulgarian section of the Danube River and its tributaries constitute a unified ichthyo complex containing 77 species and subspecies Twelve taxa of typical Danubian fish – *Hucho hucho Alosa caspia nordmani*, some of the Acipenseridae species etc – have never been found in the tributaries Conversely 10 cold loving taxa (mostly species of *Salmo Cobitis*, *Cottus* etc) inhabit only the upper parts of the middle stretches of the tributaries Within the ichthyocomplex as a whole, the most abundantly represented family is Cyprinidae (31) followed by Percidae (8) Cobitidae (7) and Gobiidae (7) This watershed contains 11 species listed in the Bulgarian *Red Data Book* as well as other species that are rare or limited in distribution and that require protection *Sabanejewia bulgarica* and *Cottus gobio heasmusi* are endemic forms

II The Black Sea Watershed

The ichthyofauna of the Black Sea rivers includes 77 species and subspecies These are divided into two groups permanent residents of the rivers (39) and temporary immigrants from the Black Sea or the lakes (38) The permanent residents are represented most abundantly by Cyprinidae species (21) followed by Gobiidae (5) and diverse representatives of different families The relative importance of the Gobiidae is increased by the presence of other species that enter the rivers occasionally The other temporary residents are sea species

The ichthyofauna of the Bulgarian seaside lakes consists of a total of 79 species and subspecies Forty three are permanent residents and 36 temporary (either occasional or regular) residents The predominance of freshwater or Black Sea species fluctuates depending on the hydrologic regime and saprobic condition of the lake waters

The unique character of the Black Sea ichthyo complex is due to the combination of original fresh water species (37 in all, including 21 relict species – 14 Ponto Caspian and 7 Boreal Atlantic) and Mediterranean immigrants (43 species) Endemic forms are *Alosa caspia bulgarica* and *Cobitis peshevi* The ichthyocomplex requires strong protection

III The Aegean Sea Watershed

The ichthyofauna of the rivers in southern Bulgaria comprises 50 species and subspecies The Cyprinidae family, represented by 23 species, is definitely predominant, followed by the Cobitidae (6) and Salmonidae (3) The other families are represented by single species In addition to those species that are listed in the Bulgarian *Red Data Book*, the rivers in this region contain 5 species with limited ranges or small populations, and others that are in the process of acclimatizing being introduced The Aegean watershed is famous for its many endemic forms which are also characteristic for the Balkan peninsula These are *Vimba melanops Cobitis peshevi*, *Rutilus rutilus mariza*, *Barbus cyclolepis cyclolepis Chondrostoma nasus vardarenses*, *Sabanejewia aurata balcanica* and *Noemacheilus angoiae bureschi* In order to preserve *Vimba melanops* and *Barbus cyclolepis* which naturally inhabit the Maritsa River measures need to be taken to protect key habitats on the lower course of the Vatch River and on the Shirokolashka River

IV Standing Waters

The ichthyofauna of the mountain lakes includes 15 species all of them belonging to Salmonidae and Cyprinidae The ichthyofauna of the large and small reservoirs and fish farms has developed as a result of intensive importation of economically valuable stocking material as well as the adaptation of genetic stock from the local aboriginal fauna Cyprinidae species predominate

As a result of this general survey of the Bulgarian freshwater and brackish water ichthyofauna we have revised upwards our figures on species composition

This is due in part to the research methods employed but also to the intensive importation of new species and natural expansion in the ranges of other species Simultaneously however, populations of the dominant species have undergone changes, resulting in a definite decline in fishstocks We require a comprehensive program to preserve the genofund and to increase the fishstock

OVERVIEW OF THE BULGARIAN FRESHWATER ICHTHYOFAUNA

The contemporary Bulgarian ichthyofauna con sists of 207 species and subspecies, 122 of which in habit fresh and brackish waters – rivers, wetlands and natural and man made lakes The formation of the freshwater ichthyocomplex of Bulgaria's northern riv ers and watersheds up to the Stara Planina Mountains has been influenced by its direct connection to the Danube River which possesses the richest ichthyo fauna in Europe The other rivers and lakes of the Black Sea watershed area are inhabited by freshwater species (including Ponto Caspian and Boreal Atlantic relicts) and Mediterranean immigrants Some Danu bian species also occur the number diminishing from north to south The rivers and other water bodies of southern Bulgaria that belong to the Aegean water shed contain species that are specific to that region as well as some Danubian and Black Sea species

Information on the diversity of the Bulgarian freshwater ichthyofauna will be presented according to the different watersheds due to their specific charac teristics

THE DANUBE RIVER WATERSHED

The Bulgarian section of the Danube River and its bulgarian tributaries are inhabited by a single and unified ichthyocomplex that includes 74 species and subspecies Thirteen species are found only in the Danube itself Ten others are found only in the tribu taries *Salmo trutta fario S gairdneri irideus, Phoxinus phoxinus Barbus meridionalis petenyi Cobitis aurata bulgarica C aurata balcanica C elongata* and *Cottus gobio* as well as *Coregonus lavaretus* and *C peled* which are being introduced to the waters near the Iskar Dam These are exclusively cold water species, and are adapted to the conditions of the mountain ar eas Some are found in the rivers of the plain as well but never reach the Danube River

The Bulgarian Section of the Danube river

The Bulgarian section of the Danube River lies wholly in the lower course of the river between its 845th and 375th kilometers Out of a total of 83 spe cies inhabiting the entire Danube 65 are found in the Bulgarian section A review of the ichthyological sci entific literature shows that up until now 64 species had been found (Kovatchev 1909 1910 1923 Dren sky 1923 1926 1928 1930 1935 1941 1943 1948 1951 Morov 1931, Shishkov 1935 1937a, 1937b 1938 1940a 1940b 1941 1943 Kolarov 1960 1965a 1964b, 1972 1982 1983 1989 1991 Ivanov 1959 1962 1970 Rusev 1963 Undjijan 1964 Marinov 1966 1978 Sivkov 1979 1980 1985 1986 1987a 1987b 1988a 1988b 1989a 198^b 1991a 1991b Sivkov and Dobrovolov 1986)

Appendix 1 lists the fish species found in the Bul garian Danube The total number of fish species in habiting the Bulgarian fresh and sea waters is over 200 Thus, about a quarter of them occur in the Bul garian section of the Danube The Danube's share of Bulgaria's strictly freshwater ichthyofauna is even larger – about 2/3 of all the species occur there This rich diversity of fish species is due to the Danube s great volume of water its varied ecological conditions, and its relative proximity to Siberia where a majority of the European freshwater fauna originated The Danube is the only large river that flows across most of Europe, connecting the central and western parts of the continent with the eastern countries The Danube thus has a significant role to play in preserving the fish genetic diversity not only of Bulgaria but of the whole of Europe

The Danube basin including its Bulgarian sec tion, is a species formation center Endemic fish such as *Sabanejewia bulgarica Gymnocephalus schraetzer G baloni*, and *Hucho hucho* can be found there In addi tion to species that are included in the Bulgarian *Red Data Book* the Bulgarian Danube contains species that are rarely caught and considered limited in num ber – members of the Acipenseridae (*Huso huso Acipenser gueldenstaedti A stellatus Syngnathus nigrolinaetus Alosa caspia nordmani Zingel zingel Z streber*) as well as some Gobiidae species (which ac cording to some authors are present in unusual num bers in the Bulgarian Danube) *Eudontomyzon don fordi* is a rare species that was discovered in the Da nube near the town of Oriahovo in 1992 As a result the conservation status of the species was able to be changed from extinct to rare

For ages the Danube ichthyofauna has been the object of both commercial and sport fishing In recent decades however the populations of many species have changed dramatically For example, the average annual fish catch between 1941 and 1958 was 930 tons, in the period 1960 74 it was 599 t, and in 1982 it was only 443 t The catch has thus ceaselessly dimin ished with the years The stock of the catches has also changed For example during the period 1925 58 *Cyprinus carpio* was the most numerous, constituting about 40 8% of the catch In the years 1960 64 carp accounted for 30 4% of the catch, and remained first in rank From 1965 to 1969 it continued to be the most numerous fish in the catch but its proportion was only 12 3% From 1970 to 1974 it accounted for 4 3% of the catch and fell to sixth in position Now this spe

cies is threatened with extinction *Barbus barbus* pro vides a contrasting example In the period 1925 58 it accounted for 4 6% of the total catch, which placed it fourth in abundance From 1960 1964 it comprised 3 5% of the catch In the years 1965 69 it rose in the ranks to second place with 11% From 1970 74 and continuing up to the present, it has been the most im portant species in the catch, reaching 21 6% in some fishing years

There are many reasons behind the sharp decline in catches and the replacement of phytophilic species with reophilic species First and foremost the con struction of hydroelectric projects along the Danube s upper and middle course and the blocking of its chan nel in Serbia by the 'Jelezni vrata" ('Iron Gate") has altered the river's basic hydrological functions Other critical factors are the appropriation of river waters for industry and agriculture the widespread pollution of the river waters and especially, the andigiring of the banks along the lower course of the river The last of these prevents the phytophilic fishes from entering the lakes and floodplain waters Although the andigiring of the Bulgarian riverbank has been com plete for 30 years, this may have had only a slight im pact on fish production, since there are few wetlands along the Bulgarian bank and they are small in size By contrast andigiring of the Rumanian riverbank where the most important riparian and floodplain wetlands are located has significantly affected phyto philic and standing water fish species that require vegetative substrates in their spawning cycle Marinov (1978) pointed out that *Barbus barbus Abramis brama*, and other species utilize the unused food resources of the carp and because of this their biomass and num bers have significantly increased

Statistical data indicate a drastic decrease in the catch (in tons) of the anadromous fish (Acipenceridae) as can be seen in the following table (Kolarov, 1989)

Species	1931 40	1961 70	1971 80	1981 86
Huso huso	482 9	262	149	45 3
A gueldenstaedti	162 8	21 5	33 4	22 5
A stellatus	96 6	9 4	4 4	4 5

These numbers represent the average amounts of fish caught in the freshwaters and seas of Bulgaria, the former Soviet Union and the former Yugoslavia The numbers have continued to decrease since 1987 There are several main reasons for the sharp decreases in stocks of these fish the continued unreasonable commercial fishing of these species especially prior to the reproduction period a total lack of limitations on the catch even as parent stocks have been reduced many times over (some of the controls on catch sizes instituted by the International Committee on Fish Catches are ineffective) the biologically groundless monthly ban on catching anadromous species of the family Acipenseridae, as it does not provide protection when they enter the river hydroelectric constructions along the Danube especially the building of dams Jer dap 1 (at km 943) and Jerdap 2 (864 km) which will lead to total liquidation of the species from the Acipenseridae family increasing pollution of the Da nube s water and numerous other negative anthropo genic influences

The Acipenseridae family is of special concern The critical state of the stocks of Acipenseridae spe cies cannot be improved rapidly Due to their long life cycles and the late onset of maturity in these species at least 8 10 years are required to establish trends in their populations Strong external measures, not previously applied, are needed to protect the stocks The intro duction of temporary (10 year) fishing moratoria for *Huso huso* and *A gueldenstaedti*, and the listing of *A stellatus* in the red data books of the countries in the Black Sea Danube River system are the only rational measures that can succeed in saving their populations from slow but certain destruction Mass artificial re production of species from this family has to be the other step, organized internationally by the countries that exploit them

The Tributaries of the Bulgarian Danube

There are 13 tributaries of the Danube River in Bulgaria There length varies from 60 km (the Archar River) to 368 km (the Iskar River) Their catchment area amounts to 33 371 km^2 – about 30% of the Bul garian land surface Their upper courses go through mountainous areas, while their middle and lower courses go through the Danubian plain They are this characterized by a wide variety of ecological condi tions This factor combined with the rivers' direct connection to the Danube accounts for their varied ichthyofauna

The first data about the ichthyofauna composition of the Bulgarian Danube tributaries come from the work of Kovatchev (1909, 1910, 1923) Shishkov's in vestigations (1929 1937a 1937b 1939a, 1939b 1940 1942 etc) were mainly taxonomic but also considered the diversity and distribution of the fish species Dren sky's scientific articles (1921, 1922 1926 1928 1932 1943 1948) as well as his monograph (1951) are de finitive contributions for the protection of the Bulgar ian ichthyofauna

In the last few decades, intensive and important ichthyological studies have been conducted They in clude investigations of all the Danube tributaries (Paspalev and Dikov, 1989, Georgiev, 1967, Michailova, 1970 Sivkov, 1980, 1985 1986 1988 1989 1991 Karapetkova 1972 1976 1979 1985a 1985b 1989 Karapetkova and Dikov 1986 Kara petkova and Pomakov 1982 1982 Karapetkova and Undjian 1988 etc) The quantity productivity and biological characteristics of the different species have been studies by Dikov and Zivkov (1985) Dikov et al (1988), Iankov and Dikov (1985) Iankov (1987), Iankov and Zivkov (1988) etc Although the ichthy ofauna of the Bulgarian Danube tributaries continues

to be an object of research many of the results that have been obtained in recent years have not vet been published in the scientific literature In this regard the contemporary data about the ichthyofauna conditions have not been available

The ichthyofauna of the Bulgarian Danube tribu taries is presented in Appendix 1 It consists of 59 taxa belonging to 15 fish families Cyprinidae with 28 spe cies is the most represented followed by Percidae (8 species) Gobiidae and Cobitidae (5 species each) and so on According to their distribution in the different rivers the fish can be divided into the following groups

- 8 species mostly Cyprinidae, have been found in all 13 Bulgarian Danube tributaries,
- 11 species of Cyprinidae and Percidae have been found in 9 11 rivers,
- 15 species of Cyprinidae, Percidae Cobitidae and Gobiidae have been found in 6 8 rivers and 7 species from these families in 3 5 rivers, and
- a very small number of species mainly *Alosa pon tica pontica*, *Lota lota Pungitius platygaster*, and some members of the Gobiidae family are found in one or two rivers

Species distribution along the rivers follows a characteristic pattern The upper courses are inhab ited by *Salmo trutta fario* joined soon thereafter by *Salmo gairdneri* These species do not reproduce natu rally in the rivers and occur there due to artificial stocking As *Salmo trutta fario* diminishes in number downstream *Phoxinus phoxinus Alburnoides bipunc-tatus Cottus gobio*, and *Barbus meridionalis petenyi* ap pear The lower extent of distribution of *Phoxinus phoxinus Alburnoides bipunctatus* and *Cottus gobio* coincides with the end of the mountain zone How ever *Barbus meridionalis petenyi* remains widespread along the middle course also and even occurs in some parts of the lower course Some Cyprinidae, such as *Leuciscus cephalus Chondrostoma nasus Barbus bar bus Alburnus alburnus, Rhodeus sericeus amarus* some species of Gobiidae, some species of Cobitidae etc are represented by relatively abundant and stable populations especially in the middle courses of the rivers Confined primarily to the lower river courses are *Scardinius erythrophthalmus, Abramis brama, A ballerus A sapa Blicca bjorna Rutilus rutilus Carassius auratus gibelio, Cyprinus carpio, Silurus glanis Esox lucius* the species from *Gymnocephalus, Perca flu viatilis* etc At this point the typical Danube fishes – *Aspius aspius Leuciscus idue Lota lota Acipenseri ru thenus* etc – are again encountered

Appendix 3 includes information on the ranges of the rare fish in Bulgaria Many species of the Bulgar ian Danube tributaries fall under this category In ad dition to those listed in the Bulgarian *Red Data Book* species representing the genera Coregonus, Thymalus, Ictiobus Ictalurus and others should be considered rare *Salmo trutta labrax Hucho hucho, Gobio urano scopus Sabanejwia bulgarica Zingel zingel* and *Zingel streber* are also rare

Endemic species (Appendix 4) include *Cottus go bio haemusi* at the subspecies level as well as the Da nube endemics that enter the lower courses and mouths of the tributaries *Gymnocephalus schraetzer G baloni* etc

General Assessment and Recommendations

The ichthyofauna complex has been enriched in recent decades despite the degradation of ecological conditions during the same period Since the ichthyo fauna has begun to be more systematically studied, some species new for the territory of Bulgaria have been discovered At the same time, other species have expanded their ranges either naturally or through arti ficial fish breeding In this fashion, for example, *Le pomis gibbosus* and *Pseudorasbora parva* have come to be found everywhere in Bulgarian over the last few decades

Other distinctive (and destructive) changes in the river ichthyofauna during the past several decades have been the shift in dominant species and the de cline in the general biomass of fish populations The problems involved in preserving and expanding the river fish stocks are very well known Effective solu tions will require that the following measures be taken

- improvement of the ecological condition of the river valleys by placing drastic limits on water pollution
- consideration of fish breeding requirements in planning hydro engineering projects (including the correction of river beds construction of small and large dams and other construction projects) and in allocating water for various purposes
- development and implementation of the laws and directives concerning the preservation of the fish genofund the preservation of natural ecological conditions the correct reintroduction of fish populations and last but not least the use of sci entifically consistent criteria for utilizing the fish stocks in our rivers

THE BLACK SEA WATERSHED

The Bulgarian Black Sea Rivers

Nineteen rivers (in addition to the Rezovska River on the Bulgaria Turkey border) belong to the Black Sea watershed area in Bulgaria Twelve of them flow directly into the sea and 8 flow into the seaside lakes – Beloslavsko (Gebedzhensko) Bourgasko and Mandrensko These Black Sea tributaries vary in size The Perpedere River is only 14 5 km long, while the Kamchia River stretches 245 km long The areas of their watersheds vary from 50 5 km^2 (the Sarandere River) to 5357 km^2 (the Kamchia River) They are characterized by the relatively low altitude of their

watersheds, the small declivity of their river beds and a well developed network of braiding in their lower courses The areas near the mouths of the rivers are strongly affected by the sea or by the lakes respec tively

Strong east winds cause alluvial sands to gather in front of some of the rivers flowing into the sea block ing the outflows of the rivers Only the Veleka River remains open throughout the year The mouth of the Ropotamo River has been dredged and allows salty water to reach about 7 8 km up the course of the river In the last few years, however the Ropotamo River was once again almost closed due to the destruction of the protective dike and a decreasing flow of river wa ter At present, the Ropotamo reaches the sea through a shallow channel

Relatively complete studies of the ichthyofauna of the Black Sea rivers were carried out in the period 1965 1976 (Peshev 1965 1969 1970, Apostolov 1972 Karapetkova and Peshev 1973 Karapetkova 1974, 1975, 1976) Only the ichthyofauna of the Rezovska River was not investigated In recent years the condi tions of the Black Sea rivers have changed Several dams have been built including the Yasna Polyana the Kamchia (Ticha), and the G Trajkov Some parts of the rivercourses were redirected These changes have certainly resulted in considerable changes to the rivers ichthyofauna but there are not up to date data on species composition or, especially the size of the fish populations

The ichthyofauna of the Bulgarian Black Sea riv ers includes a total of 77 species and subspecies which fall into two groups permanent residents of the rivers (39 species) and species residing temporarily in the rivers after entering from the Black Sea and nearby lakes (38 species) (See Appendix 2)

The group of permanent residents consists mainly of primarily freshwater species (31 of 39 species) Some sea species can be found in the rivers 6 are in digenous Ponto Caspian relicts, one is a Boreal Atlantic relict, and one is a Mediterranean immigrant The Cyprinidae family is the most widely represented, with 21 species followed by Gobiidae with 5 species (all of which are completely adapted to fresh water) The significance of the Gobiidae is further illustrated by the presence of another five species that temporar ily enter the rivers A number of species – including *Leuciscus cephalus Chalcalburnus chalcoides Gobio gobio Alburnus alburnus Alburnoides bipunctatus Barbus meridionalis petenyi Barbus tauricus Vimba vimba tenella* and *Rhodeus sericeus amarus* – are rep resented by abundant stable populations especially in the larger rivers They are especially important in that they are spread over long stretches of the rivers By contrast other species that are just as abundant are re stricted to short sections of the rivers *Rutilus rutilus Rutilus frisii Leuciscus borysthenicus Scardinius erythrophthalmus Cyprinus carpio Carassius auratus gibelio Neogobius melanostomus* etc

The temporary residents consist exclusively of species that originated primarily in the sea Mediter ranean immigrants (29 species) form the most numer ous group in this category, followed by the indigenous Ponto Caspian species (5) and Boreal relicts (4) This complex was enlarged by the presence of a consider able number of typical sea species in the firth zone of the Ropotamo River prior to its recent closing Their presence there, as well as in some other rivers is acci dental By contrast the species from the families Clu peidae, Mugilidae and Gobiidae as well as *Anguilla anguilla Atherina mochon pontica* and other species must migrate into the river waters to feed and repro duce The temporary residents live both in brackish waters as well as the fresh waters of the firth zone Some species migrate long distances from the river mouth (e g *Alosa caspia bulgarica, Anguilla anguilla* etc) Species occurring in the most rivers include *Mugil cephalus Liza saliens, Atherina mochon pontica Platichthys flesus luscus*

Endemic taxa found in the Bulgarian Black Sea tributaries are *Alosa caspia bulgarica* (distributed in the southern Black Sea tributaries and along the southern Black sea coast) and *Cobitis peshevi* spp nov (found in the Black Sea and Aegean Sea tributaries)

The density of fish populations in the small rivers fluctuates widely Because of rapid changes in the abiotic environment the simplified food chains in the rivers, and the high reproductive capacities of the spe cies some populations can multiply quickly in a very short time, while at other times there will be no fish at all

In general the fish stocks of the rivers along the Bulgarian Black Sea coast are not rich They have not been subject to commercial fishing neither in the past or in recent decades However they have been used as a food supply for local people in the past, and are increasingly used for sport fishing nowadays

The most important factors influencing the ich thyofauna in the Bulgarian Black Sea rivers are

- excessive illegal fishing
- hydro engineering and construction works (e g correction of parts of the beds of the Kamchia and other rivers construction of dams along Kamchia Ropotamo and other rivers diversion of river waters for drinking water and industrial needs) which disturb the natural conditions for fish populations, and which combine with other changes in the water budget to increase the nega tive effects on the fish populations and last but not least
- the total urbanization of our Black Sea coast and its associated impacts pollution the building of new seaside resorts and industrial enterprises near the rivers use of some rivers by tourists' for mo torboat trips without following certain rules and the lack of strict measures to protect the rivers

The Bulgarian Lakes Along the Black Sea Coast

There are 19 small and larger lakes and swamps along the Bulgarian Black Sea coast However only 7 or 8 of them deserve special attention for their ichthy ological and economic importance

The largest seaside lakes have been well studied both in the past (Drensky 1922 Netchaev 1932 1944 Valkanov 1935 1941 Paspalev 1944 and others) and in recent decades (Alexandrova 1957 1980 Ivanov 1967 1980 Zashev and Angelov 1959 Kolarov 1962 1967) All the species of fish in these lakes have been studied and described by Georgiev (1967), and sup plemented by other authors This high level of interest is attributable to the peculiar genetic characteristics and high fish production of the lakes as noted a num ber of years ago

In the last decade the observations undertaken on these lakes have been very scarce There is no recent data about their condition In the years 1990 1992 re search has been conducted only on Varnensko and Beloslavsko Lakes

The ichthyofauna of the seaside lakes includes a total of 79 species and subspecies, 43 of which are permanent residents of the lakes and 36 of which enter the lakes occasionally or regularly for feeding repro duction and hibernation (Appendix 2)

Changes in the composition and number of fish in the seaside lakes depends on different factors that are quite specific to each of them For this reason the lakes are described here separately

Blatnishko (Durankulashko) Lake

This lake is separated from the sea by an alluvial sand bar However in years of plentiful rainfall a natural temporary connection to the sea is created or a canal is dug through This allows species from the families Mugilidae Atherinidae and Pleuronectidae to enter the lake and temporarily enrich the lake ichthyo fauna

There are 16 year round inhabitants of Blatnishko Lake of which 9 are freshwater fish species and 6 are indigenous sea species the Mediterranean immigrants are represented by one species The Ponto Caspian relicts *Clupeonella cultriventris Pungitius Platygaster*, and *Knipowitschia caucasica* as well as the freshwater fishes *Chalcalburnus chalcoides* and *Vimba vimba tenella* are small in number and threatened by extinc tion

There is not pollution in the lake However its water is used for irrigation which has negative effects on the reproduction of the different populations mainly by decreasing the extent of their breeding ar eas

Shablensko and Ezeretsko Lakes

Both lakes are closed firths connected by a shal low canal They are separated from the sea by a nar row sand bar In some years the ichthyofauna is en riched by eurichalinen species from the sea The fish fauna of these lakes includes 15 permanent resident species 7 of which are freshwater fishes 7 auto chthonous and one a Mediterranean immigrant

In these lakes are 4 Ponto Caspian relict species including *Clupeonella cultriventris* which is extinct along the Bulgarian sea coast as well as *Pungitius platygaster* and *Benthophiloides brauneri* which have constantly diminished in number The latter species is found in Bulgaria only in Shablensko Lake

The fish fauna of the two lakes is of special inter est from a zoogeographic standpoint Some species found here – including Danubian elements such as *Esox lucius*, *Abramis brama* and *Misgurnus fossilis* – are not found in lakes situated further south

The protected status of these lakes should be dis cussed and legalized

Beloslavsko (Gebedzhensko) Lake

Up until 1923 Beloslavsko Lake was a closed body of freshwater connected to Varnensko Lake by a shallow river In 1976 the lake was turned into a navi gable canal (the 'Varna Bay Beloslavsko Lake") and its salinity increased to the level of that in Varna Bay

Georgiev (1967) found and noted 21 permanent resident fish species and 10 recurrent or occasional resident species Most numerous are the freshwater fish species (12) the autochthonous sea species (7) and the Mediterranean immigrant species (2)

Up until 1976 Beloslavsko Lake was one of the most productive of the seaside lakes *Cyprinus carpio Atherina mochon pontica Clupeonella cultriventris*, and *Mugil cephalus* were among the species of essential economic importance After the lake was turned into a navigable canal the incidence of pollution also rose sharply In addition part of its area was reduced In this way *Knipowitschia longicaudata* disappeared from the Bulgaria ichthyofauna Some rare and threatened species – *Clupeonella cultriventris*, *Leucaspius delinea tus Gasterosteus aculeatus Pungitius platygaster Ath erina mochon pontica*, *Knipowitschia caucasica*, etc – were annihilated

Varnensko Lake

This is an open firth connected to the sea and to Beloslavsko Lake In 1909 the first sea lake canal was built followed in 1923 by a second canal linking Be loslavsko and Varnensko Lakes In 1976 a navigable canal was built between Varna Bay and Beloslavsko Lake Since then the salt regime of Varnensko Lake has been the same as that of the adjoining bay

Georgiev (1967) described 26 permanent resident species and 29 periodic or occasional species that en ter the lake By origin they are distributed as follows 9 freshwater species, 11 autochthonous Caspian relict

species 4 Boreal relicts and 31 Mediterranean immigrants Alexandrova and Kolarov (unpub data) inventoried 38 species in Varnensko Lake in 1990 92 Sixteen qualified as permanent residents and 22 as occasional or periodic visitors entering the lake for feeding reproduction and hibernation The latter are mostly sea fish

The increased salinity of the lake water has had changes of essential importance in the condition of the ichthyofauna and the size offish populations and has exacerbated the effects of pollution from industrial and urban drainage waters An additional factor affecting fish populations is thermal pollution form the Thermo electric Power Station The regular dredging of the navigation channel has also had a negative effect on the breeding grounds of the Gobiidae Blenniidae and other families

Annually millions of fish – mostly *Mugil cephalus* and *Liza saliens* – are killed A great deal of fish mortality is due to the effects of eutrophication during the summer months Freshwater fish as well as *Gobius ophiocephalus Clupeonella cultiventris* and others have disappeared In order to reduce pollution and protect both the genetic and economic resources of the fish in the lake, a combination of measures are needed

Pomoriisko Lake

This is a lagoon connected to the sea by a narrow and shallow channel The ichthyofauna of the lake is very poor because of its high level of salinity and the insufficient link to the sea The only permanent resident of the lake is *Knipowitschia caucasica* In some years the lake has been naturally or artificially stocked with sea fish species such as *Mugil cephalus Liza auratus Liza saliens Atherina mochon pontica* and *Platichthys flesus luscus*

Bourgasko Lake

This is a shallow firth connected to the sea through a canal In the last two decades the inflow of sea water has been reduced and the lake has become a freshwater basin

The permanent residents of the lake as studied by Georgiev (1967) total 19 species 9 freshwater fish species 7 autochthonous sea species and 3 Mediterranean immigrants Temporary visitors and occasional or regular immigrants to the lake amount to 10 species including the Mediterranean immigrants *Mugil cephalus Liza auratus Liza saliens* and *Atherina mochon pontica*

Artificial breeding of *Cyprinus carpio Hypophthalmichys molitrix Ctenopharingodon idella* allowed these species to become first rate economic resources In the past Bourgasko Lake was known as a rich feeding area for fish and had high rates of fish production But after the building of the Oil Chemical plants near the town of Bourgas the lake was systematically polluted and the fish became inedible

The existing fish in the lake are poisoned periodically The species that in the past were identified as the most rare and vulnerable have now become extinct within the lake Other species are now experiencing the same trend

Mandrensko Lake

Up until 1962 this lake was connected to the sea through a deep canal In 1962 a dam wall was built and a great part of its area turned into a reservoir The eastern part of the lake, called Usungeren, maintains its link with the sea and so has a salinity level similar to that of the sea The ichthyofauna of the reservoir part comprises 18 species – 8 freshwater fish species 8 autochthonous species and 2 Mediterranean immigrants By opening the lock of the dam, many sea species (e g Mugilidae etc) enter the lake

Usungeren has 11 permanent resident species Of this group, 6 are autochthonous sea species, 4 are Mediterranean immigrants, and one species is of freshwater origin Temporary residents in that part of the lake number 15 species altogether chiefly representatives of Mugilidae, as well as occasional coastal and freshwater species

Irrigation has had a negative effect on the ichthyofauna, destroying their natural breeding grounds

The seaside lakes are distinguished by the unique composition of their ichthyofauna, their productivity and the low net price of their fish production in the past Now, according to available data fish production is being negatively affected especially in some lakes The worst conditions are in Beloslav Lake which is essentially a dead water basin The conditions in Varnensko Lake are almost the same in certain aspects More than tragic is the condition of Bourgasko Lake where the fish fauna though not destroyed is unsuitable for consumption due to the accumulation of petroleum products within the fish The other seaside lakes are in relatively better condition

The essential problems involved in protecting the genetic resources of the lakes and in rationally utilizing the fish stocks where they exist can be addressed by

- adopting measures, specific to each lake to decrease pollution
- maintaining advantageous hydrologic conditions for the biota when considering water engineering projects that affect the lake waters and
- conducting scientifically based protection of genetic resources and methods of fish breeding (use of suitable species and quantities in artificial breeding regulation of fish catches and so forth)

THE AEGEAN SEA WATERSHED

The watershed of the Aegean Sea in Bulgaria consists of several river valleys that gather water from the whole souther part of the country The valley of the Maritsa River is the largest, with a catchment are of 21 840 km2 Its tributaries, the Tundzha and Arda Rivers which join the Maritsa outside of Bulgaria have a total catchment area of 10,791 km2, while that of the Mesta River is 2 764 km2 These figures take into account the watershed of the rivers up to the Bul garian frontier with Greece and Turkey Thus the lower courses of the southern Bulgarian rivers, the ichthyo fauna of which are relatively richer, are not included

Research on the ichthyofauna in these streams has developed along two lines The morphological characteristics and taxonomic status of the different species have been studies by Chichkov (1937, 1939, 1940a 1940b 1943 etc) Drensky (1923 1926 1928, 1934 1943 etc) Marinov (1964 1973a 1973b, 1975), Michailova (1970) Pechev (1971) and others Along with these studies some researchers have undertaken surveys of the Aegean watershed in general (Chichkov 1939) or of the various rivers, such as the Strouma (Kovatchev 1921, Bulgurkov 1958 Michailova 1965) and Maritsa (Kovatchev, 1921, Di mov 1939 Michailova 1965) Data on the composi tion and distribution of the fishes in the southern Bul garian rivers can be found in the monographic works of Kovatchev (1923) Morov (1931), and Drensky (1951)

Despite these many scientific works, the ichthyo fauna of the rivers in the Aegean watershed remains the most poorly investigated There are for example, no published data on the fish fauna of the rivers To polnitsa Tundzha, Arda, and Mesta, and this can be said as well for many of the tributary streams Moreo ver all the available data on the fishes of the basin can be considered obsolete and in need of revision

The ichthyofauna of southern Bulgaria includes a total of 50 species and subspecies (Appendix 1) The most numerous are those of the Cyprinidae (24 spe cies) followed by Cobitidae (6), Salmonidae (3), and the other families (represented by just one species each) Species with relatively abundant and widely spread populations include *Leuciscus cephalus Barbus cyclolepis cyclolepis Alburnus alburnus Chondrostoma nasus vardarenses Scardinius erythrophthalmus*, *Gobio gobio*, *Phoxinus phoxinus Rhodeus sericeus amarus* and *Carassius auratus gibelio* In addition to these spe cies *Cobitis taenia Sabanejwia aurata balcanica*, *Silu rus glanis Esox lucius Perca fluviatilis Proterorhinus marmoratus* and others are also numerous *Gambusia affinis holdrooki* is characterized by high numbers in many smaller water basins, while *Lepomis gibbosus* and *Pseudorasbora parva* have recently multiplied By contrast species such as *Gasterosteus aculeatus*, *Cottus gobio* and *Stizostedion lucioperca* are restricted in number and distribution Members of the Catosto matidae and Ictaluridae as well as *Coreconus lavaletus*, which are now becoming acclimated to this area, can be included in the same category The arri val of *Anguilla anguilla* and *Acipenser sturio* in the Bul garian rivers has not been confirmed by recent data

The Aegean watershed within the Bulgarian bor ders is noted for its large number of endemic forms (Appendix 4) The following species and subspecies are characteristic for the Balkan Peninsula *Vimba melanops Cobitis peshevi Rutilus rutilus maritza Bar bus cyclolepis cyclolepis Chondrostoma nasus vardaren ses*, *Sabanejwia aurata balcanica*, and *Noemachilus an gorae bureshi*

A new species, *Cobitis peshevi* has recently been described for the Black Sea and Aegean basin (Sivkov and Dobrovolov 1986) At this point it has not been specified whether it is an endemic form for Bulgaria or for the Balkan Peninsula

The problems concerning the protection of the ichthyofauna and rational utilization of the fish re sources in the Aegean basin rivers of Bulgaria are the same as those faced by the rivers in the Danube River and Black Sea watersheds

It is recommended that *Vimba melanops* and *Bar bus cyclolepis* for which the Maritsa River is terra ti pica be immediately placed under legal protection on the lower course of the Vatcha River and on the Shi rokolashka Rivers where these two species can also be found

STANDING WATERS

Bulgaria's standing waters are divided here into two categories mountain lakes and artificial water ba sins

Mountain Lakes

There are three types of lakes in the Bulgarian mountains glacial, landslide and tectonic The glacial lakes number about 260 (140 in the Rila Mountains and 120 in the Pirin Mountains) About 50 smaller lakes 0 1 0,2 ha in size are not included in this figure because they are often dry in the summer They are located at altitudes of 1858 to 2709 m above sea level Their depth varies from 0 5 to 29 5 m Almost all are characterized by extreme changes in water levels and low biological productivity However, the lower lakes are stocked with *Salmo trutta fario* which is a subject of sport fishing No research on their stocks is being carried out *Leuciscus souffia* is found in the Dolno Kremensko Lake in the Pirin Mountain (Karapetkova Marinov 1991)

There are three landslide lakes Smolianski and Chairski Lakes in the western Rhodopes and Kosten sko Lake in the Rila Mountains They have the high est pH levels (pH=6 6 9) ever established in our country Due to this peculiarity they are low in bio

logical productivity Recently some of them were artificially stocked with *Ctenopharingodon idella* which cleaned out almost entirely the floating aquatic flora Attempts to introduce *Salmo gairdneri irideus* *Salvelinus fontinalis* and *Coregonus lavaretus* have been carried out, but so far without success The species *Cyprinus carpio* and *Scardinius erythrophthalmus* are among the others that are also found in these lakes (Appendix 1) (Karapetkova 1987, Karapetkova and Zivkov, 1989)

There are 10 tectonic lakes and wetland basins in the Rila Pirin and Stara Planina Mountains with a total area of 1 500 ha The largest are Skala Panitck ishte, and Kupensko Lakes and the three wetlands of the Klutch area in the Stara Planina Mountains They are rich in plankton and benthos and are stocked mainly with carp Ichthyological investigations have not yet been carried out there

Artificial Water Basins

The artificial water basins in Bulgaria include res ervoirs (mountain lowland and small dam) and fish farm facilities

a ***Reservoirs***

In Bulgaria, reservoirs created by dams cover a total area of 39 500 ha Larger reservoirs over 200 ha in size predominate (61 6% of the total) They con tain a high volume of water, but the water level over the course of the year fluctuates widely These char acteristics are not favorable for the development of a specific aquatic flora within them which is an abso lutely necessary condition for the natural reproduction of phytophilic fish species This results in a relatively poor level of species diversity and low fish reserves in most of them In terms of their ecology and fish pro ductivity the reservoirs in the mountain and plain re gions differ considerably

Mountain reservoirs

These reservoirs are classified as high mountain (over 1800 m above sea level) and middle mountain (600 1800 m above sea level) according to their alti tude

The high mountain reservoirs are relatively few in number the Beli Iskar, the Goliamoto Smradlivo the Gornoto ribno the Karagiolskoto and several others They are characterized by poor trophic bases, low summer temperatures (4 15° C) and low levels of biological productivity Ichthyological investigations have not yet been carried out Only *Salmo trutta fario* can be caught in these lakes

The most numerous and well studied from an ichthyological standpoint are the middle mountain reservoirs This category includes the reservoirs of all our basins Batashka Dospadska Iskarska and others (Zivkov 1974 1975 1976, 1980, 1987, Zivkov and Stoyanova 1976, Zivkov and Grupcheva, 1979, Zivkov and Petrova 1983 1984 Naumova and Zivkov 1988, Dikov and Zivkov, 1985) Most are relatively large and long, with a total area of 7,500 ha They are characterized by their rich lower flora and fauna consisting primarily of planktonic species Their potential fish production is estimated at about 0 5 1 2 kg/ha, but the actual figure is less than 0 1 0 5 kg/ha Industrial fishing is conducted only in the Batak and the Dospat reservoirs Many of the middle mountain reservoirs are used as a medium for the arti ficial breeding of *Salmo gairdneri irideus* and *Cyprinus carpio* in confinement Some 1 000 to 3 000 tons of rainbow trout are produced annually in this way in the Dospat reservoir

The diversity of species in the middle mountain reservoirs is illustrated by the ichthyofauna of the Batak dam *Cyprinus carpio*, *Carassius carassius*, *Car assius auratus gibelio*, *Tinca tinca* *Leuciscus cephalus* *Rutilus rutilus* *Alburnus alburnus* *Gobio gobio* *Scardinius erythrophthalmus*, *Barbus cyclolepis*, *Rhodeus sericeus amarus*, *Vimba melanops* *Ctenopharin godon idella*, *Salmo gairdneri irideus* *Hypophthalmich thys molitrix* *Coregonus albula*, *Stizostedion lucioperca* *Perca fluviatilis* *Lepomis gibbosus* and *Silurus glanis* The same species are found in the Dospat reservoir except for *Rhodeus sericeus amarus*, *Ctenopharingodon idella*, *Stizostedion lucioperca* *Hypophthalmichthys mo litrix* and *Silurus glanis* However, others are found there *Coregonus peled*, *Chondrostoma nasus*, and *Noemacheilus barbatulus*

Dams in the plain regions

Reservoirs situated below 600 m above sea level are called "plain region" or "lowland" reservoirs These are the most numerous and include some of the largest in Bulgaria (Mandra, Al Stamboliiski G Dimitrov, Studen Kladenez Jrebtchevo, Ovcaritsa Ivailovgrad and others)

Especially well studied from an ichthyological standpoint are Al Stamboliiski, G Dimitrov, Ovca ritsa and Piasatchnic (Marinov and Boiadjiev, 1967 Boiadjiev 1969 Dimitrov and Lyudskanova, 1967 Zivkov and Grouptcheva, 1989 Pavlov et al , 1989) They are characterized by an active exchange of wa ter thick sediment layers with rich benthos and high maximum summer temperatures (27 29° C) In the cooling ponds of the thermoelectric power stations temperatures can rise to 37° C (at the dams Ovcaritsa and Rosov kladenez), with frequent oxygen saturation in the upper layers and low quantities of oxygen in the lower layers Thus despite the high potential of these lakes for fish reproduction actual catches do not ex ceed 24 59 kg/ha (the deep water plankton and ben thos are not available to the economically valuable fish species)

Species diversity in these reservoirs is well illus

trated by the ichthyofauna of the Ovcaritsa where the highest number of species (22) has been established *Rutilus rutilus Leuciscus cephalus Tinca tinca Scardinius erythrophthalmus Aspius aspius Alburnus alburnus Abramis brama Vimba melanops Cyprinus carpio Carassius carassius Carassius auratus gibelio Ctenopharyngodon idella Aristichthys nobilis Hy pophthalmichthys molitrix Gambusia affinis, Cobitis taenia Silurus glanis Stizostedion lucioperca Perca flu viatilis Gymnocephalus cernua Lepomis gibbosus* and *Proterorhinus marmoratus*

Thirteen fish species are found in the Al Stam boliski reservoir and 15 in the G Dimitrov Almost all the plains reservoirs are stocked with carp, pike, perch, and herbivorous species Recently, other spe cies such as *Ictalurus punctatus, Ictiobus cyprinelus, Ic tiobus bubalus Ictiobus niger* have been introduced to some of these water bodies

Microdams

About 3 000 small dams have been built for irri gation and fish breeding on Bulgaria s small rivers and streams They are filled with water in winter and spring, mainly from rainfall Some are drained in the autumn Their watersheds include cultivated and fer tilized areas assuring them an ample supply of phos phorous and nitrogen and thus making them suitable for fish production They are stocked mainly with carp and herbivorous fish Their natural fish productivity can reach 200 500 kg/ha Their fish fauna coincides with that of the small rivers that feed them but often goldfish, american sunfish roach, perch, and other species are introduced along with the stocking mate rial Ichthyological studies have not been carried out in them

b ***Fish Farms***

Bulgaria has about 3,300 ha of fish production ba sins The processes of fish reproduction feeding, growth etc in the fish farms is completely controlled They have two main functions production of stocking material and production of fish for consumption Carp herbivorous species, silver carp grass carp rain bow trout brown trout buffalo fish and channel cat fish are among the preferred species for artificial re production and distribution

Status of Fish Stocks in the Standing Waters

The fish stocks in Bulgaria's standing waters are decreasing In most of the large Bulgarian reservoirs, they are depleted to such an extent that commercial scale fishing has been stopped The main reasons for the decreases are

1 The great depths and fluctuations in the water level in the reservoirs hinders the development of water flora in the shore area which makes natural reproduction of phytophilic fish impossible The number of non valuable species rapidly increases leading to decreases in the reproduction of eco nomically important species

2 Artificial breeding in these reservoirs is unsatis factory, sporadic, and often undertaken with un suitable species, in short, it is poorly grounded scientifically The development of the fish fauna is unguided It usually consists of species that cannot efficiently utilize the nutritional base in these reservoirs

3 Fish farming in these areas is not successfully or ganized The fish resources of a single dam are often overseen by several administrative bodies but none of them take real responsibility for their rational use protection and reproduction

4 The level of the allowable catch in the Bulgarian reservoirs is determined arbitrarily It is often biologically inappropriate This results in the de struction of the biological balance, which cannot then be restored for many years

5 In some reservoirs (e g the Dospot) the number of cages and the quantity of artificially reared rainbow trout in them are also scientifically un grounded This sometimes leads to the overload ing of the water basins with organic substances The consequences are fish poisoning algae "blooms " and other symptoms of eutrophication

6 Co ordination between fish farming and reservoir water consumption is lacking During the repro ductive period of the economically valuable fish species measures to control water levels are not carried out which hinders natural fish reproduc tion

To solve these problems and to assure the ra tional use, protection, and restoration of fish resources, special and important measures will be required

Appendix 1 Species Composition of Bulgaria's Freshwater Fish (Danube River and Aegean Basin)

Species	Danube River	Danube Tributaries	Aegean Basin	Mountain Lakes	Mountain Dams	Plain Dams	Micro dams	Fisheries
1	2	3	4	5	6	7	8	9
Cyclosonmata Petromyzonidae								
1 *Eudontomyzon danfordi* (Regan 1911)	+							
Pices **Osteichthyes** **Acipenseridae**								
2 *Huso huso* (Linnaeus 1758)	+							
3 *Acipenser nudiventris* Lovetzky 1828	+							
4 *Acipenser ruthenus* Linneaus 1758	+	+						
5 *Acipenser sturio* Linneaus 1758	+		+					
6 *Acipenser stellatus* Pallas 1771	+							
7 *Acipenser gueldenstaedti* Brandt 1833	+							
Clupeidae								
8 *Alosa pontica pontica* (Eichwald 1838)	+	+						
9 *Alosa caspia nordmani* (Antipa 1906)	+							
Salmonidae								
10 *Salmo trutta fario* Linnaeus 1758		+	+	+	+			+
11 *Salmo trutta labrax* Pallas 1811	+							
12 *Salmo gairdneri indeus* Gibbons 1855		+	+	+	+			+
13 *Salvelinus fontinalis* (Mitchill 1815)			+	+	+			
14 *Hucho hucho* (Linnaeus 1758)	+							
Coregonidae								
15 *Coregonus lavaretus* (Linnaeus 1758)		+	+	+	+			
16 *Coregonus peled* (Gmelin 1738)		+			+			
17 *Coregonus albula* (Linnaeus 1758)					+			
Thymallidae								
18 *Thymallus thymallus* (Linnaeus 1758)					+			
Escocidae								
19 *Esox lucius* Linnaeus 1758	+	+	+			+	+	
Cyprinidae								
20 *Rutilus rutilus mariza* Drensky 1926	+	+	+		+	+	+	
21 *Leuciscus cephalus* (Linnaeus 1758)	+	+	+	+	+	+	+	+
22 *Leuciscus souffia* Risso 1826				+				
23 *Leuciscus borysthenicus* (Kessler 1859)			+					
24 *Leuciscus idue* (Linnaeus 1758)	+	+						

Appendix 1 Species Composition of Bulgaria's Freshwater Fish (Danube River and Aegean Basin) (continued)

Species	Danube River	Danube Tributaries	Aegean Basin	Mountain Lakes	Mountain Dams	Plain Dams	Micro Dams	Fisheries
1	2	3	4	5	6	7	8	9
25 *Phoxinus phoxinus* (Linnaeus 1758)		+	+		+			
26 *Sardinius erythrophthalmus* (Linnaeus 1758)	+	+	+		+	+	+	+
27 *Aspius aspius* (Linnaeus 1758)	+	+	+			+		
28 *Tinca tinca* (Linnaeus 1758)	+	+	+	+	+	+	+	+
29 *Chalcalburnus chalcoides* (Cueldenstaedt 1772)	+	+						
30 *Alburnus alburnus* (Linnaeus 1758)	+	+	+	+	+	+	+	+
31 *Alburnoides bipunctatus* (Bloch 1782)		+	+		+	+	+	
32 *Blicca bjoerkna* (Linnaeus 1758)	+	+						
33 *Abramis brama* Linnaeus 1758	+	+	+		+	+	+	
34 *Abramis sapa* (Pallas 1811)	+	+						
35 *Abramis ballerrus* (Linnaeus 1758)	+	+						
36 *Vimba vimba carinata* Pallas 1811	+	+						
37 *Vimba melanops* Heckel 1840			+			+	+	+
38 *Pelecus cultratus* (Linnaeus 1758)	+	+						
39 *Chondrostoma nasus nasus* (Linnaeus 1758)	+	+			+	+	+	+
40 *Chondrostoma nasus vardarensis* Karaman 1928			+		+	+	+	+
41 *Rhodeus sericeus amarus* Bloch 1782	+	+	+		+	+	+	+
42 *Pseudorabora parva* (Schlegel 1842)	+	+	+	+	+	+	+	+
43 *Gobio gobio gobio* Linnaeus 1758	+	+	+	+	+	+	+	+
44 *Gobio uranoscopus* (Agassiz 1826)		+						
45 *Gobio kessleri* Bybovsky 1862	+	+						
46 *Gobio albipinnatus* Lukasch 1933	+	+						
47 *Barbus barbus* (Linnaeus 1758)	+	+				+	+	+
48 *Barbus tauricus* bergi (Chichkov 1935)			+			+		
49 *Barbus meridionalis petenyi* Heckel 1847		+			+			
50 *Barbus cyclolepis* Heckel 1840			+		+	+	+	+
51 *Cyprinus carpio* Linnaeus 1758	+	+	+	+	+	+	+	+
52 *Carassius carassius* (Linnaeus 1758)	+	+	+	+	+	+	+	
53 *Carassius auratus gibelio* (Bloch 1782)	+	+	+	+	+	+	+	+
54 *Hypophthalmichthys molitrix* Valenciennes 1844	+		+		+	+	+	+
55 *Aristichthys nobilis* Richardson 1845	+		+		+	+	+	+
56 *Ctenopharingodon idella* Valenciennes 1844	+		+	+	+	+	+	+

Appendix 1 Species Composition of Bulgaria's Freshwater Fish (Danube River and Aegean Basin) (continued)

Species	Danube River	Danube Tributaries	Aegean Basin	Mountain Lakes	Mountain Dams	Plain Dams	Micro dams	Fisheries
1	2	3	4	5	6	7	8	9
Catostomidae								
57 *Ictiobus cyprinellus* Valenciennes 1844			+		+	+	+	+
58 *Ictiobus bubalis* Radinesque 1810			+		+	+	+	+
59 *Ictiobus niger* Rafinesque 1810			+		+	+	+	+
Cobitidae								
60 *Noemacheilus barbatulus* Linnaeus 1758	+	+	+		+			
61 *Noemacheilus angorae bureschi* Drensky 1928			+					
62 *Misgurnus fossilis* Linnaeus 1758	+	+	+				+	+
63 *Cobitis taenia* Linnaeus 1758	+	+	+	+	+	+	+	+
64 *Cobitis elongata elongata* Heckel and Kner 1858	+	+						
65 *Cobitis peshevi* Sivkov and Dobrovolov 1986		+	+					
66 *Sabanejwia aurata balcanica* Karamann 1922		+	+		+			
67 *Sabanejwia bulgarica* (Drensky 1928)	+	+						
Silurridae								
68 *Silurus glanis* Linnaeus 1758	+	+	+		+	+	+	+
Ictalurridae								
69 *Ictalurus nebulosus* (Le Sneeur 1819)			+		+	+	+	+
70 *Ictalurus punctatus* (Rifanesque 1810)			+		+	+	+	+
Anguillidae								
71 *Anguilla anguilla* (Linnaeus 1758)	+	+	+					
Gadidae								
72 *Lota lota* (Linnaeus 1758)	+	+						
Gasterostiedae								
73 *Pungitius platygaster* (Kessler 1858)	+	+						
74 *Gasterosteus aculeatus* (Linneaus 1758)			+					
Syngnathidae								
75 *Syngnathus nigrolineatus* Eichwald 1831	+							
Poecilidae								
76 *Gambusia affinis holbrooki* (Agassiz 1854)		+	+			+	+	+
Centrarchidae								
77 *Lepomis gibbosus* (Linnaeus 1758)	+	+	+	+	+	+	+	+
Percidae								
78 *Stizostendion lucioperca* (Linnaeus 1758)	+	+	+		+	+	+	

Appendix 1 Species Composition of Bulgaria's Freshwater Fish (Danube River and Aegean Basin) (continued)

Species	Danube River	Danube Tributaries	Aegean Basin	Mountain Lakes	Mountain Dams	Plain Dams	Micro Dams	Fisheries
1	2	3	4	5	6	7	8	9
79 *Stizostendion volgense* (Gmelin 1788)	+	+						
80 *Perca fluviatilis* Linnaeus 1758								
81 *Zingel zingel* (Linnaeus 1758)								
82 *Zingel sterber* (Siebold 1758)								
83 *Gymnocephalus cernuus* (Linnaeus 1758)								
84 *Gymnocephalus baloni* Holcik and Hensel 1974	+	+						
85 *Gymnocephalus schraetzer* (Linnaeus 1758)	+	+						
Gobiidae								
86 *Neogobius melanostomus* Pallas 1811*	+							
87 *Neogobius cephalarges* Pallas 1811*	+							
88 *Neogobius kesslen* Guenther 1861	+	+						
89 *Neogobius fluviatilis* Pallas 1811*	+	+						
90 *Mesogobius gymnotrachelus* Kessler 1857*	+	+						
91 *Proterorhinus marmoratus* (Pallas 1811)	+	+	+			+		
92 *Benthophilus stellatus* (Sauvage 1874)	+	+						
Cottidae								
93 *Cottus gobio gobio* Linnaeus 1758			+					
94 *Cottus gobio haemusi* Marinov and Dikov 1986		+						

Note * = Their presence has yet to be confirmed

Appendix 2 Composition of the Ichthyofauna in Bulgaria's Black Sea Tributaries and Coastal Lakes
Origin Column Key 1= Freshwater, 2= Ponto Caspian Relict 3= Boreal Atlantic Relict, 4= Mediterranean Immigrant

Species	Tributaries		Lakes		Origin
	Permanent	Temporary	Permanent	Temporary	
1	2	3	4	5	6
Squalidae					
Squalus acanthias Linnaes 1758				+	3*
Acipenseridae					
Huso huso (Linnaes 1758)				+	1
Acipenser stellatus Pallas 1771				+	1
Acipenser gueldenstaedti Brandt 1833				+	1
Cluperidae					
Sprattus sprattus phalericus Risso 1810				+	3
Alosa pontica pontica (Eichwald 1838)		+		+	2
Alosa caspia nordmani (Antipa 1906)		+		+	2
Alosa caspia balgarica (Drensky 1934)		+			2
Clupeonella cultriventris (Nordamn 1840)			+		2
Engraulidae					
Engraulis encrasicholus ponticus Alex 1927		+		+	4
Salmonidae					
Salmo trutta fario Linnaeus 1758	+				1
Salmo gaerdneri irideus Gibbons 1855	+				1
Salmo trutta labrax Pallas 1811		+			3
Anguillidae					
Anguilla anguilla Linaeus 1758		+		+	3
Esocidae					
Esox lucius Linnaeus 1758	+		+		1
Cyprinidae					
Rutilus rutilus (Linnaeus 1758)	+		+		1
Rutilus frisii (Nordm 1840)	+				1
Leuciscus cephalus (Linnaeus 1758)	+		+		1
Leuciscus borysthenicus (Kessler 1859)	+				1
Phoxinus phoxinus (Linnaeus 1758)	+				1
Tinca tinca (Linnaeus 1758)	+		+		1
Scardinius erythrophthalmus (Linnaeus 1758)	+		+		1
Aspius aspius (Linnaeus 1758)	+				1
Leucaspius delineatus (Heckel 1843)	+		+		1
Chalcalburnus chalcoides (Gueldenstaedti 1772)	+		+		1
Alburnus alburnus (Linnaeus 1758)	+		+		1
Alburnoides bipunctatus (Bloch 1782)	+				1

Appendix 2 Composition of the Ichthyofauna in Bulgaria's Black Sea Tributaries and Coastal Lakes (continued)
Origin Column Key 1= Freshwater 2= Ponto Caspian Relict 3= Boreal Atlantic Relict 4= Mediterranean Immigrant

Species	Tributaries		Lakes		Origin
	Permanent	Temporary	Permanent	Temporary	
1	2	3	4	5	6
Blicca bjoerkna (Linnaeus 1758)	+				1
Vimba vimba tenella (Nordm 1840)	+		+		1
Rodeus sericeus amarus Bloch 1782	+		+		1
Gobio gobio gobio Linnaeus 1758	+		+		1
Barbus meridionalis petenyi Heckel 1847	+				1
Barbus tauricus Kessler 1877	+				1
Cyprinus carpio Linnaeus 1758	+		+		1
Carassius carassius (Linnaeus 1758)	+		+		1
Carassius auratus gibelio (Bloch 1782)	+	+	+		1
Hypophthalmichthys molitrix Valenciennes 1844		+	+		1
Ctenopharingodon idella Valenciennes 1844		+	+		1
Cobitidae					
Cobitis taenia Linnaeus 1758	+				1
Cobitis peshevi Sivkov and Dobrovolov 1986	+				1
Misgurnus fossilis Linnaeus 1758				+	1
Siluridae					
Silurus glanis Linnaeus 1758	+		+		1
Gadidae					
Gaidropsarus mediterraneus (Linnaeus 1758)		+		+	4
Merlangus merlangus euxinus (Nordm 1840)		+		+	3
Gasterosteidae					
Pungitius platygaster (Kessler 1859)	+		+		2
Gasterosteus aculeatus Linnaeus 1758	+		+		3
Syngnathidae					
Syngnathus nigrolineatus Eichwald 1831	+		+		4
Syngnathus typhle argentatus Pallas 1811		+	+		4
Syngnathus abaster Risso 1810			+		4
Syngnathus schmidti Popov 1928		+			4
Nerophis ophidion (Linneaus 1758)		+	+		4
Hyppocampus ramulosus Leach 1814			+		4
Poecilidae					
Gambusia affinis holbrooki (Agassiz 1854)	+				1
Mugilidae					
Mugil cephalus Linnaeus 1758		+		+	4
Liza aurata Risso 1826		+		+	4

Appendix 2 Composition of the Ichthyofauna in Bulgaria's Black Sea Tributaries and Coastal Lakes (continued)
Origin Column Key 1= Freshwater, 2= Ponto Caspian Relict 3= Boreal Atlantic Relict 4= Mediterranean Immigrant

Species	Tributaries		Lakes		Origin
	Permanent	Temporary	Permanent	Temporary	
1	2	3	4	5	6
Liza saliens Risso 1826		+		+	4
Atherinidae					
Atherina mochon pontica Eichwald 1831		+		+	4
Atherina hepsetus Linnaeus 1758				+	4
Serranidae					
Morone labrax (Linnaeus 1758)		+			4
Centratchidae					
Lepomis gibbosus (Linnaeus 1758)	+		+		1
Percidae					
Perca fluviatilis (Linnaeus 1758)	+		+		1
Stizostedion lucioperca (Linnaeus 1758)	+		+		1
Pomatomidae					
Pomatomus saltatrix (Linnaeus 1758)		+		+	4
Carangidae					
Trachurus mediterraneus ponticus Aleev 1956		+			4
Sparidae					
Diplodus anularis Linnaeus 1758		+		+	4
Centracantidae					
Spicara smaris (Linnaeus 1758)		+		+	4
Mullidae					
Mullus barbatulus ponticus Essipov 1927		+		+	4
Labridae					
Symphodus cinereus Bonnaterre 1788		+		+	4
Crenilabrus ocellatus (Forscal 1775)		+		+	4
Crenilabrus tinca (Linnaeus 1758)		+			
Crenilabrus quinquemaculatus (Bloch 1792)		+			4
Blennidae					
Blennius pavo Risso 1810			+	+	4
Blennius sanguinolentus Pallas 1811			+	+	4
Blennius tentacularis Brunnich 1768				+	4
Blennius sphinx Valanciennes 1836				+	4
Blennius zvonimiri Kolombatovic 1892			+		4
Ophidiidae					
Ophidion rochei Muller 1845		+		+	4

Appendix 2 Composition of the Ichthyofauna in Bulgaria's Black Sea Tributaries and Coastal Lakes (continued)

Origin Column Key 1= Freshwater, 2= Ponto Caspian Relict, 3= Boreal Atlantic Relict, 4= Mediterranean Immigrant

Species	Tributaries		Lakes		Origin
	Permanent	Temporary	Permanent	Temporary	
1	2	3	4	5	6
Ammodytidae					
Gymnammodytes cicerellus Rafinesque 1810				+	4
Scombridae					
Scomber scombrus Linnaeus 1758				+	4
Cybiidae					
Sarda sarda (Bloch 1793)				+	4
Triglidae					
Trigla lucerna Linnaeus 1758				+	4
Scorpanidae					
Scorpaena porcus Linnaeus 1758				+	4
Trachinidae					
Trachinus draco Linnaeus 1758		+			4
Uranoscopidae					
Uranoscopus scaber Linnaeus 1758		+			4
Gobiidae					
Aphia minuta (Risso 1810)			+		4
Pomatoschistus minutus (Pallas 1767)			+		4
Pomatoschistus microps (Kroer 1837)			+		4
Knipowitschia caucasica Kawrajsky Berg 1916	+		+		4
Gobius niger Linnaeus 1758		+	+		4
Gobius ophiocepholus Pallas 1811		+	+		4
Neogobius melanostomus Pallas 1811	+		+		2
Neogobius platyrostris Pallas 1811			+		2
Neogobius cephalarges Pallas 1811		+	+		2
Neogobius syrman Nordm 1840		+	+		2
Mesogobius gymnotrachelus Kessler 1857	+				2
Mesogobius batrachocephalus Pallas 1811		+	+		2
Neogobius fluviatilis Pallas 1811	+				2
Proterorhinus marmoratus (Pallas 1811)	+		+		2
Benthophiloides brauneri Bell and Illin				+	2
Bothidae					
Psetta maeotica (Pallas 1811)		+		+	
Pluronectidae					
Platichthys flesus luscus (Pallas 1811)		+	+		3
Soleidae					
Solea lascaris nasuta (Pallas 1811)		+	+		4

Appendix 3 Rare or Limited Distribution of Bulgaria's Freswather Ichthyofauna

Species	Rare	Very Rare	Extremely Rare
1	2	3	4
Eudontomyzon danfordi (Regan 1911)			+
Huso huso (Linnaeus 1758)		+	
Acipenser nudiventris Lovestzky 1828			+
Acipenser sturio Linnaeus 1758			+
Acipenser stellatus Pallas 1771	+		
Acipenser gueldenstaedti Brant 1833	+		
Clupeonella cultriventris Nordm			+
Alosa caspia nordmani (Antipa 1906)	+		
Alosa caspia bulgarica Brensky 1934		+	
Alosa maeotica maeotica Grimm 1901	+		
Salmo trutta labrax Pallas 1811			+
Salvelinus fontinalis (Mitchill 1815)		+	
Hucho hucho (Linnaeus 1758)			+
Coregonus lavaretus (Linnaeus 1758)	+		
Coregonus peled (Gmelin 1788)	+		
Coregonus albula (Linnaeus 1758)	+		
Thymallus thymallus (Linnaeus 1758)	+		
Rutilus frisii (Nordm 1840)	+		
Leuciscus souffia Risso 1826			+
Leuciscus borysthenicus (Kessler 1859)	+		
Leuciscus delineatus (Heckel 1843)		+	
Chalcalburnus chalcoides (Gueldenstaedti 1772)	+		
Gobio uranoscopus (Agassiz 1836)		+	
Cyprinus carpio Linnaeus 1758 (wild form)	+		
Ictiobus cyprinellus Valenciennes 1844	+		
Ictiobus bubalis Rafinesque 1810	+		
Ictiobus niger Rafinesque 1810	+		
Noemacheilus angorae bureschi Drensky 1928	+		
Cobitis peshevi Sivkov and Dobrovolov 1986	+		

Appendix 3 Rare or Limited Distribution of Bulgaria's Freswather Ichthyofauna (continued)

Species	Rare	Very Rare	Extremely Rare
1	2	3	4
Sabanejewia bulgarica (Drensky 1928)		+	
Ictalurus punctatus (Rafinesque 1810)	+		
Anguilla anguilla (Linnaeus 1758)			+
Lota lota (Linnaeus 1758)			+
Pungitius platygaster (Kessler 1858)			+
Gasterosteus aculeatus Linnaeus 1758		+	
Syngnathus nigrolineatus Eichw 1831	+		
Nerophis ophidion (Linnaeus 1758)			+
Atherina mochon pontica Eichw 1831	+		
Stizostedion volgense (Gmelin 1788)			+
Stizosteion marina Cuv 1828			+
Zingel streber (Siebold 1863)		+	
Zingel zingel (Linnaeus 1758)		+	
Gymnocephalus schraetzer (Linnaeus 1758)	+		
Gymnocephalus baloni Holcik and Hensel 1974	+		
Neogobius kessleri Guenther 1861	+		
Aphia minuta (Risso 1810)	+		
Knipowitschia caucasica (Kawr) Berg 1916	+		
Neogobius rata Nord 1840		+	
Neogobius syrman Nord 1840		+	
Benthophiloides brauneri Beling and Iljin 1927			+
Benthophiloides stellatus (Sauvage 1874)		+	
Cottus gobio gobio Linnaeus 1758	+		
Cottus gobio haemusi Marinov and Dikov 1986	+		

Appendix 4 Endemic Species and Subspecies of Bulgaria's Freshwater Ichthyofauna

I Endemics for Bulgaria and the Balkan Peninsula

1 *Sabanejewia bulgarica* Drensky 1928 Bulgarian sector of the Danube River
2 *Sabanejewia aurata balcanica* Karaman, 1922 Danube and Aegean Basin tributaries
3 *Cottus gobio haemusi* Marinov and Dikov, 1986 Danube tributaries
4 *Alosa caspia bulgarica* Drensky 1934 South Black Sea tributaries
5 *Cobitis peshevi* Sivkov and Dobrovolov, 1986 Aegean Sea Basin (Strouma Maritsa Topol nitsa Vardar and etc rivers)
6 *Vimba melanops* Heckel 1840 Aegean Sea Basin (Strouma, Maritsa Topolnitsa Vardar, and etc , rivers)
7 *Barbus cyclolepis cyclolepis* Heckel, 1840 Ae gean Sea Basin (Strouma Maritsa Topolnitsa, Vardar and etc rivers)
8 *Chondrostoma nasus vardarenses* Karaman, 1928 Aegean Sea Basin (Strouma, Maritsa, Topol nitsa Vardar and etc rivers)
9 *Rutilus rutilus mariza* Drensky, 1928 Danube River and the Black Sea and Aegean Sea Ba sins
10 *Noemacheilus angorae bureschi* Drensky 1928 Aegean Sea Basin (Strouma, Maritsa Topol nitsa Vardar and etc , rivers)

II Endemics for the Danube River Basin repre sented in the Bulgarian Sector of the Danube River and its Tributaries in Bulgaria

1 *Hucho hucho* (Linnaeus, 1758) only in the Danube River
2 *Gymnocephalus schraetzer*, Linnaeus, 1758
3 *Gymnocephalus baloni* Holick and Hensel

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Fish of the Bulgarian Coastal Waters

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SUMMARY

This paper discusses the ichthyofauna inhabiting the Bulgarian Black Sea coast throughout the year, both seasonally and episodically This includes 46 families and 126 species some of these, however are known only on the basis of a single specimen, which raises doubts about their real presence in Bulgaria's Black Sea waters

The species list used in this study contains 5 fami lies that were not listed in 'Fishes of the Bulgarian Black Sea coast (Stoyanov et al 1963) The repre sentatives of these families inhabit coastal lakes or river mouths but do not range into the Black Sea According to the systematic list of FAO "Fisheries Statistics,' which has been used since the end of 1987 the families Cybiidae and Thunnidae are related to the Scombridae For the same reasons, Moronidae is now separated from Serranidae and Scophthalmidae from Bothidae The two new families are Congridae and Merluccidae

The classification of Rass (1987) is accepted in the present list It is based on the catalog of fishes in the northeast Atlantic Ocean and the Mediterranean (Clofnam, 1973) For the reasons mentioned above, 23 species (freshwater fishes from the coastal lakes) have been removed from Stoyanov et al 's (1963) list of the Bulgarian ichthyofauna which included 135 species while 14 species have been added

The table and map that accompany the species list show the areas of origin of the species the character of their reproduction and their most important bio logical characteristics (population numbers migra tions etc) The data indicate that the fish fauna of the Bulgarian coastal waters is formed to a consider able extent of seasonal migrants that winter in the Sea of Marmora or at the Anatolian coast of Turkey

On the basis of calculations of fish mortality rates it is concluded that the Bulgarian fishing industry takes an insignificant part of the total quantities of anchovy Black Sea shad horse mackerel turbot and whiting sprat however are the exception to this finding At the same time the fishing industries of Turkey and the former Soviet Union have in some years over harvested and to a great extent reduced the popula tions of these species

Measures to protect different fish species from over exploitation are described It is concluded that both eutrophication and pollution (with oil products heavy metals chlorine compounds and other contami nants) are increasing in the sea and that previous steps to protect fish populations have not yielded the desired results The populations of most species have fallen sharply, especially after the rapid growth of the new ctenophore species *Mnemia maccradyi* (*Mnemiopsis leidiy*) Delays in the prohibition of bot tom trawling, which ruined the biotic communities of the sea bottom and in so doing affected the link be tween the benthic and pelagic communities have also contributed to declines in fish populations

Effective fishing regulations on the Bulgarian Black Sea coast are urgently needed as are interna tional conventions to protect the sea and the large tributary rivers (Danube, Dnestr Dnepr, etc) from pollution It is recommended that a Black Sea Com mission be created to determine catch quotas for the intensively exploited fish species, with a view toward rational utilization of their populations

A BRIEF HISTORY OF RESEARCH ON THE FISH OF THE BLACK SEA COAST

Studies of the fish fauna in the Bulgarian Black Sea coastal waters began in the early 1920s There was at the time no specialized marine scientific insti tute in Bulgaria Consequently, these early studies were descriptive in nature and gave only a rough idea of the flora and fauna in the Bulgarian coastal waters (Drensky 1923)

The monograph *Fish in Bulgaria* (Drensky 1951) describes some species that have been identified only on the basis of single specimens, such as *Squalus blain villei* (Risso) *Acipenser nudiventris* (Lovetzky), and *Li chia amia* (L) single specimens of these have been caught in different years near Sozopol and Varna The species *Conger conger* (L) and *Serranus cabrilla* (L) are also extremely rare The species *Alosa caspia bulgarica* (Drensky) = *Alosa alosa bulgarica* (Drensky) and *Alosa alosa macedonica* are according to this author members of a single geographical race of *Alosa alosa* Drensky however following Vinciguerra (1921) assumed that all three geographical races were individual species The monograph described 16 spe cies of the Gobiidae family which were attributed to the genus *Gobius*

In 1932, the Marine Biology Station and Aquar ium was established in Varna Its first director was the prominent Bulgarian zoologist G Paspalev In the

same year the Experimental Ichthyological Station was established in Sozopol The Russian scientist A Nechaev the best educated ichthyologist of the time was appointed as its director His research provided the first data on the migration and size distribution of bonito mackerel, horse mackerel mullets and other species After his retirement in 1941 these studies were discontinued until 1954 with the exception of sprat data collected by S Stoyanov

In 1954 the Marine Biological Station and Aquarium and the Experimental Ichthyological Station (the latter was moved to Varna in 1948) were inte grated to lay the beginnings of the first Bulgarian sci entific marine institute, to be known as "The Scientific and Research Institute of Fishery and Fish Industry – Varna " The name was subsequently subject to multi ple changes as reflected in the titles of the proceed ings in which the studies of the institute scientists were published After the establishment of this institute more extensive studies of fish taxonomy and biology were carried out In 1963, the book *Fish of the Black Sea (Bulgarian Coast)* by Stoyanov et al was pub lished This book provided descriptions of 135 species in 49 families Of these 23 species were representa tives of the fresh water ichthyofauna inhabiting the coastal lakes or the mouths of rivers running into the Black Sea The taxonomic list of fish did not how ever include the six rare species described by Drensky (1951), mentioned above In addition in this classifi cation the Gobiidae family contained 19 representa tives in 9 genera

Georgiev (1966) carried out a revision of the Go biidae family representatives describing 23 species The new species, with respect to those specified in *Fish of the Black Sea* were *Gobius buccichi* (Steindachner), *Neogobius platyrostris* (Pallas) *Neogobius kessleri* (Gunther) and *Benthophiloides stellatus* (Sauvage) The two latter species are representatives of the fresh water ichthyofauna inhabiting the Danube and some coastal lakes

Manolov (1970) described 11 fish species of the Sparidae family As compared to the 8 species de scribed in *Fish in the Black Sea* the new species were *Dentex dentex* (L) *Pagellus erythrinus* (L) *Diplodus vulgaris* (Geoffrey St Hilaire) and *Oblada melanura* (L) The author noted in his paper that "within some 10 or 14 years we were able to compile a collection of all the known Sparidae in our ichthyofauna (except *Lithognatus mormyrus*)"

Bearing in mind that Stoyanov in *Fish of the Black Sea*, was the first to report the species *Pagellus mormyrus* = *Lithognathus mormyrus* which had not been detected a second time for more than 10 years, it may be concluded that this is an extremely rare spe cies This is valid to the same degree for the species *Dentex dentex Diplodus vulgaris Lithognathus erythrinus* and *Oblada melanura* Prodanov and Chachev (1987) reported the capture of a single im mature specimen of *Merluccius merluccius* (L) in front of Sozopol during bottom trawling for sprat It is evi dent from these observations that a certain part of the ichthyofauna along the Bulgarian Black Sea coast consists of extremely rare species that occasionally visit the Bulgarian coastal waters

The taxonomic status of the species in the family Gobiidae is very complicated, as there are multiple intermediate forms between individual species Elec trophoresis has proven the existence of hybrid forms between allied species According to Dobrovolov (un publ data) a persistent inhabitant of the Bulgarian coastal waters is the species *Neogobius cephalargoides* Pinchuk which is closely akin to *Neogobius ceph alarges* and *Neogobius ratan* Hence, they are often mistaken

As a result of the important research of many Bulgarian ichthyologists (Stoyanov Nikolov, Georgiev Ivanov Kolarov Kolemanova, Karapetkova Pro danov, Mikhailov Daskalov etc) the major biological features of the commercial species – reproduction growth in length and mass with age, population dy namics rate of exploitation and so forth – have been established Periodic or continuous monitoring has been conducted on many features of the Black Sea ichthyofauna the size age and sexual composition of the catch of sprat, anchovy, horse mackerel whiting, bonito mackerel bluefish shad mullets gobies tur bot and other species the dynamics of catch and fish ery pressure (Ivanova) and the ichthyoplankton (eggs and larvae) and structure of the fish population along the Bulgarian coast (Dobrovolov and Dobrovolova) As a result of these studies concepts were elaborated to provide for the rational exploitation of fish re sources (Ivanov Prodanov, Kolarov) During recent years studies have been carried out to determine the effects of anthropogenic contamination of the Black Sea on the number of the most important fish species (sprat horse mackerel whiting anchovy, etc) These species have decreased dramatically particularly after the rapid spread of the new ctenophore species *Mne mia maccradyi*

In these studies ever increasing priority has been given to the adoption of an ecological approach This has also been stimulated by the structure of the Institute of Oceanology which, in addition to the sections of Ma rine Biology and Ecology has well developed sections of Marine Physics Marine Chemistry Marine Geology Marine Geochemistry Submarine Equipment and Technology as well as laboratories of Oceanographic Instrumentation and Marine Facilities All of this allows the Institute to carry out integrated research on board the Scientific Research Vessel *Akademik*, which is equipped with the most up to date navigation and hy droacoustic instrumentation However under the pres ent economic situation the lack of funding has become a problem, and the seasonal scientific expeditions of the *SRV Akademik* have been temporarily cancelled

GAPS IN KNOWLEDGE

The spawning status of the rare fish species found in Bulgarian coastal waters is unclear Data indicates that many of them are spawning in the northwestern part of the Black Sea However, this has not been proven for the Bulgarian coastal waters although most of these species are thermophilic migrating from the south to the north The reason is that no regular in vestigations are carried out in the Bulgarian coastal waters to establish the presence of ichthyoplankton species or the population of the new fish generation This is especially true for rare species, species whose populations are too low to support fishing or species that are otherwise of little fishing significance

During the last three years (1990 1993) no representative data on the amounts of catches or on fishing operations have been gathered This has prevented researchers from making precise calculations of the population dynamics of the species subject to intensive fishing

The measures for protection of the Black Sea from pollution and for regulating fishing are not coordinated The Agreement for Fishing in Black Sea (1960) and other measures to regulate fishing and to conduct scientific investigations have involved Bulgaria Romania, and the former Soviet Union, but Turkey has not participated In the General Council for Mediterranean Fishing, the former Soviet Union was not represented

Since 1990, investigations of the food base and the biomass dynamics of the new ctenophore species have been intermittent due to the lack of funds for surveys using the vessel *Akademik* No studies have been undertaken to determine the influence on the fertilized fish eggs and larvae of the different metabolites during phytoplankton blooms

Taxonomic Status

The taxonomic status of the fish in the Bulgarian part of Black Sea has not been firmly established Appendix 1 gives the contemporary taxonomic status of the marine and brackish water fish found at different times in the Bulgarian Black Sea waters The nomenclature adopted by Rass (1987) which is based to a great extent on the catalog of the northeast Atlantic and Mediterranean fish (1973) has been used For the sake of consistency with the *Yearbook of Fisheries Statistics* of the FAO and the General Council of Fisheries in the Mediterranean (*GFCM Statistical Bulletin* 1989) the Sea wolf (*D labrax*) has been deleted from the Serranidae family and included in the Moronidae family In addition the Cybiidae and Thunnidae families have been assigned to Scombridae For the same reason the Scophthalmidae family has been separated from the Bothidae family

In Appendix 1, the older non matching names of the families and species from *Fish in the Black Sea* are indicated in parentheses underneath the newer name The list does not include freshwater fish of the coastal lakes and river mouths that do not occur in the Black Sea For this reason, 23 species have been removed from Stoyanov et al 's 1963 list, which comprised 49 families and 135 species The 23 deleted species belong to 5 families Cyprinidae (17 species) Cobitidae (2 species), Siluridae (1 species) Esocidae (1 species) and Percidae (2 species) Hence, the list of families has been reduced from 49 to 44 as the families Cybiidae Thunnidae, and Scombridae are integrated into one family and the Moronidae and Scophthalmidae have been separated from respectively, the Serranidae and Bothidae families The two new families in Appendix 1 are Congridae (Drensky 1951) and Merlucciidae Thus the total number of families is 46 They comprise 126 species Of the 14 new species 8 were described by Drensky (1951) 2 by Georgiev (1966), 2 by Manolov (1970), one by Prodanov and Chachev (1987), and one by Dobrovolov (to be published) There is no mention of the very rare visitors from the Mediterranean to the Bulgarian coastal waters, such as mackerel (*Scomber scombrus* L) and anchovy (*Engraulis encrasicolus*) The first of these species differs from the common small mackerel form of the Marmara and Black Sea Neither is the Azov anchovy (*E encrasicolus maeoticus*), which in particular seasons reaches the Bulgarian coast mentioned

Species Characteristics

Of the 126 species listed in Appendix 1, 24 are Pontian relicts 9 originate from the Atlantic, and 93 are Mediterranean emigrants Catadromous fish are represented by 1 species and anadromous fish by 8 species Approximately 62 species in the Bulgarian waters migrate towards the shore and back, while about 64 migrate from south to north and back The total number of species with pelagic spawn is 66, though 27 29 species spawn in the Bulgarian sea waters 17 19 in the offshore area and 10 in the open waters Forty nine species spawn in bottom waters 41 42 spawn in the Bulgarian sea waters all of them in the near offshore area There are 3 viviparous species Two breed along the Bulgarian coast one in the near offshore strip and the other in more open waters One species spawns by attaching eggs in capsules in the offshore area Of the 7 species in which males bear the spawn in special nursing bags or in pre anal body cavities 6 inhabit the near offshore area and one lives in more open waters Six species spawn in the autumn winter season all the rest spawn in the spring summer months As was mentioned most of the fish spawn in the near offshore area rendering them very vulnerable to water contamination

STATUS OF THE BLACK SEA COASTAL ZONE AND FISHERIES

Despite recent corrective measures the stocks of most species and groups of fish have tended to dimin ish as reflected in their catch by decades in the sea (Table 1) and in lakes (Table 2) from 1941 1990 Pos sible reasons for these declines include the rapid rate of exploitation the contamination of the waters, and the changes in the Black Sea ecosystem as a whole In the coastal lakes which in the past had been fre quented by as many as 20 30 marine and brackish water species, the hydrological and hydrochemical conditions have changed dramatically Since 1962, Mandrensko Lake has been turned into a reservoir and Bourgasko Lake has been isolated and no longer receives sea water inflow The latter lake has subse quently become polluted with waste water and oil products The small Dyavolsko wetland was drained and the area of Pomoriysko Lake (lagoon) was greatly reduced Blatnishko Lake has been turned into a reserve A new navigation channel was dredged from the sea through Varna and Beloslav Lakes The life in the latter lake is almost entirely ex tinct due to pollution from the chemical plants in Dev nya

As regards the Bulgarian Black Sea zone as a whole we assume provisionally that it had been rela tively clean up to the year 1970 At that point eu trophication began to affect the sea This period has been characterized by structural and functional changes in the ecosystem, due to which local and widespread algae blooms are becoming more frequent and of ever increasing intensity, duration and extent These blooms are frequently followed by oxygen defi ciency and the perishing of bottom dwelling and mud fish species, especially in the near offshore area

Table 1 Bulgarian mean annual catches of commercial fishes in Black Sea during 1941 1990 (in tons)

Species or groups of fishes	1941 50	1951 60	1961 70	1971 80	1981 90	1990 Only
Squalis acanthias spiny dogfish	0 1	2	1	12	56	16
Raja clavata ray	1 1	7 4	45	2	+	+
Acipenseridae Sturgeons	1	10	43	40	12	+
S sprattus phalericus sprat	795	1468	1030	7551	11619	2650
Alosa kessleri pontica pontic shad	112	129	41	49	26	17
Engraulis encrasicolus ponticus anchovy	225	162	177	134	168	+
Belone belone euxini garfish	10	9	6	0 4	+	
Merlangius merlangus euxinus whiting				161	+	+
Mugilidae mullets	33	68	28	11	8	1
Atherina boyeri silverside (Boyer s sand smelt)	17	9	+	+	+	+
Dicentrarchus labrax common bass	0 1	0 2	+			
Pomatomus saltator bluefish	21	69	230	30	8	6
Trachurus mediterraneus ponticus pontic horse mackerel	480	499	444	1108	777	164
Centracanthidae, pickerels	11	103	+	+	+	
Mullus barbatus ponticus striped mullet	14	10	2	0 2	+	
Sarda sarda bonito	653	1152	945	20	25	17
Thunnus thynnus great tuna	1 5	0 4	+			
Scomber scombrus pontic mackerel	966	543	452	+		
Xiphias gladius swordfish	0 1	0 2	+			
Gobiidae gobies	98	34	25	23	28	14
Psetta maeotica turbot	69	234	334	172	12	
Platichthys flesus luscus European flounder	0 3	0 8	0 3	0 2	+	+
Other fishes	16 8	68 7	173 7	69 2		
TOTAL	3525	4477	3977	9383	12799	2898

Overharvesting

In the Bulgarian zone the last 10 to 15 years have witnessed reduced occurrences both in a majority of the year round inhabitants and in species that migrate between the south and the north

The stocks of the generatively Marmarian and trophically Black Sea mackerel (*Scomber scombrus* L) dramatically dropped, almost to the point of extinction after 1969 The stocks of bonito (*Sarda sarda* L) in the Bulgarian zone which once were substantial in the October December period sharply diminished in 1970 This anomaly continues to this day Meanwhile along the Turkish Black Sea coast and in the Sea of Marmara the stocks of this species despite a definite drop continue to be relatively abundant

The situation with the bluefish (*Pomatomus saltator* L) is similar Since 1970 its numbers have stayed relatively high in the Sea of Marmara and along the Turkish Black Sea coast, but in Bulgarian waters it occurs only in small quantities Judging by the catches (Table 3) the horse mackerel stock along the Bulgarian coast has stabilized, but its dynamics in 1990 92 demonstrated a downward trend

Especially disturbing and occurring for the first time has been the sizable depression of Black Sea anchovy stocks This species was almost absent in the 1989 1991 Bulgarian catch According to unofficial data the anchovy catch of the Black Sea nations in 1991 dropped to about 5% of the average annual catch of 1980 1989

The greatest stock and catch in the Bulgarian zone is represented by the sprat This stock of this species has also shown a downward trend especially in 1990 91 There has been some recovery since the autumn of 1992 The decline in catch however has been greater than the decline in stocks The Bulgarian sprat catch in 1990 (2650 tons) dropped to about 14% of the 1981 catch (18,880 tons) About 49% of this decline is attributed to declines in the stocks, while about 51% is due to the decline in fishing activity

Table 2 Mean annual catches of marine and brackish water fishes in Bulgarian coastal lakes (in tons)

Species or family of fishes	1941 50	1951 60	1961 70	1971 80	1981 90
S sprattus phalericus and *Clupeonella cultriventris* (sprat and common kilka)	16	7	+	+	+
Mugilidae mullets	84	189	113	7	2
Atherina boyeri silverside (Boyer s sand smelt)	27	16	+	+	+
Gobiidae gobies	40	40	97	21	8
Platichthys flesus luscus European flounder	27	53	+	+	+
Other fishes	5	1	+	+	+
TOTAL	199	306	210	28	10

The exploitation rate of fish stocks by the Bulgarian fishery industry is far below the minimum tolerable standards According to Ivanov (1970) from 1963 65 the instantaneous fishing mortality (Fex) rate of the mackerel stocks from all Black Sea countries had been 0 445 while from the Bulgarian fishery alone 0 042 For the Danube shad (*Alosa kessleri pontica*) from 1963 79 this rate has been 0 99 for all Black Sea countries, and 0 035 for the Bulgarian fishery alone (Ivanov and Beverton 1985) The Fex is higher for the turbot (*Psetta maeotica*) The mean value of Fex for the 1956 78 period had been 0 57 (Ivanov and Karapetkova 1979 Ivanov and Beverton 1985) This figure however included the turbot catch by Turkish fishermen in the Bulgarian zone Supposing their catch had been twice that of the Bulgarians the Fex would split as follows Bulgarian fishery – 0 19 Turkish fishery – 0 38

The most heavily exploited species is the sprat For sprat the tolerable value of F is 0 43 (Ivanov 1989, Prodanov 1989) In the period 1976 82 the actual value of F had been considerably lower than the theoretical tolerable value Nevertheless the sprat stock began to decline with some oscillations Since 1989 fishing pressure has dropped sharply, but the sprat stock is still below its 1978 82 level

The low exploitation rate of fish stocks by the Bulgarian fishery is confirmed by data on the commercial fish catch in the Black Sea countries (Table 3) At the same time the exploitation of fish stock in over wintering locations in the Sea of Marmara and along the Anatolian and the Caucasus Black Sea coasts is very heavy and is exceeding the tolerable standards for some species

The depression of the Black Sea anchovy stocks in 1989 1992 is due to both deteriorating ecological conditions and excessive harvesting of this species (Shlyakhov et al 1990) Together these have resulted in a reduction of the reproductive stock Ivanov and Mikhailov (1991) have also shown by means of modelling that increases in the Fex in over wintering

Table 3 Mean annual catches of commercial fishes from all Black Sea countries in subarea of 37 8 0 GFCM in 1980 1989 (in tons)

Species or family of fishes	Bulgaria	Romania	Turkey	Former USSR	Total
Sprattus sprattus phalericus	13011	5479		50824	69332
g *Alosa* shad	25	592	688	299	1604
g *Engraulis* anchovy	188	3716	269408	183162	456474
Merlangius merlangus euxinus whiting	* 30	1403	15330	2445	19208
Pomatomus saltator bluefish	10	2	14870	3	1488
Trachurus mediterraneus ponticus pontic horse	842	1190	79444	5727	87203
Sarda sarda bonita	25		16720		16745
Pleuronectiformes, flatfish	21	8	2261	1238	3927

Notes * this catch represents 50% from Bulgarian catch of "other fishes"

locations lead to strong reductions in the surviving re productive stock It has also been shown that institut ing a 50 100% ban on fishing of the youngest age group (0+ years of age) in November April would significantly increase the total stock and would in crease the reproductive stock several times over The improved quality of the larger anchovies would com pensate for the reduction in the catch at over wintering locations These theoretical results provide evidence of the need for the Black Sea countries to reach agreement on regulation of the fisheries

Bulgaria has recently adopted a number of re strictions in order to preserve the fish of the Bulgarian Black Sea area from over exploitation

- For the following fish species and groups regula tions have been established regarding minimal fish length as measured from the snout to the base of the tail fin (in cm) and permissible by catch of small size fish (in per cent) in proportion to the number of full size fish

Species	Minimal Length (in cm)	By catch (%)
1 *Huso huso*	170	0
2 *Acipenser guldenstadti colchicus*	110	0
3 *Acipenser stellatus*	100	0
4 *Psetta maeotica*	35	5
5 *Alosa kessleri pontica*	16	8
6 *Mugilidae* (in sea only)	20	20
7 *Trachurus mediterraneus ponticus*	10	20
8 *Scomber scombrus*	15	20
9 *Sprattus phalericus*	6	40

- Fishing of *Acipenser nudiventris* is absolutely banned
- In sturgeon fishing with paragada" (baited longli nes), the curved part of the hook must be at least 23 mm in length, and the weight of 1000 hooks at least 4 Kg Sturgeon fishing with "kurmatsi' (unbaited hooks) is forbidden
- A minimal mesh size of 180 mm for turbot nets has been introduced and turbot fishing has been banned for a five year period (1989 1993)
- Fishing of gobies (Gobiidae) with nets was for bidden in the spring season of 1992
- Some species of fish that are near extinction have been entered into the *Red Data Book*

Pollution

In terms of water quality the Black Sea has a small pollution acceptance capacity and faces an added handicap in the presence of hydrogen sulphide under its surface oxygen layer (in the Bulgarian zone the bottom fish down to 90 m and pelagic and mud fish down to 100 130 m occur rarely) The Bulgarian zone accepts pollutants not only from its own coast but to an even greater extent from other regions These pollutants come mainly from the northwest where the waters of the large rivers pour into the sea According to Konovalov (1992) the Black Sea is contaminated annually by some 100 thousand tons of oil derivatives, 40 50 thousand tons arriving via the Danube Contamination with heavy metals and other chemical compounds is considerable (*Marine Pollution '90* 1990) In addition to river borne pollutants, the Black Sea also receives a great deal of pollution via the atmosphere from the industrial centers of Europe and the former Soviet Union The Bulgarian Black Sea zone also receives pollutants of domestic origin the most significant being emitted from chemical plants at Devnya and Bourgas, which lie 30 and 10 km from the seashore respectively

From the Danube the Black Sea annually re ceives 60 tons of mercury, 240 tons of cadmium 4000 tons of lead and 900 tons of chromium Copper con tamination of the Black Sea is about 2 3 times greater than that of the Mediterranean The contamination of the basin with different chemical substances – includ ing DDT and other insecticides hexacyclohexane (HCH), polyvinylchlorides (PVC) and polychlori nated biphenyls (PCBs) – is also strong The rivers Danube Dniepr Dniester and South Bug annually pour from 1200 to 5000 tons of pesticides into the Black Sea According to UNEP, the most dangerous substances for living organisms are radionuclides and mercury followed by the pesticides and other heavy metals (UNEP 1986a b,c) Compared to the Mediter ranean the Black Sea is also much more heavily bur dened with phosphates and nitrates especially f only the oxygen zone is considered According to Kono valov (1992) the quantities of these substances are as follows

	Mediterr Sea	Baltic Sea	Black Sea
Phosphates			
tons	384606	82415	153842
tons/km^3	0 102	3 8 (0 19)	0 286 (2 85)*
Nitrates			
tons	1093 2187	234 4 468	437 5 875
tons/km^3	0 291 0 582	10 85 21 0	8 1 16 2*

(Note * Phosphorus and Nitrogen quantities in pro portion to the Black Sea oxygen zone volume)

The parenthesized value 0 19 is the predicted quantity of phosphates in the Baltic Sea after the *International Programme for Phosphorus Control on the Baltic* is im plemented

As is well known, the greatest effect upon marine ecosystems is exerted by the phosphates nitrates and potassium compounds which cause eutrophication of water bodies (Vollenweider 1976) In this respect the most affected part of the Black Sea is the northwest As considerable quantities of nutrients – especially ni trogen and phosphorus – are imported by the large rivers Danube Dniepr Dnestr and South Bulgare they are carried to the Bulgarian shore by the typical currents within the sea basin

Changes in the Black Sea Ecosystem

As a result of all these environmental changes se rious shifts have occurred in the Black Sea ecosystem in the last 20 years The ecosystem has also been af fected by the delayed ban on bottom trawling, which destroys the seabed communities and affects the links between the benthic and pelagic components of the system

The major changes in the Black Sea ecosystem can be briefly summarized as follows

- Qualitative and quantitative reduction of the mi crophytobenthos, especially in the northwest part of the basin
- Increased duration, intensity, frequency, and spa tial distribution of phytoplankton blooms
- Reduction of the species diversity, numbers, and biomass of the zoobenthos due to frequent and massive deaths (usually following phytoplankton 'blooms") and the spread of new species mainly the *Rapana tomasiana* snail which is a predator of the Black mussel (*Mytilus galloprovincialis*) The growth in numbers and biomass of some re sistant species cannot compensate for the overall reduction of zoobenthos biomass
- Changes in the numbers and biomass of some zooplankton species The dominance of such spe cies as *Noctiluca milliaris*, *Acartia clausi*, and *Pleopis polyphemoides* is an indication of eu trophication
- Dramatic decreases in the numbers and biomass of the small zooplankton, which are the basic food both for plankton eating fish and for the larvae and young of the other fish species due to mass spreading of the new ctenophore species The latter besides being a competitor for the trophic base directly destroys the eggs and the larvae of the spawning fish by feeding on them (though in insignificant proportion to the zooplankton)
- Dramatic decreases in the numbers and biomass of most of the fish populations as a result of the environmental changes described above and the excessive harvesting of some commercial fish spe cies

As has been noted the ichthyofauna along the Bulgarian coast is comprised to a great extent of mi grating fish species from the Sea of Marmara the Anatolian Turkish coast and the northwest part of the Black Sea Pollution and excessive harvesting of fish populations in those regions will result in further de clines in the occurrence and species diversity of the ichthyofauna inhabiting the Bulgarian Black Sea coast throughout the year seasonally or occasionally The adverse effects of pollution will likely increase by the end of the century due to the expected decrease in precipitation, which will further diminish the water ex

change in the Black Sea and will reduce the self purification capacities of the basin

RECOMMENDATIONS

In consideration of all of the above the following major recommendations are offered

- Prolong the introduced minimal length and small size fish by catch regulations as well as the other restrictions mentioned in the preceding sec tions
- Introduce a prohibition on turbot fishing from 15 April to 31 May, beginning in 1994
- Ban any turbot fishing from foreign vessels in Bulgarian territorial waters and in the Bulgarian economic zone of the Black Sea
- Ban bottom trawling, which destroys seabed communities
- Ban the fishing of gobies with nets in the period from 1 April to 15 May
- Establish a fishing prohibition zone in Varna Lake in the zone of warm water discharge from the Varna Power station
- Resume the collection of data regarding monthly and annual fish catch by species and by fishing methods and regions the number of trap and beach nets and other forms of fishing equipment and the number of trawling hours of fishing ves sels
- Sign international conventions to protect the Black Sea and the Danube from pollution
- Sign a Black Sea agreement among Bulgaria, Georgia, Romania, Russia, Turkey, and Ukraine for regulating harvests of common fish species in the Black Sea the Sea of Marmara and the Sea of Azov or, if these countries should become members of the General Fisheries Council for the Mediterranean they should coordinate their ef forts for the preservation and rational exploitation of fish populations within the framework of this council

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters

	Family, species subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
	1	2	3	4
I	Squalidae			
1	*Squalus acanthias* L spiny dogfish		+	
2	*Squalus blainville* (Risso) dogfish		+	
II	Rajidae			
3	*Raja clavata* ray		+	
III	Dasyatidae (Trigonidae)			
4	*Dasyatis pastinaca* (L) (*Trigon pastinaca* L) common stingray		+	
IV	Acipenseridae			
5	*Huso huso* L great sturgeon	+		
6	*Acipenser nudiventris* Lovetzky spiny sturgeon	+		
7	*A guldenstadti colchicus* Marti russian sturgeon	+		
8	*A sturio* L common sturgeon	+		
9	*A stellatus* Pallas starred sturgeon	+		
V	Clupeidae			
10	*Sprattus sprattus phalerieus* (Risso) (*S s sulinus* (Antipa)) sprat		+	
11	*Sardinella aurita* Valenciennes round sardinella			+

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters (continued)

Family species, subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
1	2	3	4
12 *Sardina pilchardus* (Walbaum) (*S p sardina* (Risso)) European pilchard			+
13 *Clupeonella cultriventris* (Nordm) common kilka	+		
14 *Alosa kessleri pontica* (Eichwald) pontic shad	+		
15 *Alosa caspia nordmanni* Antipa caspian shad	+		
16 *Alosa caspia bulgarica* (Drensky) Drensky shad	+		
17 *Alosa brashnikovi maeotica* (Grimm) (*A kessleri pontica* var) Brazhnikov s shad	+		
18 *Alosa fallax nilotica* (Geoffroy) twaite shad			+
VI Engraulidae			
19 *Engraulis encrasicolus ponticus* Aleks pontic anchovy			+
VII Salmonidae			
20 *Salmo trutta labrax* Pallas pontic salmon		+	
VIII Anguillidae			
21 *Anguilla anguilla* (L) European eel		+	
IX Congridae			
22 *Conger conger* (L) Conger eel			+
X Belonida			
23 *Belone belone euxini* Gunter garfish			+
XI Gadidae			
24 *Gaidropsarus mediterraneus* (L) shore rockling			+
25 *Merlangius merlangus euxinus* (Nordm) (*Odontogadus merlangus euxinus* (Nordm) whiting		+	
XII Merluccijdae			
26 *Merluccius* (L) European hake			+
XIII Gasterosteidae			
27 *Gasterosteus aculeatus* L tree spined stickleback		+	
28 *Pungitius platygaster* (Kessler) (*P platygaster* (Kessler) nine spined stickleback	+		
XIV Syngnathidae			
29 *Hippocampus ramulosus* Leach (*H hippocampus microcoronatus* (Slastenenko) short nosed seahorse			+
30 *Nerophis ophidion* L straight nosed pipefish			+

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters (continued)

Family, species subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
1	2	3	4
31 *Syngnathus abaster* Risso (*S nigrolineatus* Eichwald) black striped pipefish			+
32 *S phlegon schmidti* Popov (*S schmidti* Popov) Atlantic pipefish			+
33 *S tenuirostris* Rathke narrow snouted pipefish			+
34 *S typhle* L (*S t argentatus* Pallas) broad nosed pipefish			+
35 *S variegatus* Pallas (*S rubescens* Risso) wide nosed pipefish			+
XV Sphyraenidae			
36 *Sphyraena* L European barracuda			+
XVI Mugilidae			
37 *Mugil cephalus* L common gray mullet			+
38 *Lisa aurata* (Risso) (*Mugil auratus* Risso) leaping gray mullet			+
39 *Liza saliens* (Risso) (*Mugil saliens* Risso) leaping gray mullet			+
40 *Lisa ramada* (Risso) (*Mugil ramada* Risso) thin lipped mullet			+
XVII Atherinidae			
41 *Atherina boyeri* Risso (*A mochon pontica* (Eichwald)) Boyer s sand smelt			+
42 *Atherina hepsetus* L Mediterranean sand smelt			
XVIII Zeidae			
43 *Zeus faber* L St Peter s fish			+
XIX Serranidae			
44 *Serranus scriba* (L) lettered perch			+
45 *Serranus cabrilla* (L) comber			+
XX Moronidae (Serranidae)			
46 *Dicentrarchus labrax* (L) (*Morone labrax* (L)) common bass			+
XXI Pomatomidae			
47 *Pomatomus saltator* (L) (*P saltatrix* (L) bluefish			+
XXII Carangidae			
48 *Trachurus mediterraneus ponticus* Alleev pontic horse mackerel			+
49 *Trachurus* L (*T t trachurus* (L)) common scad			+
50 *Lichia amia* (L) leer fish			+

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters (continued)

Family species subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
1	2	3	4
XXIII Sciaenidae			
51 *Umbrina cirrosa* (L) (*Sciaena cirrosa* L) bearded umbrine			+
52 *Sciaena umbra* L (*Corvina umbra* (L)) brown meagre			+
XXIV Sparidae			
53 *Boops boops* (L) bogue			+
54 *Dentex dentex* (L) dentex			+
55 *Diplodus annularis* (L) (*Sargus annularis* (L)) annular bream			+
56 *Diplodus sargus* (L) (*Sargus* (L) white bream			+
57 *Diplodus vulgaris* (Geoffroy St Hilaire) two banded bream			+
58 *Lithognathus mormyrus* (L) (*Pagellus mormyrus* (L)) sand steembras			+
59 *Pagellus erythrinus* (L) pandora			+
60 *Puntazzo* (Gmelin) (*Charax puntazzo* (Cetti)) sharp snouted sparus			+
61 *Sarpa salpa* (L) (*Boops salpa* (L)) bamboo fish			+
62 *Sparus aurata* L (*Aurata* (L)) gilthead bream			+
63 *Spondyliosoma cantharus* (L) (*Cantharus* (L)) black bream			+
64 *Oblada melanura* (L)			+
XXV Maenidae			
65 *Spicara flexuosa* Rafinesque (*Maena chryselis* (C V)) saddled bream			+
66 *Spicara maena* (L) (*Maena* (L)) common pickarel			+
67 *Spicara smaris* (L) (*Maena smaris* (L)) plotched pickarel (stripped mullet)			+
XXVI Mullidae			
68 *Mullus barbatus ponticus* Essipov high body pickarel			+
XXVII Pomacentridae			
69 *Chromis* (L) blunt snouted mullet			+
XXVIII Labridae			
70 *Symphodus tinca* (L) (*Crenilabrus tinca* (L) blue damselfish			+
71 *Symphodus ocellatus* (Forsskal) (*Crenilabrus ocellatus* Forsskal) long striped wrasse			+
72 *Symphodus cinereus* (Bonnaterre) (*Crenilabrus griseus* L) axillary wrasse			+

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters (continued)

Family species subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
1	2	3	4
73 *Symphodus roissali* (Risso) (*Crenilabrus quinquemaculatus* Bloch) cork wing			+
74 *Ctenolabrus rupestris* (L) gold sinny			+
XXIX Trachinidae			
75 *Trachinus draco* L greater weever			+
XXX Uranoscopidae			
76 *Uranoscopus scaber* L common stargazer			+
XXXI Blenniidae			
77 *Blennius pavo* Risso peacock blenny			+
78 *Blennius sanguinolentus* Pallas Black sea blenny			+
79 *Blennius tentacularis* Brunnich tentacled blenny			+
80 *Blennius zvonimiri* Kolombatovic Zvonimir s blenny			+
81 *Blennius sphynx* Valenciennes (*B sphinx* Val) sphynx blenny			+
82 *Coryphoblennius galerita* (L) montagn s blenny			+
XXXII Ophidiidae			
83 *Ophidion rochei* Muler snake blenny			+
XXXIII Ammodytidae			
84 *Gymnammodytes cicerelus* (Rafinesque) (*Ammodytes cicerellus* Rafi nesque) smooth sand lance			+
XXXIV Callionymidae			
85 *Callionymus risso* Le Sueur (*Callionymus belenus* (Risso) datted dragonet			+
86 *Callionimus pusillus* Delaroche (*C festivus* Pallas) Delaroch s dragonet			+
XXXV Scombridae			
87 *Scomber scombrus* L (*S s ponticus* Zambr) pontic mackerel			+
88 *Scomber japonicus* Houttuyn (*Pneumatophorus colias* (Lowe)) japan mackerel			+
89 *Sarda sarda* (Bloch) bonita			+
90 *Thunnus thynnus* (L) great tunny			+
91 *Euthynnus alleteratus* (Rafinesque) little tunny			+
XXXVI Xiphiidae			
92 *Xiphias gladius* L swordfish			+

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters (continued)

Family, species subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
1	2	3	4
XXXVII Gobiidae			
93 *Aphya minuta* (Risso) transparent goby			+
94 *Bentophiloides brauneri* Beling et Iljin Brauner s goby	+		
95 *Chromogobius quadrivittatus* (Steindachner) (*Relictogobius kryzhanovski* Ptschelina) Steindachner s goby			+
96 *Gobius bucchichi* Steindacher Buchich s goby			+
97 *Gobius cobitis* Pallas giant goby			+
98 *Gobius niger* L black goby			+
99 *Gobius ophiocefalus* Pallas grass goby			+
100 *Gobius paganellus* L rock goby			+
101 *Knipowitschia georghievi* Pinchuk (*Knipowitschia longicaudata* (Kessler) lagoon goby	+		
102 *Mesogobius batrachocephalus* (Pallas) toad goby	+		
103 *Neogobius cephalarges* (Pallas) mushroom goby	+		
104 *Neogobius fluviatilis* (Pallas) monkey goby	+		
105 *Neogobius gymnotrachelus*(Kessler) (*Mesogobius gymnotrachelus* (Kessler) goad goby	+		
106 *Neogobius melanostomus* (Pallas) round goby	+		
107 *Neogobius platyrostris* (Pallas) guban goby	+		
108 *Neogobius ratan* (Nordmann) ratan goby	+		
109 *Neogobius cephalargoides* Pinchuk Pinchuk s goby	+		
110 *Neogobius syrman* (Nordmann) syrman goby	+		
111 *Pomatosshistus caucasicus* (Kawrajski) Berg (*Knipowitschia caucasia* Kawrajski) lagoon goby	+		
112 *P marmoratus* (Risso) (*Pomatoschistus microps* (Kr–yer) marbled goby			+
113 *P minutus elongatus* (Canestrini) (*Pomatoschistus minutus* Pallas) sand goby			+
114 *Proterorhinus marmoratus* (Pallas) tube nosed goby	+		
XXXVIII Scorpaenidae			
115 *Scorpaena porcus* L small scaled scorpion fish			+
XXXIX Trigidae			
116 *Trigla lucerna* L yelow gurnard			+

Appendix 1 Species Composition of the Ichthyofauna in the Bulgarian Black Sea Waters (continued)

Family species subspecies	Pontic relicts	Boreal Atlantic relicts	Mediterranean immigrants
1	2	3	4
XL Bothidae			
117 *Arnoglossus kessleri* Schmidt sea bach			+
XLI Scophthalmidae (Bothidae)			
118 *Psetta maeotica* (Pallas) (*Rhombus maeoticus* (Pallas) turbot			+
119 *Scophthalmus rhombus* (l) (*Rhombus rhombus* (L)) brill			+
XLII Pleuronectidae			
120 *Platichthys flesus luscus* (Pallas) (*Pleuronectes flesus luscus* (Pallas) European flounder		+	
XLIII Soleidae			
121 *Solea nasuta* (Pallas) snouted scole			+
XLIV Echeneididae			
122 *Echeneis naucrates* L slender sucker fisch			+
XLV Gobiesocidae			
123 *Lepadogaster lepadogaster lepadogaster* (Bonnaterre) (*L gouani* Lacepede) cornish sucker fish			+
124 *Lepadogaster candolei* Risso (*L de candollii* Risso) connemara clingfish			+
125 *Diplecogaster bimaculata euxinica* (Mugroci) (*Lepadogaster bi maculatus* Penant) two spotted clingfish			+
XLVI Lophiidae			+
126 *Lophius piscatorius* L angler			+
TOTAL	24	9	93

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Bulgaria's Amphibians and Reptiles

Vladimir A Beshkov

SUMMARY

Due to Bulgaria's geographic location and varied relief, its herpetofauna is among the richest in Europe At present 52 species of amphibians and reptiles are found on Bulgarian territory and in adjacent continental waters Of these 48 species are permanent residents Two species of poisonous snakes *Vipera aspis* and *Vipera ursinii* are considered extinct from the Bulgarian fauna Specimens of two other species the sea turtles *Chelonia mydas* and *Caretta caretta* have been found on occasion along the Bulgarian Black Sea coast They do not permanently inhabit the Black Sea but are rare "guests "

The Bulgarian herpetofauna can be divided into three groups on the basis of its zoogeography

1 Northern European and European species whose distribution extends south into Bulgaria This group includes species such as *Triturus alpestris Rana temporaria Zootoca vivipara* and *Vipera berus* which in Bulgaria are almost entirely localized in the mountains

2 Middle and southern European species including *Salamandra salamandra Bufo bufo Coronella austriaca Natrix natrix Emys orbicularis* which are found throughout Bulgaria

3 Mediterranean and Near East species such as *Ophisops elegans Eryx jaculus Elaphe situla, Coluber rubriceps* and *Mauremys caspica* which penetrate only the hottest low elevation areas of southern Bulgaria

Anthropogenic pressures on the Bulgarian herpetofauna fall into two basic categories (1) changes in and destruction of the landscape including the clearing of forests the replacement of native forests with coniferous plantations drainage of ponds and wetlands pollution of rivers changes or corrections in river flows or currents environmental degradation due to modern farming techniques and the general standardization of the landscape and (2) direct destruction of herpetofauna populations, particularly of species that are of commercial value and that are subject to poaching

The most endangered species are those whose distribution is sporadic especially species with Mediterranean or Near Eastern distribution (i e , located in low lying southern Bulgaria) Some of the commercially exploited species – the two types of dry land tortoises – and those used in terrariums (including some rare Mediterranean snakes with limited or scant distribution in Bulgaria) are highly endangered

The extensive agricultural areas of northern Bulgaria are poorest in herpetofauna The high mountain areas above 2 000 meters in elevation are also poor in herpetofauna The southern portions of the Strouma River valley the southeastern section of the Maritsa valley the eastern Rhodopes, and the narrow strip of the Black Sea coast southeast of Bourgas are the areas richest in herpetofauna Mediterranean and Near Eastern species penetrate these regions and exist alongside southern and central European species There are places in these areas where, in the space of several square kilometers, 28 31 species of amphibians and reptiles can be found

The Bulgarian herpetofauna is protected from destruction by special Order No 729/1986 of the Ministry of Environment It protects 31 species For 13 species this order protects against not only damage injury, or elimination, but against the actual capture of specimens as well Fourteen amphibian and reptile species are included in the Bulgarian *Red Data Book* (Beshkov 1985) Twenty two species of the Bulgarian herpetofauna are included in the register of the Balkan Convention (1979) fourteen of these species are protected by the previously mentioned MOE order while five are listed in the Bulgarian *Red Data Book* One marshy area, near Botevgrad 63 km northeast of Sofia is under special protection as an area used in the reproductive cycle of an interesting migratory population of *Rana temporaria*

The Bulgarian public's awareness of the protected status of amphibians and reptiles and of the legislative acts protecting the herpetofauna is extremely unsatisfactory

HISTORIC OVERVIEW OF HERPETOLOGICAL RESEARCH IN BULGARIA

Hristovitsch (1892) published the first scientific studies of the Bulgarian herpetofauna Important early

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studies of the species composition distribution, mor phology and biology of amphibians and reptiles were conducted by the founder of Bulgarian herpetology Vasil T Kovachev (1866 1926) (1894 1903 1905 1905 1906 1910 1910 1912 1917) He assembled the first collection of Bulgarian amphibians and rep tiles which was subsequently housed in his native Russe Schischkov (1914) described the discovery of two species new to the Bulgarian herpetofauna (*Triturus alpestris* and *Typhlops vermicularis*) Buresch (1929) added two more species, *Eryx jaculus* and *Malpolon monspessulanus* From 1924 1942 Dr Ivan Bu resch and his assistant Jordan Zonkov working at the Royal Natural History Museum in Sofia, conducted an intensive study of the distribution of amphibians and reptiles in Bulgaria and the Balkan Peninsula and compiled a very rich collection of representatives of these two groups The results of their studies are pub lished in five works (Buresch and Zonkow, 1932, 1933 1934, 1941 1942) that remain the foundation of Bul garian herpetology

During the 1930s, many important European her petologists visited Bulgaria at the invitation of Bu resch Their publications (Cyren 1933 1941 Lankes 1932, Mueller 1933, 1934 1940, Stepanek, 1934, 1937 1937, Werner 1936) expanded our knowledge of the species composition distribution, subspecies status, etc of the Bulgarian herpetofauna During this pe riod studies of northern Bulgaria and southern Do brudzha, which at that time was temporarily incorpo rated in Romania were also published (Bacescu 1934 Calinescu, 1924, 1931 Lankes, 1932 Lepsi, 1927, Mueller 1927)

Tuleschkov (1959) published the first work de voted entirely to the ecology of the herpetofauna Beshkov (1959 1965) announced the discovery of *Telescopus fallax* and *Rana esculenta* in Bulgaria Beshkov also published a series of works on the geo graphic and altitudinal distribution, biology, and sub species status of a number of species and the extent of range overlap for several species of frogs These works also included studies of the effects on the am phibians and reptiles of industrial pollution from a copper manufacturing plant, discussions of the prob lems involved in tortoise protection and the section on herpetofauna for the Bulgarian *Red Data Book* (Beshkov 1961 1966, 1970 1970 1972 1973 1974, 1975, 1975, 1976, 1977 1978 1981, 1984, 1985 1986, 1987)

Beshkov and additional authors also published works on the biology of *Salamandra salamandra* the distribution of the Bulgarian herpetofauna the various groups of vertebrates that serve as snake food sources, the population of *Bombina variegata* the unusually large reproductive migration of the *Rana temporaria* population the reproductive biology of *Bufo bufo* and the debate concerning the occurrence of *Vipera aspis* in Bulgaria (Beshkov and Zoncev 1963, Beshkov and Beron 1964 Bechkov et al , 1967 Beshkov and Nankinov 1979, Beshkov and Jameson 1980, Besh kov and Gerasimov 1980 Beshkov and Dushkov 1981 Beshkov and Angelova 1981 Beshkov et al 1986 Buresch and Beshkov, 1965)

Bartoschik and Beshkov (1979) announced the discovery of *Coluber rubriceps* in Bulgaria while Bar toschik et al (1981) studied the morphology and dis tribution of this species in Bulgaria

Other important contributions to the study of Bulgarian herpetofauna published during the 1960s 1970s and 1980s include Bischoff, 1969, Chlebicki, 1985, 1985 Geissler 1981, 1982, Geissler and Bruhl 1980, Hartkopf et al 1974 Kabisch 1966 1966 1972 Noellert 1983, 1980 1981 Noellert and Ritter 1986 1986, Obst and Geissler, 1982 Peters 1962, 1963 Re hak 1986 and Sura 1981 Many popular articles, dealing primarily with the conservation and biology of protected species, were also published by Bulgarian herpetologists and qualified amateurs A great many of these articles contain original research

The helminthofauna of the Bulgarian amphibians and reptiles has been studied by D Bojkov and G Buchvarov The venom of snakes, especially of *Vipera ammodytes*, has also been investigated, primarily by P Manahilov and associates Karyological studies have been undertaken by P Belcheva and P Popov Im munology has been explored by B Botev V Vul chanov and associates Mlynarski and Beshkov have published on tortoise fossils The works of these authors have not been included in the bibliography as they do not directly relate to the matters at hand

Herpetological research in Bulgaria is currently conducted by the Institute of Zoology of the Bulgarian Academy of Sciences Research focuses primarily on ecological problems and on the protection of the her petofauna Research is also conducted in part by the Ecology and Zoology faculties of the Department of Biology at Sofia University where almost every year one or two students present diploma work on herpe tology

GAPS IN CURRENT KNOWLEDGE

For the purposes of this report the main gaps in our knowledge of Bulgaria's amphibians and reptiles involve

1 Knowledge of the basic population parameters of the majority of species This is particularly true for the rare species with limited distribution – species that most need protection Major indica tors including population numbers and density age structure mortality, fertility, and survival rates are lacking For only a few of the most common species is there relatively complete in formation

2 Knowledge of the species distributions of the her petofauna in Bulgaria The only parts of the country that are relatively well known are those that are richest in species the area around Sofia

and several areas where herpetologists have worked in the past (including, for example Russe, where Kovachev worked and areas surveyed by the Royal Natural History Museum which col lected specimens in the 1920s and 1930s) The lowland regions of Bulgaria, in particular have been visited only incidentally by herpetologists, and so little information is available for these ar eas Thus, in these areas only a few of the most common species have been recorded

3 Knowledge of the numbers and distribution of species in the recent and more distant past Her petological studies in Bulgaria started at the end of the 19th century and the beginning of the 20th However data on historic changes in the popula tions of the species are almost completely lacking This absence of data makes the tracing of popu lation trends difficult Information from chroni cles travelogues, or other historical works is ex tremely rare and it is difficult to determine which species are being referred to

4 Knowledge of the methods poachers use to gather conceal and export protected species From 1986 1989 four groups of foreign poachers were captured as well as several dozen local in habitants primarily for destroying tortoises We have knowledge of dozens of other cases where poachers have managed to leave the country prior to the arrival of conservation groups working to protect the rare species

CURRENT STATUS

Areas Requiring Further Investigation

Bulgaria does not have large unexplored areas in which particularly interesting complexes of amphibians and reptiles could be expected to be found The rela tively lesser known areas and those which are poorest in herpetofauna are the Bulgarian Danube region the land along the former Yugoslavian border, an area forming a 90° angle whose apogee is Sofia, opening to the west, the area known as the "Ludogorieto" or "Wild Forest , the areas around the towns of Razgrad and Turgovisht, and the eastern most sections of the Stara Planina Mountains

The localized areas where rare amphibians and reptiles are found are of special interest and deserve greater attention The search for such areas continues presently

Species Richness

With its 52 species of amphibians and reptiles, Bulgaria's herpetofauna ranks (along with Greece Turkey Macedonia Albania, France, and Spain) among the most diverse in Europe Compared to Northern or Central Europe, Bulgaria has a high de gree of species diversity This degree of diversity is also very high given Bulgaria's limited size (111 000 km^2) Including subspecies, the total number of Bul garian herpetofauna taxa is 70

Rare Species

Nearly all the species that are classified as rare or very rare in Bulgaria are classified as common or nu merous through their entire ranges Only *Coluber ru briceps* is universally classified as rare, for its numbers are minuscule and its habitats rare

Vipera aspis balcanica can also be added to the very rare taxa Buresch and Zonkow (1934) caught only two specimens in Bulgaria the last in 1933 This taxon has not been found outside of Bulgaria

In general, the incidence of rare reptile and am phibian species in Bulgaria is considered low

Endemism

Bulgaria has no endemic species of amphibians and reptiles Bulgaria does however have five en demic subspecies

1 *Cyrodactylus kotschyi rumelicus* (Mueller 1940) Near Plovdiv

2 *Vipera aspis balcanica* (Buresch and Zonkow 1934) A type specimen from near the town of Harmanlie in southeastern Thrace

3 *Coluber rubriceps thracius* (Rehak, 1986) From the southern portion of the Black Sea coast

4 *Ophisaurus apodus thracius* (Obst 1978) Also from the southern portion of the Black Sea coast probably occurs also along the European section of Turkey, and perhaps in eastern (or throughout all of) Greece

5 *Salamandra salamandra beshkovi* (Obst, 1981) From the region near the town of Sandanski Its taxonomic status is unclear

Endemism among the Bulgarian amphibians and reptiles is judged to be low especially when compared to that of the Greek herpetofauna and in particular the island endemics

Important Ecosystems and Unique Habitats

It stands to reason that the most important habi tats for the protection of species diversity are located in areas where the greatest number of species can dwell (see maps)

The regions that are high in species diversity are so rated due to the high incidence of rare, threatened, or protected species They share almost without ex ception the Mediterranean and South European pat tern of distribution In Bulgaria all of these species are encountered within relatively tiny areas Some species occupy only 1% 3% of the territory of Bul garia Thus, for many species (even those that are more widely distributed) the most important habitats are located within extremely small areas serving to support a single population, usually for reproduction Consequently they are places of high population den sity Given that much research has yet to be done, it may be that only an insignificant proportion of these areas is known A description of the areas that have been studied is provided at the end of this report

The maps show that the three "corridors" where the Mediterranean climatic influence is strongest – the Strouma River valley the Maritsa River valley and the eastern Rhodope Mountains and the southernmost portion of the Black Sea coast (south of Bourgas) – are richest in species diversity

At these three locations can be found not only species that are distributed throughout Bulgaria (e g *Bombina variegata Rana ridibunda Rana dalmatina, Bufo bufo Bufo viridis Hyla arborea Podarcis muralis, Anguis fragilis Natrix natrix Natrix tessellata Colubera jugolaris Vipera ammodytes Emys orbicularis*), but also the Mediterranean species such as *Pelobates Syriacus Rana graeca, Mauremys caspica Ophisaurus apodus, Cyrodactylus kotschyi Ophisops elegans Typhlops ver micularis Eryx jaculus Coluber najadum Coluber ru-briceps Elaphe situla, Elaphe quatuorlineata quatuor lineata Malpolon monspessulanus Telescopus fallax*, and others Only the northern European and Euro Siberian species (*Rana temporaria Triturus alpestris, Zootoca vivipara, Vipera berus*) are missing from these three corridors The northern European and Euro Siberian species occur almost exclusively in the high mountains

Several of the Mediterranean species (*Typhlops vermicularis Mauremys caspica Cyrtodactylus kotschyi Malpolon monspessulanus*) are found in all three cor ridors Others (*Coluber najadum Eryx jaculus* etc) occur in only two Still others (*Telescopus fallax Coluber rubriceps Ophisops elegans* etc) are found in only one

Since most of the Mediterranean species inhabit ing these corridors are terrestrial reptiles not directly dependent on aquatic habitats (the exceptions being *Mauremys caspica* and *Pelobates syriacus*), we can con clude that the most important habitats for the protec tion of species diversity are those located slightly above sea level (from 0 800 m a s l) Research in the Strouma River valley near the town of Kresna has shown that most of the Mediterranean species occur on slopes up to an elevation of 450 600 m a s l On rare occasions they reach altitudes of 700 800 m a s l Those species that are widely distributed throughout the country and northern Europe settle on the higher altitude slopes

Based on our current understanding, the best hy pothetical terrain for protection would have the fol lowing qualities an altitude of up to 500 m a s l southeastern to southern and southwestern exposure a highly defined microrelief with crags clifts and ridges especially of volcanic rocks calcareous limestone or scree, mixed vegetation dominated by grass and shrubs protection from temperature inversions, ade quate moisture in the ravines or glens or permanent water sources and a lack of deep valley slopes

Current observations indicate that the three Mediterranean corridors, which possess all or at least some of these qualities are the richest and most inter esting in terms of their herpetofauna This type of terrain is found along the Strouma valley predomi nantly in the lower portion of the slopes enclosing the Petrich Sandanski vale which sharply narrows on its northern end upon the volcanic hill Kojuha and at Pchelina in the southern portion of the Kresna gorge in the Maritsa valley and the eastern Rhodopes, on the southern slopes of Sakara Svilengrad and Ivailovgrad and on the hill sides and low mountain ranges As to the Black Sea coast this type of terrain is found on the eastern slopes of Strandzhja Mountain and along a narrow band 5 to 10 km wide along the sea shore

The sites recommended for protection are speci fied at the end of this report

PROBLEMS RELATING TO THE PROTECTION OF THE BULGARIAN HERPETOFAUNA

Certain specific problems related to the protection of Bulgaria's reptiles and amphibians cannot be ad dressed in other sections of this report

A large portion of the Bulgarian herpetofauna – primarily the central European species many of which have a Mediterranean type distribution pattern – do not require protection measures at least for the pres ent Some of these species have nevertheless been placed under protection with the adoption of Order No 729/1986 They are *Triturus cristatus, Triturus vulgaris Bufo viridis Hyla arborea Rana graeca, Zoo toca vivipara*, and *Anguis fragilis* Other species such as *Bombina variegata Rana dalmatina Rana tempo raria Ablepharus kitaibeli Lacerta trilineata Lacerta viridis Podarcis muralis Podearcis erhardi, Lacerta taurica, Zootoca praticola Natrix natrix, and Natrix tes sellata* are not protected by this order

The populations of these species, both protected and unprotected are generally healthy These species are not used for commercial purposes and the effects of collection by terrarium enthusiasts are insignificant Most of these species are distributed country wide Those species that are more limited in distribution such as *Rana graeca Zootoca vivipara Podarcis er hardi* and *Rana temporaria* have high and stable population number The two *Natrix* species and *An*

guis fragilis are widely hunted due to the traditional prejudice against snakes

The remaining species in the Bulgarian herpeto fauna require, to a greater or lesser extent protection measures In the descriptions that follow, species protected by Order No 729 are marked with an aster isk (*), while those included in the *Red Data Book* of Bulgaria are marked with an exclamation point (!)

* *Salamandra salamandra*

Still frequently encountered in wooded areas throughout almost all of the Bulgarian mountains The highest numbers have been reported along the northern slope on Kom Peak in the western Stara Planina Mountains 84 specimens on a 4 4 5 km route at 700 1600 m above sea level The territory of this species is declining due to the clearing of old decidu ous broad leaved forests predominantly beech forests These areas are often reforested with conifers or left as vacant land *Salamandra salamandra* is commonly destroyed by unknowledgeable locals or tourists

*! *Triturus alpestris*

A rare relict species, with sporadic distribution in some of the Bulgarian mountains In Bulgaria this species is an ice age relict whose populations are en tirely isolated from one other Measures to protect the Alpine Newt must include preservation of the original conditions of all the ponds it inhabits Its wetland meadow habitat in the Petrohan Pass in the western Stara Planina Mountains faced complete destruction as a result of drainage In 1987 a small pond was dug out with a bulldozer in this area, and a population was successfully established The habitat underneath Bog dan Peak at Sredna Gora is entirely gone the ponds in this area having dried up as a result of the clearing of the surrounding beech forest A habitat on the Yaku ruda fishing lake located 2 185 m a s l in the Rila Mountains has also been destroyed having been transformed by a dam with an extremely variable wa terline

Bombina bombina

A relatively rare species whose southern limit of distribution traverses Bulgaria This species is directly endangered It has become extinct in the areas along the Danube In Thrace it has disappeared due to the drainage of the marshes or pollution by petroleum products Special measures for its protection are not yet necessary

* *Pelobates fuscus*

Distributed predominantly in northern Bulgaria it is also found south of the Stara Planina Mountains and (in insignificant numbers) at several locations around Sofia In the future some of these locations may re quire protection, especially the quarry lakes near the village of Dolni Bogrov (some ornithologists have also recommended that this become a protected reserve due to the marsh birds that visit the area)

*! *Pelobates syriacus*

Found primarily in southern Bulgaria Although it is not an endangered species, its richest and most famous location – the wetland across from the Kresna train station in the Strouma River valley – is highly endangered by its transformation into the town's gar bage dump

From 1969 1980 the numbers of this species along the Black Sea coast southeast of Bourgas were drastically reduced due to increased use of insecticides against mosquitos and destruction of their food sources by construction of tourist complexes In 1991 it was determined that the populations of this frog had recovered to 1964 66 levels

* *Bufo bufo*

Frequently encountered, particularly along the lower mountains Some populations are endangered as a result of exploitation for their skin secretion (which is unlawful) The Valeka company in Ahtopol southeast of Bourgas raises these frogs for commercial purposes Their unsympathetic appearance often leads to their destruction, especially during their reproduc tive period, by children

Rana ridibunda

The most commonly encountered frog in Bul garia It is quite numerous and unaffected by pres sures from the human population It is used commer cially as a food source and is exported Domestic con sumption ranges from 6 8 tons annually Exports, which began in 1959 reached record totals (281 tons) in 1971 Today 15 18 tons are exported annually pri marily to France Though the species cannot be said to be endangered in Bulgaria the great reserves found in the major ponds have been greatly reduced due to exploitation pollution and the drainage of ponds A major reason for the reduced export trade is the low wholesale price offered to the frog gatherers in the last 2 to 3 years

Every spring the Ministry of Environment deter mines the period during which frog hunting is forbid den (to allow the frogs to for reproduce) and sets a quota for export quantities A 2 3 year temporary halt is required for populations in exploited areas to rees tablish or replenish their numbers In certain regions – for example Plovdiv Pasardzhol and Yambol – the frog resources have been exhausted In other areas the frogs are not captured at all

*[r] *Testudo graeca* and *Testudo hermanni*

These two tortoise species are widespread but their numbers are rapidly declining especially in low land regions subject to intensive agriculture They are also traditionally used for food, for "medicinal treat ments' and as live souvenirs gathered by Bulgarians and foreigners alike in the low mountain areas and along the Black sea coast Areas in Bulgaria that have tortoises are shown on Map 1 with a scaled rating The map is based on a written questionnaire sent in the years 1976 1979 to all inhabited areas of the country, and on surveys of their abundance in territo ries near 111 villages

Tortoise consumption among the Bulgarian population is shown on Map 2 In 1981, Order No 128 was issued by the MOE, providing complete pro tection of the land tortoises over the entire territory of the country effective over all seasons In 1985 the In stitute of Zoology and the MOE issued a poster calling for the protection of tortoises and disseminating the text of the protection order From 1986 to 1989, some 7,000 posters were distributed and posted at around 3 000 sites in the country

Order No 729/1986 placed the tortoises under a still tighter protection regime The order not only for bid their destruction but deemed their capture an 'indismissable offense This has allowed sanctions to be imposed when poachers are caught even if the tortoises are immediately released Restaurants that specialized in cooking tortoise have shut down In formation about the tortoises protected status as well as their uselessness for medicinal treatments," was also broadcast on radio and television Many poach ers were heavily fined and this fact too was broadcast All of this resulted in a drastic reduction in the de struction of tortoises, while live capturing has become social stigmatized Unfortunately tortoise protection work has declined in the last few years due to a short age of finances and a general lack of respect for the law on the part of most Bulgarians

* *Emys orbicularis*

This species is not as acutely endangered as the tortoises It has suffered eradication throughout much of its traditional range due to the drainage of marshes, corrections or changes in the river channels and ba sins, and capture by terrarium enthusiasts However it has reestablished itself along newly built microdams ponds, and fish farms This species is not used for food or 'medicinal treatments " Many turtles, how ever are destroyed when they are caught by line or captured by the nets of fishermen Special measures for their protection will need to be undertaken in the near future

*[I] *Mauremys caspica*

Extremely limited in distribution A number of the inhabited ponds were destroyed in the Pet rich Sandanski plain near the volcanic hill Kojuha as a result of a land reclamation project These ponds had in fact been created several decades earlier as part of a land improvement program Another of its habi tats near the village of Slaveevo in the Ivailovgrad area is heavily polluted with petroleum products emitted by the Ivailovgrad metals plant The Karcho via Sazluk wetland near Svilengrad has been drained almost entirely However, the species has retained significant numbers within a 1 km distance of the neighboring floodplain created by the local river

In the years 1974 to 1979, Bulgarian and foreign tourists completely destroyed the population of two species of marsh turtles that inhabited the little river that flows into the Black Sea along Ahtopol's northern beach Meanwhile in the artificially created carp ponds near Levunova and Lebnitsa not too far from Sandanski numerous populations of *Mauremys caspica* have been observed breeding in man made ponds mi crodams and water filled sand quarries Others have been observed in Svilengrad in the village of Man dritsa and near Ivailovgrad as well as other places The total number of this species in Bulgaria is esti mated at between 600 and 1000 (Beshkov 1987)

* *Cyrodactylus kotschyi*

In Bulgaria this species almost always inhabits human habitats "Wild" populations have been ob served in the Sozopol and Primorsko regions The species is directly endangered Foreign poachers have been observed on many occasions capturing these liz ards In one 3 hour nocturnal observation period near the village of Kulata by the Greek border along the Strouma River valley, nearly 70 individuals were seen

Lacerata gilis

This species is neither hunted nor captured Al though it is still commonly encountered in the moun tains in western Bulgaria this species should be care fully monitored as it has virtually disappeared around Sofia in the past 30 years The reasons are unclear

*[I] *Ophisops elegans*

Found in Bulgaria in a small area near the village of Mandritsa in the eastern Rhodope Mountains Their occurrence near the village of Mesek in the Svilengrad area has not been reconfirmed during sev eral visits over the last 15 years Their numbers near

the village of Mandritsa are satisfactory Anthropo genic pressures on this lizard and its habitats do not exist at this time

*! *Ophisaurus apodus*

Under heavy anthropogenic pressure This spe cies is directly destroyed due to its snake like form and is also captured by foreign poachers (14 individuals were seized from a Czechoslovakian collector near So zopol in 1987) Its presence along the Strouma River valley noted in 1916, has not been reconfirmed Nei ther have they been reconfirmed in the last 25 years in former habitat south of Russe Along the Black Sea coast the tourist invasion has considerably reduced the territory inhabited by this species This is particu larly true of the 2 3 km zone that runs along the coast The status of the species is good in Sakhar the east ern Rhodopes the neighboring hillsides in Thrace and in locations at Strandzha Mountain

*! *Typhlops vermicularis*

Because of its hidden underground existence this species is considered very rare and is included in the Bulgarian *Red Data Book* Nocturnal studies con ducted over the past 10 years indicate that its numbers in known habitats and in many newly discovered lo cations are very high There is no danger of this spe cies disappearing from the Bulgarian herpetofauna Unfortunately though its most interesting location was destroyed by urbanization This site was near mineral hot water springs near the village Varbara, Pazardzhik It represented the northern limit of this species on the Balkan Peninsula and existed only be cause of the specific temperature conditions of the land around the hot spring

*! *Eryx jaculus*

The status of this species is of great concern Its northernmost location near the village of Tatari Svishtov has been destroyed as a result of reforesta tion of its hill habitat with acacias nearly 35 40 years ago Some populations in southern Bulgaria (near the village Lilyanovo Sandanski and Nadezhden Har manli) have been seriously damaged by foreign and Bulgarian collectors In the remaining habitats the species' numbers are meager In a number of localities its survival is threatened by the capture technique of turning over stones or rocks This can in a short time destroy a large portion of its population

* *Coluber jugularis*

This species is extremely numerous in Bulgaria However its number have been drastically reduced in the extensive agricultural plains of northern Bulgaria and Thrace Many are destroyed not only through traditional means but by being run over on the roads

*! *Coluber rubriceps*

Seriously endangered as a result of poaching by foreign and domestic collectors Its dwelling sites are tiny and consequently are inhabited by very few indivi duals From the publications of foreign specialists, it is apparent that tens of individual specimens have been made available by "collectors" prior to and subsequent to the publication of the Bulgarian *Red Data Book* and Order No 729/1986 We do not recommend ter ritorial protection as this would precisely pinpoint their dwelling sites for the poachers Perhaps some form of on site control of the snake hunting process might be more effective

*! *Elaphe quatuorlineata quatuorlineata*

Extremely endangered species It inhabits only about 3% of the Bulgarian territory and these areas are heavily populated As a large and slow moving snake, it is frequently destroyed by local people In the Petrich Sandanski valleys it has been drastically reduced in number, and is now found mainly along the lower slopes of the surrounding mountains It is also found in isolated island like habitats, such as the vol canic hillside Kojuha

* *Elaphe quatuorlineata sauromates*

Also of concern At the end of the last century this snake was very commonly found in northern Bul garia During the past 40 years only 2 have been found in northern Bulgaria The primary cause of its catastrophic reduction is the radical transformation of the landscape due to collectivized farming No territo ries or refuges survived for this readily noticeable snake to use Conditions are similar with the northern Thracian plain 3 known occurrences in the As senovgrad area during the last 31 years! The situation is somewhat better in the eastern Rhodopes, Sakkar the Derven heights, and at Strandzha Mountain In these areas, no particular changes in its numbers ap pear to have occurred over the past decades It is taken by foreign poachers Six specimens were found captured by citizens of the former German Demo cratic Republic in 1986

*! *Elaphe situla*

An extremely common species along the Strouma River valley, even though it is an object of poaching and of destruction by local residents One individual was reported near Assenovgrad (southeast of Plovdiv) nearly 100 years ago but its occurrence in this region has remained unconfirmed since then The species has been greatly reduced in the Sozopol area (south of Bourgas) as a result of direct destruction and urbani zation of its terrain in connection with the tourist inva sion According to information from foreign col leagues a Czechoslovakian citizen dug up a winter hi

bernating site and captured several tens of *Elaphe situla* nearly 4 5 years ago Protection of the Sozopol population is very difficult, and a solution to the situation is hard to imagine

*! *Elaphe longissima*

Very commonly encountered throughout Bulgaria It is included in the Bulgarian *Red Data Book* due to its inclusion in the European *Red Data Book* Destruction or reduction of old deciduous forests and the hollowed out trees where they lay their eggs are potential dangers This species is also frequently destroyed by local people or tourists due to traditional prejudices It is most endangered in regions with intensive farming and in the mountain foothills, where forests are most commonly being cleared

* *Coronella austriaca*

Commonly encountered Parts of its range have been destroyed by human activities Conversely other terrains perhaps larger in size, have become hospitable to its existence This is mainly a result of clearing of the deciduous broad leaved forests There are no direct dangers to its existence in the country or over large

* *Malpalon monospessulanus*

Greatly increased in numbers in the Strouma River valley where it was unknown prior to 1960 From 1961 to 1970 4 5 individuals were found 13 were found from 1971 80 during which time extensive research was undertaken From 1982 to 1990 30 32 individuals were located using no more intensive methods This radical increase in numbers is probably due to global scale phenomena (possibly increased aridity and xerophilization of the vegetation due to global warming) No apparent changes in numbers have occurred in the remaining portion of the Bulgarian segment of its range Observations, however have been infrequent

*! *Telescopus fallax*

Considered an extremely rare species since its status was first determined in 1953 Nocturnal research conducted along the Strouma River valley has shown that under appropriate conditions, this snake is not especially rare During the past 5 years 12 or 13 individuals have been captured Nearly 10 other young specimens have been run over on the roads along a frequently visited segment of the Kresna gorge This species, like *Malpolon monspessulanus* is probably increasing its numbers along the Strouma River valley

Vipera ammodytes

Widely distributed throughout Bulgaria During the last 3 years it has become an object of increased attention by snake catchers who sell the specimens to snake farms for the extraction of poison for export Hunting has seriously injured the populations in its richest habitats – namely, the southeastern quarter of the country as well as the Petrich and Sandanski region, northwest Bulgaria (Belogradchik), the Iskar gorge north of Sofia, and the southern slopes of Sredna Gora in Stara Zagora Poaching or capture has taken place not only during the hot months but through the autumn, winter, and early spring Poachers have dug up their winter refuges converting them into essentially open traps, useless as hibernating grounds in subsequent years In March 1991 the MOE issued an order banning the capture of this species through excavation of its winter habitats as well as trade and exchange, in the period between 30 September and 30 April An annual quota of 2 000 3 000 individuals was also instituted The establishment of new snake farms can be undertaken only after approval of the conditions for their breeding by the regional inspectors for environmental protection

Export of *Vipera ammodytes* is permitted with an agreement from the MOE At present there are 40 regulated snake farms along with 20 25 unregulated ones Fortunately this business has not produced the expected income, and many practitioners have gone bankrupt During the next 3 4 years capture of this species is expected to decline It is anticipated that this will allow the populations to reestablish themselves in the most heavily exploited areas Concurrently in areas where the snakes are less numerous and where capture has not taken place the snakes have maintained their numbers As a result of human activities especially on the lower mountain slopes new areas conducive to *Vipera ammodytes* are being created through the clearing of ancient forests, erosion of the terrain degradation of pastures and so forth

Vipera berus

Confined almost exclusively to the high mountains It is not subject to poaching The decline of tourism over the last 3 4 years has reduced the number of destroyed specimens Special measures are unnecessary at present

!! *Vipera aspis* and *Vipera ursinii*

Listed in the Bulgarian *Red Data Book* as extinct species

IMPACT OF HUMAN ACTIVITY

1 Human Activities With Negative Impacts

a Intensive farming in the plains which entails the creation of large monoculture tracts and homog enization of the landscape has a very negative impact in particular on the two species of *Testudo Elapha quatuorlineata sauromates, Elaphe longissima and Coluber jugularis* This trend also affects *Bufo bufo Hyla arborea Ablepharus kitaibeli, Anguis fragilis, Lac erta viridis Lacerta trilineata Lacerta taurica Coronella austriaca* and *Vipera ammodytes*

b The cutting of broad leaved deciduous forests and their replacement with conifers combined with the creation of clearings, eroded lands and other open areas, has a heavy negative impact on *Salamandra salamandra Bufo bufo Rana dalmatina Zootoca prati cola, Elaphe longissima*, the two species of the genus *Testudo* (in particular), *Anguis fragilis* and others

c Drainage or pollution of ponds and the correc tion of river courses have an unfavorable impact on all amphibians, and in particular on *Triturus alpestris Bombina variegata Rana esculenta Rana temporaria* and *Rana graeca* due to the character and location of their habitats have also been affected by these factors though to a somewhat lesser degree Among reptiles, the negative impacts have been definitive for the two species of the genus *Natrix* and *Mauremys caspica*

d Actual destruction instigated by local residents due to traditional prejudices, has an unfavorable im pact on the populations of *Salamandra salamandra Bufo bufo Anguis fragilis Ophisaurus apodus* as well as all species of snakes *Emys orbicularis* and *Maure mys caspica* are frequently destroyed by fishermen who catch them with lines or capture them in nets

e Commercial use affects most heavily the populations of both types of tortoises of the genus *Testudo* and to a lesser degree *Vipera ammodytes* The populations of *Rana ridibunda* are also heavily impacted They, however can reestablish themselves quickly – within a 2 3 year period following the cessa tion of commercial exploitation

2 Human Activities With Positive Impacts

a The clearing and replacement of the old growth deciduous broad leaved forests has created new dwelling sites for both species of the genus *Testudo* Other species that have benefitted from this trend are *Ablepharus kitaibeli Ophisaurus apodus Podarcis muralis Podarcis erhardi Lacerta agilis Lac erta viridis Lacerta trilineata Lacerta taurica Ophisops elegans Eryx jaculus Coluber jugularis Coluber na jadum Elaphe situla Coronella austriaca Malpolon monspessulanus, Telescopus fallax*, and *Vipera ammo dytes*

b The uncovering of rocky surfaces and the breaking up of rocks during road construction quar rying work, etc can have a beneficial impact on some species especially on the plains and in grassy or for ested areas Species that settle in these places are *Podarcis muralis Podarcis erhardi, Lacerata viridis Lacerata trilineata, Ophisops elegans* and at times *Coluber jugularis* and *Coronella austriaca*

c The creation of new ponds pools, or flooded areas near fish farms microdams, and potable water sources has a positive impact All species of amphi bians with the exception of *Salamandra salamandra* and *Rana graeca* settle and reproduce in these aquatic habitats Nearly 70 75% of the ponds inhabited by one or more species of amphibians within a 20 km ra dius of Sofia have been man made This includes ponds created by U S bombs dropped during World War II *Emys orbicularis* and *Mauremys caspica* also settle in these artificially created ponds They nearly compensate for the destruction of the species due to the drainage and pollution of the natural ponds The same is true of both species of the genus *Natrix*

In general it can be stated that human activity has increased the area inhabited by the xerophilous species predominantly reptiles with Mediterranean and southern European distributions At the same time, human activity has limited the moisture loving forest species primarily those with central European distributions The destruction of natural ponds has been compensated to a great extent by the creation of artificial ones

KNOWN DANGERS

Aside from the well known dangers to the global biosphere that have resulted from human activity the following represent concrete dangers to the Bulgarian herpetofaouna

- Continued denudation of the country's forest lands especially the reduction in area of the de ciduous, broad leaved forests In the previous section we have clarified which species are en dangered and which enlarge their range as a re sult of clearing

- Further drainage and pollution of ponds We can expect that the creation of new ponds will be drastically reduced under the new economic con ditions but no reduction in pollution is foreseen

- Increased interest in rare interesting or beautiful amphibians and reptiles by Bulgarian and foreign terrarium enthusiasts and traders in pets The number of Bulgarian terrarium enthusiasts is

rapidly increasing, and hundreds of animals are captured for domestic breeding This includes species cited in Order No 729 There now exists a Bulgarian company that with an MOE permit exports hundreds of unthreatened amphibians and reptiles to pet stores in Great Britain This is a dangerous precedent and directs attention to this type of a business which without doubt would eventually attempt to export illegally some rare or endangered species that are in demand by foreign pet store owners The sums of money they offer are extremely attractive to our poachers

- Urbanization, construction, and other anthropo genic changes in the habitats of the species with sporadic distributions At the same time, the pre sent and forthcoming restitution of private lands offers some limited optimism The process might prove to be a boon to some species, principally the lizards and to a lesser extent the snakes This would result from the subdivision of the land into smaller segments and the presumable crea tion of borders, amongst which shrubs, individual trees stone fences or other small structures with beneficial building materials may be placed Such a landscape is from a conservation standpoint, preferable to the monocultures inherited from collectivization

IMPORTANT AREAS FOR BIODIVERSITY

This section identifies areas that are important for the protection of herpetofaunal biodiversity as well as particular places that are important for the existence of specific populations It is recommended that these areas receive greater attention in future protection ef forts

The following territories contain the greatest di versity of species

1 The volcanic hill Kojuha, between the towns of Petrich and Sandanski in the Strouma River val ley This area is presently protected, but is under heavy human pressure from construction activi ties quarry mining land reclamation projects and increasing travel (which entails an increase in poaching) A total of 26 species – 7 amphibian species and 19 reptile species – exist in this area Seven of these are listed in the Bulgarian *Red Data Book*, while 16 are protected by Order No 729/1986 of the MOE Kojuha also supports a large number of other Mediterranean plants and animals and is the single Bulgarian site for many Its protection should focus on their preservation

2 The characteristic terrain found along the south ern end of the Kresna gorge in the Strouma River valley We propose that the present Tissata Re serve be maintained as an important appropriate habitat for the herpetofauna Although it was es tablished primarily for the population of *Juniperus excelsa* and other rare Mediterranean vegetation it is also inhabited by 7 species of amphibians and 18 species of reptiles Of these 5 are listed in the Bulgarian *Red Data Book* and 16 are protected by Order No 729/1986 The Tissata Reserve is relatively free of human impact (although it is used illegally for grazing goats) and its protection would create far fewer obstacles than the protec tion of Kojuha

3 Protection of the Ropotamo Maslen Nos area along the Black Sea coast east of Sozopol The exact borders and status of this area are presently being determined The territory has a rich variety of plants and animals Thirty one species of the examined groups – 8 amphibians and 23 reptiles – are found within it Of these 6 species are in cluded in the Bulgarian *Red Data Book* while 19 species are protected by Order No 729/1986 The northernmost habitat of *Coluber rubriceps* which in Europe is found only in the narrow band of sea coast south of Sozopol is found there

The following territories are important for the ex istence of the specified populations and also deserve special attention

1 The marshy plain along the Petrohan Prohod, in the western Stara Planina Mountains with an al titude of 1380 1400 m a s l The one relict popu lation of *Triturus alpestris* in the Stara Planina sur vives here and is artificially supported by a spe cially made pond constructed in 1987 At the same place live the remaining 3 components of the high mountain herpetological complex – *Rana temporaria*, *Zootoca vivipara* and *Vipera berus* Protection of this location would not affect any special interest

2 The protected area around the Muhalnitsa wet land south of Botevgrad 63 km northeast of Sofia It is protected by Order No 328/8 5 1992 issued by the MOE The protected area includes 1 9 hectares of land Several hundred sexually mature *Rana temporaria* arrive at this tiny (in terms of size and depth) swamp in the late winter and early spring descending from the high mountain of the neighboring Bilo Planina to re produce After a 7 25 day stay they return to the high areas of the mountain The distance trav elled ranges from 4 5 to 10 5 km with vertical mi grations between 450 950 m a s l

This is the largest periodic migration yet ob served in the amphibian world It has been ex plained as a result of the coming of the end of the Vurm" glacial period and the warming of the climate During this period the ancestors of all the other populations of this species in the Balkan peninsula have retreated to the high mountains

However, the ancestors of the population at the place in question adapted by climbing up the mountain which lacks ponds appropriate for re production Consequently, every year, the frogs have returned to reproduce at the original birth place in the plain, of their ancestors To protect this site the requirements in the order issued for its protection need to be strictly followed

3 The swamp across from the Kresna train station in the Strouma River valley, used by *Pelobates syriacus* for reproduction It is located 70 100 m away from the train station Several hundred in dividuals of the above mentioned species use it as their reproductive grounds During the past two years it has become a dumping ground and there is an immediate danger that the richest Bulgarian population of this species will disappear Meas ures for cleaning up this habitat need to focus on the restoration of the site to its condition prior to its pollution with waste

GENERAL RECOMMENDATIONS

As general measures to protect the species diver sity of the Bulgarian herpetofauna, we recommend

1 A wide ranging campaign to inform the public of the protected status of the rare and endangered species with particular attention paid to the lack of danger from snakes and the direct practical use of these species (for example, *Bufo viridis*) It should include a message about the importance of biodiversity and ecosystems

2 Wide spread communication of the official acts issued for the protection of species and habitats At present the Bulgarian population is virtually uninformed as to which species are protected and which collection activities are permitted or pro hibited All the poachers that have been caught have excused themselves by citing their lack of knowledge of the law, and the fact that the pro tection acts have not been popularized

3 Mutual cooperation among environmental pro tection organizations and personnel – the regional inspectors for the protection of the environment non governmental organizations, outdoor enthusi asts, mayors and other municipal officials na tional forest rangers, customs officials, police, and so forth – for rapid response to poaching and other destructive acts Perhaps the best solution would be the creation of a "green police " A "green telephone hotline" should be established, and its number advertised to alert officials of violations

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The Bulgarian Ornithofauna

Tanyu Michev and Petar Iankov

SUMMARY

This report presents a brief review of the history of ornithology in Bulgaria Several stages in its development are described The contributions of Bulgarian and foreign scientists to our knowledge of the Bulgarian birds are noted, as are the important publications (e g , Reiser 1894 Patev 1950 Simeonov et al , 1990, Simeonov and Michev, 1991)

The second part of this report describes major gaps in knowledge and research needs The species composition of the Bulgarian birds is well known but subspecies affiliations of the birds in several orders have been insufficiently studied The delineation of ornitho geographical provinces of the country is incomplete Establishment of ornitho geographical districts will be possible only after full regional investigation of the Bulgarian territory The birds of many large areas – the Danubian plain the mountains near the border with Serbia and Macedonia (excepting the Stara Planina and Ograzhden), the Rila Mountains the western Rhodope Mountains – have not been well investigated Certain biological characteristics (feeding and food habits, eggs shapes, sizes, and colors incubation periods, hatching, molting periods etc) of the majority of the Bulgarian birds are insufficiently studied Full inventory of the birds of the protected areas has not yet begun The emphasis in future studies should be on the preparation of the "Atlas of the Breeding Distribution of the Bulgarian Birds " Investigations of the influence of agricultural changes on the Bulgarian avifauna are essential Research should also be undertaken to derive solutions to several current problems (e g , conflicts between birds and fish farms between birds and aviation and between birds and powerlines)

The third part of this report provides a current assessment of the Bulgarian avifauna according to 10 criteria

1 Poorly known geographic regions Eleven geographic regions where the species composition of the birds has been insufficiently studied are identified The largest of these is the Danubian Plain, the smallest is Bakadzhicite

2 Species richness The number of established species, the number of breeding species, the area (if data are available) and the sources of information for 22 geographic regions are presented The number of species is greatest in the eastern Rhodope Mountains, where in an area of 6005 km^2 258 species of birds have been established Of these 167 are breeding species

3 Rare species Sixteen species are accepted as globally threatened and 61 rare and threatened bird species from the Bulgarian *Red Data Book* are noted Unpublished information (including information from the *Atlas of European Breeding Birds* was also used Rare species are most concentrated in the region of the Bourgas Lakes

4 Endemism Endemism has not been established for any members of the Bulgarian ornithofauna

5 Unique ecosystems habitats and communities Two globally significant sites are discussed Pirin National Park and the Srebarna Nature Reserve The region of Durankulak and Shabla where almost all of the world's population of the red breasted goose (*Branta ruficollis*) winters is also of global importance Several other geographical regions of European and national importance are noted

6 Ecological services The Via Pontica – one of the largest and most important bird migration routes in Europe – and other smaller migratory routes are described The main winter waterfowl concentration points (Shabla, Durankulak, the Bourgas lakes Ovtcharitsa reservoir) are also noted

7/8 Fragility and threats These are depicted together on a single map The authors regarded wetland ecosystems as the most threatened and fragile ecosystem type followed by the alpine parts of the high mountains Several known threats (direct persecution habitat destruction etc) are pointed out

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9 Sites containing the most representative samples of Bulgaria s biodiversity This list was prepared on the basis of 15 habitat types according to the classification proposed in the CORINE Biotope Project Habitat types are represented by differ ent colors on the applied map

10 Species of proven or potential economic impor tance The white fronted goose cormorant, star ling and white stork are included in this group of species

Past, current, and potential threats to the survival of the biota are described in the fourth part of the re port Current and potential menaces are emphasized

Proposals for the conservation of the Bulgarian avifauna are offered in the report's conclusion The discrepancy between the existing protected areas (which are concentrated in the high mountains) and relatively low elevation but species rich areas is pointed out The authors recommend that scientific studies be intensified due to accelerated rates of deg radation and the loss of Bulgarian faunal integrity

A BRIEF HISTORY OF ORNITHOLOGY IN BULGARIA

Bulgaria's avifauna has long been of the utmost interest This is due to the fact that Bulgaria with its special central location in the Western Palearctic re gion and the Balkan Peninsula, includes parts of four biogeographical provinces (according to Udvardy s 1975 classification) This is a rare phenomenon for a country with such a small (111 000 km^2) territory

Scraps of information about Bulgaria's birds have come down to us in the works of the writers and natu ralists of antiquity Some data about the more ordi nary bird species in Bulgaria can be found in Old Bul garian literature The pastoral eulogy of the creation in John the Exarch s Hexameron mentions about ten species of birds More exact data have been found in the descriptions of travellers during the Renaissance

The information on birds contained in the fifth volume of the six volume work by Conte Luigi Fer nando de Marsilli (1650 1730), founder of the Acad emy of Sciences in Bologna proved to be the earliest of real scientific importance This volume, published in 1726 is entitled *A Description of the Danube from Kalenberg Mountain in Austria to the Mouth of River Jantra* One of the earliest explorers of nature of Bul garia the Hungarian scientist academician Emerich (Imre) von Friwaldsky (1779 1874), organized four natural history expeditions in Bulgaria, and took part himself in two of them He provided data on certain species of birds found in the foothills of the Rhodopes near the town of Stanimaka (now Assenovgrad), and in 1838, using a specimen found in Plovdiv, described the turtle dove as a species new to science

From the second half of the 19th century on for eign ornithologists who had visited certain parts of Bulgaria or who travelled throughout the country regularly published their findings The first attempt at a more thorough study of the Bulgarian avifauna was made by O Finsch who in 1859 published data on the distribution of 178 bird species Papers by many authors (E Hodek C Farman H J Elwes, T E Buckley L Lorenz Liburnau W N Radakoff L Kalbermatten E F Homeyer and G Sintenis) ap peared in this period The great contributions made by Georgi Christovich (1863 1926) the first Bulgarian ornithologist, should be pointed out At the time he was in charge of the natural history collections of the Higher School in Sofia (now Sofia University "St Kli ment Ohridski") He was the founder of the first or nithological collection and author of 150 articles on our fauna

Dr Othmar Reiser (1861 1936) curator of the museum in Sarajevo, had special significance not only to Bulgarian but to Balkan ornithology He published a four volume series *Materialen zu einer Ornis Bal canica* the second volume of which was devoted en tirely to the birds of Bulgaria This volume was used by Dr E Klein in writing his popular science book *Our Birds* (1909)

During the first half of the 20th century, orni thological studies were undertaken in Bulgaria by V Varbanov, V Vlaskov, K Kuzev V Kovachev A Petrov N Radev I Sokachev, P Drenski, and V Strybrni and by the foreign ornithologists K Ander sen H Boetticher, D Gengler A Jordan B Rensch H Schumann G Wallis, A Wolf and many others

The Bulgarian Bird Banding Centre was founded in 1928 Its first director was Pavel Patev (1889 1950) who was engaged in bird banding and other research work He wrote the monograph "Birds of Bulgaria" on the basis of data from the literature and his own stud ies This monograph became the *vade mecum* for gen erations of ornithologists Paralleling his research work he engaged in wide ranging activities as a mem ber of the Union for the Protection of Nature for the preservation and protection of birds In 1940, on his initiative Srebarna Lake was proclaimed Bulgaria's first bird refuge

Nikolaj Boev (1922 1985) continued the work of Patev He worked at the Zoological Garden in Sofia at the Institute of Zoology of the Bulgarian Academy of Sciences and at the Research and Coordinating Centre of Ecology and Environmental Protection He undertook broad scientific research and environmental work not only as regards birds but the entire spectrum of biodiversity in the country It was his idea to com pile the Bulgarian *Red Data Book*

In the last 20 to 30 years ornithological studies in Bulgaria have become better planned, more purpose ful and better supported with finances equipment, and staff Ornithological research is now performed

by the Institutes of Zoology and Ecology of the Bul garian Academy of Sciences the Faculty of Biology at Sofia University the Forestry Institute Plovdiv Uni versity, the Museums of Natural History in Plovdiv, Kotel and Srebarna and the natural history depart ments of the museums in Bourgas, Varna, Pleven, Russe Belogradchik Dobrich and Blagoevgrad, among others Research work is also assisted by hun dreds of amateurs many of whom are members of the Bulgarian Society for the Protection of Birds and the Bulgarian Ornitho Centre Publication of a "Bulletin of Ornithological Information" has recently begun and long term stationary research has been initiated at the biosphere reserves of Srebarna Rupite and Atanassovsko Lakes

Additions to the ornithological collection of specimens eggs and nests at the National Museum of Natural History are constantly made This is the old est collection in the Balkan Peninsula and contains more than 10 000 eggs from about 1 000 bird species (approximately 1/9 of the world's avifauna)

In recent decades a number of important ongoing ornithological projects have been undertaken some of which still continue

- Mid winter counts of the birds of Bulgaria Since 1977 field investigations of the species composi tion and numbers of birds have taken place annu ally in the middle of January This project covers the most important natural and artificial wetlands in the country Additional information about winter populations of the birds of prey and pas serine birds is also collected

- Investigation of bird migrations Banding activi ties have been carried out since 1929 In recent years this work has been especially intensive (some 30 40 000 birds are banded every year) Up to the present about 300 000 birds of more than 250 species have been banded

- Autumn migration of soaring birds along the Black Sea coast Since 1978 observations have taken place annually between August 10 and Oc tober 30 Abundant information about bird num bers and population dynamics for almost all birds of prey as well as for pelicans storks and cranes is collected In addition to visual observations radar has been used

- Participation in the International Project for the Development of a Network of Important Bird Ar eas (IBA Project) guided by the International Council for Bird Protection (ICBP) Results have been published

- Participation in the international project Atlas of the Breeding Distribution of the European Birds guided by Johan Bekhuis of The Netherlands

- Participation in the international project on the distribution of dispersed bird species, guided by Graham Tucker of the ICBP Results have been published in a Preliminary Report

During the last few years several primary orni thological works have been published including Vol ume 1 of the *Fauna of Bulgaria Aves* (Volume 2 is being prepared and work on Volume 3 is on going) and the *Field Guide of the Birds of the Balkan Penin sula* (a Peterson type guide) Some new trends and methods in Bulgarian ornithology (urban ornithology, radar ornithology, paleo ornithology, marking with colored bands, etc) have been initiated An especially positive trend is the significant increase in the number of bird watchers in Bulgaria All of these shall con tribute to the realization of the "Atlas of the Breeding Distribution of Bulgarian Birds " based on a 10 km-grid format These trends also hold promise for the more effective protection of Bulgaria's avifauna

GAPS IN KNOWLEDGE

Despite the fact that species of birds new for Bulgaria are found almost every year, the species composition of the Bulgarian avifauna is well explored However the situation with bird subspecies is not the same This gap in our knowledge is especially impor tant in terms of bird that migrate across or winter in Bulgaria They belong mostly to the orders Passeri formes or Charadriiformes The lack of data about subspecies is due to the fact that biometrical and mor phological studies have not kept abreast with other ar eas of ornithological study This is why for example data about body sizes weight and other morphologi cal features are still taken from foreign sources

We have not yet been able to divide our territory into ornitho geographical regions or districts despite the serious attempt of Georgiev and Simeonov (1992) to do so It will be possible to solve this problem only as the gaps in the regional investigations of the Bul garian territory fill up The species composition of the birds of many large geographical regions – the Danu bian plain the mountains along our western border (except the Stara Planina and Ograzhden) Belasitsa Slavyanka the western Rhodopes and Rila Moun tains) – has not been completely investigated Some of the regional studies (such as those of the Stara Planina and Pirin Mountains) were conducted decades ago and must therefore be updated

For the majority of Bulgarian birds, a number of biological characteristics (feeding and food habits egg shapes sizes and colors incubation periods hatching molting periods manner and places, etc) are incom pletely or insufficiently studied Systematic and com plete information about the periods character and migration routes of the migrating birds is lacking In formation on the concentration points and staging ar eas of birds during migration periods is also insuffi

cient Despite the increased number of birds banded in Bulgaria during recent years, the wintering sites of the Bulgarian birds are poorly known Data about the negative factors that affect bird populations at on their wintering grounds are scarce For example only when most of the Dalmatian pelicans of the Srebarna re serve were banded with colored plastic bands was it established that they over winter in Porto Lago (northern Greece) It was further discovered that many of them perish as a result of collisions with a power transmission line that is located between their roosting and feeding places

An inventory of the avifauna of all natural re serves, national parks, and other protected areas has not yet begun There is no information about trends in the population numbers, nesting success, or the nega tive factors that influence bird populations in the pro tected areas Answers are lacking for two basic ques tions 1) Does the Bulgarian network of protected ar eas cover the needs of the birds and if so to what de gree? 2) What changes or additions to the network should be made to make it more effective for the pro tection of the birds? There are no serious studies of the population dynamics ecological requirements and influence of anthropogenic factors on the birds in cluded in the Bulgarian *Red Data Book* The influ ence on the birds of heavy metals, artificial fertilizers, and different chemical substances (herbicides insecti cides, toxic wastes, etc) and of oil pollution in the water basins is incompletely studied The possibilities for cooperation in protecting birds that sojourn in Af rica the Orient, and the Middle East after their breeding period have not been investigated

RESEARCH NEEDS

Changes in economics and agriculture have cre ated a need for correct information on the winter and summer distribution of the birds over the whole terri tory of Bulgaria i e for an 'Atlas of the Breeding Distribution of the Birds in Bulgaria" and an 'Atlas of the Winter Distribution of the Birds in Bulgaria " Some European countries have published second edi tions of such atlases while others have completed winter atlases, Bulgaria in the meantime has fallen behind Such atlases provide a substantial basis for tracing changes in species composition over long peri ods of time They aid in the correct determination of threatened vulnerable and rare bird species They would undoubtedly help to distinguish the ornitho geographical regions or districts of our country

Compiling this information would require the or ganization of a Center for Biological Information In this center, all information on the distribution and numbers of species should be collected, elaborated, and published The compiling of a Bulgarian atlas of breeding birds should be facilitated by the recent pub lication of the *Field Guide of the Birds of the Balkan Peninsula* and by the establishment of the Bulgarian Society for the Protection of Birds (BSPB) A plan to undertake this work has been organized within the BSPB and it will probably produce the atlas

The effect on the avifauna of changes in agricul tural policies and practices (especially changes in field sizes and cropping patterns) needs to be examined For example we know that virtually the entire popu lation of the red breasted goose over winters in South Dobrudzha and feeds in vast sown fields We do not know whether this species will keep the same winter ing site under changing land uses and what measures are needed to guarantee its survival At the same time the problem of crop damage by the red breasted goose needs to be addressed

Ten years have passed since information for the *Red Data Book* was collected It is very important to check breeding habitats to determine trends in the numbers of every species, to review current protection measures, and to plan new initiatives New species status categories need to be devised and brought into closer agreement with international categories

Research on mid winter numbers of waterfowl and on the autumn migration of soaring birds along the Black Sea coast (a special form of monitoring of many species, including rare and threatened species from eastern Europe) should continue

Another area of investigation ought to involve the influence of artificial fertilizers, heavy metals pesti cides, and other chemical substances on the Bulgarian avifauna The first issue that should be addressed is the extent to which the Bulgarian birds have been harmed by these substances

Solutions to several practical problems also need to be addressed These include the conflicts between birds and fish farms aviation agriculture (including the problem of the damage caused by the more than 150,000 wintering geese) apiculture and power transmission lines

Biometrical morphological, ecological zoologi cal, nidological ornithocenological and ornitho geographical investigations need to be more fully de veloped in the future

CURRENT ASSESSMENT

The assessments presented here are based on published scientific information and on data and ob servations collected by the authors during tours throughout Bulgaria The personal communications of Bulgarian and foreign ornithologists both profession als and amateurs have also been used

Areas Requiring Further Study

The territories listed below have been designated as "poorly known geographic areas ' Although there is scientific information about these areas, it is scarce fragmentary outdated and unreliable and so was not used for the purposes of this report

1 The Danubian plain Located along the Danube's

shore the Stara Planina Mountains and Ludogorie Its area together with south Dobrudzha and Ludogorie (except the Danube shore) is 28 523 km² This region has been heavily influenced by human activity Virtually the entire area consists of agricultural lands "Wild nature" exists only in several valleys of the rivers that cross the plain (Iskar Vit, Ossam Yantra, Russenski Lom Tchernzhalka) Medium species richness

2 Kraischteto Historical geographic area in Serbia and Bulgaria located among Znepole, Radomirska Kotlovina the valley of the Strouma River Kjostendilska Kamenischka Kotlovina, and the valley of Morava River In the Bulgarian territory it includes the following mountains Karvav kamak Milevska planina, Zemenska planina Rudinite Stranzha and Tcherna gora It is covered by sparse deciduous and coniferous forests and is sparsely populated Medium species richness

3 Verila Mountain A mountain in the western part of Bulgaria with orographical connections to the mountains of Rila and Vitosha Its highest point is at 1450 m above sea level (a s l) Covered with sparse deciduous forests except for its deforested southwest part Low species richness

4 Rila Mountains The highest mountain group of Bulgaria and the Balkan Peninsula (2925 m a s l) Its area is 2629 km² The Rilas are rich in coniferous forests (consisting predominantly of *Pinus* and *Picea*) Small areas are covered by *Fagus* forests There are 223 alpine lakes High species richness

5 Maleshevska Planina A mountain of the Osogovsko Belasishka mountain group Its ridgeline serves as the border with Macedonia Its highest point is at 1803 m a s l Forests of *Fagus* and *Quercus daleschampii* predominate Medium species richness

6 Belasitsa A mountain in the southwestern part of Bulgaria Its ridgeline serves as the border with Greece and Macedonia The highest point is at 2029 m a s l *Fagus* forests predominate and at lower elevations are mixed with *Acer pseudoplatanus Platanus orientalis* and *Castanea sativa* Medium species richness

7 Slavyanka A mountain in the southwestern part of Bulgaria Its ridgeline serves as the border with Greece The highest point is at 2212 m a s l Most of the mountain s area is beyond the territory of Bulgaria Forests of *Quercus Fagus* and *Pinus heldreichii* predominate High species richness

8 Western Rhodope Mountains The western part of the Rhodopes, the highest point of which is at 2191 m a s l A portion of this area is in Greece Coniferous forests of *Picea abies*, *Pinus silvestris*, and *P nigra* predominate Deciduous forests of *Fagus*, *Quercus*, and *Carpinus* also occur High species richness

9 Hills of St Ilija and Monastery Hills These hills are located between the small rivers of Blatnitsa and Tundzha Their highest points are at 416 and 600 m a s l respectively The highest areas are covered with deciduous forest Medium species richness

10 Bakadzhicite A hill located southwest of the town of Yambol Its highest point is at 515 m a s l Deforested Low species richness

11 Sakhar Planina A mountain located along the Maritsa, Sazlijska, and Tundzha Rivers The highest point is at 856 m a s l It is covered by sparse deciduous forest Medium species richness

Species Richness

We here use "species richness" in the sense of "number of species " The best, most accurate, and latest estimates from the Bulgarian ornithological sources have been used Two options were available in determining species richness using the total number of established birds or the number of breeding species only We accepted the second option The same approach was used by Simeonov and Georgiev (1992) in describing the zoogeographical characteristics of the Bulgarian avifauna Numbers for both, however are provided in the text that follows The first is the total number of species occurring in a given area the second is the number of breeding species

The classification of groups as proposed in the instructions to the authors is not suitable for characterizing the regions with different species richness in Bulgaria The proposed classification would have allowed us to mention only two groups – those areas with 10 100 species and those areas with 100 500 species We adopted the following grouping system (and the following colors for the applied map Map 20 p)

Green	50 99 species
Violet	100 149 species
Red	150 199 species
Black	200 249 species
Blue	poorly known areas

Determination of species richness was made bearing in mind several potential sources of error The elapsed time between the oldest (Petrov and Zlatanov 1955) and most recent (Milchev, 1991) publications used is 36 years Some authors did not provide information on the exact borders and area of their study sites Finally, the borderlines were plotted

on small scale maps instead of standard topographical maps and thus are inexact

Species richness of the different geographic regions is as follows

1 Danube shore 3500 km² with 122/103 species (Paspaleva Antonova, 1961)

2 Srebarna Natural Reserve 600 ha with 162/103 species (Michev 1968a)

3 Russenski Lom National Park 2227 ha with 110/81 species (Profirov and Undjijan, 1985)

4 Ludogorie 194/54 species (Simeonov, 1975)

5 South Dobrudzha 203/96 species (Petrov and Zlatanov 1955)

6 Varna District 236/136 species (Peshev 1971)

7 Western Stara Planina Mountains 201/145 species (Donchev, 1970)
   7a Iskar Gorge (Iskarski Prolom) 132/78 species (Simeonov, 1967)
   7b Valley of Botevgrad (Botevgradska Kotlovina) 172/112 species (Simeonov et al 1984)

8 Central and Eastern Stara Planina Mountains 230/152 species (Donchev 1971)
   8a Boatin Natural Reserve 1228 ha with ?/80 species (Spiridonov et al 1983)
   8b Tzaritchina Natural Reserve 1420 ha with 134/57 species (Spiridonov et al , 1983)

9 The Rose Valley About 1000 km² with 232/128 species (Donchev 1977)

10 Lyulin Mountain 137/96 species (Georgiev, 1989)

11 Town of Sofia 181 km with 243/106 species (Iankov 1983a)

12 Vitosha Mountain 278 km² with 114/96 species (Donchev 1961)

13 Plana Mountain 99/72 species (Sufi 1990)

14 Mountains of Sredna Gora 5950 km² with 230/152 species (Petrov, 1981)
   14a Lozenska Mountain 127/65 species (Dimitrov 1991)

15 Bourgas District 269/141 species (Prostov 1964)
   15a Atanassovsko Lake Natural Reserve 1050 ha with 214/38 species (Roberts 1985)

16 Strandzha Mountain 2950 km² with 273/147 species (Milchev 1991)

17 Konyavska Mountain 178/109 species (Simeonov and Delov 1989)

18 Osogovska Mountain 126/108 species (Marinov 1989)

19 Trakia 248/127 species (Boev et al 1964)

20 Ograzhden Mountain 166/109 species (Simeonov and Baeva, 1988)

21 Pirin Mountains 2585 km² with 217/156 species (Simeonov, 1986)

22 Eastern Rhodope Mountains 6005 km with 258/167 species (Iankov 1991b)

Analysis shows that species richness within the territory of Bulgaria is lowest in northern Bulgaria and highest in the southern parts of the country The highest total number of resident, migrating, and wintering birds is found at Strandzha Mountain area (273 species as compared with a total of 383 reported for the whole of Bulgaria)

The overview of species richness in Bulgaria obtained as a result of this review allows us to evaluate the poorly known geographic regions on the basis of their species richness These evaluations, classified into three groups are shown in Map 20 page

Rare Species

Map 21 (page) showing the distribution of Bulgaria's rare bird species is based on information about Bulgaria's breeding birds Two groups of species have been included in this category

1 Globally threatened species included in the European Red Data List

The European Red List consists of 29 species 16 of which are found in Bulgaria and 9 of which breed or occur during the breeding season in the country

Pelecanus crispus
Haliaetor pygmeus
Milvus milvus
Haliaeetus albicilla
Aegypius monachus
Aquila heliaca
Falco naumanni
Crex crex
Otis tarda

2 Rare and threatened breeding species included in the Bulgarian *Red Data Book*

Information on the distribution of 78 rare breed ing species including the 9 species listed above was used to create the map Most of these species are also rare at the regional (Balkan Peninsula) and continen tal scale The information comes from the Bulgarian *Red Data Book* and from unpublished data submitted for the "Atlas of the Breeding Distribution of the European Birds "

The following levels of species rarity are depicted on the map

0 to 15 species – low rarity
16 30 species – medium rarity
> 31 species – high rarity

The Bourgas region had the highest level of rarity (48 rare species in an area of 2500 km), followed by the Black Sea coast (between 30 and 40 species) the Srebarna region (40 species), Russenski Lom (39 spe cies) the central Stara Planina Mountains (38 spe cies) the Sofia region (36 species), the eastern Rho dope Mountains (33 species) and Belene (31 species)

Endemism

In the past eleven bird subspecies were described as unique to Bulgaria but these are now accepted as synonymous with previously published species

Unique Ecosystems, Habitats, and Communities

In preparing this discussion and the accompany ing map (Map 22, page 828) three types of unique communities have been identified communities unique for Bulgaria, communities unique for Europe, and communities unique for the world

Two Bulgarian natural sites were included in the International Convention for Protection of the World Cultural and Natural Heritage These are the Pirin National Park and the Srebarna Natural Reserve They are both of great importance for the conserva tion and protection of bird species

The region of Shabla and Durankulak Lakes is also of global importance Almost the entire global population of the red breasted goose (a total of about 60 000 individuals) winters there The geese spend the period between October and March there roosting at night in the lakes and feeding in the winter wheat field during the day

The follow regions are unique at the continental scale

1 The Bourgas lakes and adjacent lands This is an important bottleneck area In Europe other re gions of this type include the Bosphor Gibraltar and Falsterbo (in Sweden) Almost the entire population of the white stork flies over or over nights in the region of the lakes near the town of Bourgas The same is true of the white pelican lesser spotted eagle, and red footed falcon

2 Riparian forests In particular, the forests along the lower stretches of the small rivers of Batova Kamchia Ropotamo and Veleka with their dis tinctive bird communities Unfortunately, some of these areas have been strongly influenced by anthropogenic factors (e g the riparian forest "Baltata" on the Batova River)

3 The eastern Rhodope Mountains This region is high in numbers and density of rare and threat ened species (e g black vulture griffin vulture egyptian vulture black stork and white tailed ea gle) and in species richness It should be noted that the highest numbers of birds of prey in Europe have been found in the southeast part of the Rhodopes in Greece, near to the Bulgarian portion of these mountains

4 The Island of Vardim Supports a unique combi nation of very old flooded forest of *Quercus robur Salix alba*, and *Populus nigra* and large breeding colonies of cormorants, pygmy cormorant grey herons purple herons squacco herons night her ons, little egrets spoonbills, and glossy ibises

The Atanassovsko Lake Natural Reserve which contains the greatest number of rare and threatened bird species is unique at the national scale

In conclusion it should again be pointed out that, although small in territory, Bulgaria is remarkable for its relatively high number of unique bird habitats

Ecological Services

One of the two most important European migra tion routes the Western Black Sea migration route (also known as the Via Pontica), crosses Bulgaria (see Map 23 page 829) This is a result of our country's central location in the Balkan Peninsula and in the Western Palearctic biogeographic region The species composition and number of migrants, main routes flying heights, and migration periods and peaks have been described in detail by Michev (1984)

Another migration route – the Via Aristotelis (so called because of Aristotle provided the first de scription of it) crosses northeast Bulgaria and the Sofia Plain and continues along the Strouma River valley There are smaller migration routes along the valleys of the Maritza and Tundzha Rivers Relatively large mi gration flights have been observed near the Island of Belene and the Srebarna Reserve

In the winter high numbers (about 150 000 200 000 total) of white fronted geese red breasted geese greylag geese lesser white fronted geese mal lards green winged teals and pintails congregate in the region of Durankulak and Shabla There is also a winter concentration of the white fronted geese (an average of about 30 000 birds) near the Ovtcharitsa

reservoir

During the spring and winter waterfowl and many birds of prey and passerine birds are concentrated in the region of the Bourgas lakes It is difficult to ascertain a total number for these birds

Fragility

We regard as the most fragile and vulnerable the ecosystems along the Danube River and the Black Sea coast, as well as the ecosystems in the valleys of the following rivers Iskar, Yantra Russenski Lom, Kamchia, Strouma, Mesta, Tundzha, Maritsa, and Arda (Fragility and threats are depicted together on Map 24 page 830)

The ecosystems of the high mountains are also highly vulnerable This is especially true in regions where tourism and winter sports are well developed, including the alpine parts of the Vitosha, Rila Pirin, and Stara Planina mountains

The agricultural lands of Dobrudzha should also be included in this category In the winter of 1988 large amounts of poisons were used unreasonably in an attempt to control rodents The result was the extermination of thousands of geese ducks rabbits deer and other wildlife

THREATS

Direct Persecution

Birds are directly persecuted by poachers photographers scientists bird watchers forestry workers, tourists and others This is a problem throughout the country especially in the outlying areas of the protected areas Unfortunately there are many cases of infringement on these conservation areas

Recently the number of Bulgarian and foreign hunters in the region of Shabla and Durankulak has increased In January 1993 we found a dozen hunter killed red breasted geese We further ascertained illegal shooting of wintering geese in the places where they roost at night The poachers enter these places at night by boat This practice is especially harmful

Many songbirds are caught for home breeding during their migrations and while wintering in the Bourgas lakes region

Indirect Persecution

Indirect persecution takes a number of forms

1 Habitat destruction This includes a number of activities draining of marshes and swamps, felling of natural forests on the Danube islands and their replacement with hybrid *Populus*, felling of old forests and their replacement with *Pinus* plantations, destruction of dunes along the Black Sea coast and so forth

2 Shortage of food This is characteristic of the region of the Danube, where fish supplies have decreased

3 Over use of pesticides fertilizers, and other chemicals This causes the eutrophication of many wetlands (e g , Srebarna Shabla, Durankulak) that are important bird habitats

4 Over exploitation This category includes the destruction of the predominant part of the *Quercus* forests of Strandzha Mountain the *Fagus* forests of the Stara Planina Mountains, and the coniferous forests of the Rhodope, Rila, and Pirin Mountains The over exploitation of water resources of the Shabla and Durankulak Lakes leads to changes in their water regime, followed by abnormal decreases in water surface and eventually changes in the fish fauna This activity presents a danger to the large breeding colonies on Vardim Island

5 Collisions
   a) With cars Data about the actual numbers of birds killed in such accidents are inadequate
   b) With airplanes Dozens of accidents are reported for the airports at Bourgas, Varna and Sofia
   c) With powerlines This occurs most frequently during the autumn migration in southern Dobrudzha and in the region of Bourgas White storks are often the victims of these collisions On occasion more than ten birds have been found dead as a result of collision with high voltage powerlines The powerline in the region of the Atanassovsko Lake Reserve is situated crosswise to the direction of the migration

6 Petroleum and oil pollution This has become a more frequent phenomenon in recent years and is of special concern in the regions of Tjulenovo, Dobrich and Bourgas where white pelicans swans ducks, and other waterfowl covered by petrol are very often found

SITES CONTAINING THE MOST REPRESENTATIVE SAMPLES OF BULGARIA'S BIODIVERSITY

Habitat types are represented by different patterns in Map 25, page 831

1 Salt marshes
   Atanassovsko Lake
   Pomorie Lake
   Naneva Tuzla
   Shabla Tuzla
   Balchik Tuzla

2 Coastal sand dunes and sand beaches
- Ropotamo Alepu
- Kamchia Skorpilovtzi
- Sinemorets Veleka

3 Sea cliffs
- Tzhulenovo Kaliakra
- Cape "Masslen noss"

4 Islets
- Sveti Ivan and Petar
- Zmiiski ostrov (Sveti Toma)

5 Lakes, marshes reservoirs and rivers
- Srebarna Lake
- Durankulak Lake
- Shabla Lake
- Vaja Lake
- Mandra Lake with the Poda Uzungeren complex
- Alepu Arkutino Marshes
- Stomopulu Marsh
- Belene Marshes
- Malak Preslavets Marsh
- Garvan Marsh
- Aldomirovtsi Marsh
- Chuklzhovo Marsh
- Marikostinovo Marsh
- Pzhasachnik Reservoir
- Tsanko Tzerkovski Reservoir
- Ovcharitsa Reservoir
- Rozov Kladenetz Reservoir
- Ivailovgrad Reservoir
- Studen Kladenets Reservoir
- Maritsa River
- Strouma River (near Rupite)
- Veleka River
- Rezovska River
- Rilska River
- Bistritsa River
- Vucha River
- Suchitsa River
- Arda River (above the Reservoir of Kardjali)
- Byala River

6 Steppes and pseudosteppes
- Durankulak Balgarevo

7 Wet grasslands
- Golzhamo Malovo

8 High mountain grasslands
- Rila
- Pirin
- Slavyanka
- Stara Planina
- Vitosha

9 Pseudomaquisses
- Strouma Valley
- Eastern Rhodope Mountains

10 Community of Paliurus aculeatus near the village of Borislavtzi (Haskovo District)

11 Deciduous, coniferous, and mixed woodlands
- Ludogorie
- Aitosska Planina
- Preslavska Planina
- Steneto
- Boatin
- Tsarichina
- Tchuprene
- Bistrischko Branischte
- Parangalitsa
- Pirin
- Slavyanka
- Belasitsa
- Kastrakli
- Beglika
- Mandaritsa
- Shishmantsi

12 Riverside and flooded forests
- a) Along the Danube River
  - Belene
  - Vardim
  - Vetren
  - Nova Tcherna
  - Kossui
- b) Along the Black Sea Coast
  - Baltata
  - Kamchia
  - Ropotamo
  - Veleka
- c) Inland
  - Gorna and Dolna Topchia

13 Rocky habitats
- North of Chiprovci
- Ginzi
- Vratsa Mountain
- Iskar Gorge
- Dzhendema
- Russenski Lom National Park
- Suha Reka Valley
- Dry Valley north to the Tervel
- Luda Kamchia Valley
- Provadia Nevsha
- Sinite Kamani National Park
- Zemen Gorge
- Kresna Gorge
- Rila High Mountain Rocks
- Pirin High Mountain Rocks
- Trigrad Gorge
- Martziganitsa Rocks
- Karadzhov Kamak

Arda Valley (between Studen Kladenets and Ivailovgrad Reservoir)
Krumovitsa Valley
North bank of the Studen Kladenets Reservoir
North bank of the Kardzhali Reservoir
Jult Kamak
Tundzha Valley (northern to the Radovets)
Kotel Rocks
Melnik Pyramids
Loess Faces near towns of Nikopol Svishtov, and
Somovit

14 Agricultural ecosystems
Crops in Dobrudzha
Crops near Bolzharovo
Rice fields between Pazardzhik and Plovdiv

15 Urban areas
Sofia
Tsibar villages near Lom

SPECIES OF PROVEN OR POTENTIAL ECONOMIC IMPORTANCE

1 White fronted goose The White fronted goose causes damage to agricultural crops in the region of the Shabla and Durankulak Lakes, near the Ovtcharitsa reservoir and in the region of Bour gas The damage caused by the birds is some times quite significant This damage could be es timated on the basis of insurance payments

2 Cormorant Cormorants cause damage to fish farms in Orsodzha Karaissen Mechka Nova Cherna Tchelopechene Blagoevgrad, Samokov Bourgas and other areas Numerical data are not available

3 Starling Starlings cause damage to vineyards and fruit gardens throughout the country, particularly when they form large (up to 10,000 individuals) flocks Numerical data are not available

4 White stork During migration this species causes frequent electricity cut offs in South Dobrudzha and in the Bourgas region Several other water fowl species have caused air crashes Numerical data are not available

HISTORIC, CURRENT, AND POTENTIAL THREATS

Negative impacts on the Bulgarian avifauna were first identified in the earliest years following the liber ation from the Turkish regime These impacts in volved mainly indirect damage to several species as a result of the uncontrolled cutting of forests and land reclamation

The small arms and other weapons kept by people after the wars at the end of the last century and espe cially during the beginning of this century resulted in uncontrolled and unregulated hunting Many birds – especially of the larger and more curious species – were killed off Mass killing focused on the birds of prey and birds used as food

There are numerous customs and traditions con nected with the killing of birds in many towns and vil lages of the country For example many ice covered great bustards have been caught during hard winter periods in Dobrudzha Birds of prey have been caught by traps for their fat which is used for medical pur poses Body parts of many birds (especially eagles) have traditionally been used in occult preparations These activities coupled with the lack of legislation for nature protection, damaged some species considerably

Vulture populations were harmed by the mass use of strychnine baits against wolves This practice began at the end of the last century and continued up to the 1960s In the years since, and even at the present time strych nine has been used on occasion for the same purposes

One of the most significant far reaching and even catastrophic threats to the Bulgarian avifauna has been the mass draining of marshes swamps and other wetlands and their transformation into agricultural lands These activities began in the 1920s with the draining of 100 km^2 of the Straldzha Marsh and con tinued to their apogee during the 1950s As a result almost all the marshes along the Danube River as well as the inland marshes (Dragomansko Dzhavolsko Blato) and the swamps in the mountains (Batashko Blato) have been destroyed The breeding popula tions of many species were severely and fatally af fected These species are now included in the list of extinct, threatened and vulnerable species

The beds of many rivers in the Bulgarian lowlands (the Iskar Vit Yantra, Ossam etc) have been "cor rected" and embanked In the process, many wetlands of value as breeding and feeding sites were destroyed

An all out war against birds of prey was carried out beginning in the 1930s This war became horrific during the 1950s All possible means – including di rect hunting, the destruction of nests, the taking of

eggs and nestlings, and the use of poisoned baits – were employed Despite recent successes in efforts to protect these birds – in 1986 they all became protected by special law – there are currently some dangerous moves afoot to legalize falconries and to remove the conservation status of several birds of prey This latter move will have a harmful effect on the whole group due to the insufficient biological knowledge of hunters and the fact that most of them cannot or do not distin guish the different species

Similarly, the fight against fish eating birds has historically been quite strong, especially during the 1950s It continues up to the present day with mass fowling in and near fish farms This trend is likely to be reinforced in the future due to the privatization of the fish farms

It is highly probable that pesticide use has had se rious after effects on the populations of many bird species Until the reforms of 1989 the data on this matter were kept secret We do not have direct data about this threat, except for the finding of DDT in the eggs of the Dalmatian pelican (Michev and Dilchev, 1987) It is not definitely established however that Bulgaria was the source of this substance

Many birds were also killed during the campaign against rodents

One of the significant threats to Bulgaria's bird life was the mass merger of agricultural fields, espe cially during the 1950s when collectivization was car ried out

The building of the Zheleznı Vrata reservoir caused drastic changes in the total discharge of the Danube and had aftereffects on the Belene Vardım Srebarna, and other wetlands alongside the river

The mass cutting of the forests and their replace ment by plantations of exotic tree species has resulted in the establishment of many green spots unsuitable for birds

Potential threats to the Bulgarian avifauna include the restoration of private control of lands forests fish farms and grazing grounds and the lack of control over pollution from newly created or privatized indus trial sites

CONSERVATION RECOMMENDATIONS

The recommendations offered here fall into three groups legal recommendations management recom mendations and scientific recommendations

Legal Recommendations

1 Changes in national conservation legislation are needed due to current changes in Bulgarian agri culture and industry

2 Legislation should be carried out in accordance with the conservation requirements of the Euro pean Community

3 The Ministry of the Environment should be given legal responsibility as manager of all protected ar eas and species of national and international im portance

4 Meaningful compensation for damage caused by birds needs to be furnished, only token payments are provided at this point

Management Recommendations

1 A Nature Conservation Agency needs to be es tablished to enforce legislation on biodiversity conservation

2 The proportion of participation by governmental institutions and non governmental organizations in the protection of biodiversity needs to be re versed At present, most conservation activities are assigned to the governmental institutions

Scientific Recommendations

1 Support is needed for monitoring of the numbers and distribution of Bulgarian birds the state of their habitats and the relative degree of influence of the different types of threats

None of the recommendations proposed in this section will be effective if special measures are not taken to increase public awareness of conservation through education

ACKNOWLEDGEMENTS

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Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status

Key to Appendix 1	
Conservation status	'+" in the column indicates the species is protected under Bulgarian law
Fine for Taking	indicates the legal fine assessed for taking each individual shown in Bulgarian leva
Species listed in Bulgarian Red Data Book	indicates the species is designated at extinct threatened or rare
European Red List Status	indicates that the species is listed in the European Red List of Globally Threatened Species under the following categories, Ex Extinct E Endangered V Vulnerable R Rare K Insufficiently known

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
1 *Gavia stellata*	+	75				
2 *G Arctica*	+	150			+	
3 *G Immer*	+	75				
4 *Tachybaptus ruficollis*	+	75				
5 *Podiceps grisegena*	+	150			+	
6 *P Cristatus*	+	75		+		
7 *P Auritus*	+	75				
8 *P Nigricollis*	+	75	+			
9 *Calonectris diomedea*	+	75				
10 *Puffinus puffinus*	+	75				
11 *Hydrobates pelagicus*						
12 *Morus bassanus*	+	75				
13 *Pelecanus onocrotalus*	+	300	+			
14 *P Crispus*	+	600		+		E
15 *Phalacrocorax carbo*	+	150		+		
16 *Ph Aristotelis*	+	150		+		
17 *Haliaetor pygmeus*	+	150		+		K
18 *Botaurus stellaris*	+	150		+		
19 *Ixobrychus minutus*	+	75				
20 *Nycticorax nycticorax*	+	75				
21 *Ardeola ralloides*	+	75				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
22 *Bubulcus ibis*	+	75				
23 *Egretta garzetta*	+	150				
24 *E Alba*	+	300		+		
25 *Adrea purpurea*	+	75		+		
26 *A Cinerea*	+	75				
27 *Ciconia nigra*	+	150		+		
28 *C Ciconia*	+	150				
29 *Plegadis falcinellus*	+	150		+		
30 *Platalea leucordia*	+	300		+		
31 *Phoenicopteris ruber*	+	150			+	
32 *Cygnus olor*	+	150		+		
33 *C Cygnus*	+	150				
34 *C Columbianus*	+	150				
35 *Anser fabalis*	+	150				
36 *Anser albifrons*						
37 *A Erythropus*	+	150		+		R
38 *A Anser*	+	150		+		
39 *A Caerulescens*	+	150				
40 *Branta canadensis*						
41 *Br bernicla*						
42 *Br ruficollis*	+	300		+		
43 *Tadorna ferruginea*	+	300		+		
44 *T Tadorna*	+	150		+		
45 *Aix galericulata*						
46 *Anas penelope*						
47 *A Falcata*	+	75				
48 *A Strepera*	+	150				
49 *A crecca*						
50 *A platyrhynchos*						
51 *A acuta*						
52 *A querquedula*						
53 *A clypeata*						
54 *Marmaronetta angustirostris*	+	75			+	
55 *Netta rufina*	+	150			+	

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
56 *Aythya nyroca*	+	150		+		
57 *A Ferina*	+	150		+		
58 *A Fuligula*						
59 *A Marila*	+	75				
60 *Somateria mollissima*	+	75			+	
61 *Clangula hyemalis*	+					
62 *Melanitta nigra*	+	75				
63 *M Fusca*	+	75				
64 *Bucephala clangula*						
65 *Mergus cucullatus*						
66 *M Albellus*	+	75				
67 *M Serrator*	+	75				
68 *M Merganser*	+	75				
69 *Oxyura leucocephala*	+	150			+	
70 *Pandion haliaetus*	+	300		+		
71 *Pernis apivorus*	+	150		+		
72 *Elanus caeruleus*	+	150				
73 *Milvus migrans*	+	150		+		
74 *M Milvus*	+	150			+	
75 *Haliaeetus albicilla*	+	600		+		R
76 *Neophron percnopterus*	+	300		+		
77 *Gypaetus barbatus*	+	600	+			
78 *Gyps fulvus*	+	600		+		
79 *Aegypius monachus*	+	600	+			V
80 *Circaetus gallicus*	+	300		+		
81 *Circus aeruginosus*	+	150		+		
82 *C Cyaneus*	+	75			+	
83 *C Macrourus*	+	75			+	
84 *C Pygargus*	+	75			+	
85 *Accipiter gentilis*	+	150		+		
86 *A Nisus*	+	150		+		
87 *A Brevipes*	+	150		+		
88 *Buteo buteo*	+	75				
89 *B Lagopus*	+	75				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
90 *B Rufinus*	+	300		+		
91 *Aquila pomarina*	+	300		+		
92 *A Clanga*	+	300			+	
93 *A Rapax*	+	300			+	
94 *A Heliaca*	+	600		+		R
95 *A Chrysaetos*	+	300			+	
96 *Hieraaetus fasciatus*	+	300			+	
97 *H Pennatus*	+	300	+			
98 *Falco naumanni*	+	75	+			K
99 *F Tinnunculus*	+	75				
100 *F vespertinus*	+	75		+		
101 *F columbarius*	+	75				
102 *F subbuteo*	+	150		+		
103 *F eleonorae*	+	150				
104 *F biarmicus*						
105 *F cherrug*	+	300		+		
106 *F peregrinus*	+	300		+		
107 *Tetrao tetrix*			+			
108 *T urogallus*				+		
109 *Bonasa bonasia*	+	150		+		
110 *Alectoris graeca*						
111 *A chukar*						
112 *Perdix perdix*						
113 *Coturnix coturnix*						
114 *Phasianus colchicus*				+		
115 *Grus grus*	+	300	+			
116 *Anthropoides virgo*	+	600	+			
117 *Rallus aquaticus*	+	75				
118 *Crex crex*	+	150		+		
119 *Porzana parva*	+	75				
120 *P pusilla*	+	75				
121 *P porzana*	+	75				
122 *Gallinula chloropus*	+	50				
123 *Fulica atra*						

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
124 *Tetrax tetrax*	+	300	+			R
125 *Otis tarda*	+	300		+		R
126 *Haematopus ostralegus*	+	150		+		
127 *Himantopus himantopus*	+	150		+		
128 *Recurvirostra avosetta*	+	75			+	
129 *Burhinus oedicnemus*	+	75		+		
130 *Glareola pratincola*	+	75		+		
131 *Gl nordmanni*	+	75				
132 *Vanellus vanellus*	+	75				
133 *V spinosus*	+	50				
134 *V gregarius*						
135 *Pluvialis apricaria*	+	75				
136 *Pl squatarola*	+	75				
137 *Charadrius hiaticula*	+	25				
138 *Ch dubius*	+	25				
139 *Ch alexandrinus*	+	25			+	
140 *Ch leschanaulti*						
141 *Eudromias morinellus*	+	75				
142 *Limosa limosa*	+	50				
143 *L lapponica*	+	75				
144 *Numenius phaeopus*	+	75				
145 *N tenuirostris*	+	75				K
146 *N arquata*	+	75				
147 *Tringa erythropus*	+	75				
148 *Tr totanus*	+	150		+		
149 *Tr stagnatilis*	+	150			+	
150 *Tr nebularia*	+	75		+		
151 *Tr ochropus*	+	150		+		
152 *Tr glareola*	+	50				
153 *Xenus cinereus*						
154 *Actitis hypoleucos*	+	75				
155 *A macularia*						
156 *Arenaria interpres*	+	50				
157 *Phalaropus lobatus*	+	75				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
158 *Ph fulicarius*	+	75				
159 *Scolopax rusticola*					+	
160 *Gallinago media*	+	300			+	
161 *G gallinago*			+			
162 *Lymnocriptes minima*	+	75				
163 *Calidris cannutus*	+	50				
164 *C alba*	+	50				
165 *C minuta*	+	50				
166 *C temminckii*	+	50				
167 *C alpina*	+	50				
168 *C ferruginea*	+	50				
169 *Limicola falcinellus*	+	75				
170 *Philomachus pugnax*	+	75				
171 *Catharacta skua*						
172 *Stercorarius pomarinus*	+	75				
173 *St parasiticus*	+	75				
174 *Larus delawarensis*						
175 *L canus*	+	75				
176 *L argentatus*						
177 *L fuscus*	+	75				
178 *L marinus*	+	75				
179 *L ichtyaetus*						
180 *L melanocephalus*	+	75			+	
181 *L ridibundus*	+	75			+	
182 *L genei*	+	75			+	
183 *L minutus*	+	75				
184 *Rissa tridactyla*	+	75				
185 *Xema sabini*						
186 *Chlidonias hybrida*	+	75		+		
187 *Chl leucoptera*	+	75				
188 *Chl nigra*	+	75		+		
189 *Gelochelidon nilotica*	+	300		+		
190 *Hydroprogne caspia*	+	150			+	
191 *Sterna hirundo*	+	75				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
192 *St paradisaea*						
193 *St albifrons*	+	75		+		
194 *Thalasseus sandvicensis*	+	75				
195 *Uria aalge*						
196 *Syrrhaptes paradoxus*	+	50				
197 *Columba livia*	+	25				
198 *C oenas*	+	50		+		
199 *C Palumbus*						
200 *Streptopelia turtur*						
201 *Str decaocto*						
202 *Str roseogrisea*						
203 *Clamator glandarius*	+	75				
204 *Cuculus canorus*	+	25				
205 *Tyto alba*	+	150			+	
206 *Otus scops*	+	75		+		
207 *Bubo bubo*	+	150	+			
208 *Glaucidium passerinum*	+	150				
209 *Athene noctua*	+	25				
210 *Strix aluco*	+	25				
211 *Str uralensis*	+	300			+	
212 *Asio otus*	+	75				
213 *A Flammeus*	+	75			+	
214 *Aegolius funereus*	+	150			+	
215 *Caprimulgus europaeus*	+	75				
216 *Apus melba*	+	25				
217 *A Pallidus*						
218 *A Apus*	+	25				
219 *Alcedo atthis*	+	50				
220 *Merops apiaster*	+	50				
221 *Coracias garrulus*	+	50				
222 *Upupa epops*	+	75				
223 *Jynx torquilla*	+	25				
224 *Picoides minor*	+	50				
225 *P Leucotos*	+	75			+	

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
226 *P medius*	+	50				
227 *P syriacus*	+	25				
228 *P major*	+	25				
229 *P tridactylus*	+	150			+	
230 *Dryocopus martius*	+	75			+	
231 *Picus canus*	+	25				
232 *P viridis*	+	25				
233 *Melanocorypha calandra*	+	25				
234 *M leucoptera*	+	5				
235 *M yeltoniensis*						
236 *Callandrela cinerea*	+	5				
237 *C rufescens*	+	5				
238 *Galerida cristata*	+	5				
239 *Lullula arborea*	+	5				
240 *Alauda arvensis*	+	5				
241 *Eremophilla alpestris*	+	25				
242 *Riparia riparia*	+	5				
243 *Hirunda repestris*	+	5				
244 *H rustica*	+	5				
245 *H daurica*	+	25				
246 *Delichon urbica*	+	5				
247 *Motacilla flava*	+	5				
248 *M citreola*						
249 *M cinerea*	+	5				
250 *M alba*	+	5				
251 *Anthus novaeseelandiae*						
252 *A campestris*	+	25				
253 *A pratensis*	+	25				
254 *A trivialis*	+	25				
255 *A cervinus*	+	25				
256 *A spinoletta*	+	25				
257 *Lanius collurio*	+	25				
258 *L minor*	+	25				
259 *L excubitor*	+	25				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
260 *L Senator*	+	5				
261 *L Nubicus*	+	25				
262 *Bombycilla garrulus*	+	25				
263 *Cinclus cinclus*	+	25				
264 *Troglodytes troglodytes*	+	5				
265 *Prunella collaris*	+	5				
266 *Pr modularis*	+	5				
267 *Erythropygia galactotes*	+	25				
268 *Erithacus rubecula*	+	5				
269 *E Luscinia*	+	5				
270 *E megarhynchos*	+	5				
271 *E Svecicus*	+	25				
272 *Phoenicurus ochrurus*	+	5				
273 *Ph phoenicurus*	+	5				
274 *Saxicola rubetra*	+	5				
275 *S Torquata*	+	5				
276 *Oenanthe isabelina*	+	25				
277 *O oenanthe*	+	5				
278 *O hispanica*	+	25				
279 *O pleschanka*	+	25				
280 *O Leucura*	+	5				
281 *Monticola saxatilis*	+	50				
282 *M solitarius*	+	50				
283 *Zoothera dauma*						
284 *Turdus torquatus*	+	25				
285 *T merula*	+	5				
286 *T Ruficollis*	+	25				
287 *T Pilaris*	+	25				
288 *T Iliacus*	+	25				
289 *T Philomelos*	+	25				
290 *T Viscivorus*	+	25				
291 *Panurus biarmicus*	+	50				
292 *Cettia cetti*	+	5				
293 *Locustella lisciniodes*	+	25				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
294 *L fluviatilis*	+	25				
295 *L naevia*	+	5				
296 *Acrocephalus paludicola*	+	5				K
297 *A schoenabenus*	+	5				
298 *A agricola*	+	25				
299 *A scirpaceus*	+	5				
300 *A palustris*	+	5				
301 *A melanopogon*	+	5				
302 *A arundinaceus*	+	25				
303 *Hippolais icterina*	+	25				
304 *H olivetorum*	+	5				
305 *H pallida*	+	5				
306 *Sylvia nisoria*	+	5				
307 *S hortensis*	+	25				
308 *S borin*	+	5				
309 *S atricapilla*	+	5				
310 *S communis*	+	5				
311 *S curruca*	+	5				
312 *S melanocephala*	+	25				
313 *S cantillans*	+	5				
314 *Phylloscopus trochilus*	+	5				
315 *Ph collybitus*	+	5				
316 *Ph bonelli*	+	5				
317 *Ph sibilathrix*	+	5				
318 *Ph borealis*						
319 *Ph trochiloides*						
320 *Regulus regulus*	+	5				
321 *R ignicapillus*	+	5				
322 *Cisticola juncidis*						
323 *Ficedula hypoleuca*	+	5				
324 *F albicollis*	+	5				
325 *F parva*	+	5				
326 *Muscicapa striata*	+	5				
327 *Aegithalos caudatus*	+	5				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
328 *Remiz pendulinus*	+	50				
329 *Parus palustris*	+	5				
330 *P lugubris*	+	5				
331 *P montanus*	+	5				
332 *P ater*	+	5				
333 *P cristatus*	+	5				
334 *P major*	+	5				
335 *P caeruleus*	+	5				
336 *Sitta europaea*	+	25				
337 *S neumayer*	+	25				
338 *Tichodroma muraria*	+	25				
339 *Certhia familaris*	+	5				
340 *C brachydactyla*	+	5				
341 *Emberiza calandra*	+	5				
342 *E citrinella*	+	5				
343 *E leucocephala*						
344 *E cia*	+	5				
345 *E hortulana*	+	5				
346 *E cirlus*	+	5				
347 *E pusilla*	+	5				
348 *E rustica*	+	5				
349 *E melanocephala*	+	5				
350 *E schoeniclus*	+	5				
351 *Calcarius lapponicus*	+	5				
352 *Plectophenax nivalis*	+	5				
353 *Fringilla coelebs*	+	5				
354 *Fr montifringilla*	+	5				
355 *Serinus serinus*	+	5				
356 *Carduelis chloris*	+	5				
357 *C spinus*	+	5				
358 *C carduelis*	+	5				
359 *Acanthis flavirostris*	+	5				
360 *A flammea*	+	5				
361 *A cannabina*	+	5				

Appendix 1 Bird Species Found in Bulgaria (up to 1 January 1993) and their Conservation Status (continued)

Species Name	Conservation Status	Fine for Taking (in leva)	Species listed in Bulgarian *Red Data Book*			European Red List Status
			extinct	threatened	rare	
362 *Rhodopechys obsoleta*						
363 *Carpodacus erythrinus*	+	5				
364 *Loxia curvirostra*	+	5				
365 *L Leucoptera*						
366 *Pyrrhula pyrrhula*	+	5				
367 *Coccothraustes coccothraustes*	+	5				
368 *Passer domesticus*						
369 *P Hispaniolensis*	+	25				
370 *P montanus*						
371 *Petronia petronia*	+	50				
372 *Montifringilla nivalis*						
373 *Sturnus roseus*	+	25			+	
374 *St vulgaris*						
375 *Oriolus oriolus*	+	25				
376 *Garrulus glandarius*						
377 *Pica pica*						
378 *Nucifraga caryocatactes*	+	25				
379 *Pyrrhocorax graculus*	+	50				
380 *Corvus monedula*						
381 *C Frugilegus*						
382 *C corone*						
383 *C corax*	+	75				

Several additional species (*Grus leucogeranus Haliaeetus leucoryphus Phoenicurus erythrogaster* and *Oenanthe deserti*) have been reported for the Bulgarian ornithofauna (Nankinov 1992) Because these reports need confirmation we have not included these species in the above list

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The Small Mammals (Insectivora, Lagomorpha, Rodentia) of Bulgaria

Vassil Popov

SUMMARY

Due to its geographical location and varied environment (climate topography, vegetation) Bulgaria has a relatively rich small mammal fauna After nearly 100 years of investigations by native and foreign scholars 42 taxa have been recognized This information is scattered throughout a vast body of literature The main sources are of three types 1) regional faunistic studies and taxonomic investigations of particular species, 2) studies of the regional foci of parasitic diseases and 3) studies of the prey of raptorial animals (mainly owls)

Despite the relatively high number of publications on small mammal biology (more than 100 are cited in this report), many important knowledge gaps exist Some geographical areas are insufficiently studied consequently the inventories of local species are incomplete The taxonomy of groups containing closely related species has not been studied in detail hence, the distribution and ecology of some of these species is poorly known The actual conservation status of the rarest species in the national *Red Data Book* is unknown and data on their ecology do not exist Nevertheless the published literature allows us to outline regional species richness and the regions containing rare and/or endemic species and to designate the important or fragile habitats ecosystems, and communities

Two especially important territories are specified 1) parts of the main mountain chains where the most species of small mammals are represented and 2) low land territories where steppe (Dobrudzha, the northern Black Sea coast) and Mediterranean (the southern Black Sea coast, the Strouma and Mesta River valleys) small mammal faunal elements can be found The sensitivity of, and possible threats to small mammals and their habitats are analyzed The lowland habitats because of their declining area and the destruction of the natural corridors between them, are of particular importance in this respect Of the most important threats special attention needs to be given to the isolation of natural habitats the modification of the physical environment the development of intensive forms of agriculture pollution and urban growth

Studies of the evolution of the small mammal fauna since the Pliocene indicate that climatic deterioration and fluctuation during the Pleistocene are the main factors behind the present pattern of local distribution Some species are relicts from the Pliocene (*Myomimus roachi*) or Early Pleistocene (*Apodemus mystacinus*) and are restricted to the southernmost parts of the country By contrast some rare species that occur mainly in north and especially northeast Bulgaria are remnants of a rich Late Quaternary forest steppe fauna (*Sicista subtilis*, *Mesocricetus newtoni* *Cricetus cricetus*, *Cricetulus migratorius*) During the Holocene the most important factor affecting small mammals has been the human impact on the environment Increasingly intensive land use in lowland areas has considerably altered the natural habitats and their respective small mammal communities in these areas Particularly vulnerable are steppe species

The final section of this report presents several recommendations regarding small mammal conservation It is important to establish a large network of protected areas Special research on the distribution and ecology of the rarest species should be undertaken

INTRODUCTION

The territory of Bulgaria is characterized by a high degree of climatic variability due primarily to its geographical location and varied topography A complex mosaic of mesoclimates best understood in terms of local gradients of temperature and humidity can therefore be found These features combine to produce a diverse and heterogeneous landscape that, along with geological variation, provides for a wide range of habitats and a high degree of biodiversity It is also important to emphasize that Bulgaria extends into the central part of the Balkan Peninsula, where the influence of several biogeographical zones can be observed Consequently Bulgaria represents the limits of the geographical ranges of many small mammal species It can therefore be regarded as a territory of exceptional conservation value, enriching Europe with unique habitats and species and supporting a considerable proportion of the continent's mammalian fauna

A BRIEF HISTORY OF SMALL MAMMAL RESEARCH IN BULGARIA

The first data on Bulgarian small mammals appeared in Chritovitch's (1892) work on pest animals Kozarov (1909) addressed similar problems in a paper

on the damage caused by the hamsters in Bulgaria Of particular interest are Nehring's (1898a 1898b 1899 1901) and Miller s (1903 1910) investigations on the taxonomy of the golden hamster mole rat and forest dormouse These works are of mainly historical interest but it should be noted that the designation of the Bulgarian golden hamster as a separate species (*Mesocricetus newtoni* Nehring 1898) has only recently become widely accepted

The field work and materials collected by C Anderson in Bulgaria provided the basis for the first monographic study of Bulgarian mammals by B Kovatchev (1925) Subsequent faunistic data were collected through the investigations of Boetticher (1925 1933), Heinrich (1936) and Wolf (1940)

The investigation of small mammals entered a new stage after World War II and accelerated in the early fifties as studies became more regular and intensive Special attention was given to regional faunistic studies of small mammals (Atanassova, 1978, 1981 1990 Atanassov et al , 1982, Boev 1983, Iotova, 1972, Markov, 1955, 1962b, 1964 1968, 1974a, 1974b, Mateva and Christov 1970, Mitev 1973 1980 Paspalev et al , 1952, Christov, 1961, 1974) Some of these studies were undertaken in connection with biomedical investigations of the natural foci of parasitic diseases (e g Kolebinova 1974 1978 Kojumdjieva 1971a 1971b, 1973 1974, Mateva and Christov 1971, Paspalev and Markov 1962, Surbova, 1961 1974 Ianchev, 1974)

These efforts led to a revision of the country's species inventory (Markov 1952 1953 Paspalev et al 1950 Peshev 1955, Peshev et al 1960 Peshev et al 1960 Straka 1964, Vohralik 1985 1991 Popov and Nijagolov 1991) The wealth of materials and comprehensive information gathered during these investigations allowed for more detailed consideration of the taxonomy and distribution of particular species or groups of species (Markov 1957a, 1957b 1960a 1960b 1962a Martino and Paspalev 1953 1956 Mitev 1968 1970 1971 1979a Mitev and Peshev 1977 Peshev and Hussein, 1990 Peshev D 1992 Peshev Ts 1955a 1969, Peshev and Angelova, 1985, Peshev and Iotova 1961, Peshev and Mitev 1975, 1979 Popov, 1981, 1982 1993) In the last decade special attention has been given to studies of the taxonomy of several species complexes using biochemical and cytogenetic methods (Beltcheva et al 1977 Gerasimov et al 1984 Gerasimov et al , 1990 Kral 1975 Orsini et al , 1983)

Several recent investigations have centered on aspects of small mammal ecology, especially the population dynamics of pest species dominant species in natural ecosystems and other species of particular interest (Markov et al 1972a Markov et al , 1972b Markov and Christov 1975 Markov et al 1978, Mitev 1980 Petrusewicz et al 1972 Straka 1967, 1965 1966a 1966b Straka and Gerasimov 1977)

Very important information on regional species composition became available through investigations of the diets of different animals primarily birds of prey and especially owls (Baumgart 1975 Baumgart et al 1973 Beshkov and Gerasimov 1980 Michev et al 1984 Simeonov 1963a 1963b 1966 1968 1970 1978 1980 1981 1983a 1983b 1984 1985 Simeonov and Boev, 1988, Simeonov et al 1981, Simeonov and Petrov, 1986)

The Quaternary history of the Bulgarian small mammal fauna has recently become a subject of special interest (Kowalski 1982 Popov 1984 1985 1986, 1988, 1989, Popov and Gerasimov, 1988) Studies in this area have revealed the relationship between climatic fluctuations environmental changes, and the evolution of particular phylogenetic lineages and small mammal communities (Popov 1991) The patterns revealed in these studies allow us to understand the current distributions of the species and to predict changes in small mammal communities under increasing human environmental impacts

GAPS IN KNOWLEDGE

The distribution of species is of particular interest in the effort to protect biodiversity The specific set of environmental conditions upon which an organism or group of interdependent organisms depends constitutes its habitat Most habitats can be closely related to particular types of natural environments where the association of an ecological community and the dominant vegetation can be identified It is thus convenient to refer these associations to natural regions that show a high degree of uniformity in their environmental characteristics and their flora and fauna (Gruev, 1988)

The available knowledge on the ecology of small mammals indicates that although they form a very heterogenous group from an ecological point of view they have in common one very important feature their small size As a consequence of their small size they are directly dependant on small scale environmental factors Hence the local distribution of small mammals reflects primarily the character of vegetation which in turn depends primarily upon temperature and humidity Natural areas endowed with specific environmental conditions (climate, topography, and vegetation) may be expected to support a relatively homogeneous small mammal fauna

Some summary works on various aspects of small mammal biology appeared after Kovatchev's 1925 monograph (Atanassov and Peshev 1966, Markov 1957 Peshev, 1975 Markov and Christov 1974) However in order to construct a comprehensive picture of the spatial distribution of species richness it is necessary to draw information from other specialist sources and from disparate regional data Some of these sources have been mentioned previously Others are presented in the reference section without special

citation in the text In general information about the current latitudinal and longitudinal distribution of small mammals in Bulgaria comes from three main types of sources (1) regional faunistic studies of small mammals or taxonomic investigations of particular species (2) studies of the regional foci of parasitic diseases and (3) studies of the food habits of raptorial birds The species distribution data extracted from these sources are compiled according to the natural areas listed in Table 1

The available information suffers from certain gaps Some of the conclusions especially these presented in the last two types of sources, are doubtful In particular this involves the degree of discrimination within groups of closely related species (such as *Crocidura leucodon/ suaveolens Neomys fodiens/anomalus* and *Apodemus sylvaticus/flavicollis*) In this report the distribution of these species is presented according to extrapolations based on the present knowledge on their ecology and taxonomy (Popov 1993, Aufrray et al 1990 Orsini et al 1983 Popov and Gerasimov unpubl materials)

On some occasions very important faunistic findings are reported but not fully discussed causing doubt about the veracity of these data For example Kolebinova (1978) in studying small mammals as hosts of trombiculid larvae in Ropotamo National Park reported a specimen of *Clethrionomys glareolus* This species is usually restricted to the mountains It occurs rarely in extensive forests at lower altitudes (below 800 m a s l) in northern Bulgaria but as a rule only in landscapes near the mountains Such doubtful data are included in this review of the regional distribution of the small mammals but they are given special designation (see Table 1)

The small mammal remains found in owl pellets pose similar problems In these cases unusual occur rences of particular species are probably due to long distance transport from neighboring areas These data are also specially designated in Table 1

Analysis of the available information indicates that past studies have been unevenly distributed geographically However there is no correlation between the number of information sources for a given area and the established species number It can thus be assumed that in general the regional species assemblages are relatively well known Nevertheless, some of the species absences noted in Table 1 reflect omissions in the regional investigations rather than real biological causes

In this regard the distributions of the rarest species in the Bulgarian *Red Data Book* (Christov 1985 Peshev 1985 Peshev and Spassov 1985) are of particular interest A review of the available sources shows that they have been reported only once or twice in the past and no current information on their actual distribution and conservation status exists There is an almost complete lack of information on the ecology of these species and the threats they face Even in the last few years, several mammalian species not previously reported in Bulgaria have been identified (Vohralik, 1985, 1991, Popov and Njagolov, 1990) It can thus be assumed that the species list of the small mammal fauna is not definitively complete There have been practically no investigations of small mammal communities or of the patterns in their composition along environmental gradients

CURRENT ASSESSMENT

Poorly Known Geographic Areas

Assessment of the information in Table 1 indicates that seven regions are insufficiently investigated the eastern Rhodopes, the southern parts of the Maritsa and Tundzha River valleys, the eastern Stara Planina Mountains the upper part of the Strouma River valley, Dobrudzha the northern part of the Black Sea coast, and the mountains along the western border These areas have been identified based on the low number of relevant information sources Taking into account that for many regions, the principal source of data has been owl pellets the following areas merit special faunistic studies the Danubian plain the Predbalkan region and the Kraishte Konyavo region

Species Richness

The list of Bulgarian small mammals contains 42 species The number of species, including species associated with human settlements, per region (as defined above) varies from 16 to 27 Three areas contain more than 25 species the eastern part of the Stara Planina Mountains the Danubian Plain and the southern Black Sea coast

Rare Species

Some species, such as *Neomys anomalus*, *Dryomys nitedula Apodemus microps Microtus epiroticus* show low abundance and discontinuous distribution This, however, is likely due to their specific life histories or insufficient investigations (*A microps, M epiroticus*) rather than threat factors These species probably inhabit many parts of the country

Some species are confined to clearly delimited regions, but in these areas are relatively numerous This group includes such species as *Apodemus mystacinus Microtus guentheri Mesocricetus newtoni Oryctolagus cuniculus Chionomys nivalis Mus spicilegus Mus spretoides* The restricted ranges of these species reflect their specific ecological tolerances Some are steppe species whose ranges are restricted mainly to northeast Bulgaria others are Mediterranean elements in the Bulgarian fauna and are found in parts of southern Bulgaria where the Mediterranean climatic influence is greatest *Chionomys nivalis* is a specialized high mountain dweller characteristic of the mountains in southern

Europe and the Near East In Bulgaria it is associated with the highest mountains

A third group consists of species represented by small scattered populations at a limited number of sites *Suncus etruscus* (the southern Black Sea coast), *Sicista subtilis* (Dobrudzha) *Myomimus roachi* (southeast Bulgaria), *Cricetulus migratorius* (scattered localities in northern and southern Bulgaria)

In general the Bulgarian small mammal fauna contains few rare species but some of the rarest are of particular interest within the European context In this respect steps should be taken to protect the fauna in Dobrudzha the southern part of the Black Sea coast, and southeast Bulgaria

Endemism

Generally speaking the Bulgarian small mammal fauna is dominated by widely distributed species (European Euro Siberian Mediterranean Irano Turanien etc) (Markov and Christov 1974) However, two species, though not strictly Bulgarian or Balkan endemics deserve special attention

The main portion of the Bulgarian golden hamster's range is within the territory of northern Bulgaria This species *Mesocricetus newtoni* may be considered an endemic for the Lower Danubian plain

The other species, *Myomimus roachi*, is a relict of the relatively diversified Pliocene glirid fauna This group of dormice is now reduced to only two vicarious species *Myomimus roachi* and *M personatus* The current distribution of the first species is primarily in southeast Bulgaria

Unique Ecosystems, Biotopes, and Communities

Because of its different climatic and topographic regions and the important influence of its mountain ecosystems Bulgaria contains virtually all of the main classes of European habitats

According to the CORINE (Coordination of Information on the Environment) classification, five selection criteria must be applied in identifying the most important natural and semi natural habitat types (1) habitat types characteristic of a particular large scale biogeographical zone (2) habitats characterized by natural ecological processes (3) habitats that support a high level of biodiversity, (4) habitats with endemic or threatened critical species present and (5) habitats of particular significance for migratory species Within the scope of these criteria, the small mammals in Bulgaria of special interest are found in steppe habitats As a rule these habitats are in part artificial and occur in some parts of northern Bulgaria especially in Dobrudzha Despite their semi natural origin, they support some characteristic elements of the steppe biota including several rare small mammal species (e g , *Sicista subtilis Mesocricetus newtoni, Cricetus cricetus Cricetulus migratorius*)

Interestingly enough some of the rarest and most threatened small mammal species tend to be confined to agricultural landscapes or territories highly influenced by human activity (the localities, for example, of *Myomimus roachi Suncus etruscus* and *Cricetulus migratorius* in southern Bulgaria) However the intensification of land use may destroy these habitats Thus although these habitats are not of particular importance for other elements of the biota they must be given special attention

Prior to the introduction of agriculture forests were the dominant form of climax vegetation in Bulgaria In the lowlands, only small fragmented areas of natural forest remain after centuries of exploitation and clearing In some parts of the country, however, especially in the region of Loudogorie and Strandzha Mountain, it is still possible to find relatively large forested areas with well preserved animal communities including small mammals

Although the river banks and valley bottoms have been subject to intensive human activity some aquatic habitats remain relatively unchanged Some of these riparian habitats extend over long distances and pass through many landscapes These habitats are of exceptionally high value as natural corridors for many small mammal species Of particular interest in this respect are the valleys of the Strouma Mesta Maritsa Tundzha and Veleka Rivers as well as some parts of the Danube River bank The lowland swamp forests along the rivers running into Black Sea sustain very rich small mammal communities Species that are adapted to humid conditions and characteristic mainly of the mountains in Bulgaria can be found in these lower altitude forests

The dry rocky habitats with elements of Mediterranean vegetation that occur in the Strouma River valley in the southwest "corner" of Bulgaria have specific communities of small mammals including some rare species

Many habitats of great importance as samples of the most diversified small mammal communities can be found in the mountains These extensive areas often embrace a wide range of environmental conditions It is therefore appropriate to regard them as habitat complexes The most important habitats in these complexes are the high mountain meadows of the Rila Pirin Rhodope Vitosha and Stara Planina Mountains Some old and mature coniferous and beech forests in these mountains contain representative samples of the Bulgarian small mammal fauna (Parangalitsa Boatin Steneto, etc)

Territories of Ecological Importance

The valuable habitats mentioned above can be grouped into two regionally and ecologically defined territories of particular importance (1) territories in the main mountain chains and massifs where most of

the Bulgarian small mammal species are represented, and (2) lowland territories where the steppe (Dobrudzha and the northern Black Sea coast) and Mediterranean (the southern Black Sea coast and Strouma and Mesta River valleys near the southern border of the country) small mammal faunal elements can be found

Sensitivity to Certain Human Activities

The habitats most sensitive to human impact are in the lowlands These habitats are gradually declining in area and the natural corridors between them are being ruptured This has become clearly evident during the last twenty years and could become even more severe with the prospect of further economic development Wetland habitats are among the most fragile Drainage, land improvement, and agricultural intensification affect dramatically these fragile habitats The remnants of steppe or forest steppe grassland in northeast Bulgaria have diminished considerably Some have been appropriated for urban and agricultural use, others plowed in order to grow grains Moreover some steppe areas unsuitable for agriculture have been afforested which generally reduces their value to steppe wildlife

The severe conditions of the high mountains make their ecosystems very fragile Recreation and tourism development of all kinds have caused considerable damage to the habitats in some parts of the Rila, Rhodope Vitosha and other mountains

Taking into account these general considerations the following species and/or populations are considered very sensitive to the human impact the populations of all the species included in the *Red Data Book* lowland populations of the water shrews (*Neomys anomalus* and *N fodiens*) and species associated with peculiar habitats of pseudo mediterranean type (*Apodemus mystacinus Suncus etruscus* and *Talpa caeca*)

Current and Potential Threats

The most important threats to small mammals in Bulgaria include the fragmentation and isolation of their natural habitats as a result of road building the expansion of tourist and residential development the modification of the physical environment and the development of certain more intensive forms of agriculture The increasing use of pesticides is probably the principal cause of the drastic reductions in the populations of the rare and vulnerable species However relatively little information about trends in the populations of rare small mammals or changes in the status of their habitats is available at the regional or national scale

Sites Containing the Most Representative Samples of Bulgarian Small Mammal Diversity

- The Dodrudzha Black Sea coast between the Batova River and Shabla Lake The combination of steppe and Mediterranean vegetation associations in this area provides conditions for a rich small mammal community that includes various zoogeographical elements
- The swamp forests along the rivers entering the Black Sea (Baltata, Longosa and Ropotamo)
- The whole territory of Strandzha Mountain in Bulgaria
- The karst regions in the western Rhodope Mountains (in the vicinity of the villages of Trigrad Teshel Borino and Mugla)
- Pirin National Park
- The "Rupite" area on the lower Strouma river valley near the town of Petrich
- Vitosha National Park near Sofia
- The gorges of the rivers crossing the Predbalkan region and the Danubian Plain

Species of Economic Importance

Lepus europeus
Orictolagus cuniculus
Microtus arvalis
Nannospalax leucodon

HISTORIC, CONTEMPORARY, AND POTENTIAL THREATS TO THE SURVIVAL OF THE BIOTA

The climate during the Pleistocene deteriorated gradually This forced changes in the Pliocene small mammal fauna Some warm loving species disappeared, including many insectivores, murids, and glirids Other species evolved rapidly and adapted to the changing environment During the Middle Pleistocene, most of the present day species of small mammals appeared Parts of southern Europe, where the climatic changes were not very great, served as refugia for some Pliocene taxa In the region of Thrace, between the Black and Aegean Seas the climate remained relatively warm and humid Here *Myomimus roachi* a relict of the Pliocene fauna was able to survive

The end of the Pleistocene was marked by a considerable "continentalization" of the climate As a result, the small mammal fauna in Bulgaria came to be dominated by species adapted to open habitats – steppe and forest steppes Some species that are now rare or whose current distribution is restricted were widely distributed over the country during the final phase of the

last glaciation (*Sicista subtilis, Mesocricetus newtoni, Cricetulus migratorius Chionomys nivalis*) Moreover the characteristic elements of the Late Pleistocene fauna were steppe inhabitants – *Allactaga major Ochotona pusilla Lagurus lagurus, Eolagurus luteus* – that no longer occur in this part of Europe

The beginning of the Holocene is characterized by an increasingly humid climate Consequently forest vegetation increases The steppe communities gradually decline in area Many steppe species decline in numbers and disappear These changes in environmental conditions adverse for species adapted to open habitats caused long term declines in the populations of *Sicista subtilis*, *Cricetulus migratorius*, and *Mesocricetus newtoni* during the Holocene, and have resulted in their currently restricted distributions

Increasing human activity caused further deterioration of the environment, leading to continuous losses in most of the main categories of natural habitats Many habitats have been reduced to a fraction of their former size It is not only the above mentioned rare species that have been affected, many relatively common species also are experiencing declines in their numbers In recent decades, additional habitats have been subject to severe pressure from agricultural intensification tourist development pollution urban growth, waste disposal, and other factors Frequently, the inappropriate planting of new forests damages valuable habitats

RECOMMENDATIONS

It has recently come to be a widely accepted axiom that species can survive only in appropriate and healthy habitats Thus conservation policy that focuses only on individual species is clearly unable to ensure the long term survival even of the species themselves Habitat protection must therefore be given far greater priority For this reason it is important that a broad program of habitat inventory be developed in Bulgaria On the basis of this information it will no doubt be necessary to enlarge the network of protected areas

Special attention should be given to the regions along the southern border of the country and Dodrudzha, including the respective parts of the Black Sea coast

Special studies of the distribution and population ecology of the most threatened small mammal species should be conducted

It is particularly important that the small mammal communities in the protected areas be studied in terms of fundamental ecological theories This will contribute to our understanding of the relationships between global and regional environmental gradients on the one hand and the patterns in species assemblages on the other

Table 1 Legend

Region I Southern Bulgaria
- 1 Subregion of Strouma and Mesta Rivers
- 2 Subregion of eastern Rhodope Mountains
- 3 Subregion of lower parts of the Maritsa and Tundzha River valleys
- 4 Subregion of Strandzha Mountain

Region II Middle Part of Bulgaria
- 1 Subregion of upper Thracian lowland
- 2 Subregion of Tundja River lowland
- 3 Subregion of eastern Balkan Mountain chain
- 4 Subregion of upper Strouma River valley

Region III Northern Bulgaria
- 1 Subregion of Danubian Plain
- 2 Subregion of Loudogorie
- 3 Subregion of Dobrudzha
- 4 Subregion of Predbalkan
- 5 Subregion of Sofia and Radomir basins

Region IV Region of the Black Sea Coast
- 1 Subregion of southern coast
- 2 Subregion of northern coast

Region V Region of uplands (above 1000 m)
- 1 Subregion of Stara Planina (Balkan) Mountain chain
- 2 Subregion of Rila, Pirin and Rhodope Mountains
- 3 Subregion of Vitosha Ichtimanska Sredna Gora Mountains
- 4 Subregion of Kraischte Konyavska Mountain
- 5 Subregion of the western border mountains

Notes
- * = natural areas according to Gruev, 1988
- 1 = sure occurrence
- + = data that requires further argumentation

Table 1 Occurrence of small mammal species (Insectivora, Lagomorpha, Rodentia) in particular natural areas* of Bulgaria

Species	I				II				III					IV		V			
	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	1	2	3	4
Erinaceus concolor	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1	1	1
Talpa europaea	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Talpa caeca														1					
Sorex araneus	+		+	+	+	+	1	1	1	1	+	1	1	+	1	1	1	1	1
S minutus									+				+			1	1	1	1
Neomys fodiens	1			1	1	1	1			1		1	1	1		1	1	1	
N anomalus	1		1	1	1	1	1		1			1	1		1	1	1	1	1
Crocidura leucodon	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
C suaveolens	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Suncus etruscus														1					
Oryctolagus cuniculus														1					
Lepus europaeus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sciurus vulgaris	1			1		1	1	1	1	1	1	1	1	1	1	1	1	1	1
Spermophilus citellus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dryomis nitedula	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Myomimus roachi		1	1	1										1					
Glis glis	1	1		1	1	1	1		1	1	1	1	1	1	1	1	1	1	1
Muscardinus avellanarius	+			1	1	1	1	1	1	1	1	1	1	1		1	1	1	1
Micromys minutus	1		1	1	1	1	1		1				1	1				1	
Apodemus mystacinus	1							1											1
A flavicollis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 1 Occurrence of small mammal species (Insectivora, Lagomorpha, Rodentia) in particular natural areas* of Bulgaria (continued)

Species	I				II				III					IV		V			
	1	2	3	4	1	2	3	4	1	2	3	4	5	1	2	1	2	3	4
A sylvaticus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
A microps													1						
A agrarius	1			1	1	1	1	1	1	1	1	1		1		+			
Rattus rattus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R norvegius	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mus musculus musculus							1	1	1	1	1	1	1		1	1			
M m domesticus	1	1	1	1	1	1								1			1	1	1
M spicilegus									1	1	1	1			1				
M spretoides	1	1	1	1	1	1	1	1						1					
Cricetus cricetus									1	1	1	1							
Mesocricetus newtoni									1	1	1								
Cricetulus migratorius				1	1	1			1	1									
Clethrinomys glareolus	+					+	1	+	+			1	1	+		1	1	1	1
Arvicola terrestris	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Microtus arvalis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M epiroticus	1				1	1	1	1		1			1	1					
M guentheri			1	1										1					
M subterraneus	+				+	+	1		1				1	1	1	1	1	1	1
Chionomys nivalis		+													1	1	1		
Sicista subtilis											1				+				
Nannospalax leucodon	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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The Bats of Bulgaria

Vladimir A Beshkov

SUMMARY

The twenty nine species of bats that occur at pre sent in Bulgaria include nearly all of the species extant in the European fauna A number of these species are very common others are rare and still others have been seen and found only once or several times The variety of bat species is well documented and their number and distri bution have been relatively well re searched However their biology – especially their re production, feeding habits and migration patterns – has been studied to a much lesser degree

The habitat or sites of the bat colonies are well documented for they occur almost exclusively in caves, mine shafts, other underground structures, and (upon rare occasions) cliffs Species composition and abundance seasonal fluctuations in bat numbers, threatening factors and changes in the variety of spe cies during the last three to four decades have all been well studied and documented The ecto and endo parasites of cave dwelling bats are also extremely well researched

The Bulgarian studies of bats have focused pri marily on species that inhabit caves, rather than those that dwell in hollowed out trees, human dwelling sites, etc Very little information is available for these spe cies

All bat species are protected by law (Order No 1021/1989 of the Ministry of Environment) with fines, penalties and claim damages imposed for every de stroyed specimen This law has been publicized and popularized through a poster and information sheet distributed throughout Bulgaria in 1989

Two species of bats – *Myotis emarginatus* and *Myotis capaccinii* – are listed in the Bulgarian *Red Data Book* (1985) as endangered species One aban doned mineshaft near the village of Golak in Sofia County has been given protected status due to the large bat colonies that inhabit it The legislative order granting this protected status (Order No 1141/1981) was issued by the Ministry of Environment Dozens of other caves with important archaeological historic or natural features enjoy special status as protected areas and also serve as bat habitats

The non cave dwelling bats are relatively less en dangered than cave dwellers whose habitats are lo cated in cave vaults and arches and in the deep cracks of the cave walls The large colonies in greatest dan ger from anthropogenetic influences are those that dwell in readily accessible and heavily visited caves There the bats are disturbed, chased, and sometimes destroyed by visitors lacking ecological awareness The worst damage to bats is inflicted through the lighting or fires in caves or cave entrances (especially during winter), and through direct destruction Great harm has also been inflicted through attempts at commercial use of caves (for example for storage cheese manufacturing and aging, or conversion into restaurants or tourist centers)

At present, no research has been conducted to study the impact of pesticides or industrial and chemi cal pollution on the population sizes and status of bats in Bulgaria

The warm and lowland regions of Bulgaria (such as the Strouma River valley the eastern Rhodopes and the southern third of the Black Sea coast) have the greatest abundance and variety of bat species Those areas and the lowland regions around 700 800 meters a s l , contain the largest bat colonies with total numbers ranging from 2000 to 3000 At higher eleva tions, both the species richness and abundance of bats that inhabit underground dwellings decrease

The large bat colonies are distributed unevenly in Bulgaria This is a consequence primarily of geologi cal factors, such as the irregular distribution of lime stone and stalactite formations with caves

A BRIEF HISTORY OF BAT RESEARCH IN BULGARIA

The first report on the bat fauna of Bulgaria is found in the work of Kovachev at the end of the 19th century and the beginning of the 20th He gives a brief account of the eight species he discovered for the first time in Bulgaria

Around 1908 1909, Ivan Buresch visited the caves near the Lakatnick train station several times gather ing bats for Professor Porfery Bahmatiev s experiments pertaining to the **anabiosis** in bats In 1917 Buresch published the first work specifically on bats in Bul garia in which he provided detailed descriptions of the morphology of 14 species

Heinrich (1936) announced the existence of 16 species of bats, and described three new subspecies in Bulgaria (these subspecies designations were later re jected by other scientists)

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Buresch (1941) published a report on the banding of 138 bats in Bulgaria, not one of which was later found Banding was later undertaken by a group of young zoologists By 1 July 1956, they had banded 626 bats (Beron, 1958) The number of bandings eventu ally increased to 3296 specimens (Beron, 1962, Beron, 1963)

Atanasov and Peschev (1963) identified 24 spe cies of bats for Bulgaria and described numerous new locations

The first study of the ecology of bats was con ducted by Beron (1964), who identified 27 caves unique for their bats inhabited by approximately fifty thousand individuals

The three catalogues on Bulgarian cave fauna (Gueorguiev and Beron 1962 Beron and Gueorgiev, 1967 Beron 1972) enumerate every species of bats found in the Bulgarian caves and describe all of their underground habitats

Studies pertaining to the discovery of individual species and their habitats were published by Markov and Jambazov (1962), Gaisler and Hanak (1964) Ha nak and Jossifov (1959) and Kwartirnikov (1956 1957) Beshkov and Beron (1962) published informa tion on the distribution and biology of the rare species *Barbastella barbastellus Vespertilio sertinus*, and *Myotis emarginatus* Kalchev and Beshkov (1963) announced the finding of *Tadarida teniotis* and Molossidae south of Plovdiv Cerveny et al (1971) found twelve species of bats in the Rhodopes some of which are new or very rare species for Bulgaria Kowatschev and Sime onov (1970) published studies of a number of charac ters of the skeleton of Rhinolphidae and Vespertili onidae species Gaisler (1970) studied the tempera ture conditions of the winter habitat of 19 bat species, but unfortunately does not distinguish between meas urements taken in Czechoslovakia and Bulgaria

Buresch and Beron (1962) found three bats of three different species banded in the Soviet Union and recovered in Bulgaria Horacek et al (1974) un dertook a study of the species richness and diurnal cy cle of bats in a number of Rhodope caves Pandurska (1992) announced a second location for the very rare *Tadarida teniotis* in southwestern Bulgaria

Researchers from the Institute of Zoology of the Bulgarian Academy of Sciences together with amateur speleologists were particularly active in studies of habitat caves and their respective colonies in the pe riod 1988 1989 Their work was financed by the Min istry of Environment This detailed report was used extensively in preparing this paper

The parasites found on the Bulgarian bats are well researched Helminths have been studied by Buchvarov (1963) and especially by Jantschev and Stoikova (1973) The ectoparasites have been re searched by Kolebinova and Beron (1965) Dusbabek (1964), Kolebinova (1967 1970) and Beron (1968, 1974)

Many popular articles on the biology and protec tion of bats have been written by V Beshkov P Beron, V Popov and others Scientific information and other practical knowledge has been communi cated through magazines newspapers radio, and tele vision The popular science documentary "Bats" de serves particular mention It was directed by K Grigoriev and produced by the "Vreme" studio in 1971 The colored poster entreating bat protection with a 6000 copy issue and distributed throughout Bulgaria during 1989 1990 also deserves mention

INFORMATION GAPS

The absence of data or lack of information in certain areas is due primarily to biases in the interests of the researchers of this field The majority of them have focused on the bat fauna in the field, others on bat parasitology As a consequence the species com position of the bats – twenty nine species – is well es tablished as are their abundance (which can be de scribed under the headings "numerous," "common ' 'rare " and "extremely rare") Their distribution is also relatively well known particularly in terms of the habitats of the cave dwellers and the character of their preferred summer and winter shelter We also have partial knowledge of the temperature conditions of their dwellings during the different seasons

The ectoparasites of bats such as ticks fleas win gless flies, and helminths are also well studied But once again this pertains mainly to the more numerous species and the predominantly cave dwelling species Of the latter, greater information is available on those that spend their days on, or hibernate on the walls and arches of the caves as they are more readily noticed and captured These include species from the genera *Rhinolophus*, *Myotis*, *Plecotus* and *Miniopterus* Spe cies that dwell and hide in cave cracks and among stalactites (such as members of the genera *Vepertilio* and *Myotis*) have been studied to a much smaller de gree

Bat researchers have only recently begun to cap ture bats using mist nets placed at the entrance of caves This method has allowed researchers to dem onstrate that species thought to be rare or extremely rare are considerably more numerous These species had not been noticed and remained unnoticed simply because of their habit of hiding and our inability to capture them

The major gaps in scientific information about the bats in Bulgaria pertain to the following areas

- Insufficient knowledge of the non cave dwelling species
- Insufficient knowledge of the bat fauna in areas lacking caves cultural landmarks wilderness and villages and in the high mountains especially the cliff massifs of the Rila, Pirin Rhodope Vitosha and Osogovska mountains

- Insufficient knowledge of bat migration including local migratory patterns A few dozen bats, banded during the years 1955 1965, were cap tured either in the same location or at a distance up to 160 km from the banding site The data thus far obtained is extremely inadequate, but in dicates that repeat migration from cave to cave is taking place However, there is some evidence that non periodic migration also occurs

- Insufficient knowledge of the biology of the re spective species Only in the last three years has research on bat food habits been conducted This information has not yet been published Basic data on reproduction (particularly birth cycles), pelage and first flight of the young has been gathered for seven to eight species, with up to 10 12 observations for some of these species Infor mation on the diurnal nocturnal activities of bats is scarce and is readily available only for the common and highly colonial cave dwelling spe cies Data on flight 'levels " competitive relation ships and other aspects of bat biology and ecol ogy is extremely scarce

- Information on the effects of human activity on the large bat colonies is also inadequate This information is drawn primarily from rare or occa sional visits to these colonies Thus the results serve only to orient or provide "bare bone" pa rameters In most cases the results are worrisome No observations or research have been con ducted on the effect on bats of pesticides and in dustrial and chemical pollutants

- Our knowledge concerning the level of awareness among the Bulgaria population of the protected status of bats is inadequate We have insufficient information on the effect of bat related publicity and the distribution of the poster in 1989 90 We also lack understanding of the effect of the film about bats that was shown on Bulgarian television in November 1992

CURRENT STATUS

In 1988 89 a group of researchers from the Insti tute of Zoology of the Bulgarian Academy of Sciences, together with amateur speleologists (primarily students and members of speleology clubs around Saofia) con ducted a thematic study entitled Prooucbvane na sustoyanieto i stepenta na zastrashenost na prilepnite colonyi v Bulgaria s ogled na tyahnata zashtita ('Study of the Status and Level of Threat of the Bat Colonies of Bulgaria With a View Toward Their Pro tection') The study was commissioned by the Bul garian Ministry of Environment To a great extent, the data presented in this section is derived from this study Other data was gathered during the period 1955 1988 Studies conducted from 1990 1992 pro vided a third source of data

Areas Requiring Further Study

A more appropriate term might be "less familiar territories " Areas that have been least studied are

1 The upper reaches of the mountains especially mountains with silicate cliff composition but lacking caves Although bats in nocturnal flight have been observed in these areas there are virtually no records of captured specimens At the same time it is precisely in these re gions that we may expect to find in greater abundance species that in the lower altitudes are considered "extremely rare," like *Vespertilio murinus*, *Barbastella barbastellus*, *Myotis bech steinii*, *Myotis nattereri* *Vespertilio nilssonii* and perhaps others

2 Relatively few bat specimens are known from the wide ranging Danubian and Thracian plains of Bulgaria Very little work has been conducted in these areas due to the lack of caves Consequently the species composition of the bat population is probably considerably different from that of the "cave" regions

3 It is highly probable that new colonies of bats could be discovered in cave openings located on vertical cliffs and in gorges created as a re sult of water erosion – sites that are inaccessi ble without mountain climbing gear Informa tion about significant bat colony finds and of diurnal or hibernating bats dwelling in caves whose entrances are located on steep vertical cliffs, is growing Bulgaria has hundreds of such unexplored cave openings

Species Richness

With its twenty nine species Bulgaria's bat fauna is richer than that of the countries of Central or Northern Europe, and measures up well against the Mediterranean countries or those closest in proximity to the Mediterranean Sea Among the European states, Bulgaria rates "high" on the scale of species di versity Compared to other areas of the Palearctic Bulgaria rates as "average "

Rare Species

All of the species of bats encountered in Bulgaria are either abundant or commonly encountered – there is a difference! – in Europe, the Near East North Af rica and even Australia (one species)

The majority of species that are deemed rare or even extremely rare in Bulgaria are in other areas common, or at least abundant This is the case with *Barbastella barbastellus Vespertilio murinus Myotis natteren*, and *Myotis bechsteinii* which are extremely rare in Bulgaria but common in Central and Northern Europe The same is also true of *Tadarida teniotis Vespertilio savii*, and *Vespertilio kuhlii* which are rare in Bulgaria, but not so in Southern Europe or the Near East

No species that are frequently encountered in Bulgaria are rare in other parts of their ranges The value of the Bulgarian bat fauna lies in the existence of large colonies of most species common to our biogeographic region Throughout the European states, such colonies no longer exist or are extinct due to human impacts Bulgaria falls into the region where many northern species reach the southernmost borders of their distribution, and some southern species have their northernmost occurrence Consequently the presence of rare species is not high

Endemism

As a consequence of their extreme mobility, bats have large distributional ranges (excluding certain island fauna) All bats in the Bulgarian fauna are encountered across wide areas Some inhabit virtually all of Europe and portions of neighboring continents as well including some of their far flung corners No bat species are endemic to Bulgaria or the Balkan peninsula Three endemic subspecies have been described in the territory of Bulgaria *Myotis capaccinii bureschi Miniopterus schreibersii inexpectatus* and *Myotis mystacinus bulgaricus* (these are the three from Heinrich s 1936 work) Contemporary specialists however, do not recognize these as valid subspecies

Ecosystems, Habitats, and Unique Communities

The problems in preserving the diversity of species and the distribution of the large and medium sized cave dwelling bats extant in Bulgaria will be examined under this heading

The large bat colonies are distributed extremely unevenly throughout the territory of the country Their locations are determined by the existence of caves that are conducive to their survival and removed from human activities The importance of the latter quality is demonstrated by the eviction or destruction of some cave dwelling colonies whose caves are frequented by visitors or through the adaptation of caves to suit tourist or business needs

During the active period of the year between April through October *Miniopterus schreibersii* is the dominant large bat In the majority of cases this species constitutes 70 95% of the bat population in the colonies *Myotis myotis* and *Myotis blythii* can coexist with *Miniopterus schreibersii* constituting some 5 10% of the bats present These two species are virtually indistinguishable without capturing and measuring them as their biological characteristics are very similar In the following text they are referred to as the "large *Myotis*,' for in many cases their capture has been impossible due to the inaccessible height of their location within their colonies or to the disturbance and frightening away of the colony *Myotis daubentonii* is also found on occasion

In still rarer instances *Myotis capaccinii* inhabits the same caves Individual or tens of *Rhinolophus ferrumequinum* have also been found to cohabit these caves, and occasionally individual *Rhinolophus hipposideros* live there as well *Rhinolophus blasii* and *Rhinolophus euryale* can also be found on rare occasion These latter two species are quite similar in their biological characteristics In cases where the species are not definitely distinguished or when both species are determined to occur they are termed "average *Rhinolophus*," as they are average in size when compared with the much smaller *Rhinolophus hipposideros* or the much larger *Rhinolophus ferrumequinum* In many cases they live along with dozens and at times hundreds of *Myotis emarginatus* This latter species is rarely found alone but cohabits with the *Rhinolophus* bats

During the second half of October and the first half of November some of the larger colonies leave their summer quarters and migrate to underground sites that are appropriate for hibernation In such instances, up to ten species can be found in a single cave This includes bats that during the summer are never found in caves

Miniopterus schreibersii hibernate in large groups some 10 200 individuals having been observed in one place The two large *Myotis* species hibernate in groups of up to 800 *Myotis capaccinii* in groups of up to 3000 *Rhinolophus ferrumequinum* in groups of up to 400, the two average *Rhinolophus* in groups of up to 250 300 The remaining species occur in groups of several dozen or as single individuals

A list of Bulgaria's 13 most significant bat dwelling caves follows These caves are of primary importance for the existence of bats in the country in that many serve as important reproduction centers or "nurseries" and as roosting and hibernation sites for thousands of bats Some of these caves are protected by the nature protection acts or other legislative bills They are marked here with an asterisk (*) But in the majority of caves bats are extremely vulnerable and indications of their destruction or disturbance – including long sticks, dead bats and the lighting of fires – are in evidence

1 ***"Nanin Kamak" near the village of Musselievo in Nikopolsko County***

This cave is located approximately 1 km from the village at the base of a crown of limestone cliffs and at the uppermost reach of the characteristic hill During

five visits between the end of April 1968 and February 1989, 1500 to 3250 *Miniopterus schreibersii* were observed and a few tens of *Myotis blythii*, on some visits between 400 1500 *Myotis capaccinii* up to 50 average *Rhinolophus* and up to a few hundred *Rhinolophus ferrumequinum* were reported

During two winter visits (January and February) no bats were found They flee as they are often disturbed during purposeless visits by local youths who at times destroy them The cave in itself is unremarkable except for the existence of the large bat colonies within

2 ***"Serpanovata Peshtera," near the Cherpish train station in the Iskar gorge***

During several repeated warm season observations of the chasm at the end of the cave (which is 14 meters deep) and of the cave's arches, 300 400 *Rhinolophus ferrumequinum*, 2600 2900 *Miniopterus schreibersii* approximately 60 *Myotis myotis*, and an individual *Rhinolophus ferrumequinum* were reported

During winter visits approximately 1500 *Miniopterus schreibersii* 21 *Myotis myotis*, and 30 *Rhinolophus ferrumequinum* were found On another winter visit no bats were found The difficult drop into the cave's interior as well as the height of the arches on the upper lever assure that these bats will be relatively well protected from human visitation

* 3 ***"Parnitsite," near the village of Bejanovo in the Lovetch region***

This cave serves as a water route for an underground stream It is 2950 m long with an upper entrance where the water enters from underground and a lower one where the water exits Visits made during the summer season established the presence of 550 600 *Miniopterus schreibersii* 700 800 *Myotis myotis* and *Myotis blythii* and hundreds of *Myotis capaccinii* During other visits 2700 2800 *Myotis myotis* and *Myotis blythii* and approximately 800 *Miniopterus schreibersii* were observed

During a winter visit there were found hibernating in the cave approximately 4000 *Miniopterus schreibersii* between 2000 and 2500 *Myotis capaccinii* several tens of *Rhinolophus ferrumequinum* and individual representatives of other species The cave is generally visited by speleologists both specialists and hobbyists who leave the bats undisturbed

* 4 ***The mineshaft near the village of Golak in the Kostenets area, located in the Ihtiman Sredna Gora mountain range***

The mineshaft was dug approximately 400 years ago to extract iron ore The shaft is 63 meters long and 10 12 meters in height and width In 1916 Ivan Buresch estimated that 20 000 bats inhabited the mineshaft In March 1958, the bat population was estimated at 3000 5000 In subsequent visits between the end of March and 10 October of various years, the bat colonies were found to consist of 90 95% *Miniopterus schreibersii* and to range from 3000 5000 individuals during March, April, and October to 12 000 14,000 individuals in June and July During the winter, the hibernating colony was usually estimated to contain from 2000 3000 individuals The minimum population reported was 1200 and the maximum 9800 9900 During the winter of 1970 71 no bats were found hibernating in the mineshaft

Two other species of bats – large ones but in considerably fewer numbers – have also been found in the shaft *Myotis*, with up to 40 50 individuals, and *Rhinolophus blasii*, occurring as single individuals *Rhinolophus ferrumequinum* and *Rhinolophus hipposideros* have also been found on occasion

The shaft serves as the "maternity ward" or "nursery" for thousands of *Miniopterus schreibersii* At the end of June and in the first days of July they flock in from other places Their protection is ensured by special order No 1141/1981 of the Ministry of Environment However, urgent measures are needed for their actual protection

5 ***"Gargina Dupka" near the village of Mostove in the Assenovgrad region in the Rhodope Mountains***

Huge amounts of bat guano are found in this cave It is approximately 300 m^2 in size, and ranges from 16 18 meters in height It has served as a gathering site for millennia

During a total of seven visits both winter and summer colonies of several thousand *Miniopterus schreibersii* have been observed In February 1989, 10 000 individuals of this species were found Local inhabitants have made a practice of setting fire to rubber and plastic garbage at the cavesite A great many bat corpses have been found This colony is unique and remarkable for its persistence and permanence Its population is extremely vulnerable

6 ***The cliff crevices near the "Madarskyiat Konnik" (the Madara Knight) near Shoumen***

The crevice is located 100 to 120 meters from the bas relief of the knight at an upper left angle of 50 to 55 degrees The climb to the crevice is dangerous as is the drop to the ledge, which is unstable

During the summer 2600 2650 *Miniopterus schreibersii* and 2900 3000 large *Myotis* have been observed These craggy cliffs serve as the colony's nursery

In the middle of October the bat population disappears The high wind currents and low temperatures of the openings are not conducive to hibernation

The quantities of guano indicate that this site is inhab ited by large colonies Special protection is needed

* 7 ***The cave near the village of Prolas, near the town of Turgovishte***

Summer season visit results in 1958 several thousand *Miniopterus schreibersii* and hundreds of *Myotis* in 1970, the same plus a few tens of *Rhi nolophus ferrumequinum* in 1988 13,500 14,000 *Min iopterus schreibersii* and approximately 350 large *Myotis*, in 1989 8000 9000 *Miniopterus schreibersii* and individuals of other species

Winter season visit results in 1971, 5000 8000 *Miniopterus schreibersii*, 300 400 large *Myotis*, and ap proximately 300 *Rhinolophus ferrumequinum* in 1988, 5000 7000 *Miniopterus schreibersii*, approximately 150 large *Myotis* and some 20 *Rhinolophus ferrume quinum*

This cave is visited frequently by local youths from the village of Prolas who light fires and destroy the bats This colony is extremely important, and quick and effective preservation measures are urgently needed

* 8 ***"Orlovata Peshtera" in the Zelenich area, near the town of Kotel***

This cave is about 100 meters long with a simple configuration During visits in the summer of 1958 around 5000 *Miniopterus schreibersii* and several tens of *Rhinolophus ferrumequinum* and large *Myotis* were reported In 1989 approximately 3700 *Miniopterus schreibersii* were found including newborn bats

No bats were reported during winter visits in 1989

The protection of this cave is absolutely necessary Speleologists from the town of Kotel have observed large colonies on numerous occasions The cave is readily accessible and frequently visited by people, in cluding groups that disturb the bats

9 ***"Yars Iny" or "Prilepnata Doupka," near the Sredna Arda train station in the Kurdjaly area***

The cave is approximately 15 meters long 8 9 meters wide and 4 meters high

Summer observations in June 1989, 7000 8000 large *Myotis* were counted, most of which were in ad vanced stages of pregnancy A small number of new borns were included

Winter observations no signs of bats were found in a November 1989 visit

In April 1989 a group of youths from Kurdjaly set a huge bonfire in the cave and with sticks and branches killed several hundred bats primarily *Myotis* and some what fewer *Miniopterus schreibersii* Urgent protection of this cave is needed in order to prevent further incidents of this kind

* 10 ***"Ponora " a water cave near the village of Chiren in the Vratsa region***

This cave contains underwater lakes and streams and is approximately 3 5 km long The cave still shows signs of abandoned attempts to convert it into a tourist center and is in a sorry state A water pump at the entrance emits unbearable noise During the years 1958 1966 large colonies of *Miniopterus schreibersii* large *Myotis*, and *Myotis capaccinii* were observed, along with hundreds of *Rhinolophus ferrumequinum* and *Rhinolophus blasii*, with other species found as single individuals Amateur speleologists have ob served colonies of 3000 to 6500 members

During the summer of 1988, 900 large *Myotis* were observed On another visit the same year the water pump was emitting intense noise, so that only individ ual bats remained A colony of nearly 100 individuals was found within 50 meters of the cave inside a cliff crevice with a 'chimney' above the crevice Several weeks later, 300 400 *Rhinolophus blasii* were observed resting in the cliff's crevices near the cave

* 11 ***"Orlova Chooka," near the village of Pepelina in the Rousse region***

This is an extremely large spacious, branching cave It is partially electrified and an object of high tourism activity At the time of its discovery nearly 50 years ago, huge bat colonies were observed, both dur ing the summer and winter

During numerous visits over the last 30 years and throughout the four seasons, large colonies of *Miniop terus schreibersii* large *Myotis*, *Rhinolophus ferrume quinum*, and others have been observed Over the past decade, the numbers have progressively declined due to the human presence In April 1988 hundreds of bats were seen to fly though the door gratings of the cave In March 1989, nearly 400 *Rhinolophus ferru mequinum* were spotted as well as hundreds of *Min iopterus schreibersii*, and tens of *Myotis* In November 1989 between 14,500 and 15 000 *Miniopterus schreibersii* nearly 200 *Rhinolphus ferrumquinum* and several large *Myotis* specimens were noted

12 ***"Manailovata Peshtera," near the village of Ribnovo in the Gotze Delcheve area***

The cave is approximately 1 km long A stream flows through it In the course of numerous visits made from 1958 1988 thousands of bats were re ported, among which *Miniopterus schreibersii* domi nated In October 1988, 1200 *Miniopterus schreibersii* were reported In October 1989, several thousand *Miniopterus shreibersii* were observed flying out of the cave in the early evening hours s

13 ***The bat cave near the village of Yantra, between the towns of Sevlievo and Dryanovo***

The cave is nearly 50 m long and has two cavities During May 1989, nearly 5600 large *Myotis* were pre sent some of which were with newborns The cave is visited regularly fires are lit and bats are destroyed Protection is urgently needed as the colony is ex tremely vulnerable

The following caves and other sites like those listed above, are inhabited by sizable bat colonies However they are not of primary importance because either (a) the bat colonies are not readily accessible due to steep cave entrances or other impediments or (b) the number of bats extant is not high

* 14 ***"Toplya," in the village of Golyama Jelyasa in the Lovech region***

During one visit in October 1989 3000 *Miniop terus schreibersii* and considerably smaller numbers of 3 species of *Rhinolophus* and large *Myotis* were re ported

* 15 ***The water-eroded precipice "Drunchi Poopka " near the village of Melnitsa in the Topolovgrad area***

Colonies were spotted in August 1970 March 1971 and November 1989 and the existence of 1200 to 4000 *Miniopterus schreibersii* and from ten to sev eral hundred large *Myotis* was established The bats dwell in the 22 meter deep precipice and are essen tially inaccessible Visitors are extremely infrequent and consist for the most part of speleologists

16 ***"Devetashka Peshtera," between the trains sta tions of Levski and Lovech***

During September 1989 2000 3000 *Miniopterus schreibersii* approximately 30 *Rhinolophus ferrume quinum* several tens of *Vepertilio pipistrellus* a single *Rhinolophus hipposideros* and a single *Myotis* were re ported here The bats are virtually invulnerable due to this large cave s high arches which reach a height of 40 50 meters

* 17 ***"Haidoushkata Peshtera," near the village of Devnitsa in the Cherven Bryak region***

This pattern of habitation in this cave is highly variable In February 1989 bats were completely ab sent In April 1989 researchers counted 5000 to 5200 *Miniopterus schreibersii* an individual large *Myotis* and an individual *Rhinolophus hipposideros* On another visit in December 1988 up to 250 *Rhinolophus euryale* and other species represented by single individuals were found

18 ***The cliff crevices resembling block like for mations near "Taouk-liman," north of Cape Kaliakra, Balchik***

A colony of about 100 *Rhinolophus ferrume quinum* dwells in the crevices This colony is essen tially invulnerable

* 19 ***"Morovitsa," near the village of Glojene, Tete ven***

The great quantities of guano found in the depths of the cave indicates the periodic habitation of large colonies The presence of the following species was confirmed through the use of mist nets *Rhinolophus ferrumequinum*, *Rhinolophus euryale*, *Vespertilio serotinus* the two species of large *Myotis* and *Miniopterus schreibersii*

20 ***"Bozhkova Doopka," near the village of Krivnya in the Rasgrad region***

In April 1988 300 400 *Rhinolophus euryale* were reported A March 1989 visit found several hundred *Miniopterus schreibersii*, around 200 average *Rhi nolophus*, and single representatives of *Myotis emargi natus* *Myotis capaccinii*, and *Myotis bechsteinii*

21 ***"Yamata," a precipice located behind the restaurant "Lednika" on Bratsa Mountain***

In November 1988 55 large *Myotis* were found to be hibernating in the 45 meter deep precipice

* 22 ***"Giminata Peshtera," near the village of Sadovets in the Pleven region***

In July 1988 nearly 1500 *Miniopterus schreibersii* approximately 100 *Myotis capaccinii* and 50 average *Rhinolophus* and several large *Myotis* were observed

In December 1988, nearly 50 *Miniopterus schreibersii* 2 *Vespertilio serotinus*, about 20 *Myotis capaccinii*, 2 *Plecotus* and an individual *Rhinolophus hipposideros* were seen

23 ***The water cave "Mandrata," between the vil lages of Chavdartsi and Alexandrove in the Lovech region***

In July 1988 2000 3000 *Miniopterus schreibersii* and approximately 20 *Rhinolophus ferrumequinum* were reported

In January 1989 around 60 *Rhinolophus ferrume quinum* and 15 *Rhinolophus hipposideros* were re ported

24 ***"Boskite," near the village of Mramor in the Topolovgrad area***

In October 1988 a colony of nearly 500 *Miniop terus schreibersii* was observed In February 1989 no bats were observed In 1971 local inhabitants either chased or killed nearly 800 *Rhinolophus blassi* In the years 1958 1970 a significant colony of *Myotis emar ginatus*, ranging from tens to hundreds of individuals, was observed around the entrance area Bats have either been chased or killed a great many times in this cave

25 ***"Kaleto," near the village of Mladezhko in the Strandzha Mountain region***

In June 1989, a colony of *Miniopterus schreibersii* was identified During summer visits, colonies of sev eral tens of *Miniopterus schreibersii* and *Rhinolophus ferrumequinum*, as well as average *Rhinolophus* were observed

During the winter, individual hibernating average *Rhinolophus* were found The cave is frequently vis ited by tourists and treasure hunters As a conse quence, the existence of large colonies of bats is im possible

* 26 ***The southern underground cave near the cape Maslen Nos, southwest of Sozopol***

This cave can be entered only through swimming or with a boat It is inhabited by thousands (between 5000 and 8000?) of *Miniopterus schreibersii* and by large *Myotis*

During the last visit, in October 1989, 3000 *Miniopterus schreibersii* were counted as well as several tens of large *Myotis* The cave is very rarely visited Consequently, the bats are virtually invulnerable

27 ***Karaul tash, a cliff approximately 1 8 km from the cape Maslen Nos, Bourgas region***

During the summer months, this cliff is inhabited by a mixed colony of approximately 500 *Myotis emarginatus* and average *Rhinolophus* The bats reproduce in the half lit and windy openings of the crags The colonies are extremely vulnerable

* 28 ***"Lyastovitsata," near the village of Glojene, Teteven***

This wide cave has an abundant population of bats Nearly 900 large *Myotis* and at least 300 400 *Miniopterus schreibersii* 50 *Rhinolophus ferrume quinum* 30 40 average *Rhinolophus* and 10 *Rhi nolophus hipposideros* were observed here

During other visits, up to 80 large *Myotis* 73 *Rhinolophus ferrumequinum* and 12 *Rhinolophus hip posideros* were counted

29 ***Zandana, near the village Ploski in the Sandanski area***

This is a semi dark narrow tall slit or crack, with a horizontal floor set between craggy columns In May 1988 there were 350 400 *Rhinolophus ferrumequinum* present Two weeks later 150 200 of the same species were sighted The bats of Zandana are virtually invul nerable

* 30 ***"Sedlarkata," near the village of Rakita in the Pleven area***

This aquatic cave is nearly 1100 meters long It is difficult to visit without diving gear At the beginning of the cave, and somewhat later in the interior, it is necessary to swim through a number of underground pools

In July 1988 800 1000 *Miniopterus schreibersii*, 20 30 *Rhinolophus ferrumequinum*, and approximately 20 *Myotis daubentonii* were seen Special measures for the protection of these bat populations are necessary

31 ***"Kalenska Peshti," near the village of Kalen, north of Mesdra, in the Vratsa area***

Entry to this cave is illegal as it is used as a water source

During visits conducted in March of 1988 and 1989 400 500 *Miniopterus schreibersii* approximately 20 *Rhinolophus ferrumequinum* and a single *Rhi nolophus hipposideros* were observed

During the second visit, approximately 260 *Min iopterus schreibersii* and 75 *Rhinolophus euryale*, 13 *Rhinolophus ferrumequinum* 6 *Rhinolophus hip posideros*, and 2 large *Myotis* were present

32 ***"Czarskata Peshtera," near the village of Belyakovets, Veliko Turnovo***

A March 1988 visit found approximately 1600 *Miniopterus schreibersii* and 20 *Myotis daubentonii* Today the cave has been blocked and is used for commercial purposes There is a slight possibility that the bats can enter it through a several hundred meter long opening that connects the cave with its source

33 ***"Kalna Mutnitsa," between the villages of Glavatsi and Byali isvor in the Mihailovgrad area***

In the years 1965 1971 colonies containing up to 1000 1500 *Miniopterus schreibersii*, 250 300 hibernat ing *Rhinolophus ferrumequinum* and single represen tatives of four other species were observed

In July 1988, a colony of around 2500 *Miniopterus schreibersii* was observed with several tens of large *Myotis* among them

* 34 ***"Mishin Kamuck," near the village of Gorna Looka in the Mihailovgrad area***

In April 1988 observers counted nearly 9000 9500 *Miniopterus schreibersii*, nearly 50 *Myotis blythii*, around 10 *Rhinolophus hipposideros* and approximately 20 average *Rhinolophus* In December 1988, 13 large *Myotis* and a single *Miniopterus schreibersii* were reported

* 35 ***"Soohi Pech," near the Orshets train station, Belogradchik***

In April 1988 a colony of 7500 8000 *Miniopterus schreibersii* single representatives two species of *Rhinolophus* and individual large *Myotis* were observed In December 1988 individual *Rhinolophus ferrumequinum* and *Miniopterus schreibersii*, as well as 15 20 *Myotis capaccinii* were seen Similar data emerged from a January 1991 visit The large quantities of fresh guano toward the back of the cave indicate that large colonies use the cave during the warm seasons

36 ***The precipice "Kirov Vurtop," near the village of Bohot in the Pleven area***

This cave has a perpendicular entrance 10 12 meters high and can only be visited by well equipped speleologists or cave hobbyists Nearly 300 *Rhinolophus ferrumequinum* were found in a side gallery during the summer In a winter visit at least 100 of the same species as well as individual large *Myotis* and *Rhinolophus hipposideros* were observed

* 37 ***"Bozhiyat Most," near the village of Lilyache in the Vratsa area***

The cave is located at a height of 9 10 meters on the wall of a cliff arch known as 'God's bridge " The climb is very difficult The cave is nearly 100 meters long In July 1958 a colony of several thousand *Miniopterus schreibersii* and large *Myotis* was located During subsequent visits small groups of *Miniopterus schreibersii* and *Rhinolophus ferrumequinum* have been sighted The quantities of guano indicate that the cave is periodically visited by large colonies of bats

38 ***'Kecedzhiytsa," near the village of Melnitsa, Topolovgrad***

During visits in August 1970 and March 1971 a colony of 150 200 *Rhinolophus ferrumequinum* was reported No bats were found in October 1988

39 ***"Kolibata," near the village of Belidye-han, 25 km northwest of Sofia***

In August 1955, a colony of 600 800 *Miniopterus schreibersii* and several tens of large *Myotis* inhabited this cave In August 1989 a colony of 60 80 of the same species was reported Fires are periodically lit in the cave by visitors As a result, the colony has been unable to reestablish itself at its 1955 (or prior) level Individual bats of the genera *Plecotus* and *Rhinolophus* have been found to hibernate

* 40 ***"Dyavolskoto girlo" ("the Devil's thought"), near Trigrad in the Devonsko area in the Rhodopes***

In June 1977 around 400 *Miniopterus schreibersii* were observed In March 1989, nearly 10,250 bats of the same species were observed The cave has been developed and is heavily visited by tourists However, they do not appear to disturb the bats

41 ***"Karnata Peshtera," near the "Yagodisnskata Peshtera," near Devonsko in the Rhodopes***

Amateur speleologists have reported the existence of large colonies of bats using the cave for hibernation

42 ***"Urushkata Maara" near the village of Krooshoona, Lovech***

During visits in 1958 1960 1966, and in subsequent years researchers found colonies of between 2000 6000 *Miniopterus schreibersii* lesser numbers of large *Myotis* and individual bats of other species In March 1989 20 30 *Miniopterus schreibersii* and 3 *Rhinolophus ferrumequinum* were reported

43 ***"Tumnata Doopka," near the village of Resselets, Chervenbregg***

Colonies of several hundred bats have been observed on numerous occasions Their numbers are difficult to determine due to the inaccessibility of their dwelling places (they are some 30 m above the cave floor) The following species have been confirmed *Miniopterus schreibersii* large *Myotis Myotis emarginatus* and during the winter individual *Rhinolophus ferrumequinum*

* 44 ***The cave near the village of Emen in the Veliko Turnovo area***

Various attempts to commercialize or develop the cave have been made and abandoned The cave is in a

decrepit condition Furthermore it is visited fre quently by tourists

Around fifty *Miniopterus schreibersii* as well as 29 *Rhinolophus ferrumequinum* and individual bats of other species were found during a January visit

During an October visit around 100 *Rhinolophus ferrumequinum* and 200 220 large *Myotis* were ob served The quantities of guano indicate that sizable colonies of bats dwell in this cave during certain sea sons

45 ***"Vodnata Pesht," near the village of Lipnitsa in the Botevgrad area***

During the years 1960 1973, and at numerous times since, colonies of 80 100 *Rhinolophus ferrume quinum* and up to 300 400 *Miniopterus schreibersii* have been reported Speleologists built a cabin near the cave in 1980 to serve as a training base They have reported finding on occasion small groups of up to 20 bats

46 ***"Footyofska Peshtera," near the village of Car pachevo, Lovech***

In September 1960 several individual bats were found to hibernate here However, the considerable amount of fresh guano present indicates that this cave is periodically inhabited by a colony of several hun dred *Miniopterus schreibersii*

* 47 ***The precipice Soohata Drunchi doopka" be-tween the villages of Ostrem and Mramor, To-polovgrad***

This precipice is nearly 100 meters deep At its bottom are two chambers that contain considerable quantities of guano

In August 1970 several tens of *Miniopterus schreibersii* and an equal number of *Rhinolophus* were observed In November 1989 the entrance was found to have been filled in with thorny shrubs Shepherds had filled it to prevent their flocks from falling in Consequently no bats were found If free access is once again established the bat colonies will probably return to their old habitat

* 48 ***The precipice cave "Lednitsata" in Zlosten, near the town of Kotel***

This structure is 1142 m long and 242 m deep from the entrance to the cave's bottom In September 1970, between 1500 1700 *Miniopterus schreibersii* were reported In September 1989 only 520 550 *Miniop terus schreibersii* and two *Myotis blythi* were found The quantities of guano indicate that large colonies of bats regularly inhabit this cave The deeper areas of this cave require the use of mountain climbing gear Consequently no special protection measures are nec essary for the time being

Documentation is available concerning nearly eight hundred other caves precipices and artificial mineshaft galleries across the country These sites serve as dwelling places for individual bats for tiny colonies that inhabit them inconsistently or occasion ally and for larger colonies that occasionally use them as stop off points for one or two nights during their migratory flights

Many of the bat species that inhabit caves can also be found outside caves, particularly during the warm seasons (*Miniopterus schreibersii* which is closely associated with caves and dwells within them almost exclusively, is an important exception) The species of the genus *Rhinolophus* can be observed dwelling in man made structures on cliffs, etc Colonies of 200 300 *Myotis emarginatus* can at times be found along side the *Rhinolophus*

During the hot months *Vespertilo serotinus* habi tually occupies cracks in human dwellings or construc tion sites, as well as craggy cliffs and other natural niches This also holds true for the two *Plecotus* spe cies From June to August the two large *Myotis* settle in the warm and well ventilated domes of cave en trances and arched cliffs These two species some times choose to inhabit human structures settling in clock towers and other suitable sites Members of the genus *Nyctalus* dwell exclusively outside caves They reside primarily in tree hollows However, during the spring and autumn they will settle for brief periods of time in hidden corners of human habitats In rare in stances, colonies of *Nyctalus noctula* will occupy cracks and chinks in human dwellings for the entire summer season (this occurred on one occasion at the Ministry of Interior's building in Sofia)

Areas of Special Ecological Significance

The biological requirements of the bats determine their daily and seasonal habitats, including those terri tories of special ecological significance Bats are found in all regions from arid and semi desert areas to farmlands deciduous and coniferous forests and the subalpine belt of the high mountains

The distribution or dispersion of large colonies depends more than anything on the existence of caves and other underground chambers that are large in vol ume meet particular microclimatic requirements and are protected from human visitation and aggression The altitude of the cave undoubtedly plays an impor tant role in establishing its temperature and in ensur ing the presence of the fauna primarily flying insects, that serve as a food source for the bats Thus the large colonies inhabiting the caves listed above are between 5 and 800 meters above sea level At higher eleva tions the colonies are few and tiny or the bats occurs as individuals

The protection of bat dwelling caves that are con tinuously or occasionally inhabited is the most impor tant requirement for the preservation of bats in Bul garia Rare species, species that occur as individuals,

and non cave dwelling species can be protected through information dissemination educational activi ties and in some specific instances through protection of their territories or habitats (such as hollows in trees or trunks and other temporary dwellings) Informa tion dissemination can also help protect those bats that either dwell or hibernate in caves that cannot for whatever reason, be given protected status

Sensitivity to Human Activity

Comparison of cave dwelling bat populations in Bulgaria for the periods 1955 1971 and 1988 1992 in dicates a considerable decline This decrease has been estimated at between 20 and 40 percent Observation and analysis of the data indicates that the determinant factor in this population decrease is the frequent dis ruption violence and destruction perpetrated by visi tors Researchers from Central and Western Europe have come to the same conclusion

The number of visitors to caves has greatly in creased over the last 20 30 years During the past 3 years however, this number has been reduced Active professional and amateur speleologists number several thousand while unorganized tourists numbers in the several hundred thousands The caves located in the Lakatnic cliff massif are a case in point supporting the above contention This area is located 60 km north of Sofia Thirty to thirty five years ago some 200 250 bats belonging to 9 species hibernated within these caves The number of raucous groups setting up camps and lighting fires inside the caves has subse quently increased greatly As a consequence there are presently no more than 15 20 bats of 3 to 4 species hi bernating in the caves The survey methodology used was the same for both time periods Conversely the Golak mine shaft (#4 above), which had smaller bat populations 20 to 25 years ago has shown a consider able increase in its population during the past 10 12 years This is a result of reduced visitation and distur bance (the village of Golak has itself had a reduction in its population)

Only tiny groups or individual bats enter hiberna tion caves that have been commercialized or converted into tourist centers (caves such as "Magoora ' "Ledenika," "Snejana " "Batcho Kiro " and a few oth ers) However the large hibernating colonies that dwell in the "Diavolskoto Girlo" (#40) the Yagodinskata Peshtera ' (near #41) and in the Orlova Chooka" (#11) have been protected Com parisons between current populations and those pres ent prior to commercialization indicate that bats in the caves that have been developed or commercialized (#s 10 23 34 44) have been massively eradicated There are also cases where the caves have not been devel oped but the bats are frequently disturbed and even destroyed (#s 9 17 20 22 24 25 37 39 45)

It is important to note that bat population num bers have not declined appreciably over the past dec ade in caves 15 and 26 where entry is difficult

The hypothesis that bat populations have been re duced due to the effects of pesticides on their food base is unproven Special studies of the quantities on nocturnal flying insects have not been carried out Even if such studies had been carried out, we lack baseline data with which to compare them no data on these insect populations are available for the period prior to the onset of chemical pesticide use in farming and forestry However indirect observations indicate that the use of insecticides and other chemicals has not had a visible impact on the population of bat colonies

Large bat colonies can exist in highly developed intensive farming areas as long as their habitats are not frequently visited (cave #1 is an example) No bats have been found to have been killed by poisons or pesticides On the contrary, in all cases the carcasses have shown evidence of direct extermination by physi cal blows or through the effects of hot stinging smoke

According to our analysis, the factors that nega tively affect bat population can be grouped as follows

1 ***Highly intensive negative factors***

a Fires in caves or cave entrances especially during bat reproductive stages (end of May through middle of July)

b Direct destruction of bat colonies with sticks usually in combination with the lighting of fires inside caves

c Noise in caves, particularly startling shouts or sounds from other sources If noises are fre quently repeated, the bats will desert the cave

2 ***Negative factors with average effects***

a Artificial illumination of colonies This is al most always accompanied by noise

b Development of caves into tourist centers or conversion to commercial use Construction it self as well as the subsequent uses, are always accompanied by the above factors

c Enclosure or outright closing of cave entrances and demolition of cave entrances for quarries These cases are still rare, and fortunately have not affected the bat population density of the country as a whole

d Destruction of tree hollows This adversely affects species such as those in the genus *Nyc talus* that regularly inhabit tree hollows Of 12 13 tree hollows in the vicinity of Sofia inha bited by *Nyctalus noctula* in the years 1955 1958, only 4 remained during 1971 The others had been cut down

3 *Negative factors with slight effects*

a The effects of industrial pollution chemicals and pesticide use As previously noted we lack specific data as to these effects It can be assumed *a priori* that chemicals have a negative effect on bats It appears, however, that the effects are neither rapid nor drastic

Known Dangers

The future threats to Bulgaria s bat populations are essentially the same as those actively present today However, the most imminent dangers faced by the bats such as disruption, chasing away, and outright destruction by visitors have probably been reduced in the last 3 4 years A number of factors might explain this among them the economic recession, greater public interest in politics, and the possibility of starting private enterprises These may have veered interest away from tourism These factors have also resulted in a drastic decline in visits to the developed caves as reflected in reduced ticket sales and fewer visits to vacation cabins We have reason to believe that this pattern also holds true for "non developed" caves when current visitation rates are compared with those of the 1970s and early 1980s

At the same time increasing private business initiatives could once again focus on the caves, and lead to the conversion of some of them into restaurants storage facilities, and other commercial enterprises This would cause bats to abandon caves or even to go extinct This would also result in the destruction of priceless archeological and paleontological data as well as the impairment of natural beauty Consequently commercial development of caves should not be allowed

Bats are also threatened by the extraction of guano from some caves Over the last 20 years this practice has been virtually abandoned in Bulgaria However with the return of private farming, it is likely to resume It is important that decisions about guano extraction be made on a case by case basis following a study of the status of the colony, its seasonal habits and concrete measures that can be taken to protect the bats

Sites Containing Representatives Samples of Biological Diversity

In the case of bats determination of such areas would be artificial and inexpedient We recommend that measures be taken to protect the most important caves This would to a great extent ensure the protection of the large bat colonies in Bulgaria as well as their territories and the nocturnal insects upon which they depend In order to protect the non cave dwelling species or those that only temporarily inhabit caves we recommend a public awareness campaign and the establishment of fines to serve as penalties

RECOMMENDATIONS

1 The most important caves (#s 1 13 on the above list), as well as other caves on the list that support the larger and more vulnerable colonies should be placed under protected status Caves 20, 22, 24, 28, 35, 39, 42, and 47 should be given highest priority for such protection Some of these are marked with the "*" symbol, indicating that they have protected status However, actual measures for their protection, and in particular the protection of the bats, have not been undertaken

In addition to legislative recognition, a number of specific measures must be taken to protect the caves Strong steel doors with gratings to permit the bats easy access need to be erected Access to cave entrances needs to be limited Built in steps wooden bridges ladders and other constructions that provide easy access to the bat colonies need to be removed Cave "instruments" used to destroy bats (e g , sticks) need to be cleared away and steps taken to prevent the breakage of stalactites Materials that have been abandoned in the caves by visitors and that can easily be lit for fires (e g , straw rubber plastics) should be removed The activities of visitors need to be controlled (by for example temporarily barring visitors to caves particularly during the bats' reproductive or hibernation phases) Appropriate periods for guano collection need to be determined

2 The protection of bats should be pursued through a public awareness campaign More precisely, information concerning pertinent legislative acts and reasons for the protection of bats and their habitats should be disseminated All available media should be used and the campaign should be geared to all levels

3 The legal measures that have already been enacted should be applied and enforced At present not one individual has been penalized for the destruction of bats their habitats or their ecosystem It is important that when such penalties are invoked, they be announced in the mass media

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Large Mammals (Macromammalia) of Bulgaria

Geko Spiridonov and Nikolai Spassov

SUMMARY

The earliest scientific studies on the living and fossil large mammals inhabiting Bulgaria date from the end of the 1800s Research has become much more intensive over the last two decades developing along three main lines – game biology species mor phology and taxonomy, and species ecology and status There is still considerable ambiguity regarding the ecology and intraspecific taxonomy of a number of species For this reason research to clarify the status of the large mammals and to determine conservation measures is of paramount importance

Bulgaria s specific zoogeographic location and the nearly intact state of its natural areas are the main factors behind the occurrence in the country of a rich and characteristic mammalian fauna The number of large mammal species is 23 They are distributed in the different orders as follows

Carnivora	14	species
Pinnipedia	1	species
Cetacea	3	species
Artiodactyla	5	species

These figures do not include exotic species or those that have been introduced but have not successfully adapted

The largest group is the carnivores They are the most greatly influenced by anthropologic factors (two species have gone extinct in Bulgaria in the present century) Two species and one subspecies – the wolf (*Canis lupus*) otter (*Lutra lutra*) and European mar bled polecat (*Vormela peregusna peregusna*) – are listed in the IUCN Red List of Threatened Animals The long term preservation of the marbled polecat in Bulgaria would be one of the required actions for its conservation on the European scale

Also heavily impacted are the marine mammals One of the dolphins – the bottle nosed porpoise (*Phocaena phocaena*) appears on the IUCN Red List of Threatened Animals Two of the three dolphin species (represented by endemic subspecies) are en dangered The monk seal (*Monachus monachus*) a species included in the World Red Data Book is vir tually extinct in Bulgaria Due to the work of the state game husbandries populations of the artiodactyls have been maintained at stable levels up until now The only exception is the endemic Balkan chamois (*Rupicapra rupicapra balcanica*)

Active anthropologic influence on the large ani mals began a long ago – in the Neolithic which devel oped and flourished in the Balkans one to two thou sand earlier than in other parts of Europe The diver sity of natural conditions and the lay of the land in Bulgaria have contributed to the preservation of rare species and subspecies that have long been extinct in other parts of Europe

The direct deterioration of natural habitats is the main factor behind the recent disappearance of spe cies Right after this in importance is the direct ex termination of species Last, though not least as a threatening factor is the disturbance of both species and their habitats

To ensure long term preservation of the large mammal fauna further studies of the status and in some cases the ecology of the species is urgently needed Among the other important prerequisites for the preservation of the large mammalian fauna are improvements in degraded habitats, effective protec tion of the natural habitats that still exist reintroduc tion of some species and captive breeding of others increased international cooperation in the area of na ture conservation and the development and adoption of additional legislative measures

HISTORY OF THE STUDIES OF MACROMAMMALIA IN BULGARIA

Macromammalia or the large mammals, do not represent a group in the taxonomic sense of the term The term is largely accepted and regularly used to unify a group of species belonging to different taxa that are characterized by their large size and that oc cupy a specific place within their ecosystems The term Macromammalia also covers a range of species that due to the characteristics noted above are of high ethnological significance Because of their rela tionships to the life styles economic activities and folklore of people their aesthetic appeal and their sci entific importance they are of special and definite in terest to mankind

Specialized data on the large mammals was first compiled after the national liberation of Bulgaria at the end of the last century (e g the studies of Khris tovich and Irecek) The first systematic information in this field was published in *The Mammal Fauna of Bul garia* by Kovatchev (1925) Susbsequently trends in

research in the field of mammalogy placed consider able emphasis on surveys of the micromammalia rather than the macromammalia This trend continued up until the end of the 1980s

By contrast the study of paleomammalogy in Bulgaria (as elsewhere) began with surveys of the macromammalia The first studies of fossil remains date from the end of the last century (Fush, 1879) and the beginning of our century (Bontchev 1900) The development of our knowledge of the Quaternary large mammals is associated with the name of Rafail Popov whose work was undertaken mainly between 1910 and 1940 The most important studies of the Neogene large mammalian fauna were carried out mainly by P Bakalov, as summarized in the volume *Tertiary Mammals* (Bakalov and Nikolov, 1962) in the series *The Bulgarian Fossils* Between 1960 and 1970 paleontological surveys were carried out by I Nikolov The names of D Halvadjiev G Markov (senior), and D Kovatchev should also be noted Since the early 1980s, these studies have been conducted mainly through the National Museum of Natural History in Sofia (see N Spassov's works) A new stage in terms of a systematic approach to the study of the Quater nary fauna was marked by the Paleolithic excavations of the Bulgarian Polish team in the Batcho Kiro Cave (Kozlovski 1982) In terms of the Neogene fauna a similar stage has now been reached in the work of the Bulgarian French excavations near the village of Dorkovo (Thomas et al 1986)

The sub fossil Holocene fauna, although discussed in a number of works – the more substantial of which are those of Ivanov and Vassilev (1975) and Vassilev (1985) – has been looked upon in a traditional man ner, that is, predominantly from the point of view of archeology and the "Ancient Man" mode of life Only during the last ten years have more systematic investi gations of the formation and evolution of the Holo cene large mammals begun (N Spassov, 1990 a 1992, I Spassov in press)

The monographs of Atanassov (1953, 1958) should also be pointed out as important pioneering works Basic data on species distribution were in cluded in some zoogeographic and general faunistic works published between the 1930s and the end of the 1960s (e g , Beotiher 1933 Atanassov and Peshev, 1962 Zimina 1962 Peshev and Boev 1962 Marches 1970) Publications focusing on particular species are scarce until the late 1970s They are concerned mainly with data about the discovery of the species and its distribution in the country Such are the works of Ruskov (1961), Buresh and Boev (1951), and Atanassov (1966 1968) In these works, there is much discussion of the "damage" caused by predatory species considered "harmful" at that time

Research on the contemporary large mammal fauna of Bulgaria became more intensive in the 1970s and 1980s with the establishment of 3 main research trends

1 Game biology (e g , Petrov et al , 1968, Dra goev 1978 Grigorov 1979 1982, Grigorov and Djambazova 1985 Genov 1985 1987a 1987 b Genov and Kotsakov 1986

2 Morphology and taxonomy (among the most important papers are Ruskov and Markov 1974 Gerasimov, 1983 1985 Markov et al 1985 Markov et al , 1989 Spassov 1989, 1990b Ganchev 1990 Petrov et al 1990 Petrov et al 1992 Genov et al 1991, Massei et al in press Spassov and Spiridonov in press) In this field the karyosystem atic biochemical approach has also been intro duced (see Peshev et al 1985 Markov and Dobrianov, 1985 Markov et al , 1984)

3 Research on the status and ecology of species This work has also involved ethological studies In some cases, attention has focused on species important for hunting and in forestry How ever a trend toward comprehensive studies of threatened species has also been established In addition to the chapters on large mammals in the Bulgarian *Red Data Book* (1985), pre pared mainly by Spassov and Spiridonov, a number of other important papers should also be pointed out Tjufekchiev, 1978 Ganchev, 1979, 1982a 1982b, 1986 Raichev, 1988 Genov and Ganchev 1987 Genov, 1989 Genov and Vassilev 1989, Ivanov 1988 Spiri donov and Spassov 1989 1990 Spassov 1993 (Note the publications of Ganchev and Raitchev are actually by the same author R Gantchev Raitchev) Works on parasitology and paleozoology are not included here

MAIN GAPS IN KNOWLEDGE

Game species and species important in terms of forestry and agriculture have been the subjects of many studies Special attention has recently been given to issues involving the morphology of the carni vores, using new qualitative and statistical methods These studies are relevant to questions related to the intraspecific systematics and ecological adaptations of the species This trend emerged mainly during the 1980s Many of those studies have not yet been pub lished Studies of this sort deserve special attention and are important on more than a theoretical level The clarification of a population's taxonomic status – that is whether a given population is unique or not in terms of the species gene pool – is of a primary im portance in evaluating its conservation status This can be seen, for example in the discussions below of the marbled polecat Balkan chamois and bear

The most poorly studied aspect of the large ma mas is their ecology This is particularly a concern with species that are difficult to observe such as the carnivores Such research is of paramount necessity It is in fact the carnivores that are the most endan gered group of large mammals and because of the lack of information about them the status of many species is not clear Detailed studies on the biology of

these species and their habitats will be extremely beneficial in determining and eliminating the factors that threaten their survival

Analysis shows that despite a rapid increase in the number of studies on the conservation status of the fauna in the last 10 15 years data on habitat quality, conservation status and protection measures for most large mammal species (especially the carnivores) re mains scarce (see Table 1)

CURRENT ASSESSMENT

The specific zoogeographic location variety of natural conditions and preservation of almost intact natural areas (see the next item) in Bulgaria are the main factors accounting for the existence here of a relatively rich and in some aspects unique large mammal fauna as compared with that of other Euro pean regions

The following analysis of the fauna is presented in systematic order with the threatened species discussed in much greater detail at the end of each family sec tion Of the various orders of mammals found in Bul garia, the following are included in the group of large mammals (Macrommalia) Carnivora, Pinnipedia, and Artiodactyla The category of threat is deter mined according to the criteria given in the IUCN Red Data List

1 CARNIVORES (CARNIVORA)

1 1 Dogs (Canidae)

1 1 1 Golden jackal (*Canis Aureus*)

In Europe this seems to be a single species de spite the presence of certain distinct populations It is the same species that inhabits the Caucasus and Asia Minor (Spassov, 1989 Demeter and Spassov 1993) The jackal reached Europe after initially occupying the Balkans where it seems to have arrived during the Holocene by swimming across the Bosphorus (Spassov 1989) Its population and range began to expand rapidly in the early 1970s and reached a maximum in the middle 1980s This trend has not yet diminished even today This is probably the greatest expansion of the jackal in Europe since concrete in formation about its distribution became available (that is since the beginning of the century) (Spassov 1993)

Most recently, migrants from the east have reached northern Italy It is interesting to note that the general expansion of the species to southeastern Europe has not influenced the status of the jackal in Greece where an isolated population occurs (Ioannidis and Giannatos 1991 Adamakopulos et al 1991)

Investigations in Bulgaria which is a center of its distribution in Europe show the speed direction and density of its distribution At the beginning of the century the jackal was distributed throughout the southeast part of the country The destruction of its habitat pushed it toward the extreme southeastern portion of its range In the 1950s its main stronghold was along the Black Sea Coast south of Bourgas and Strandzha Mountain It was designated a rare species in 1962, after which time its numbers became more stable By the mid 1980s, it had reestablished itself over almost the whole country Since then, the popu lation has been relatively stable Its numbers have been controlled since the late 1970s, and in 1984 its protected status was abolished

The population boom is due to a number of fac tors (Spassov 1989) According to some calculations its number at the end of the 1980s comprised about 7 500 animals (Rosler, 1989) This figure seems exag gerated We estimate its population (in early spring) to be at under 5,000 animals

1 1 2 Red fox (*Vulpes vulpes*)

Widespread The population in 1983 was esti mated at more than 53,000 animals Populations are most dense in typical field habitats primarily in north ern Bulgaria (Grigorov, 1987)

1 1 3 Racoon dog (*Nyctereutes procyonoides*)

This species was introduced into Europe earlier this century, and consequently is of little interest from the standpoint of the protection of natural ecosystems and species The species migrated on its own into Bulgaria from the northeast expanding out from an artificially introduced population in Eastern Europe It was first recorded in the northeast part of Bulgaria near Shabla, in 1968 (Dragoev, 1978) It inhabits pri marily marshes and lakeshores In 1971 the species was found in the Pleven area as well as the Silistra area (Srebarna Lake) By the mid 1970s it seems to have expanded beyond the Stara Planina range and since then has been observed in the lower parts of the Teteven range (St Chovkanski pers comm) By the late 1970s it was recorded at different sites in the Sofia area At present the species seems to have reached southern Bulgaria It has been observed at Atanassov Lake (Bourgas) Everywhere the species is rare

1 1 4 Wolf (*Canis lupus*)

This species reached its critical minimum (about 100 individuals) in the late 1960s and early 1970s In the 1970s its numbers increased slightly, but remained low By the beginning of the 1980s the population comprised about 200 individuals In 1985 the species was listed in Bulgarian Red Data Book (Spiridonov and Spassov 1985a) In the 1970s and 1980s as the wolf population remained low the number of feral dogs and hence of dog wolf hybrids increased as for example in the western Stara Planina (Djuninski, pers comm) This phenomenon has been observed in similar situations in other parts of Europe and con

stitutes an additional danger for the wild species

After 1980 the population began to increase rap idly It is interesting to note that the drastically de pleted population of wolves in Romania has also be gun to increase (see Rosler in *Zeitschrift fuer Sieben burgisshe Landeskande*, 15 (1) 1992) The mass movement of wolves to from Romania across the Da nube to Bulgari has not been recorded since the 1950s The highest density in the Balkan Peninsula – at about 300 500 individuals in 1991, it is a bit lower than Bulgaria's – is found in the border region of Greece (see Hatzirvassanis in *Biol Gallo Hellen* 18 (1) 13 20) The increase in the number is due most probably to several factors, including an increase in game animal populations in Bulgaria, extensive cattle breeding (as in the eastern Rhodopes), and small human popula tions in areas with suitable habitats (i e , regions with good breeding conditions deserted areas, etc)

According to an inquiry made among the State Forestry Departments in 1989 90 (Spiridonov, and Mileva, unpub) the wolf population has increased almost four times and its species range between 2 5 and 3 times from 1978 to 1988 Thus, its population now covers more than 2/3 of the forest area of the country The inquiry also showed that 1/2 of the ter ritory of the country is populated by feral dogs, and only half of this area is occupied by wolves

The wolf is now reclaiming areas, such as Sredna Gora and Central Stara Planina Mountains from which it disappeared 20 30 years ago The largest population remains in southwest Bulgaria and in the eastern Rhodopes Mountain The especially high number of wolves shot since 1987 indicate an annual increase of 200 wolves (Velitchkov, pers comm) This data allows us to estimate the number of wolves at between 600 700 in the spring before the young are born

Classified as an endangered species in the Prog nosis of the Condition of the Endangered Mammal Species in Bulgaria (Spiridonov, 1989), the wolf can now be transferred to the "vulnerable" category – a lower level of endangerment – where it is also classi fied on the IUCN World Red List (1992)

1 2 Bears (Ursidae)

1 2 1 Brown Bear (*Ursus arctos*)

This is a rare species in Bulgaria potentially threatened with extinction due to its limited number and territory and the pressures of anthropogenic im pacts Since the liberation of Bulgaria – i e , in less than 100 years – the bear has disappeared from 2/3 of its previous range In the 1930s it reached the low point in its numbers – about 300 individuals After the hunting of bears was banned in 1941 the population gradually increased Today the population has grown 200 250% above its low point, although with few exceptions it has not recolonized its previously inhab ited territories

Presently the species survives as four local popu lations in the mountains above 700 800 m in elevation the central Stara Planina, the Rila, the Pirin, and the western Rhodopes The latter three populations are more or less connected through the mountains south of Sofia The Stara Planina population, however, is iso lated (Spiridonov and Spassov 1990) During the 1980s, some researchers estimated the total number of bears at over 800, a more realistic figure would be 750 bears at the end of the 1980s (Spiridonov and Spassov 1990) The previously mentioned inquiry among the State Forestry Departments (Spiridonov and Mileva, unpub) found 210 individuals in the Rila Rhodope population in 1989 90

The recent creation of two bear-hunting husban dries – in the Rhodopes (Kormisosh) and in the Cen tral Stara Planina Mountains – and the introduction there of captive bred bears from the Carpathians and elsewhere has had negative impacts on the bear population It has resulted in a sharpening of the con flicts between bears and people and has damaged the genetic purity of the population At present, greater scientific attention is being focused on the unclear taxonomic status of the Balkan bear and on the spe cies' genetic characteristics and diversity, based on morphological and zoogeographic considerations (Spassov, 1990)

The Balkan bear differs in its morphology and behavior from the more northern Russian Carpathian population The present population of the Balkan brown bear probably resulted from crossbreeding be tween the Pleistocene era local Mediterranean popu lation (closest to which is the Syrian type) and an *U a arctos* population migrating from the north in the late Pleistocene and early Holocene Some Russian scien tists (Tihonov in *The Ecology of Bears* 1987) suggest that crossbreeding occurred between the Syrian and Caucasus subspecies Genetic investigations (Taberlet and Bouvet in *C R Acad Sci* Vol 134, Ser III, pp 15 21, 1992, Taberlet pers comm) show a significant difference between the Iberian bear (which is close morphologically to the Balkan bear) and the bear of Central and Northern Europe

The resumption of legal bear hunting in Bulgaria in 1984 (after 43 years of protection) and the increase in poaching in the last 3 4 years (as a result of destabi lization in the forest and hunting administrative struc ture) are potential threats to this species These trends made it necessary to proclaim the bear an endangered species in January 1993 There are also some 30 40 dancing bears in Bulgaria These domesticated bears should be registered and immediate steps taken to prevent their increase and reproduction

1 3 Weasels (Mustelidae)

1 3 1 Weasel (*Mustela nivalis*)

The weasel is widely distributed in Bulgaria Be cause it is a useful natural predator of rodents, it has been protected by law since 1962 The Bulgarian population belongs to the group of large Mediterra nean and Asia Minor weasels The Balkan weasel may be a separate subspec es but its taxonom c status needs further clarification (Peshev et al , 1985, Douma Petridou and Ondrias, 1986)

Note it has been reported that remains of the stoat (i e , the ermine *Mustela erminea*) were found in pellets of the eagle owl in northeastern Bulgaria De spite additional reports of this species in Romanian Dobrudzha and some dubious data from northeastern Bulgaria (N Spassov, unpub) there is no positive proof that this species occurs here (see Spassov, 1980)

1 3 2 European mink (*Mustela lutreola*)

The species was last described in the early 1950s when it was reported along the eastern Danube It is listed in the Bulgarian *Red Data Book* (Spassov 1985) as an extinct species

Note The American Mink (*Mustela vison*) has not reached Bulgaria and has not been intentionally introduced in the country In the 1960s individual animals were observed in southern Bulgaria after they had escaped from mink farms No subsequent obser vations exist The species has definitely not acclima tized

1 3 3 European polecat (*Mustela putorius*)

A widely distributed species In the 1970s and early 1980s the market in game furs in Bulgaria was annually supplied with about 6000 furs from this spe cies A slight downward trend in the population exists Changes in the distribution of the species in Europe (including Bulgaria) are currently being investigated (De Marinis, under preparation)

1 3 4 Stone marten (*Martes foina*)

Widely distributed species It occurs in all forest types as well as open biotopes with bushes and rocks It occurs in coniferous forests up to 1,800 m, but is more typically found in broad leaved forests up to 1 000 m coniferous forests up to 1 500 m (Grigorov 1986) A strong tendency to associate with human settlements can be observed the species has been seen several times within Sofia even in the center of the city (N Spassov pers obs The species seems to pre fer drier terrains broad leaved forests and open rocky habitats The stone marten (moreso than the pine marten) can readily exist in populated areas where large forests have been cut in recent decades It easily inhabits even houses and other buildings (particularly deserted buildings) As a result, this species exists in high numbers, and inhabits almost all types of suitable habitat Grigorov (1986) estimated its population at around 35,000

1 3 5 Badger (*Meles meles*)

Widely distributed, the badger inhabits hilly plain regions in the oak forest zone In 1986 its population numbered about 30,000 (Grigorov, 1986)

Threatened Species of Carnivora

1 3 6 Steppe polecat (*Mustela eversmanni*)

Definitive identification of this species' conserva tion status is difficult, since scientific data is not suffi cient to specify its degree of endangerment It is obvi ous that the species is in danger It inhabits limited territories, and in these is rarely met It is known to occur in northeastern Bulgaria It range seems also to extend west within the Danube valley (Spassov and Spiridonov 1985) The borders of its area of distribu tion are not quite clear It is quite probable that the mass poisoning of rodents that occurred in open areas in the late 1980s proved fatal for the Steppe Polecat

Observations were made in the early 1980s, but unfortunately no special studies have since been un dertaken The species was first formally reported in the country in 1951 (Buresh and Boev, 1951), although a representative specimen has existed in the collections of the National Natural Scientific Museum show since 1931 These and other facts contradict the hypothesis that the species moved east in the 1940s and 1950s in response to deforestation It is probably a Lower Pleistocene relict (for details see Spassov, 1982) This hypothesis finds support in the recent discovery of a skull of this species from the Neolithic in the Du rankulak excavations (determined by N Spassov)

1 3 7 Marbled polecat (*Vormela peregusna*)

Information on the European Marble polecat (*Vormela peregusna peregusna*) is available only for Bulgaria which is the center of the subspecies' range In response to a proposal by Bulgarian experts in 1985 (Spassov and Spiridonov 1985), it was recently placed on the IUCN Red Data List of Threatened Animals In Bulgaria, the species is probably relatively abun dant as it distributed in a mosaic like pattern over a considerable territory However, it is subject to strong human impacts We consider the species to be vulner able

The Marbled Polecat occurs predominantly in the Danubin plain the Thracian plain in the Sofia area and in the lower karst regions of the country It in habits open terrains Consequently, its main territories are very vulnerable and have already been partially destroyed by the conversion of the steppe regions to cultivated land During the last 200 years the species

has disappeared from Pannonia and other areas of Eastern Europe

The biology of this carnivore is poorly understood Like the Steppe Polecat its distribution is related to that of the large colonies of rodents (hamsters dormice etc) The relationship between the two polecat species seems to be strongly competitive (Spassov and Spiridonov in press) Additional research is needed A comprehensive program for the study and conservation of the Marbled Polecat within the different steppe communities of Bulgaria should be undertaken This would be an important step in ensuring protection of the subspecies generally

1 3 8 Pine marten (*Martes martes*)

At present this species is regarded as vulnerable It inhabits forest habitats over 1000 m a s l , its typical habitat being areas over 1500 m (i e , higher than the habitat of the Stone Marten) (Grigorov, 1986) In 1986 the population numbered about 3000 The species occurs in the low mountainous regions such as Strandzha Mountain and the Stara Planina Mountains, as well as in the Loudogorie region (Spiridonov, unpub)

Between the 1940s and 1960s the Pine Marten was in danger of extinction and ceased to exist in the valleys and the foothills of the mountains Over the next 10 15 years after measures were taken to control the hunting of furbearing animals the number of both the Stone and Pine Marten increased While the number and distribution of the Stone Marten continued to expand in the 1970s a new period of crisis began for the Pine Marten most probably in connection with the massive cutting of old forests In young forests the Stone Marten replaces the Pine Marten (Spassov and Spiridonov, 1985, Spiridonov 1989) At this time the number of pine marten furs in the Central Game Fur Store decreased from 5% to some 1% of those of the stone marten

The main threats to the species are the changes in and loss in area of its typical habitats This is aggravated by other anthropogenic pressures and competition with the Stone Marten Direct exploitation is a third important threat although the species is protected in the higher parts of the mountains and within the borders of vast mountainous national parks and reserves

Delibes (1983) and Fennika (1974) offer the hypothesis that the competitive relationship between the Stone and Pine Marten has altered the partitioning of habitats between the species According to this hypothesis the Pine Marten is in direct competition with the Stone Marten and pushes it out of its inhabited forests forcing it to occupy more open rocky and bushy terrains as well as settled areas On the basis of paleontological paleozoographic, and ecological data, we (Spassov) suggest another model of competitive relations that the origins of the Stone Marten as a species lie in the Pleistocene and was connected with the expansion of the forest steppe and open, dry, rocky bushy regions in Central Asia The Pine Marten survived as a more specialized predator in the mountainous relict forests in the montane regions of Asia Minor the Caucasus and Urals and perhaps southeastern Europe Changes in the forests during the Holocene were beneficial for the Stone Marten The last glaciation allowed the species to migrate to the western parts of the continent After that it was aided by the constant human activity in the region especially the gradual deforestation In one and the same biotope the species occupied different ecological niches Urbanization land abandonment, and the recent massive deforestation have created habitats that imitate those typical for the Stone Marten, and at the same time are unsuitable for the Pine Marten

1 3 9 Otter (*Lutra lutra*)

The otter is a vulnerable species The most critical period for the otter in Bulgaria occurred prior to the mid 1960s when it was declared a protected species Its food base, which had been lost due to industrial pollution of rivers was reestablished with the construction of a large number of fish breeding ponds and dams As a result the number of otter has increased The otter's natural living conditions however have continued to deteriorate throughout the species' entire range Consequently the species was entered in the Bulgarian *Red Data Book* It should be mentioned however that the status of the otter in Bulgaria is markedly better than in other European countries Three fourths of its natural habitat occurs in areas under 1000 m in elevation (Spiridonov and Mileva unpub) The high density of the otter population in southeast Bulgaria and the total number of the species – some 1000 1400 individuals (Spiridonov and Spassov, 1989) – are proof that the species though vulnerable is not highly endangered within Bulgaria

1 4 Cats (Felidae)

Both representatives of the Felidae family in Bulgaria are classified as endangered One is considered extinct (see below)

1 4 1 Wild Cat (*Felis silvestris*)

This species is considered rare in Europe although it would probably be better characterized as vulnerable in view of the continual decline in its population The decline is due to continuous persecution and crossbreeding with feral domestic cats Some years ago, Suminski identified this latter factor as the reason for the lack of purebred wild cats in Central and Western Europe This conclusion borders on the extreme but also extreme is the conclusion of Ragni and Randi (1986), who practically deny the role of hybridization It must be pointed out that their conclusions are based on specimens from Italy, where hybridization occurred as far back as Roman times

As a result, the distinction between actual "wild" cats and domestic cats 'gone wild" is vague (Spassov, un pub)

Not counting the Caucasus population of *Felis sil vestris* the Balkan population of this species outnum bers all others in density and is of utmost importance for the preservation of the species in Europe The bi otopes are extremely suitable in the Balkan peninsula and especially in Bulgaria According to Petrov (1991) the average annual population of the species in Bulgaria between 1969 and 1989 was about 5340 indi viduals The population was most dense in the lower mountains and hilly forest regions – up to 0 84 indi viduals per 1 000 ha (petrov, 1991) He estimates the numbers of wild cats as 3 700 individuals in the spring According to our estimations the numbers are firmly over 4,000 In his calculations Petrov has overlooked natural mortality as well as incidental death caused by night traffic on the highways (which according to Stahl and Aritos is rather high in other European countries) If these facotrs are taken into account a lower popu lation number results

Although the status of the species is satisfactory – irrespective of the immense persecution it experiences (see Petrov 1991) – we consider the wild cat a poten tially endangered species Until their status is clari fied, we have placed it in the category "status un known " The main threat is hybridization with feral cats Research carried out on 350 wild cat furs in 1986 proved that at least 5% of the furs entering Bulgaria's central fur storage unit were from hybrids A much higher percentage showed signs of more distant cross bred Furthermore the Bulgarian population is one of the purest The status of the wild cat in the country, especially the main centers of hybridization is under investigation at the moment

1 4 2 Lynx (*Lynx lynx*)

Here and in the Bulgarian *Red Data Book* we list the lynx as an extinct species (Spiridonov and Spassov 1985) The last lynx in the Rila Mountains (and in Bulgaria) was recorded in 1941 (Spiridonov and Spassov 1985) and was killed in Parangalitsa The last occurrence in the central Stara Planina Mountains was recorded near Karlovo in 1940 We have com piled more than 20 published accounts of lynxes ob served or killed from the 1950s to the present Ac cording to these accounts lynxes have been present in the regions of Ihtiman and Sustinska in the Sredna Gora mountains in the central Stara Planina Moun tains the Rila and Strandzha Mountains, and even in northeastern Bulgaria Many 'observations were based on rumors in the press of the lynx's return Other rumors are probably based on the vivid imagi nations of wild animal lovers and their desire to en counter this enigmatic' creature There is evidence however of individuals surviving into the 1950s (for example at Strandzha Mountain in 1952) and, until the late 1960s of individuals drifting into Bulgaria from Macedonia (where its population has increased greatly) The same sort of evidence (i e , unconfirmed observations and reports of tracks) indicates the possi ble existence (through migration?) of the lynx in northern Greece (see T Kominos and M Panagiotopoulou in *Biol Gallo-Hellenica* 18 75 80) At present, however, it would be presumptuous to as sume that the lynx has spontaneously reestablished it self in Bulgaria

With the support of the European Council pre liminary research has begun on a joint project of the Ministry of Environment and the Wilderness Fund (an NGO) to reintroduce the species in Bulgaria The species has been successfully reintroduced in five European countries, and has recently migrated into another – Italy – on its own In seven other countries its numbers have recovered after the species was on the verge of extinction In Bulgaria conditions to sup port a vital wild population are best in some of the montane forest regions where the lynx is the most promising predator for the hoofed animals and for the improved functioning of the forest and mountain eco systems

2 SEALS (PINNIPEDIA)

2 1 Black Sea monk seal (*Monachus monachus*)

An endangered species Even though a very rare encounter of monk seals is theoretically possible along the Bulgarian Black Sea coast in reality the species should be considered extinct The statement that it inhabits the Bulgarian coastline around Capes Ka liakra and Maslen Nos (Izraels, 1992) is based on old data Its population within the country is "skeletal" and its self restoration is already impossible It is dif ficult to know whether it would be possible to support a viable population of the monk seal Lone individuals have made their way north from the Turkish coast where some 40 are said to survive Another ten may inhabit the Marble Sea (Gurpinar pers obs) Bear ing these number in mind it is highly likely that the species will be extinct in the next few decades if its population is not genetically enhanced

The largest habitat along the northern coast of Bulgaria had been at Cape Kaliakra but the species has neither bred nor been observed there since 1979 (Michev, 1985) There is one observation dating back to 1981 (St Andreev, pers comm) and an uncon firmed report from 1987 (St Vamporov pers comm) The most reliable recent observation in the northern Bulgarian Black Sea coast region occurred in the vi cinity of the Shabla lighthouse in 1982 (Spassov un pub)

Data from the same survey supported several oc currences along the southern Bulgarian Black Sea coast A monk seal was observed in the vicinity of Cape Maslen in the early 1980s (Spiridonov unpub) A few years later the species was photographed near the Michurin coast by a German vacationer (Boev pers comm) In 1987 a seal pair was observed on a

number of occasions north of Tsarevo A year later the sea cast up the dead body of a young seal in the same region (St Vamporov and Kumanski, pers comm)

During the 1970s local fishermen observed at least one seal couple in the caves along a stretch of coast 1 3 km north of the village of Rezovo In 1987 a diver spotted a large adult specimen in the cave near est to the village (Biolchev pers comm) The latest report dates from 1991 when an individual seal was spotted on the beach near Tsarevo by Ivan Kubat of the Prague Zoo (Kubat, pers comm) It is most likely that the southern Bulgarian Black Sea coast is inhab ited by 2 or 3 adult individuals (and a maximum of 1 2 mature females), while single (young?) individuals sporadically reach the northern coast

3 WHALES (CETACEA)

3 1 Dolphins (Delphinidae)

Three species of dolphin occur in the Black Sea the common dolphin (*Dolphinus delphis*), the harbor porpoise (*Phocaena phocaena*) and the bottle nosed porpoise (*Tursiops truncatus*) The bottle nosed por poise and harbor porpoise are endangered species These species are represented in the Black Sea by en demic subspecies (*T trancatus ponticus* and *Ph pho caena relicta*) They are endangered despite a 1966 agreement involving Bulgaria, Rumania, and the for mer Soviet Union that terminated the catching of dol phins

The status of dolphins in the Black Sea has not been studied thoroughly and further investigations are urgent needed It has been estimated that the ratio of the common dolphin to harbour porpoise to bottle nosed porpoise is 200 10 1 (Peshev, 1985) The repro ductive potential of the bottle nosed porpoise is very low, and its average density in the Black Sea is 1 per 1000 km^2 Its population along the Bulgarian shore line barely exceeds some few dozen It is likely that the species is drifting further out into the Black Sea due to pollution of the coastal waters (see the *Red Data Book of Russian Republic of the USSR*, published in 1983) According the same *Red Data Book* the spe cies numbered some 36 000 in 1977 The harbour porpoise is vulnerable all along the European coasts but the Black Sea subspecies is especially endangered Over the last few years the population has experi enced high mortality rates as a result of unknown, and practically unstudied, reasons

4 ARTIODACTYLS (ARTIODACTYLA)

(Figures involving game species are provided by V Velichkov of the Ministry of Environment)

4 1 Boars (Suidae)

4 1 1 Wild Boar (Sus scrofa)

After a significant decline in the population of the wild boar in the 1950s measures were taken to en courage its reproduction Now it is widely distributed throughout Bulgaria In some places the species is so abundant that it causes damage to agricultural fields forests, and game breeding areas Numbers 1147 in 1951 48,880 in 1992 (spring count)

4 2 Deer (Cervidae)

4 2 1 Fallow deer (Dama dama)

The chronological record of bone remnants from this species in the Balkans is almost continuous and may provide a clear answer in the controversial issue of its existence as a native Holocene population in Europe The population has survived for a long time in southeastern Europe Its presence in these regions can be followed through bone remnants from the former Yugoslav Republic (at the end of the Pleistocene) to Bulgaria and Romania (through the Neolithic and the Eneolithic times) and in Bulgaria through the Thra cian and Roman eras up to the late Middle Ages (N Spassov et al in press) The present European popu lation seems to have been reintroduced on the conti nent since Roman times At the end of the 1940s it was introduced and released in Bulgaria (Dragoev 1978) It has practically reestablished itself in portions of the Danubian plain, the northern slopes of the Stara Planina Mountains the Sredna Gora and the Strandzha Sakar Mountain region (according to data of the former Ministry of Forests in the early 1980s)

4 2 2 Red deer (*Cervus elaphus*)

This species was close to extinction in Bulgaria during the 1930s and 1940s It is now widely distrib uted Favorable natural conditions especially in northern Bulgaria, have a positive influence on the species, which is high valued for hunting trophies Ar cheozoological remains indicate that populations dur ing the neolithic and eneolithic epochs were even larger than at present (N Spassov and Iliev, unpub) The question of whether the Balkan population is tax onomically distinct, raised by Katsarov during the 1930s, remains unresolved Numbers 600 700 in 1932 33, 15,890 in 1982 28,370 in 1992 (spring count)

4 2 3 Roe deer (*Capreolus capreolus*)

In the recent past this species occurred mainly in large expanses of forest and montane regions Re cently it has adapted to flat, slightly forested regions in northern Bulgaria as well At present the roe deer is distributed almost everywhere in Bulgaria Numbers 9500 in 1952 134 069 in 1982, 121 160 in 1992 The recent decrease is related to the weakening of forest and hunting administrative structures and the in creased incidence of poaching that has resulted from the social changes of the last three years

4 3 Cattle (Bovidae)

4 3 1 European bison (*Bison bonasus*)

The European bison was first bred at the Voden game farm and later at the Preslav farm The bison live within fenced pastures and are fed by people They are not considered a truly native Bulgarian spe cies

Note A few years ago a small group of yaks (*Poephagus mutus*) was released on an experimental basis There are still several yaks in the central part of the Stara Planina Mountains It cannot however, be confirmed that this species has been totally natural ized At the same time we cannot support similar ex periments with other game species, as they do not be long to Bulgaria's indigenous fauna

4 3 2 Alpine ibex (*Capra ibex*)

This species was released in the wild for hunting purposes in 1978 in the northern Pirin Mountains and in the Rila Mountains in the region of the Beli Iskar dam Although they have survived in these places for the last 15 years we have no reason to believe that these small populations have been fully naturalized

The question of whether the ibex (and which par ticular species) survived until the Holocene in Bulgaria is still controversial (see Spassov, 1982) The discov ery of ritual astragaluses in an ancient Greek sanctuary (see Poplin in *L'Antre corycien II Bull de correspon dence Hellenique Supl IX* Ecole Francaise d'Athenes) give some reason to believe that ibexes (either *Capra ibex* or *Capra aegagrus*) survived in the region until historic times It is not known whether the remnants came from islands or from the continent, but most probably they are of a local (i e continental) species

Note A proposal has recently been made to in troduce the bezoar ibex (*Capra aegagrus*) in the Rho dope Mountains This is presently being discussed by experts in the Ministry of Environment

4 3 3 Mouflon (*Ovis musimon*)

The mouflon is barely able to survive in nature without artificial maintenance There are some who believe that the Corsican mouflon is a primitive semi domestic, rather than a wildlife, species (see Poplin) We do not accept the mouflon as a repre sentative of the native Bulgarian fauna, although its population is increasing and in 1992 it has reached 3,870 individuals

Threatened Species of Artiodactyls

4 3 4 Chamois (*Rupicapra rupicapra balcanica*)

The species is considered threatened due to its limited numbers and habitats and the existing and po tential threats to its survival The Balkan subspecies is included in the IUCN Red Data List of Threatened Animals Its populations in Bulgaria are absolutely isolated Only the Rila Mountain population, consist ing of some 570 650 individuals, is relatively large The western Rhodope Mountain population, with 380 individuals, is considered vulnerable, and the Stara Planina population of 170 200 animals is threatened with extinction (Spiridonov and Mileva, unpub) The main threats to the species are possible genetic dete rioration as a result of inbreeding (Spiridonov 1985) effects of previous hunting, and poaching

THREATS TO THE SURVIVAL OF LARGE MAMMALS

The formation in Bulgaria of various and highly productive Holocene ecosystems and within them a rich Holocene complex of large mammals is due to a number of factors the country's specific geographical location and favorable climatic conditions (in south east Europe between the lower Danube the Black Sea, and the nearby Mediterranean) its varied relief the influence of the East European steppe community, and the presence of elements from the Asia Minor bi ota

During the early Holocene, Bulgaria was inhab ited by a great variety of cloven hooved mammals, in cluding 2 (possibly 3) equids, and 7 (possibly 8) spe cies of artiodactyls (Spassov 1990) The advent of the Atlantic Holocene and the deforestation of the high mountains may have created the conditions under which the ibexes disappeared (see above) This might also account for the extinction of the last European leopards which were present through the Warm gla ciation maximum and probably survived as montane island" populations in the Balkans The latest re mains (dated to 15 000 17 000 years ago) of this car nivorous species in Europe have been discovered in the Triugulnata Cave in the Rhodope Mountains in southeast Bulgaria (Spassov and Raichev in press) Three discoveries of bone remnants indicate that the

lion was present during the eneolithic epoch Historical data shows that it survived until recently (Spassov and Bozhkov 1981 Ninov 1989)

The neolithic revolution and the eneolithic cultures took hold in Bulgaria and the Balkans about 1000 2000 years before their development in other parts of Europe These cultural changes no doubt influenced the animals and the natural environment in general, especially the plains steppes, and forest steppe regions The last European 'wild asses" (*Equus hidruntinus*) were found near Dobrudzha having been extirpated exterminated 5,500 years ago (Nobis 1986)

Highly developed cultures in the Thracian and Roman times exerted a strong negative influence on the native fauna and its species diversity Roman inscriptions from the 2nd century a d in northeastern Bulgaria (the town of Montana and village of Staliiska machala) speak of impressive bear and bison hunting by one or more Roman cohorts and local huntsmen and of transporting these animals to Roman arenas along the Danube The last bison remains in Bulgaria date from the 9th 10th century a d The primitive European bison or auroch (*Bos primigenius*) seems to have survived until the early 17th century The fallow deer was definitely represented by an indigenous populations, the existence of which can be traced from the end of the Pleistocene to the Middle Ages (Spassov 1990a)

Despite human impacts the forests in the inaccessible mountainous regions of Bulgaria survived relatively intact over the centuries Their varied topography made settlement difficult and has allowed species that were destroyed in most parts of Western Europe to persist here This is especially true only for the carnivorous species More critical is the status of the inhabitants of the plains especially those species that live in open habitats and along the Black Sea coast (such as the monk seal)

The extent of the current threats to Bulgaria's species diversity is determined by a number of factors Threats vary among the different taxa Taxonomic differences reflect differences in biological "design" and thus in ecological and behavioral characteristics The biological characteristics ecological requirements, and adaptability of the various taxa determine the character of their relationships with people This in turn determines the different threats that different species face

The large mammalian carnivores are an especially important group in terms of the conservation of biological diversity They constitute the largest and most diverse group At the same time, this group includes the most critically endangered species in terms of their absolute numbers This is due not only to the relatively high number of carnivorous species but also to the various human factors affecting the group as a whole These threats can be outlined as follows

1 Predators are being exterminated by the deterioration of their habitats

1 1 Direct destruction of refuge habitats (forests bushes coastline) and increases in the area of cultivated lands (affecting species of the open spaces)

1 2 Aggravation of the trophic base (affecting the lynx etc) It should be pointed out in this context that extinction may occur through the use of toxic substances to poison and exterminate harmful rodent species that serve as prey for the carnivores

1 3 Disturbance (especially with regard to the bear)

1 4 Alteration of the natural balance between species as a result of human impacts on the environment (see the discussion of stone marten pine marten competition above)

2 Direct human persecution and pursuit of predators

2 1 "Harmful" species (wolf polecats otter etc)

2 2 Hunted species of economic value (almost all species)

2 3 Hunted subjects with trophy value (Recently trophy hunting has become highly fashionable and includes not only traditional species such as the bear, but also the wolf and wild cat)

All of these factors stimulate poaching of threatened species It is not by chance that the two species that have disappeared during this century were from the carnivore family If the monk seal (order Pinnipedia) is also included in the Carnivora as most experts in systematics believe it should be, it becomes obvious that the same complex of threatening factor applies to it, namely

1 Direct destruction of its habitats due to the development of the Black Sea coast increased tourist pressure and aggravation of the trophic base (i e , the fish resources)

2 Direct extermination of the species by fishermen (a factor important not only in the past, but even now)

The dolphins (Cetacea) are in a critical state Two of the three species, and especially the harbor porpoise are threatened with extinction As a threatening factor the destruction of habitats has a certain specificity in this case water pollution directly affects

the organisms while also leading to the decline of the trophic base Other factors, of course are fishing and (in the past) direct extermination

Hoofed animals highly valued and threatened by overhunting in the past, now appear to be in a more favorable state than other large mammals The estab lishment of well organized hunting husbandries after the 1950s and the intensive efforts undertaken to maintain and develop them as game species proved to be very positive factors It does seem a paradox at first glance but in fact centralized hunting (i e , concern for the existence of the principal hunting species) proved to be the factor that prevented the complete extinction of the hoofed mammals

It should be pointed out that since 1950 the status of most of the threatened species has declined and one species – the monk seal – has almost disappeared On the other hand, the status of some species has im proved – bear stone marten, chamois and golden jackal (the last is no longer endangered) Control over their direct extermination has made this possible The status of the otter and, more recently the wolf may also have improved

Analysis of the Bulgarian *Red Data Book* shows that direct destruction of natural habitats is the major factor threatening the country's large mammals For ten of the species, it is a major factor, and for two oth ers a factor of secondary importance The second leading factor is direct exploitation of the species and the third leading factor is disturbance

RECOMMENDATIONS

It is obvious that the different ecological circum stances of the large mammal species and the various factors affecting them will determine the variety of measures needed for their long term preservation These measures can be classified into a few main groups In Table 1 the need for different types of protective measures is rated on a scale of 1 to 3 This analysis indicates several critical priorities

The most critical need is additional research on the extent of threat In many cases precise data on the status of the species, the threatening factors and the extent of impact are lacking This means that more detailed research on the biology of the species is also required

Second it is important that measures be taken to improve environmental conditions and to establish protected areas that encompass the main natural habitats of the species

Third other important protective measures need to be taken, including captive breeding reintroduction and (where appropriate) the introduction into new lo cations of endangered species international coopera tion and agreements on conditions for preservation, and additional legislative measures

In our opinion, additional priorities for preserva tion should include

1 Establishment of an single institution with the authority to carry out effective control of the protected areas In this respect the Ministry of Environment's proposal to establish a National Agency to safeguard the protected ares is timely

2 Establishment of a governmental fund to reim burse landowners who have suffered losses on their farms from endangered species (at least within the natural territories of these species)

3 International cooperation to control pollution of the Black Sea, and to undertake additional pro tective measures This is a major issue in efforts to preserve the sea mammals The two endemic dolphin subspecies should be listed as endangered in the Bulgarian *Red Data Book*

4 Reintroduction of species This is another im portant tool for preserving biological diversity In relation to this very sound general proposal (see above), specific actions should be taken to rein troduce the lynx Reintroduction of the European mink and eventually the ibexes should also be considered (see the respective items above)

Table 1 Status of Large Mammal Species

Legend E= Endangerd U= Unclear Status, V= Vulnerable Ex= Extinct or threatened with extinction, R= Rare

Degree of Threat	Species												Total
	Bear	Wolf	Steppe Polecat	Marbled Polecat	Pine Marten	Otter	Lynx	Wild Cat	Monk Seal	Chamois	Bottle Nose Por poise	Harbor Por poise	
In Bulgaria 1950	E		U	V	E	V	Ex		E	E	E	V	
In Bulgaria 1992	R	V	U	V	V	V	Ex	U	Ex	R	E	E	
IUCN Red List		V		V		V			E			V	
Priority conservation measures	Total number of species concerned												
Legislative adminis trative measures	3	3	0	0	0	1	0	2	0	2	0	0	5
Protected Areas	1	1	1	1	1	1	0	2	0	1	0	0	8
Improvement of En vironment	1		3	3	2	3	0	1	2	0	2	2	9
Reintroduction or Captive Breeding	0	0	1	2	0	1	3	1		1	0	0	6
International Coop eration	0	2	0	0	0	0	3	1		0	2	2	5
Research	2	2	3	3	2	2	3	3	1	1	3	3	12

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Section Two

Management of Bulgaria's Biological Resources

Protected Areas Management in Bulgaria

Michail Michailov and Lubomira Mileva

INTRODUCTION

The conservation of biodiversity is one of the most significant goals in environmental protection Thus, it is vitally important for all countries to estab lish a clear national conservation strategy and appro priate institutions for implementing it In Bulgaria, government policy and control in this areas is executed by the Ministry of Environment (MOE) and involves three major areas of activity

- development of the National Protected Areas System (NPAS),
- total protection of animal and plant species, and
- rare and endangered species management

This report focuses on management under the Na tional Protected Areas System as a prerequisite to the successful multi functional implementation of a con servation strategy In order to provide a solid under standing of management problems some general characteristics of the protected areas and of relevant legislation and institutions are examined

I THE NATIONAL PROTECTED AREAS SYSTEM

The National Protected Areas System encom passes a total area of 382,000 ha (3 5 % of the coun try's total territory) within five categories of protected areas national parks, nature reserves, (see Table 1)

Within the system, the *national parks* with their relatively vast areas (Pirin is 40 067 ha and Rila 107,924 ha) are especially significant The national parks are established to preserve the natural ecosys tems and their rich biodiversity Some of the parks – Etara Kobaklaka and some others – are relatively poor in biodiversity and their status as national parks will be reviewed

From a management point of view the most characteristic feature of the parks is the presence within them of agricultural lands managed by a num ber of agricultural entities In Vitosha National Park 8% of the land is agricultural in Rila 38% and in Central Balkan 40% (Table No 2) Within the Rila Pirin and Central Balkan parks the agricultural areas are mainly high mountain non forested lands, while in the other parks they comprise mainly arable lands, pastures, and meadows surrounded by forests There are no expectations that the agricultural lands within these three parks will be turned over to private owners, but elsewhere hundreds of private owners have already declared their rights A large part of the territory within the parks is covered by forests, and thus is still treated as state owned and managed by government entities as follows Vratza Balkan - 4, Central Balkan 11 (see Table 2) The parks also include parts of a number of municipalities (Vitosha 3 Rila 11)

Recreation, tourism, and sport sites within the parks generate water pollution land pollution erosion and other problems For example, in Vitosha National Park there are more than 100 hotels rest houses, ma jor ski resorts and their associated infrastructures Vratza Balkan National Park includes some populated areas and a mine

Strictly protected *nature reserves* (IUCN category I) are areas of representative natural ecosystems and habitats of rare animal and plant species Of the 89 existing reserves 18 are situated within the boundaries of the national parks, including one in Pirin 5 in Rila and 9 in Central Balkan Most of the reserves consist of forests, but some (e g Kaliakra Tisata Srebarna) include agricultural land Others (e g , Srebarna, Atanasovsko Ezero) include wetlands Because many of the reserves are close to populated areas or recrea tional sites, or are intersected by tourist routes, they are vulnerable to human disturbances such as timber collection, grazing, and hunting Most of the reserves have been internationally recognized Seventeen are designated biosphere reserves 3 are wetlands of inter national importance under the Ramsar Convention (including Srebarna, which is also a World Natural Heritage Site) and 38 are included in the United Na tions' list of national parks and other protected areas

Although they cover a limited area (1 to 500 ha) *natural landmarks* and *protected sites* (which number more than 500) also play a concrete role in environ mental protection They include inanimate objects such as rock formations waterfalls and caves, as well as communities of rare and endangered plant and animal species They consist mainly of forestland al though some agricultural lands are also included

Table 1 National Protected Areas System

No	Category	Number	Area (ha)	% of total
1	National Parks	11	249 323 (293 000)	65 (76)
2	Reserves	89 (71)	76 987 (33 000)	20 (9)
3	Natural Sites	430	22 849	6
4	Protected Areas	99	21 015	6
5	Historical Sites	972	12,139	3
	Total	1,601	382,313	100

Notes In item 1 (in brackets) the real park territory and the percentage of the total territory are shown in cluding 18 reserves with total area of 44 000 ha within the parks boundaries In item 2 (in brackets) the number of reserves not included in the parks their area and the percentage of the total territory are shown

Table 2 Land Uses and Types in National Parks

Type of area (year of establish ment)	Total area (ha)	Type of land (ha)		Territorial ad ministration		Forestries (number)	Private farm land	Environmental inspectorates (number)
		Forest land	Farm land	Dist rict	Muni cipal			
Pirin (1962)	40,067	31 791	8 276	1	9	9	no	1
Rila (1992)	107,924	67 359	40 565	2	11	11	no	4
Central Balkan (1991)	73,262	44 080	29,182	4	7	11	no	5
Vitosha (1934)	26 602	24,078	2,528	2	3	4	yes	2
Vratchanski Balkan (1990)	30,130	22,557	7,573	2	4	4	yes	3

Major significance is attached to wetlands – which also face some of the most serious problems These areas include wetlands associated with lakes and swamps, dense forests the Danube River and the Black Sea sand dunes

Most of the sites included in the fifth category in the protected areas system – historic sites (972) – have been established on the basis of narrow political inter ests and have little value from an environmental con servation perspective However historic sites of na tional importance with important natural features must be maintained with appropriate protection under the National Protected Areas System

Conclusions

1 The present National Protected Areas System in cludes a great number of different sites with re spect to their use, area and conservation value, and therefore a diverse approach in management is required They can be classified as follows

a Large areas of state owned forest and agricul tural lands, with limited construction works, for recreational use This includes the national parks (IUCN category II) of recognized inter national conservation significance – Pirin Rila

and Central Balkan – that may encourage tourism development in their respective re gions

b Relatively large ares of forest and agricultural land held by various owners (state, municipal, and private) and including some construction works (i e permanent residences and tourism and recreation facilities) Some face environ mental problems involving their land and water resources This category includes national parks such as Vratza Balkan, Vitosha and Sinite Kamani, which seek to combine nature protection and sustainable environmental, eco nomic and tourism development (IUCN cate gories III IV, and V)

c Reserves and other sites of international sig nificance over 500 ha, beyond the national park boundaries and owned by the state (e g Ro potamo, Srebarna and Atanasovsko Ezero)

d Other sites covering limited areas (1 to 3 ha), held under all types of land ownership and subject to diverse uses

2 The sites under categories (a) and (b) require special park administration and management Those 6 parks encompass over 65% of the total territory covered by the National Protected Areas System Focusing state investment and effort here, for the implementation of nature conserva tion policy would be especially worthwhile

3 The sites under item (c) require protection and effective management in recognition of their in ternational significance

4 The sites under item (d) do not necessarily re quire the creation of special structures for their effective management Reliance on the goodwill careful use and protection of sites by their re spective owners in combination with periodic MOE inspections is inevitable

II LEGISLATION

The Protected Areas System was established by and is managed in accordance with the existing 1967 Nature Protection Act The Act described the catego ries of protected areas and their intended uses and status The MOE is the designated body responsible for establishing protected areas The Ministry defines their specific status measures for the use and protec tion of their natural components (forests lands and water) and the construction activities permitted within their boundaries The Act specifies that the use and conservation of the protected areas is the overall re sponsibility of the MOE The Nature Conservation Act also designates the MOE as the administrative body responsible for biodiversity protection in direct relationship with the management of protected areas The Act enables the MOE to implement measures for the overall protection of endangered species through out the country

The Act has a number of deficiencies that are se riously magnified and exacerbated by the rapidly changing social and economic environment in Bul garia

- it does not treat in an up to date manner the site categories and uses
- it does not clearly allocate responsibility for fi nancing management plans scientific research or restoration measures
- with respect to the restitution of private property and land ownership, it does not provide clear resolution of important problems involving land acquisition, compensation, and agreements with property owners for the inclusion of land within protected areas,
- it does not provide for the imposition of fees and taxes for the use of protected and rare biore sources,
- it does not provide clearly defined, efficient mechanisms for the regulated use and protection of economically important species such as herbs,
- it does not define requirements measures, and mechanisms for the protection of widely distrib uted species that are not strictly protected and that do not fall within the purview of other re source oriented acts

Several additional laws are relevant to the man agement of protected areas

- The 1991 Environmental Protection Act This act designates the MOE as the institution responsible for implementing government policy, and for monitoring and overseeing environmental quality The act entitles MOE to prescribe protective measures, including the closure of environmen tally harmful factories and bans on polluting ac tivities These responsibilities and mechanisms are required for the effective management of pro tected areas
- The Forests Act Hunting Economy Act and Ter ritorial and Housing Management Act These and other legislative acts provide measures stan dards and mechanisms for the economic use and protection of specific resources and for planning and construction in specific areas They also des ignate the responsible institutions – the Commit tee of Forests, the Ministry of Agriculture the Ministry of Construction the municipalities etc Provisions of the above mentioned acts that con

tradict those in the Nature Protection Act do not apply to newly declared protected areas Institu tions and economic entities that apply the acts are obligated to adopt corrective actions or cease plans in accordance with the status of the pro tected area

- The 1991 Ownership and Agricultural Land Use Act This act defines the conditions for reesta blishment of private ownership of agricultural land Article 24 paragraph 4 states that owner ship rights are not regained in the case of agri cultural lands included in reserves and other pro tected areas of national and international signifi cance as outlined in the Nature Protection Act

- The Forest Property Reestablishment Act This act is currently being developed It suggests that state ownership of forests in reserves and national parks should be retained, since Article 18 of the Constitution states that all forests of national sig nificance are state owned

Conclusions

1 The MOE is the legitimate institution enforcing government policy regarding biological diversity conservation and the management and control of the protected areas system

2 The MOE is the legally competent body moni toring and controlling the quality of all environ mental components and mechanisms affecting the owners and users of the different resources (e g forests land, water) and other activities per formed within the protected areas

3 Other institutions within the framework of the government are assigned limited management authority concerning the use of resources within the protected areas as permitted and conditioned by the MOE

4 State ownership of land in the Pirin Rila and Central Balkan National Parks and in the reserves is more or less guaranteed and this in turn re quires the establishment of an effective state management structure The structure under dis cussion should also cover other parks with mixed patterns of land ownership

5 New environmental legislation is required, in cluding a Protected Areas Act a Biological Diver sity Act and an Herb Protection Act

III PROTECTED AREAS MANAGEMENT INSTITUTIONS

At present activities concerning protected areas are performed by the following manner

- The MOE is responsible for researching and esta blishing protected areas for defining the catego ries of protection and for designating the status and use of resources (e g land use construction, etc) on a site by site basis

- Entities entitled by the state to use land or re sources within the established protected area are obliged to cease, limit, or alter their activities in accordance with the new status as defined by MOE In this case, reference is made mainly to the Committee of Forests the former state agro economic enterprises and municipalities

- The MOE is responsible, directly or through its 16 Regional Inspectorates for the implementation of regulations on the activities of owners and users with respect to the protected areas status

Two main considerations reflect the current reali ties of protected area management First, until 1990, the MOE as the institution responsible for managing the protected areas system and protecting biodiversity had developed only limited structures and staff poten tial By way of illustration the MOE currently has only 3 experts at its disposal at the national level, with 16 more in the Regional Inspectorates Thus all efforts at national level were focused on the enlargement of the protected areas system where the achievements have been obvious At the regional level, priority has been given to the development of enforcement func tions But because the number of protected areas is large and the availability of staff is limited, enforce ment has been periodic, and concerned mainly with the large areas such as Vitosha and Pirin In other words, the enforcement functions have not been suffi cient

The MOE finances some research supports rec reational measures within the protected areas, and prints materials for increasing public awareness Un fortunately, these activities have been undertaken with no clear strategy financial policy, or program of short term and long term goals The main reason for this state of affairs is the lack of a direct link between these activities and the national budget They are financed on the basis of fines fees, and other revenues periodi cally collected by the Ministry from environmental polluters

Only after 1990 when the inadequate relationship between functions and available staff became widely

recognized did the number of the latter gradually be gin to increase At present the MOE has a newly formed Biodiversity and Protected Areas Division with 8 experts while the Regional Inspectorates now em ploy 30 biologists and foresters This has definitely re sulted in improvements in the management of the protected areas system and the conservation of species International environmental activities and projects in volving the protected areas biodiversity environ mental tourism information and education, and other areas have developed rapidly

Despite this progress the MOE's management of the protected areas especially with respect to the large national parks and reserves is seriously lagging Table 2 illustrates this situation For example the Central Balkan National Park embodies two types of land – forests and agricultural lands (40%) The forest re sources are overseen by 11 entities under the supervi sion of 5 Regional Forest Directorates Before 1991 agricultural lands were used by 10 agricultural enter prises At present the land remains in state ownership, but no one is designated to manage look after, and protect it From an administrative standpoint the park embodies parts of the land of 4 regional and 7 municipal administrations State control and protec tion of the park and the quality of its environmental components is executed by MOE s 5 Regional Inspec torates

Obviously the many economic and administrative entities are not in a good position to properly manage the Central Balkan park as a single protected area since they are interested only in the use or manage ment of a particular resource or area of the park These entities or their superior institutions – the Committee of Forest Committee, the Ministry of Agri culture the Ministry of Construction and Regional Development – are not in a position to make decisions affecting the park's development and functioning On the other hand, it is impossible for the MOE and its subordinates alone to implement a uniform policy or to manage and monitor all the environmental compo nents and all types of activities in the park

The second main consideration to bear in mind with regard to the current realities of the protected ar eas is that when analyzing the practical uses of the protected areas by the users and managers of land and resources emphasis must be placed on the fact that these users are not legally obliged to – and have no interest in – spending funds for the areas concerned These are mainly economic entities whose financial performance depends to a great extent on the success of their economic activity the protected areas are therefore of peripheral interest For example within the system of the Committee of Forests only limited funds are allocated for the marking of protected site boundaries

For the same reason development plans for the Pirin Sinite Kamani and Shumensko Plato parks which are all financed by the Committee of Forests, focus mainly on resource and infrastructural matters They lack elements basic to the multi function use and man agement of the parks – the collection of animal and plant species data, the development of management measures supportive of some of the rare species, scien tific research and educational programs the monitor ing of all environmental components, etc The other sites do not have management plans at all In this re gard, the state of the protected areas, including some agricultural and communal lands, is virtually cata strophic These are mainly pasture ecosystems wet lands and sand dunes with a special role to play in protecting biodiversity All of this reflects on the state of the organization of, and conservation measures within the protected areas and the previously men tioned lack of park administration These sites are overseen by special forest engineers and patrols, whose duties are nevertheless merely economic The same pertains to the remaining forest sites The lands within the protected areas that are not included in the forest fund – some 30% of the total park territory – are left with practically left no control and protection

The only exception is Pirin National Park The directorate has been successful in establishing its own park administration However that administration is still under the supervision of the Committee of Forests and is therefore not able to perform basic park ad ministration functions – gathering information, man aging visitation coordinating research programs, regulating environmental quality etc Moreover on a number of occasions it has had to perform such func tions as timber harvesting and animal farming With respect to this record, the Forest Committee officially declared that the experience of the Pirin National Park was unfit and that it should not be introduced else where in the parks That conclusion is justified by the structures of the Committee of Forests and its limited authority in nature conservation and protection

In summary as a result of these institutional and organizational shortcomings, the protected areas sys tem is characterized by

- a lack of park administration with appropriate authority,
- a lack of up to date complex plans for protected areas management
- insufficient research and publicity functions
- a lack of appropriate educational programs for visitors and for local people
- intermittent controls on threats to environment quality
- inadequate support for measures related to the protection of rare animal and plant species and their habitats and
- an underdeveloped information system and data base

Conclusions

1 At present effective management of protected ar eas is lacking and therefore those areas do not perform their necessary scientific social cultural and in some cases even conservation goals

2 The MOE does not possess the adequate admin istrative structures for managing the protected ar eas system management at the national and local levels

3 A secure funding source scheme to finance MOE management of the protected areas has not yet been developed

IV IMPROVING MANAGEMENT OF THE PROTECTED AREAS SYSTEM AN OVERVIEW

Figure 1 illustrates the plan for the institutional development of protected areas management and its legal placement within the administrative structure of the MOE

(i) It is suggested that the present Biodiversity and Protected Areas Department within the MOE be transformed into a National Nature Protection Agency This is seen as a necessity for ensuring the relative independence of the agency's financial policy, and in assigning authority for both the establishment and direct management of park administration The functions of the proposed National Nature Protection Agency should be as follows

1 Development and implementation of a national strategy and government policy for protection the integrity of the nation's flora fauna, and protected areas

2 Development of the regulatory basis for nature protection through the following measures
- a Protected Areas Act,
- a Biodiversity Protection Act,
- rules fees and tariffs for damages, and other regulations

3 Development of the system of protected areas as follows
- implement the procedures required for estab lishment of protected areas
- prepare the necessary documentation for es tablishing or alternating protected areas,
- assume responsibility for the State Register and data base of the protected areas

4 Implementation of protected areas manage ment
- establish administrative bodies (directorates) for national and natural parks, special natural reserves and protected areas of national and interna tional significance
- assign fund and authorize protected area management plans and oversee their im plementation,
- adopt consistent methodologies for managing park administration and the Regional In spectorates

5 Protection and management of flora and fauna
- designate protected plant and animal species and oversee their protection,
- oversee and determine the status and use of endangered plant and animal species subject to economic use

6 Planning and financing
- support scientific research in the protected areas on the status and protection of flora and fauna
- support specific measures in the protected ar eas to protect plant and animal species and their habitats,
- develop educational programs for local peo ple and visitors
- prepare public awareness materials for the protection of protected areas and flora and fauna

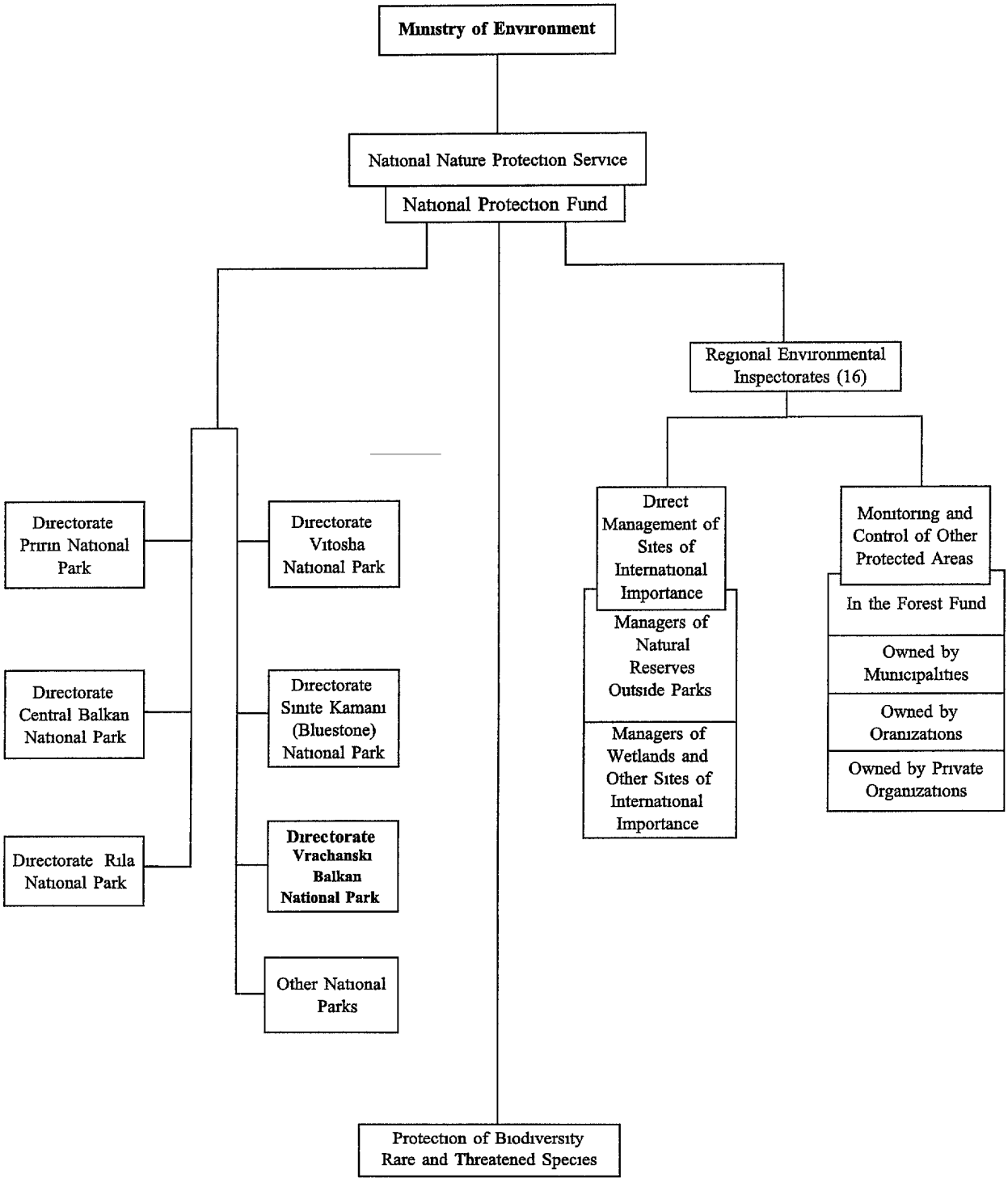
7 International activities
- maintain contacts and represent the MOE at international meetings concerning the topic of biodiversity and protected areas,
- participate in the development and imple mentation of international conservation projects
- oversee the implementation of international conventions – i e CITES, the Bern Con vention on the Conservation of European Wildlife and Natural Habitat the Ramsar Convention on Wetlands of International Importance – as well as the bilateral agreements

8 Management of the Environmental Protection Fund
- collect funds,
- allocate and oversee fund expenditures

9 Maintain contacts and coordinate activities with government and scientific institutions and with public organizations and movements con cerned with protected areas and the protection of flora and fauna

10 Ensure that the protected area system's staff is well qualified

Figure 1


Ministry of Environment
National Nature Protection Service
National Protection Fund
Regional Environmental Inspectorates (16)
Directorate Pirin National Park
Directorate Central Balkan National Park
Directorate Rila National Park
Directorate Vitosha National Park
Directorate Sinite Kamani (Bluestone) National Park
Directorate Vrachanski Balkan National Park
Other National Parks
Direct Management of Sites of International Importance
Managers of Natural Reserves Outside Parks
Managers of Wetlands and Other Sites of International Importance
Monitoring and Control of Other Protected Areas
In the Forest Fund
Owned by Municipalities
Owned by Oranizations
Owned by Private Organizations
Protection of Biodiversity Rare and Threatened Species

(ii) The scheme may de divided into two major parts at the regional level (a) the development of park ad ministration by the National Agency and (b) the de velopment of protected area management, closely or periodically monitored by the Regional Inspectorates

a The goals of improved park administration are based on existing models and depend on inter pretations of the character intended use and status of the parks and other conditions in Bul garia Those conditions call for the future divi sion of Bulgarian parks into two categories national and natural

- National Parks are characterized by their vast territories, state ownership of land, and almost total restriction on resource use The American (US) model of park ad ministration can be adopted in this case The National Park Directorate staff will be much larger than that of the Natural Park staff and will thus require the crea tion of a number of divisions, including security information, science mainte nance and finance The functions of the National Park Directorate will be as fol lows

  (1) Guard the territory of the parks

  (2) Participate in the development of management plans

  (3) Monitor the state of the forests, pasture ecosystems, populations of rare or endangered plant and ani mal species, and tourism pressures

  (4) Organize and conduct educational programs for the visitors and locals Organizes guided tours Ensures the functioning of visitors centers

  (5) Oversee and adopt measures con cerning water quality water treat ment plants, and waste manage ment and coordinate activities with other organizations included in management plans

  (6) Take measures to maintain and re store plant and animal populations and habitats

  (7) Cooperate and participate in scien tific research programs and interna tional projects

  (8) Ensure the development and main tenance of tourism and recreation facilities educational and informa tional materials, etc

  (9) Establish and maintain contacts with other parks in the country and abroad and participate in appropri ate international meetings

  (10) Maintains the data bases for the parks

  (11) Maintain contacts and coordinate activities with the MOE National Agency, local authorities and eco nomic, public, and scientific organi zations

  (12) Take punitive actions against viola tors of statutes

- Natural Parks include forests and agricultural lands under all types of property owner ship The constraints on land and re source users are mild These peculiarities allow for the adoption of the Western European models of park administration The staff of the Natural Park Directorate will be limited in number since the secu rity needs of the areas are minimal and can be met for example, through the maintenance division or other means Thus while there are some differences in comparison with the National Park Di rectorate they are in general similar

b The second part of the plan involves the role of the existing Regional Environmental Protec tion Inspectorates in the management of the remaining protected areas beyond the parks' boundaries as follows

- Reserves and other protected areas of inter national importance are directly man aged The land in these cases is state owned These are mainly sites over 1000 ha in size where the designation of an administrative "manager" and financially management by the Regional Inspector ates is appropriate The manager shall be responsible for maintaining control over and monitoring the site coordinating re search and educational programs and keeping a data base for the site

- Regional Inspectorates oversee and monitor all remaining PAs The Inspector ate periodically inspects the owners and users of land and resources for compliance with the adopted statutes relevant to the site The Regional Inspectorates shall oversee the state of the sites proposes the funding of maintenance or recreational measures to the National Agency levies fines for damage etc The Regional In spectorates shall maintain site data bases Since the sites are numerous and the exer cise of oversight and protection responsi bilities is difficult it may be a good idea to establish an armed and mobile police force under the Regional Inspectorates For ex ample, alongside the Black Sea shore there are a number of sites – swamps, lakes, dense forests, small reserves sand dunes, etc – that require special protection meas ures In addition to the existence of small small protected areas, there exist in some cases other serious problems – for exam ple, the illegal collection and smuggling of protected reptile species The formation of a rapid deployment police force will be a very efficient measure in the struggle against the increasing incidences of illegal hunting and collection of rare plant and animal species within the protected areas

The structures of the different park administra tions will be further developed with special attention given to the particular characteristics of each site

V NATURE PROTECTION FUND

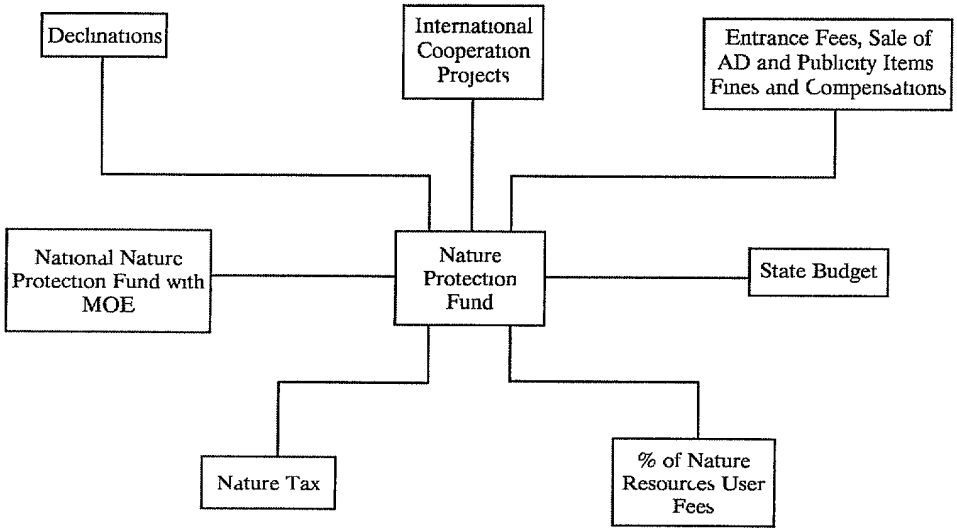
Sufficient funds are necessary to implement the strategy for the protection of biological diversity and the effective functioning of the protected areas man agement system This, in turn suggests the need to form a Nature Protection Fund This fund could ei ther be independently established or form part of the already existing National Environmental Protection Fund within the MOE In any case there are two main conditions that need to be met

- funds should be directly allocated for the protec tion of biodiversity and the management of the protected areas, and
- the fund should be managed either by the Na tional Agency or, for example, by a Governing Council in the MOE established on the recom mendation of the National Agency

The prospective sources of the funds required are shown in Figure 2 The main aims of the Nature Pro tection Fund are to provide financial support for

- park administration and protected areas manage ment
- development of protected areas management plans,
- implementation of the management plans
- scientific research in the protected areas, and for conservation of the flora and the fauna,
- maintenance and restoration measures for pro tected and rare species and their habitats,

Figure 2



- implementation of international and other projects for protected areas and for floral and faunal conservation
- development of educational and awareness programs and publicity
- development of visitors centers and
- indemnities and land purchases

The three major three sources of funds (1,2 3 in Figure 2) are self explanatory

Source No 4 is an existing fund within the MOE that is financed by fees imposed on industry for the pollution of water, air, or soil This fund is now used by the MOE for financing research and special measures taken with respect to the protected areas for the protection of plant and animal species We believe that a certain portion of these funds should be allocated to the Nature Protection Fund simply because pollution has direct or indirect negatively affects on the flora and fauna of the protected areas

Source No 5 is tax revenues paid for the use of natural resources within the state owned protected areas There is no regulatory function in this case

Source No 6 is the so called "Nature Tax' to be paid by all owners of real estate – hotels restaurants etc – located within the state owned protected areas There is no regulatory function in this case either

The last but not least source of funding is the national budget It should provide the major portion of the required funds

In order to ensure the most effective structure and functioning of the fund including its regulatory function, detailed development and research work will be needed

VI RECOMMENDATIONS

1 The MOE should develop and submit to the Council of Ministers an official proposal for the establishment of a National Environmental Protection Agency within the structures of the Ministry

2 The MOE, in cooperation with foreign institutions should
   - develop park administrative structures in accordance with the specific site characteristics,
   - develop the structure of a Nature Protection Fund together with economic incentives and mechanisms for raising funds
   - prepare a package of environmental protection legislative acts

Contemporary Trends in the Development of Bulgaria's Protected Areas System

Geko Spiridonov and Lubomira Mileva

HISTORICAL SURVEY

Bulgaria's system of protected areas is over 60 years old The first protected areas were declared in connection with the activities of the Bulgarian Union for the Protection of Nature founded in 1928 The first strict nature reserves, Silcosia and Parangalitsa were established in 1933 after many complicated and prolonged procedures In the following year, Baiovi dupki and Vitosha National Park were established as protected areas At that time only a few countries in Europe – Sweden Switzerland Spain Italy Finland – had created their first national parks It is worth not ing that the pioneers of nature conservation in Bul garia realized the importance of the size of the pro tected areas for the preservation of their biota as well as the importance of protecting the watersheds in which the areas were located As a result a relatively large proportion of the strict nature reserves were lo cated within the borders of national parks

Unfortunately after 1935 only one significant protected area was created The vision of Rila Na tional Park however remains unfulfilled and nature conservation activities continued to be ineffective until 1947 In the years 1948 1963 several of the most worthy Bulgarian strict nature reserves were declared – Sreberna Dzhendema, Kamchia Boatin Dupkata Uzunbudzhack Pirin National Park also had its be ginning at this time, and Vitosha National Park was expanded

This period was followed by fourteen years of stagnation during which the policy of intensive exploi tation of forests became an obstacle to the expansion of the protected area system Because the central for estry administration directed both activities the results concerning protected areas were unsatisfactory Only a few significant areas – Russenski Lom National Park the Chuprene Nature Reserve – were declared and Pirin National Park was expanded

The following 15 years (1978 1992) marked a turning point in the policy regarding protected areas The main reason for this was the creation of a separate state body responsible for environmental protection and independent of the forestry administration – the Committee on Environmental Protection During this period the total area of the protected area system grew by 400% The years 1978 to 1985 saw a real "boom" in reserve designation During these years protected ar eas were announced at Tisata, Sokolna Peeshti Skali Steneto, Stara Reka, Lake Atanasovsko, Orelak, Ibar, protected sites were established at the Belenski islands and the Urdini lakes, the reserves Ali Botush, Bajovi Dupki and Torfeno Branishte were expanded signifi cantly, the national parks at Sinite Kamani and Shu mensko Plato were announced and Vitosha and Pirin National Parks were significantly expanded In addi tion most of the large strict nature reserves were pro vided with reliable buffer zones There followed a few "ineffective years" when the Committee on Environ mental Protection did not declare new protected areas Nevertheless a few good reserves were created in the period 1986 1990 Rilo Manastirska gora Sredoka Congura Tissovitsa the protected site Veleka and the Vratchanski Balkan National Park

The greatest increase in the protected areas sys tem occurred during 1991 1992, when the Central Balkan (73 000 ha) and Rila (108,000 ha) National Parks were announced, the reserves Chervenata Stena Tzarichina, Ropotamo, Beglika, Kupena, and Man taritsa were expanded significantly, and the southern part of the Black Sea coast (the mouths of the rivers Veleka and Silistar) were placed under protection Within the borders of Rila National Park the Central Rila Nature Reserve was established – a natural re serve of 12 250 ha (6650 ha new strict nature reserve area) that is among the areas least influenced by hu man activities in Europe

SCIENTIFIC BASIS OF THE PROTECTED AREAS SYSTEM IN BULGARIA

For more than 40 years the national system of protected areas in Bulgaria was not informed by sci entific programs or governed by a state nature conser vation policy The choice of new areas for special protection depended on the personal view of whom ever was proposing it Biologists and foresters con cerned about protecting areas famed for the richness of their flora and fauna or containing samples of pri mary forests were unable to express their preferences The absence of a purposeful approach in the selection of protected areas is also illustrated by the fact that, until 1977, there was not even one geographical region in which a coherent plan for protected areas, able to protect all of its natural biological resources had been developed (excepting Vitosha and other places where

a single protected area could encompass a significant part of the region) This is not meant to imply that Vitosha and other protected areas were poor choices About 40% of the Bulgarian protected areas declared before 1978 were included in the United Nations list of national parks and other PAs (1992) However it is worth noting that half of these protected areas would not have been listed if plans to expand them had not been made

In the mid 1970s, the categories and criteria for use of protected areas established by the International Union for the Conservation of Nature (IUCN) were adopted, and biosphere reserves were instituted in accord with Project 8 of the International Man and the Biosphere (MAB) Program Both were undertaken in connection with the creation of the national system of biosphere reserves (Spiridonov, 1977, Spiridonov and Mileva, 1981) This was the first time that questions about the choice of PAs in Bulgaria were raised using biogeographical criteria

The idea of a national system of protected areas based primarily on vast spacious national parks and relatively large strict reserves had its first important manifestation in the preparation of proposals for creating the Central Balkan National Park (1981) and Rila National Park (1982) Some aspects of the scientific rationale for these suggestions, as prepared by the Bulgarian Academy of Sciences have been published (Spiridonov, 1982 1983)

The protection of samples of representative ecosystems plays a significant role in the creation of new sites within the national system of protected areas (Spiridonov 1984) Large national parks and strict nature reserves provide the opportunity to protect larger or smaller complexes of representative ecosystems Because the internationally accepted classifications of biome types and biographical regions unify regions with very different biota (Udwardy, 1975) representative ecosystems must be differentiated according to phytogeographical and zoogeographical criteria and the distribution of sub biomes within the country (Spiridonov and Mileva, 1981 1988, Spiridonov 1992) An area of 500 to 2000 3000 ha is considered the minimum territory required for conservation of representative forest vegetation formations In order to include the diversity of local plant associations, mountain territories have proven to be more "economical " The minimal representative area of the sub biomes in the reserves is 2500 3000 ha This area is relative, however as in mountain regions it generally includes the biota on slopes with only one primary exposure The best representative samples of the sub biomes are in the mountain reserves with elevations of from 1350 to 1800 m above sea level (Spiridonov and Mileva, 1985 Spiridonov 1992)

The concept of a national protected areas system helps to solve the problems associated with the consequences of island biogeography in some regions In addition to the right choice of areas to be protected, the size of the protected areas also needs to be addressed Central Balkan National Park includes about 90% of the Central Balkans' vertebrate fauna and higher flora, as well as their endangered and rare species (Spiridonov 1982, 1983 1992 Spiridonov unpub) The minimal optimal size for national parks is 35 000 to 60 000 ha The above mentioned sources analyze the condition of the vulnerable vertebrate species with small numbers and the conditions necessary for their long term protection In fact if the five national parks over 275 000 ha (median size – 55 000 ha) are managed properly the continuity of natural processes and the vitality of populations of rare vertebrate species can be ensured The ecological corridors for some species of large mammals (e g brown bears) are not secured The most important region for reestablishing contact between isolated populations from the five mountains is Sredna Gora Mountain The optimal size for the strict nature reserves is 1500 ha (Spiridonov, 1992) The relatively small size of such reserves is in part "compensated" for by the designation of buffer zones, especially when they add adjacent lands in the watershed to the reserve territory (Spiridonov and Mileva, 1985)

Even the two largest national parks – Rila and Central Balkan (whose corresponding sub biomes are mixed montane systems with complex zonation) – do not include the lowest belt of xerothermic oak forests This vegetation has been badly damaged as a result of human exploitation These areas have been used extensively by local populations and could be the object of partial preservation in the zones around the parks if they are legislatively designated

The zoning of the national parks (IUCN category II) is another important way to protect biodiversity elements of high conservation priority The most important feature of Bulgarian parks is that they contain a relatively high proportion of the strict nature reserves within their boundaries Their optimal territory is between 20 and 30% of the park's area This size is determined by the large concentration of valuable and unique biodiversity elements that have to be protected through strict management, by the need for "compensation" of territories where required support and management activities take place (including traditional economic activities) and by the free (at present) movement of visitors in the parks and the relatively dense network of tourist chalets and huts The creation of nine strict nature reserves with an area of more than 20 000 ha, prior to the declaration of Central Balkan National Park is proof of the appropriateness of this approach to protected area designation Eight of the reserves are included in IUCN Category I and four are also biosphere reserves Presently they constitute 28% of the total area of the national park

Among the other current needs within the Bulgarian national parks, management plans for habitats above timberline in the high mountain zones are especially important The subalpine belts of the Rila Pirin and Central Balkan Mountains feature high floristic

endemism and many highly specialized species and communities with limited ranges At present the only accepted practice for maintaining the habitats of the high mountain biota is the exclusion of goats from summer pasture which lasts for a period of 2 4 months (Spiridonov 1992)

PRIORITIES IN THE CREATION OF A NATIONAL PROTECTED AREAS SYSTEM

Priorities for creating a national system of protected areas began to incorporate existing scientific information more systematically after 1978 Descriptions of the representative ecosystems and their biogeographical extent are an important even major focus of some recent scientific publications (Spiridonov 1984, Spiridonov and Mileva, 1985 1988 Spiridonov 1992a 1992b) In most cases, biogeographic characteristics are used to identify priority areas for designation as strict protected areas and national parks as examples of sub biomes and representative ecosystems In some cases, protected areas are recommended on the basis of their relationship to existing nature reserves and national parks

Many high priority sub biomes, representative ecosystems and other areas of special importance have already been placed under protection This has happened for example, in the preservation of mountain systems in the Rilas, Central Balkans (Stara Planina), and Vratchanski Balkans the declaration of the strict nature reserves at North Dzhendem, Ibar Central Rilski Ropotamo Sredoka Tissovitsa and Kongura and the expansion of a great number of strict nature reserves Much more numerous are the areas of high priority as samples of sub biomes or as floristic species formation centers that have not yet received protected status. e g , Strandzha the western Rhodopes Dobrostan, Mursalitsa Tetevenski Balkan Osogovska mountain the eastern Rhodopes Sredna Gora Belasitsa etc Ecosystems that are not yet (or only slightly) represented in protected reserves include mixed oak forests in the Danubian plain, the Thracian lowland the north part of Strandzha Mountain, the eastern Stara Planina and the eastern Rhodope Mountains mixed broad leaved mesophytic and beech forests in the western Stara Planina, the eastern Stara Planina the western border mountains the Predbalkan and Sarnena Gora, boreal coniferous forests in the Rila Pirin and western and middle Rhodope Mountains mixed montane systems on silicate rock substrate in Pirin National Park and sub Mediterranean ecosystems in the Kresnenski gorge

In determining the choice of new protected areas as samples of representative ecosystems and sub biomes, priority regions are defined by overlaying elements important for conservation The following basic criteria were used the richness of the vertebrate fauna and higher plant flora the incidence of endemism in the biota (usually in the higher plants), the presence of endangered and rare species and communities the variety of habitats and montane biocenoses, the primary vegetation the degree of accessibility of the region and the threat of disruption due to human activities The order and ranking of these criteria is somewhat arbitrary in that their relative importance depends on the conservation status of each concrete proposal

Priority could also be assigned based on habitat type Forests and natural meadows are widespread habitats, but are still of first rate importance for conservation Only 6 5% of the Bulgarian forests are included within protected areas Bearing in mind that 67% of Bulgaria's forests are of native origin, the need for more complete preservation of these forestlands within protected areas is urgent Habitats of limited distribution comprise a relatively large proportion of the protected areas Hence more than 90% of the high mountain belt above timberline (above 1800 m a s l) is included within four national parks Wetlands (except for those in the middle and downstream of rivers), the sea shore many of the caves with rich fauna, and the most important rock massifs have been placed under protection already

By overlaying maps that illustrate these different priorities, we are able to identify areas where the system of protected areas is evidently unsatisfactory Strandzha the middle and western Rhodopes, the eastern and western Stara Planina (Balkan Mountains), and the eastern Rhodopes The structure of the protected areas system plays a special role in achieving protection for the elements of high conservation value Here the problem of prioritizing rises again The main task is to protect the most valuable natural areas within the boundaries of the national parks (IUCN Category II) and within relatively extensive strict nature reserves Nature or regional parks of the Western and Central European type are given second priority In these nature parks traditional uses of natural resources will be "compensated" through the adoption of limiting measures and by creating a network of reserves and protected sites In fact parks of this kind will be created in areas where it is impossible or inappropriate to create real national parks (as for example in the case of the mountain areas listed above) The habitats of endangered and rare species and communities must be considered as a third priority Many of these species and communities are located within the plant species formation centers vast forests high mountain zones natural water basins and other habitats that are protected within large national parks and strict nature reserves (Spiridonov and Mileva, unpub Spiridonov 1992)

PROGNOSIS FOR THE DEVELOPMENT OF THE PROTECTED AREAS SYSTEM

Spiridonov and Mileva (1985) provided the first prognosis for the network of nature reserves Subsequently prognostic surveys for the whole system of protected area (i e for all categories of protected areas) were conducted for the Ministry of Environment (Spiridonov and Mileva unpub) Corrections in the prognosis have been made by the same authors (Spiridonov and Mileva, 1990, Spiridonov 1992a) National parks can be considered as already established on 95 100% of the appropriate area Only in Pirin National Park can further expansion be expected That is why high priority is given to the expansion of strict nature reserves within nature parks of the European type (IUCN Categories II and IV) In addition to existing national parks of this type, which now cover a total area of 70 000 ha – Vratchansky Balkan, Vitosha Sinite Kamani Shoumensko plato – the designation of about 10 new nature parks is expected This process is likely to continue until 1996 97, by which time the total area of protected areas in this category will have expanded by 500% This will make this category the dominant type of protected area in Bulgaria

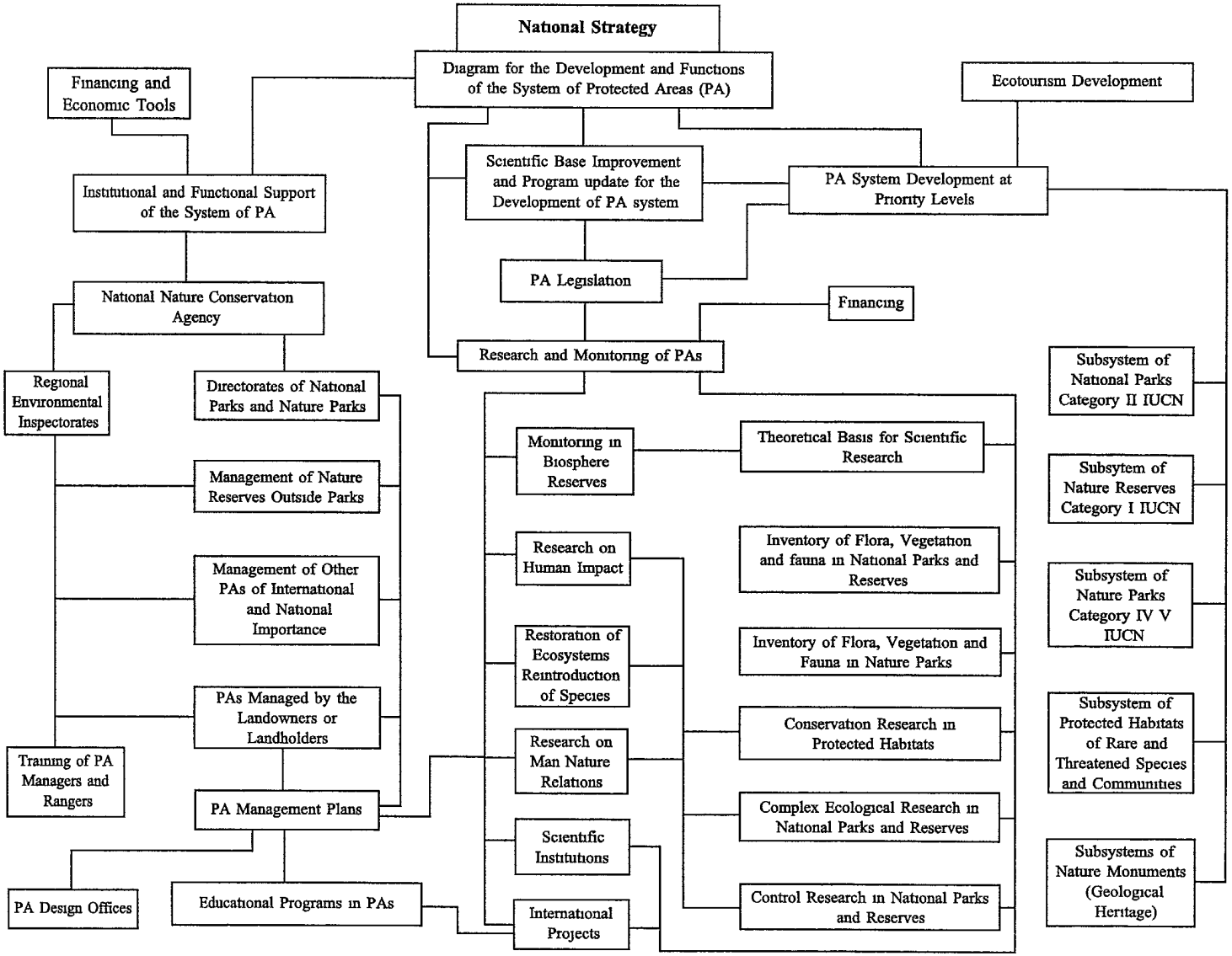
It will become more and more difficult to achieve the effective total area of strict nature reserves (IUCN Category I) – 1 15 1 3% of the territory of the country as a whole Attaining 1% before the year 2000 would be a great achievement but would also represent the probable limit Not less than 3000 ha are expected to be dropped from this category – mainly wetlands that require special management

The prognosis for protection of habitats of endangered and rare species and communities is based on the Bulgarian *Red Data Book*s (1984 1985) in which habitats already included in existing protected areas were not been taken into consideration It is estimated that about 2500 habitats require protection, based on an average area of 40 ha for plants and 120 ha for animals The total area required would be about 200 000 ha It is expected that 25% of this area will be within the borders of future national parks (Spiridonov and Mileva 1988)

The designation of such a large number of protected habitats is complicated by the localized nature of the lands needed to ensure their protection as well as the procedures that must be fulfilled in working with the owners of these lands and with local authorities This is why we can expect to achieve a complete network of protected habitats only after the year 2000 By 1995 96 it is both necessary and possible for the national parks (IUCN Category II) and strict nature reserves (IUCN Category I) to occupy 2 5% of Bulgaria's territory national parks (IUCN Categories IV and V) about 4% and other protected areas about 1 1 5% At least 15% of the Bulgarian forests will be included within protected areas

No matter how greatly the system is expanded after 1995 it is unlikely that it will reach as much as 12 15% of the nation's territory or 25% of its forests This means that a Biodiversity Law will be necessary to protect not only the native forests and biodiversity within protected areas, but other habitat types and their characteristic biodiversity outside protected areas The newly proposed Law on Protected Areas seeks mainly to create a well developed national system of protected areas by the year 2000 It will replace the good, but already dated Law for Nature Protection The basic goals that the new law should help us advance towards are the establishment of categories and criteria for protected areas that correspond to those of the IUCN but take into account the specific conditions within Bulgaria the continuation of the natural processes and preservation of biodiversity within protected areas, a real opportunity for placing under protection areas of national and international importance for conservation the creation of a specialized authority for managing the system of protected areas, and the elaboration and implementation of management plans for the protected areas

Figure 1


National Strategy
Diagram for the Development and Functions of the System of Protected Areas (PA)
Financing and Economic Tools
Ecotourism Development
Scientific Base Improvement and Program update for the Development of PA system
PA System Development at Priority Levels
Institutional and Functional Support of the System of PA
PA Legislation
Financing
National Nature Conservation Agency
Research and Monitoring of PAs
Regional Environmental Inspectorates
Directorates of National Parks and Nature Parks
Subsystem of National Parks Category II IUCN
Monitoring in Biosphere Reserves
Theoretical Basis for Scientific Research
Management of Nature Reserves Outside Parks
Subsytem of Nature Reserves Category I IUCN
Research on Human Impact
Inventory of Flora, Vegetation and fauna in National Parks and Reserves
Management of Other PAs of International and National Importance
Subsystem of Nature Parks Category IV V IUCN
Restoration of Ecosystems Reintroduction of Species
Inventory of Flora, Vegetation and Fauna in Nature Parks
PAs Managed by the Landowners or Landholders
Conservation Research in Protected Habitats
Subsystem of Protected Habitats of Rare and Threatened Species and Communities
Training of PA Managers and Rangers
Research on Man Nature Relations
PA Management Plans
Complex Ecological Research in National Parks and Reserves
Scientific Institutions
Subsystems of Nature Monuments (Geological Heritage)
PA Design Offices
Educational Programs in PAs
Control Research in National Parks and Reserves
International Projects

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Forest Resources and Their Ecological Functions in Bulgaria

Christo Bojinov

SUMMARY

The paper is divided into seven parts

1) Management, ownership, and general characteristics of the forestland area

All forests in Bulgaria are managed and exploited according to the Forest Law and forest management projects The organizational structure for management of the forests consists of three levels the Committee of Forests, 16 Regional Forestry Boards, and 164 Forest Enterprises Until recently, all forests in the country were owned by the state, having been nationalized in 1947 The restoration of ownership rights on municipal forestland (57% of the forests prior to 1947) and private forestland (19% before 1947) is expected soon In 1990 the total forestland area comprised 3871 4 thousand hectares The stands of natural origin covered 2295 0 th ha, or 59 3% of the total The stands of artificial origin covered 1032 1 th ha (26 7%) Dwarf pine stands covered 20 900 ha (0 5%) The afforested area was 3348 0 th ha or 86 5% of the total forestland area This is 30 16% of the total area of the country (or 0 372 ha of forest per citizen)

The first part of this report describes the distribution of the afforested area by type of forest and age class, site index and densities The forest species composition consists of Scots pine (17 0% of the woody area) Norway spruce (4 7%) Austrian pine (3 5%) and other conifers, and by beech (16 5%), oaks (23 8%) Turkey oak (7 8%), and other deciduous species In 1990 the total forest growing stock volume of Bulgaria was 404 872 th m^3 (121 7 m^3/ha) The average annual increment was 9,600 m^3 or 2 9 m^3/ha

2) Forest sites, territorial distribution, and characteristics of the wood resources

The Forest Sites Classification Scheme published in 1983 classified Bulgaria's forests into 147 forest sites For the purposes of this paper, these were aggregated into 55 eco units Detailed information for the area and growing stock volume distribution of the tree species in the framework of the eco units is presented in 7 tables

3) Forest health

Dramatic changes in ecological conditions, combined with physiological instability in some forests, are the major factors behind the present decline in forest health In 1992 62 8% of the country's forests were affected by air pollution In 1992, 62 8% of the forests were affected by air pollution For 34 3% of the forest ecosystems the degree of the damage (discoloration and defoliation) was rated as moderate or severe The young conifer stands were more strongly affected There is also great danger however for the survival of fir and oak stands in the country

4) Ecological functions of the forests

By "ecological functions," we mean the aggregate of infrastructural material and non material services that conserve and improve the living environment as a condition for the comfortable, wholesome and spiritually complete life of man and that conserve and improve the nation's stability and the economic potential of the environment as the basis for society's production within and beyond the forestry sector A general impression of the ecological functions of the forests can be drawn from information on the growing stock of the forests and the distribution of the forests by area which is presented here in terms of the forests dedicated to special purposes

5) Level of economic importance of tree species, endemism, and fragility under human activities

The tree species (135 in number) are separated into 3 levels according to their economic importance The most important are those of autochthonous origin The tree species of endemic origin and those that have been introduced into Bulgaria from other parts of the world are also presented The fragility of the tree species under different human activities is expressed in terms of the resistance of the species to air pollutants

6) Human activities in the forests

Afforestation management of young forest stands, forest protection, and the tending of forests through

thinning and final cutting are the main human activi ties in the forests In recent years about 40 45 000 ha have been afforested annually Forest protection is re alized through pest and disease control, forest fire control, and protection against infringement The re sults of thinning, clear cutting of low productivity stands and final cutting are discussed in this section The total timber yield in 1990 was 4755 m^3 This was 71 45% of the total volume provided for in the forest management plans and 1 17% of the total growing stock volume of the forests in the same year

7) Economic analyses and analyses of the develop ment of the Bulgarian forests

The expenditures in the forestry sector that are not met through cash inflow from direct commercial exchange are compensated for through governmental subsidies Expenditures for implementation of some forest activities in the period 1980 1989 and expendi tures for labor and construction investments are pre sented in a table

The value of the forests ecological functions are determined on the basis of the social expenditures made for the production of environmental benefits and goods from the forests It is logical to accept that the capital value of the ecological functions of the forests in Bulgaria is about twice as high as the value of the forestland and tree resources, and amounts to ap proximately 33% of the total value of the country's tangible assets

The development of the Bulgarian forests in the period 1955 2035 is analyzed in this paper The future development of the forest is determined through the computerized Model of Forest Lands (Bojinov 1988) In the model the forests' natural processes are simu lated and concepts about a future management of these forests are expressed in numbers Changes in certain important forest characteristics – total affor ested area species composition growing stock volume, mean annual increment yield from thinnings and final fellings etc – are analyzed The growing stock vol ume is expected to exceed 500 million m^3 and the fu ture annual cut is predicted to be about 10 million m^3 of standing timber

The characteristics of our forests reveal the need for an enormous investment of work in tending the young mainly coniferous stands, in converting coppice stands, suitable for such purposes, into high stem stands over an area of 784 000 ha, and in reconstruct ing stands of low value and productivity over an area of 608 000 ha and replacing them with high stem stands of suitable composition The general approach to solving these problems involves investments of credit for building forest roads and facilities, for con verting undersized stands of oak (mainly Turkey oak) and poplar for increasing the production of seedlings in nurseries and for improving the effectiveness of af forestation and reforestation work

MANAGEMENT, OWNERSHIP, AND GENERAL CHARACTERISTICS OF THE FORESTLAND AREA

The forests in Bulgaria occupy one third of the country's territory and are extremely important as for its socioeconomic development and for the state of the environment in the Balkan Peninsula and Europe The forests with their productive protective and en vironmental functions comprise an environmental element that is irreplaceable in the man/nature rela tionship They also underlie to a great extent the de velopment of society

All forests in Bulgaria are managed and exploited according to forest management plans Until recently, the forests and lands foreseen for forest purposes were included in the total figure for forestland area The Law for Ownership and Use of Agricultural Lands, enacted in 1991 permits forests to be classified as ag ricultural lands also This problem along with many others associated with the forests and arising from the new trends in the development of society toward de mocracy and a market oriented economy will be ad dressed through a new forest law

In the Forest Law Project a three level organiza tional structure for the management of the country's forests is offered

- The Committee of Forests manages the state for ests and controls all the forests in the country
- Regional Forestry Boards (16 in number) are structures of the Committee of Forests They im plement state forest policy at the regional level
- The local organs of the state authority are the 164 Forest Enterprises They control in cooperation with the Regional Forestry Boards, the private, municipal, and all other public forests according to the Forest Law

The Forest Enterprises are independent corporate bodies Their main function is to direct growth and reproduction management and logging on the state forestland area All forests in the country are owned by the state This is due to the fact that in 1947 the forests were nationalized The restoration of owner ship rights on the municipal forests (57% of the forests prior to 1947) and on private forests (19% before 1947) is expected soon It will be realized through a law that is now being developed and that will be sub mitted to Parliament for passage simultaneously with the new Forest Law

The total area of forestland in Bulgarian in 1990 was 3871 4 th ha This area is distributed according to the categories of lands presented in Table 1

Stands of natural origin covered 2295 0 th ha or 59 3% of the total area Stands of artificial origin

Table 1 Distribution of the total forestland area according to type of land

	Thousands hectares							%
	Forest land	Stands	Dwarf pine	Afforested area	Bare ground to be afforested	Other bare grounds	Forest pasture ground	
Total	3327 1	20 9	3348 0	132 6	281 7	109 1	3871 4	100 0
%	86 0	0 5	86 5	3 4	7 3	2 8	100 0	
Includes								
Forests managed by the state	3236 8	20 9	3257 7	128 0	277 8	109 0	3772 5	97 5
Forests managed by the agro industrial complexes	78 7		78 7	4 5	3 3		86 5	2 2
Forests managed by the Higher Institute of Forestry	11 6		11 6	0 1	0 6	0 1	12 4	0 3

totalled 1032 1 th ha (26 7%) and dwarf pine stands 20 9 th ha (0 5%) The afforested area was 3341 6 th ha (0 5%) The afforested area was 3348 0 th ha, or 86 5% of the total forestland area This is 30 16% of the total area of the country or 0 372 ha of forest per citizen of the country

The distribution of the high stem and low forests area according to age classes is presented in Table 2

Coniferous forests cover 1107 0 th ha, or 33 3% of the afforested portion (not including dwarf pine forests) of the forestland area Broad leaved high stem forests cover 710 5 th ha (21 4%) The percentage of low productivity and non valuable stands is high The species composition of these stands is to be reconstructed using tree species with higher productivity and higher quality timber The area of these stands is 608,100 ha or 18 3% The coppices that can grow into high stem stands by applying higher rotation ages cover 388 400 ha (11 6%), those that can be converted into high stem stands by applying shorter rotation ages cover 395 600 ha (11 9%) The low stem forests con sisting mainly of black locust stands cover 3 5% of the afforested portion (excluding dwarf pine) of the for estland area, or
117,000 ha

The average age of the forest is 42 years Table 2 presents data on the total area of the stands (excluding dwarf pine) according to forest type and age class The table shows that the Bulgarian forest is relatively young The most widely distributed stands are from the II (21 40 year) age class (31 9%) and the I (up to 20 years) age class (30 6%)

Table 2 Percentages of high stem and low stem forests

Kind of Forest	Age class								Total	%
	1 20	21 40	41 60	61 80	81 100	101 120	121 140	141 160		
	Thousand hectares									
Coniferous high stem forests	590 1	199 3	78 2	107 6	77 4	34 9	11 6	7 9	1107 0	33 3
Broad leaved high stem forests	212 5	111 8	50 3	76 4	83 7	71 4	63 3	41 1	710 5	21 4
Broad leaved forests for reconstruction of tree species composition	77 7	264 2	121 3	57 2	43 6	25 7	13 6	5 3	608 1	18 3
Coppice forests for growth into high stem stands (long rotation)	25 1	215 4	132 1	15 8					388 4	11 6
Coppice for conversion into high stem stands (short rotation)	33 9	235 1	111 2	15 4					395 6	11 9
Low Forests	77 5	35 4	3 5	0 6					117 0	3 5
Total	1016 8	1061 2	496 6	273 0	204 7	132 0	88 5	54 3	3327 1	100 0
%	30 6	31 9	14 9	8 2	6 2	4 0	2 6	1 6	100 0	

Table 3 Distribution of the afforested area according to site index and stand density

Kind of forest	Thousand hectares						Average site index	Average density
	Site index					Total site index		
	I	II	III	IV	V			
Coniferous high stem forests	101 3	262 2	384 5	402 5	33 3	1183 8	3 00	0 77
Broad leaved high stem forests	66 5	95 1	202 6	194 7	67 1	626 0	3 16	0 76
Broad leaved forests for reconstruction of the tree species composition	1 0	2 3	8 6	86 9	467 3	566 1	4 13	0 60
Coppice forests for growth into high stem stands (long rotation)	37 9	102 4	191 6	46 0	8 2	386 1	2 70	0 83
Coppice for conversion into high stem stands (short rotation)	26 5	45 2	97 6	167 3	33 1	369 7	3 36	0 81
Low forests	7 9	14 4	34 7	27 4	20 7	105 1	3 38	0 84
Total	241 1	521 6	919 6	924 8	629 7	3236 8	3 37	0 75

Table 4 Tree species distribution (ha)

Tree species	Abbreviation	Thousand hectares	%
Pinus silvestris L	Ps	566 4	17 0
Picea abies L /Karst	Pa	155 7	4 7
Pinus nigra Arn + other conifers	Pn	336 5	10 1
Abies alba Mill	Aa	31 8	1 0
Pinus peuce Grisb + Pinus heldreichii Christ	Pp	16 6	0 5
Total coniferous		1107 0	33 3
Fagus sp	FA	549 9	16 5
Quercus petraea Liebl	Qp	425 3	12 8
Quercus trainetto Ten + other	Qt	502 8	15 1
Quercus cerris L	Qc	258 4	7 8
Carpinus betulus L	Cb	113 6	3 4
Fraxinus sp	F	13 7	0 4
Tilia sp	T	46 6	1 4
Populus tremula L	Pt	4 9	0 2
Betula sp	B	10 3	0 3
Carpinus orientalis Mill	Co	172 9	5 2
Robinia pseudoacatia L	R	98 4	2 9
Populus sp	P	23 3	0 7
Total broadleaved		2220 1	66 7
Total		3327 1	100 0

Table 3 presents data on the distribution of the afforested area (excluding dwarf pine) of the forests managed by the state, according to forest type, site in dex and density As can be seen in Table 3, the aver age site index of the forests is III (3 37) Coppices that are to grow into high stem stands have the highest in dex III (2 7) Forests that are to be reconstructed have the lowest IV (4 13) The average stand density for the forests of national importance is 0 75 The highest stand density (0 84) is found in the low forests and the lowest in forests for reconstruction (0 60)

The distribution of tree species in the Bulgarian forests is presented in Table 4 This table shows that the widely occurring coniferous tree species in the country are the Scots pine (*Pinus silvestris* L) black pine (*Pinus nigra* Arn) and spruce (*Picea abies* L /Karst) and the most widely occurring broad leaved trees are beeches (*Fagus* sp) and oaks (*Quercus petraea* Liebl , *Quercus trainetto* Ten , *Quercus cerris* L)

The total wood reserve of the Republic of Bul garia was 404,872 thousand m^3 in 1990 The distribu tion of the growing stock volume according to age class and forest type is represented in Table 5 Coni fers comprise 39 2% of the wood reserve Broad leaved high stem forests constitute 28 4% of the total wood reserve, and coppices for transformation into high stem forests 24 1% The wood reserve for the country per unit of area is 121 7 m^3/ha The highest amount of wood reserve per ha is found in the broad leaved high stem forests (161 8 m^3/ha), and the lowest in the forest intended for reconstruction (44 4 m^3/ha) The average increment of the total growing stock is 9,600 m^3 annually or 2 9 m^3/ha The current annual increment, averaged over the period 1900 1985 is 12 0 m^3 on the total area or 3 61 m^3/ha

Table 5 Growing stock distribution (m^3)

Kind of forest	Thousand cubic meters									%	Wood reserves
	Age classes								Total		
	1 20	21 40	41 60	61 80	81 100	101 120	121 140	141 160			(m^3/ha)
Coniferous high stem forest	27239	31692	18275	34943	27577	12031	4046	2731	158534	39 2	143 2
Broad leaved high stem forest	6219	142038	9753	17382	21122	18162	15887	12229	114957	28 4	161 8
Broad leaved forests for re construction of tree species composition	1694	8816	5527	3672	3314	2149	1276	538	26986	6 6	44 4
Coppice forests for growth into high stem stands (long rotation)	1593	27278	22172	3110					54153	13 4	139 4
Coppice for conversion into high stem stands (short ro tation)	1477	24378	14936	2584					43375	10 7	109 6
Low forests	3262	3250	333	22					6867	1 7	58 7
Total	41484	109617	70996	61713	52013	32342	21209	15498	404872	100 0	121 7
%	10 3	27 1	17 5	15 2	12 8	8 0	5 2	3 2	100 0		

FOREST SITES, TERRITORIAL DISTRIBUTION, AND CHARACTERISTICS OF THE WOOD RESOURCES

The forest zonation of Bulgaria is based on cli matic changes in both the horizontal and vertical di rections From a forestry perspective the country is differentiated into 3 forest climatic regions northern Bulgaria with a temperate continental climate (Mizia) southern Bulgaria with a transitional Medi terranean climate (Trakia) and a southern marginal region with a climate more closely related to that of the northern Mediterranean region (South) The boundaries of the forest regions can be seen in Map 1

The main divisions in the forest zonation reflect climatic changes that occur as a result of variations in elevation and that influence the species composition distribution, and productivity of woody vegetation (Zahariev et al , 1979) (see Table 6) Edaphic factors are the other main determinants in the development of woody vegetation The most widely distributed soils under the forests are black earth, alluvial, gray forest soils, maroon forest soils, yellow soils, humus carbon ate soils, brown forest soils, and mountainous forest dark soils

The Forest Sites Classification Scheme (1983) co ordinates the division of forest climatic zones in Bul garia with edaphic conditions and identifies 147 forest site types For the purposes of this paper the sites with similar characteristics have been unified into 55 groups of site types or (so to speak) eco-units " Data regarding these units are presented in Table 7 The numbers of the forest site types that are included in the eco units are indicated in Column 3 The fertility of

the soil (Column 5) follows Pogrebniak's scheme Species composition (given by abbreviations) and the productivity of present vegetation (given by site in dexes) are presented in Columns 6 and 7 respectively

Data on the area and growing stock volume distribution of the tree species in the framework of the forest climatic regions are presented in Table 8 Data on the area and growing stock volume distribution of the tree species in the framework of the forest eco units are presented in Tables 9 to 14

Table 6 Main divisions of forest zones in Bulgaria

Forest zone and subzone	Forest regions (altitude meters a s l)		
	Mizia	Trakia	South
I Low plain hill and hill foothill zone of the oak forests			
1 1 Subzone of the river plain forests, and 1 2 Plain hill subzone of the deciduous oak and xerothermic forests	0 400	0 500	0 600
1 3 Hill foothill subzone of the mixed broad leaved forests	400 600	500 700	600 800
II Middle mountain zone of beech and coniferous species			
2 1 Low mountain subzone of the durmast,beech, and fir forests	600 1000	700 1200	800 1500
2 2 Middle mountain subzone of the beech fir and spruce forests	1000 1500	1200 1700	1500 1900
2 3 High mountain subzone of spruce forests	1500 1800	1700 2000	1900 2200
III High mountain zone			
3 1 High mountain subzone of spruce and white fir forests	1800 2000	2000 2200	2200 2500
3 2 Subalpine subzone of single tree, dwarf pine, and bush formations	2000 2200	2200 2500	2500 2700

Table 7 Characteristics of the forest eco units (Regions M Mizia, T Trakia, S South)

No region zone subzone	Forest site type	Soil		Vegetation	
		Type	Fertility	Tree species composition	Site index
1	2	3	4	5	6
1 M I 2	10 11 12	black earth gray forest	D	Qt Qc Qp Cb T F Pn Ps Pa	I II
2 M I 2	13 14 15 121*	black earth gray forest	CD,C	Qt Qc Qp T Cb Co Pn Ps Pa	III
3 M I 2	138 122* 123* 131* 132*	gray forest hum carbonate	B	Qt Qc Co Qp T Cb Pn Ps	IV V
4 M I 3	16 17 22	gray forest brown forest maroon forest	D CD	Qp Qt Qc F Cb T	II III
5 M I 3	18 19 20 24 121*	gray forest maroon forest	C	Qc Qp Qt Cb T Co F B Pn Ps Pa	III IV
6 M I 3	21 23 139 122* 123*131* 132*	gray forest, maroon forest hum Carbonate	B	Qt Qc Co Cb T Qp Pn Ps	IV V
7 M II 1	29 30	brown forest	D CD	FA Qp Cb Qc T Pt Ps Pn Pa Aa,Pp	II III
8 M II 1	27 32 124*	gray forest maroon forest	C	Qp FA Cb Qc Qt T Co B Pt Ps Pn Pa Aa Pp	III IV
9 M II 1	28 31 33 125* 126*,133* 134* 136 137 145*	gray forest hum carbon ate maroon forest, brown forest	B	FA Qt Qc Co Cb Qp T Ps Pn Pp	IV V
10 M II 2 (lower part)	34	brown forest	D CD	FA Pt Ps Pp Aa Pa	II III

Table 7 Characteristics of the forest eco units (Regions M Mizia, T Trakia, S South) (continued)

No region zone subzone	Forest site type	Soil		Vegetation	
		Type	Fertility	Tree species composition	Site index
1	2	3	4	5	6
11 M II 2	36 143*	brown forest	C	PA,Qp,Qc,Qt Co,B,Ps,Pp Aa,Pa	III IV
12 M II 2 lower part)	38 part 126* 133* 134* 145*	brown forest hum carbon ate	B	FA Qp Qc Qt Co Ps Pp	IV V
13 M II 2 up per part)	35	brown forest	CD	FA Ps Pa Aa Pp	II III
14 M II 2 up per part)	37 143*	brown forest	C	FA,Pa Ps Aa Pp	III IV
15 M II 2 up per part)	38 part 126* 133* 134* 145*	brown forest hum carbon ate	B	FA Ps Pa Pp	IV V
16 M II 3	39 40 41 42 44	brown forest mount dark	CD C	FA Ps Pa Pp	III
17 M II 3	43 45 126* 133* 134*	brown forest mount dark hum carbonate	B	FA Ps Pa Pp	IV V
18 T I 2	55 58 60 140 141 147	maroon forest black earth	D CD	Qt Qc Qp T Cb F Pn Ps	II III
19 T I 2	57 61 122* 123* 131* 132*	maroon forest	C	Qt Qc Qp,Cb Co T F Pn Ps	III IV
20 T I 2	57 61 122* 123* 131* 132*	maroon forest hum car bonate gray forest	D CD	Qt Qc Qp Co Qb T Pn Ps	IV V
21 T I 3	62	maroon forest	D CD	Qt Qp Cb Qc T F Pt Pn Ps	II III
22 T I 3	63 121*	maroon forest	C	Qp Qt Qc Cb T Co Pn Ps	III IV
23 T I 3	64 122* 123* 131* 132*	maroon forest hum car bonate	B	Qt Qp Qc Co Cb T Pn Ps	IV V
24 T II 1	67 70	brown forest maroon forest	D CD	FA Qp Cb Qc Qt Pt F T Ps Pn,Aa Pa	II III
25 T II 1	71 142 124*	brown forest maroon for est hum carbonate	C	FA Qp Cb Qc Qt T Co B Ps Pn Aa Pa	III IV
26 T II 1	68 69 72 125* 126* 133* 134*	brown forest, hum carbon ate maroon forest	B BC	Qt Qp,FA Qc Co Cb T Ps Pn Aa Pa	IV V
27 T II 2 (lower part)	73 78	brown forest mount dark	D CD	FA Cb Qp Qc Pt Ps Aa Pa	II III
28 T II 2 (lower part)	75 143*	brown forest hum carbon ate	C	FA Qp Qc Cb B Pt Qt Co Ps Aa Pa	III IV
29 T II 2 (lower part)	77 126* 133* 134* 145*	brown forest hum carbon ate	B	FA Co Qc Qp Qt Cb Ps Pa Aa	IV V
30 T II 2 (upper part)	74	brown forest mount dark	C	FA Pp Pa Ps Aa Pp	II III
31 T II 2 (upper part)	76 80 143	brown forest mount dark	C	FA Pt B Pa Ps Aa Pp	III IV
32 T II 2 (upper part)	79 126* 133* 134* 145*	brown forest hum carbon ate mount dark	B	FA Ps Aa Pa	IV V
33 T II 3	81 82 84	brown forest mount dark	CD C	FA Pa Ps Pp	II III

Table 7 Characteristics of the forest eco units (Regions M Mizia, T Trakia, S South) (continued)

No region zone subzone	Forest site type	Soil		Vegetation	
		Type	Fertility	Tree species composition	Site index
1	2	3	4	5	6
34 T II 3	83 85 126* 133* 134*	brown forest mount dark hum carbonate	B	FA Pa Ps Pp	IV V
35 T III 1	86	mount Dark	C	Pa Pp Ps	III IV
36 T III 1	87 88 130*	mount Dark	B	Pa Pp Ps	IV V
37 S I 2	94,97,99	maroon forest, ?, ?	D,CD	Qt,Qp,FA,Qc,Cb T,F,Pn Ps	II III
38 S I 2	95 98 100,121*	maroon forest, ?, ?	C	Qt Qp FA Qc Cb T,Co Ps Pn	III IV
39 S I 2	96 122* 123* 131* 132*	maroon forest, hum car bonate	B	Qt Qp Co Qc Cb FA T Pn Ps	IV V
40 S I 3	101	maroon forest	D CD	Qp FA Qt Qc Cb T,Pn Ps	II III
41 S 1 3	102 121*	maroon forest	C	Qp Qt Qc Cb FA Co Pn Ps	III IV
42 S I 3	130 122* 123* 131* 132*	maroon forest hum car bonate	B	Qt Qc Qp Co Cb FA T Pn Ps	IV V
43 S II 1	104 105	brown forest	D CD	FA Qp Qt Cb Qc Pt Ps Pn Pa Aa	II III
44 S II 1	107 108 124*	brown forest hum carbon ate	C	FA Qp Cb Qt Qc B Co Ps Pn Pa Aa	III IV
45 S II 1	106 106 125* 126* 133* 134* 145*	brown forest hum carbon ate	B	FA Qt Qp Qc Co Cb Ps Pn Pa Aa	IV V
46 S II 2 (lower part)	110	brown forest	D CD	FA Pt Ps Pn Aa Pp	II III
47 S II 2 (lower part)	112 143*	brown forest hum carbon ate	C	FA B Ps Pa Aa Pp	III IV
48 S II 2 (lower part)	113 126* 133* 134* 145*	brown forest hum carbon ate	B	Fa Ps Pa Pp Aa	IV V
49 S II 2 (upper part)	111 114 143*	brown forest mount dark hum Carbonate	CD	FA Pa Pp Ps Aa	II III
50 S II 2 (upper part)	115 126* 133 134* 145*	mount dark, hum carbon ate brown forest	B	FA Pp Pa Ps Aa	IV V
51 S II 3	118	mount Dark	CD C	Pp Pa Ps	III
52 S II 3	119 126* 113* 134*	mount dark hum carbon ate	B	Pp Pa Ps	IV V
53 S III 1	120 130*	mount Dark	BC	Pp Pa Ps	IV V
54 M T S I 2 I 3	1 6,8,9 (M) 18 20 (T) 37 39 (S)	black earth gray forest maroon forest ?	C D B	Black locust	III IV
55 M T S I 1	1 9 (M) 51 54 (T) 90 93 (S)	alluvial	D CD	Poplar	I II

Note * = These site types are included in different forest regions, zones, and subzones in different ecounits

Table 8 Distribution of the afforested area and growing stock volume of the tree species within the framework of the forest climatic regions

Tree species	Mizia		Trakia		South		Total	
	1000X ha	1000X m³	1000X ha	1000X m³	1000X ha	1000X m³	1000X ha	1000X m³
Pin silvestris	100 3	9510	276 5	51388	189 6	24417	566 4	85315
Picea abies	21 9	1871	108 6	27876	25 2	5356	155 7	35103
Pinus nigra	84 0	6140	158 5	10838	94 0	6481	336 5	23459
Abies alba	3 0	825	24 9	8522	3 9	1103	31 8	10450
Pinus peuce	0 8	77	8 6	2410	7 2	1720	16 6	4207
Total coniferous	210 0	18423	577 1	101034	319 9	39077	1107 0	158534
Fagus sp	248 0	55431	211 9	41718	90 0	14108	549 9	111257
Quer petraea	133 8	9783	162 1	11835	129 4	8727	425 3	30345
Quer trainetto	187 5	14374	175 6	18687	139 7	9353	502 8	42414
Quercus cerris	152 4	13862	90 7	10655	15 3	1295	258 4	25812
Carp betulus	72 1	10305	36 4	7039	5 1	421	113 6	17765
Fraxinus sp	8 9	699	4 6	1066	0 2	12	13 7	1777
Tilia sp	37 0	5726	8 7	611	0 9	64	46 6	6401
Populus tremula	1 0	93	3 4	595	0 5	52	4 9	740
Betula sp	3 6	248	4 1	200	2 6	88	10 3	536
Carp orientalis	73 6	839	71 4	939	27 9	201	172 9	1979
R pseudoacatia	77 2	4534	17 0	750	4 2	138	98 4	5422
Populus sp	15 9	1286	5 2	410	2 2	194	23 3	1890
Total broadleaved	1011 0	117180	791 1	94505	418 0	34653	2220 1	246338
Total	1221 0	135603	1368 2	195539	737 9	73730	3327 1	404872

Table 9 Area (ha) of tree species distribution in the present species composition Mizia region

No of the ecounit	Pinus peuce	Picea abies	Pinus sylvestris	Abies alba	Pinus nigra	Fagus sp	Fraxinus sp	Populus trem.	Betula sp	Quercus petraea	Quercus trainetto	Quercus cerris	Carpinus betulus	Tilia sp	Carpinus orientalis	Total	Black locust	Populus sp
	Hectares																	
16	80	1806	3840			13296										19022		
17	50	447	1808			3800										6105		
13	100	2050	2038	260		10100										14548		
14	80	1240	2445	200		8219										12184		
15	80	823	4940			10612										16455		
10	50	1010	3025	610		30566		260								35521		
11	80	3115	14980	482		76435			850	7182	957	5300			750	110131		
12	80		3020			8329				7654	1276	2539			3885	26783		
7	80	3630	12505	650	7500	30900		310		9965		6219	10500	3800		86059		
8	85	5406	32300	750	15010	41201		432	1500	44166	13835	38420	22473	6725	10180	232483	1233	
9	50		11250		15005	14560				17627	9827	9644	7080	2755	13020	100818	3500	
4		505	920		7345		2150			2511	8375	8910	1300	750		32766	2000	
5		850	2400		15606		4300		1254	17071	20342	24100	14200	8920	9592	118635	11800	
6			1850		15352					8379	31611	8367	6160	1820	26500	100039	3933	
1		400	525		1824		2500			5308	27798	9040	3350	4360		55105	24060	15872
2		620	1510		4306					10206	62836	34510	5200	6080	3520	128788	25074	
3			925		2030					3740	10817	5330	1800	1750	6120	32512	5600	
	815	21902	100281	2952	83978	248018	8950	1002	3604	133809	187674	152379	72063	36960	73567	1127954	77200	15872

Table 10 Area (ha) of tree species distribution in the present species composition Trakia region

No of the ecounit	Pinus peuce	Picea abies	Pinus sylvestris	Abies alba	Pinus nigra	Fagus sp	Fraxinus sp	Populus trem	Betula sp	Quercus petraea	Quercus trainetto	Quercus cerris	Carpinus betulus	Tilia sp	Carpinus orientalis	Total	Black locust	Populus sp
	Hectares																	
35	2600	6010	2549													11159		
36	2050	22140	6976													31166		
33	2681	44429	29727			12300										89137		
34	919	12110	31455			7125										51609		
30	150	8215	6800	2020		13820		420								31425		
31	200	8960	22261	3510		22320		330	535							58116		
32		1360	14543	1723		6210										23836		
27		890	16360	2215		29565		650		762		1100	449			51991		
28		1625	30594	4421		49825		710	1050	7295	305	2210	1820		1015	100900		
29		250	23060	860		12200				945	804	2100	1040		4155	45414		
24		810	17600	2520	9900	21155		702		12798	3350	3615	3120	264		75834		
25		1509	37579	5731	17015	30199			2515	49970	7040	10850	5950	1650	7300	177308	173	
26		292	17625	1900	14120	7181				20151	9740	6450	2260	150	10920	90789	522	
21			2180		12420		503	550		3501	2552	4080	3610	810		30206		
22			4521		24334					35463	14712	13103	5400	1320	7360	106213	522	
23			3750		21180					13526	23750	8681	3520	715	15055	90174	174	
18			2264		13245		2162			3500	21123	6210	3162	1136		52802	4655	5200
19			3135		22000		1850			8120	53313	20145	4410	1945	8420	123338	9911	
20			3521		24286					6102	39004	12156	1629	710	17175	104583	1043	
	8600	108600	276500	24900	158500	211900	4515	3362	4100	162130	175693	90700	36400	8700	71400	1346000	17000	5200

Table 11 Area of tree species distribution in the present species composition South region

No of the ecounit	Pinus peuce	Picea abies	Pinus sylvestris	Abies alba	Pinus nigra	Fagus sp	Fraxinus sp	Populus term.	Betula sp	Quercus petraea	Quercus trainetto	Quercus cerris	Carpirus betulus	Tilia sp	Carpirus orientalis	Total	Black locust	Populus sp
	Hectares																	
53	1512	1008	277													2797		
51	1150	987	380													2517		
52	909	691	154													1754		
49	1627	1918	510	325		225										4605		
50	1083	958	150	240		150										2581		
46	220	3800	3789	521		3831		220								12381		
47	405	5212	12521	1259		4140		420								23957		
48	265	1020	1887	221		2836										6229		
43		3420	11050	385	4180	12886		239		2320	800	450	160			35890		
44		5140	81125	750	13220	22361			1080	10125	4500	1420	410		1120	141251		
45		1015	38085	195	10900	12603				10896	5120	1215	983		4850	85862	170	
40			2180		5011	4020				5520	950	1025	190	52		18948		
41			12840		11809	9820			981	12812	4901	2070	500	146	1650	57529	170	
42			6001		8000	2510				6807	6896	1620	1025	50	5150	38059		
37			1520		7850	3940	234			4965	7159	1840	234	120		27862	1228	2198
38			12095		20100	9197				57888	75406	3286	621	450	4120	183163	2416	
39			5075		13009	1514				18102	33953	2350	995	90	11050	86138	254	
	7171	25169	189639	3896	94079	90033	234	459	2481	129435	139685	15276	5118	908	27940	731523	4238	2198

Table 12 Volume (m^3) of tree species growing stock in the present species composition Mizia region

No of the ecounit	Pinus peuce	Picea abies	Pinus sylvestris	Abies alba	Pinus nigra	Fagus sp	Fraxinus sp	Populus trem.	Betula sp	Quercus petraea	Quercus trainetto	Quercus cerris	Carpinus betulus	Tilia sp	Carpinus orientalis	Total	Black locust	Populus sp
	1000X m^3																	
16	8	154	288			2781										3231		
17	4	38	135			437										614		
13	9	175	152	73		2112										2521		
14	8	106	183	56		1719										2072		
15	8	70	470			1220										1768		
10	4	86	327	170		7124		24								7735		
11	8	266	1422	135		18955			35	598	76	517			9	22021		
12	8		326			958				378	63	146			44	1923		
7	8	310	1237	181	469	7163		29		785		607	1664	478		12931		
8	8	463	3219	210	1140	10617		40	111	3554	1097	3751	3562	1146	116	29034	72	
9	4		1142		1140	2345				1039	485	576	596	346	148	7821	205	
4		43	69		562		170			199	664	870	206	94		2877	118	
5		73	180		1169		336		102	1402	1618	2353	2251	1700	109	11293	693	
6			138		1158					413	1922	482	519	229	302	5163	231	
1		34	39		90		193			421	2209	883	531	548		4948	1414	1286
2		53	113		312					809	5706	3369	825	965	40	12192	1472	
3			70		100					185	534	308	151	220	71	1639	329	
	77	1871	9510	825	6140	55431	699	93	248	9783	14374	13862	10305	5726	839	129783	4534	1286

Table 13 Volume (m^3) of tree species growing stock in the present species composition Trakia region

No of the ecounit	Pinus peuce	Picea abies	Pinus sylvestris	Abies alba	Pinus nigra	Fagus sp	Fraxinus sp	Populus term.	Betula sp	Quercus petraea	Quercus trainetto	Quercus cerris	Carpinus betulus	Tilia sp	Carpinus orientalis	Total	Black locust	Populus sp
	1000X m^3																	
35	792	1641	400													2833		
36	603	5571	1300													7474		
33	619	11515	5800			2416										20350		
34	313	3414	5400			653										9780		
30	36	2096	1321	670		2737		70								6930		
31	41	2250	4804	1275		4987		52	35							13450		
32		281	2640	515		569										4005		
27		184	2830	750		6342		122		64		206	66			10564		
28		335	5352	1645		10625		131	55	568	26	311	430		10	19488		
29		51	4300	260		2027				37	32	181	150		60	7098		
24		167	3100	901	801	4644		130		1039	330	502	708	31		12353		
25		311	7521	1816	1330	6059			110	4316	794	1708	1126	77	120	25288	8	
26		60	3100	690	931	659				798	586	500	337	17	164	7842	22	
21			509		800		137	90		265	250	600	780	96		3527		
22			633		1412					2991	1941	2154	1301	156	110	10698	22	
23			660		1580					535	1540	633	483	37	175	5643	8	
18			517		973		486			295	3543	607	619	59		4099	217	410
19			601		1702		443			685	6904	2653	789	112	130	14019	427	
20			600		1309					242	2741	600	250	26	170	5938	46	
	2410	27876	51388	8522	10838	41718	1066	595	200	11835	18687	10655	7039	611	939	194379	750	410

Table 14 Volume (m^3) of tree species growing stock in the present species composition South region

No of the ecounit	Pinus peuce	Picea abies	Pinus sylvestris	Abies alba	Pinus nigra	Fagus sp	Fraxinus sp	Populus trem.	Betula sp	Quercus petraea	Quercus trainetto	Quercus cerris	Carpinus betulus	Tilia sp	Carpinus orientalis	Total	Black locust	Populus sp
	1000X m^3																	
53	363	214	29													606		
51	276	210	40													526		
52	218	147	16													381		
49	390	408	54	92		40										984		
50	260	204	16	68		12										560		
46	53	809	503	147		695		25								2232		
47	97	1109	1632	357		796			15							4006		
48	63	217	302	63		230										875		
43		728	1475	109	399	2306		27		204	70	49	32			5390		
44		1094	10829	212	930	3886			38	962	397	154	60		8	18570		
45		216	5251	55	719	1021				417	196	47	36		35	7993	5	
40			290		439	715				487	84	111	28	4		2158		
41			1422		762	1746			35	1283	432	225	73	10	12	5900	6	
42			624		581	203				260	264	63	38	4	36	2073		
37			133		574	700	12			447	632	200	34	8		2740	40	194
38			1257		1257	1635				4074	5980	356	92	32	30	14713	79	
39			544		820	123				693	1298	90	37	6	80	3691	8	
	1720	5356	24417	1103	6481	14108	12	52	88	8727	9353	1295	421	64	201	73398	138	194

FOREST HEALTH

Dramatic changes in ecological conditions combined with the physiological instability of some forests are the major factors behind the present decline in forest health Table 15 presents estimates of the visible damage to tree crowns attributed to air pollution The data is derived from a long term program to assess the impacts of air pollution on the forests This program was initiated in Bulgaria to evaluate the degree of environmental contamination and associated damage (discoloration and defoliation) to forest ecosystems The program follows the manual prepared by the European Forestry Commission of the United Nations Food and Agriculture Organization (FAO, 1989)

In 1992 62 8% of the forests were affected by air pollution For 34 3% of the forest ecosystems the degree of the damage (discoloration and defoliation) was rated as moderate or severe The young conifer stands were more strongly affected There is also great danger however for the survival of fir and oak stands in the country

Table 15 Estimated visible damage to tree crowns attributed to air pollution

Degree of damage (damage class)		1992		Change between 1992 and 1991 percentage of forest (%)
		Forest damaged (million ha)	Percentage of forest (%)	
0	No damage symptoms	1 2382	37 2	+22 0
1	Light damage	0 9471	28 5	+2 6
2	Moderate damage	0 5355	16 1	9 6
3 4	Severe damage dead	0 6063	18 2	15 0
	Total wooded land	3 3271	100 0	
2 4	Moderate and severe damage, dead	1 1418	34 3	24 6
1 4	Total damage	2 0889	62 8	22 0

ECOLOGICAL FUNCTIONS OF THE FOREST

By 'ecological functions" we mean those forest processes that influence the state of the environment, and that accompany the production of timber This is the aggregate of infrastructural material and nonmaterial services that

- conserve and improve the living environment as a condition for the comfortable wholesome, and spiritually complete life of man and
- conserve and improve the nation's stability and the economic potential of the environment as the basis of society's production within and beyond the forestry sector

However there is no doubt that the dominant proportion of our forests shall serve from now into the predictable future as multi function and multi-purpose sources of raw materials as well as bearers of environmental benefits and influences

Under current legislation the forests of Bulgaria are classified into two groups in accordance with their social purposes The first group includes "forests of commercial purpose," which are managed mainly for the production of timber The second group includes "forests of special purpose " According to their configuration, the latter are subdivided into shelter forests, recreation forests protected areas, and other forests of special purpose The main social purpose of these forests is to produce ecological benefits and other environmental goods The harvesting of timber and other raw materials in these forests is regulated by strict forestry methods following environmentally sound standards, or is not allowed at all

The relative proportion of forests of special purpose has increased from 10 2% in 1960 to 30 4% in 1990 A general impression of the ecological functions of the forests can be drawn from data on the distribution of the forests by area and growing stock which is presented for the forests of special purposes in Table 16

Table 16 Distribution of the Bulgarian forests according to their purposes

Purpose	Total area		Afforested area		Growing stock	
	ha	%	ha	%	ha	%
I Commercial forests	2694249	69 6	2364539	70 6	259175	64 0
II Special forests						
1 Shelter forests	546264	14 1	430253	12 9	58066	14 3
incl water protective	308705	8 0	254204	7 6	40277	9 9
erosion protective	216139	5 6	157897	4 7	16148	4 0
meliorative	21420	0 5	18152	0 6	1641	0 4
2 Recreation forests	248161	6 3	221615	6 6	31118	7 7
incl resort forests	145144	3 7	132765	4 0	21895	5 4
green zones and systems	97700	2 5	84422	2 5	8735	2 2
parks out of settlements	5317	0 1	4428	0 1	488	0 1
3 Protected areas	164232	4 2	131551	3 9	21950	5 4
incl natural reserves	58279	1 5	47309	1 4	10175	2 5
national parks	77389	2 0	60819	1 8	8098	2 0
beauty spots	9321	0 2	6852	0 2	967	0 3
protected places	9887	0 3	8441	0 3	1356	0 3
historical sites	8891	0 2	8069	0 2	1350	0 3
protected landscapes	465	0 0	61	0 0	4	0 0
4 Others	218541	5 6	200074	6 0	34563	8 6
incl resort resources	3150	0 1	2421	0 1	218	0 1
resort places	648	0 0	583	0 0	191	0 0
monuments of the culture	12	0 0	10	0 0	5	0 0
hunting territories	142095	3 7	128195	3 8	18229	4 5
seed lots and plantations	43672	1 1	43613	1 3	12606	3 1
arboretums	1619	0 0	1321	0 1	149	0 0
botanical and zoo gardens	100	0 0	80	0 0	36	0 0
200 m around hats	1082	0 0	1028	0 0	195	0 1
buffer zones	7841	0 2	6611	0 2	1203	0 3
of other institutions	18322	0 5	16212	0 5	1731	0 5
TOTAL II	1177198	30 4	983493	29 4	145697	36 0
TOTAL (I + II)	3871447	100 0	3348032	100 0	404872	100 0

LEVEL OF ECONOMIC IMPORTANCE OF TREE SPECIES, ENDEMISM, AND FRAGILITY UNDER HUMAN ACTIVITIES

The species composition of the forests in Bulgaria is quite varied but a fairly limited number of species are of economic (commercial) importance In Table 17 the 135 tree species are separated into 3 levels according to their economic importance The assessments of the relative level of importance of the species is based on their distribution and on their area of origin The most important are those of autochthonous origin The tree species of endemic origin and those that have been introduced from other parts of the world are also noted (Stefanov and Ganchev 1958 Delkov 1988)

The fragility of tree species under different human activities is expressed in terms of the resistance of tree species to air pollutants In the last column of Table 17 the tree species most tolerant of harmful air pollutants are labeled with "++" those that are tolerant are marked "+", those that are not tolerant are marked "0" and species for which information is lacking are marked " " (Prokopiev 1978) It should be mentioned that this scale is relative since the tree species have different levels of tolerance for different pollutants

Table 17 Economic importance of tree species, place of origin (endemism), and fragility

Tree Species	Importance			Origin			Fragility
	1	2	3	1	2	3	
Coniferous							
Abies alba Mill	x			x			0
Abies borisu-regis Mattf		x			x		
Abies cephalonica Loud			x			x	
Abies concolor Lindl		x				x	0
Abies nordmanniana (Stev) Spach		x			x		
Abies numidica De Lannoy			x			x	
Abies pinsapo Boiss			x			v	
Cedrus atlantica Manetti		x				x	
Cedrus deodara Loud			x			x	
Cedrus libani Laws		x				x	
Chamaecyparis lawsoniana Parl		x				x	++
Cryptomeria japonica D Don			x			x	
Cupressus arizonica Mill			x			x	
Cupressus sempervirens L		x				x	
Juniperus virginiana L			x			x	++
Larix europea DC		x				x	+
Metasequoia gymtostroboides Hu at Cheng		x				x	
Picea exelsa Link	x			x			0
Picea omorica (Panc) Purk			x			x	+
Picea orientalis (L) Link		x				x	+
Picea pungens Engelm			x			x	++

Table 17 Economic importance of tree species, place of origin (endemism), and fragility (continued)

Tree Species	Importance			Origin			Fragility
	1	2	3	1	2	3	
Coniferous							
Pinus aristata Engelm		x				x	0
Pinus cembra L		x				x	0
Pinus coulteri D Don			x			x	0
Pinus exelsa Wall		x				x	0
Pinus halepensis Mill			x			x	0
Pinus heldreichii Christ	x				x		+
Pinus montana Mill	x			x			+
Pinus nigra Arn	x			x			+
Pinus peuce Gris	x				x		+
Pinus pinaster Alt	x					x	0
Pinus ponderosa Dougl		x				x	0
Pinus radiata Don		x				x	0
Pinus rigida Mill			x			x	0
Pinus sylvestris L	x			x			0
Pinus strobus L	x					x	0
Pseudotsuga menziesii (Mirb) Franco	x					x	+
Sequoia sempervirens (D Don) Endl		x				x	
Sequoiadendron giganteum (Lindl) Buchh		x				x	+
Taxus baccata L		x		x			++
Taxodium distichum (L) Rich			x			x	
Thuja gigantea Nitt		x				x	++
Thuja occidentalis L		x				x	++
Thuja orientalis L		x				x	++
Tsuga canadensis (L) Carr		x				x	+
Tsuga caroliniana Engelm		x				x	+
Non coniferous							
Acer campestre L	x			x			+
Acer dasycarpum Ehrt			x			x	+
Acer heldreichii Orch		x			x		+
Acer hyrcanum Fisch et C A Mey		x		x			+
Acer negundo L		x				x	+

Table 17 Economic importance of tree species, place of origin (endemism), and fragility (continued)

Tree Species	Importance			Origin			Fragility
	1	2	3	1	2	3	
Non coniferous							
Acer palmatum Thunb			x			x	+
Acer platanoides L	x			x			0
Acer pseudoplatanus L	x			x			0
Acer tataricum L	x			x			+
Aesculus hippocastanum L		x			x		0
Aesculus carnea Hayne			x			x	0
Ailanthus altissima (Mill) Swingle		x				x	+
Alnus glutinosa (L) Gaertn	x			x			0
Alnus incana (L) Moench	x			x			0
Alnus viridis (Chaix) DC	x			x			0
Betula pendula Roth	x			x			+
Betula Maximowiczii Rgl			x			x	+
Carpinus betulus L	x				x		+
Carpinus orientalis L	x				x		++
Castanea sativa Mill	x					x	0
Celtis australis L		x		x			+
Celtis caucasica Willd		x		x			+
Celtis occidentalis L		x				x	+
Cerasus avium (L) Moench		x		x			+
Cerasus vulgaris Mill		x		x			+
Corylus colurna L		x		x			
Fagus orientalis Lipsky	x			x			+
Fagus silvatica L	x			x			+
Fraxinus americana L			x			x	+
Fraxinus excelsior L	x			x			+
Fraxinus ornus L	x			x			+
Fraxinus oxycarpa Willd	x			x			+
Fraxinus pensylvanica Marsh			x			x	+
Gleditshia triacanthos L		x				x	++

Table 17 Economic importance of tree species, place of origin (endemism), and fragility (continued)

Tree Species	Importance			Origin			Fragility
	1	2	3	1	2	3	
Non coniferous							
Juglans nigra L		x				x	+
Juglans regia L		x				x	+
Liriodendron tulipifera L		x				x	0
Magnolia denudata Desr			x			x	+
Magnolia kobus DC			x			x	+
Magnolia liliflora Desr			x			x	+
Magnolia stellata Maxim			x			x	+
Morus alba L		x				x	+
Morus nigra L		x				x	+
Ostria carpinifolia Scop		x		x			
Platanus acerifolia Willd		x				x	++
Platanus occidentalis L		x				x	++
Platanus orientalis L		x		x			++
Populus alba L	x			x			+
Populus canescens Sm	x			x			+
Populus deltoides Marsh	x					x	+
Populus euramericana (Dode) Guinier	x					x	+
Populus nigra L	x			x			+
Populus piramidalis Rozier	x			x			+
Populus tacamahaca Mill	x					x	+
Populus tremula L	x			x			+
Populus trichocarpa Torr	x					x	+
Prunus serasifera Ehrt		x		x			+
Quercus aegilops L			x			x	++
Quercus cerris L	x			x			++
Quercus coccifera L		x		x			++
Quercus frainetto Ten	x			x			++
Quercus hartwissiana Stev		x		x			++
Quercus petraea Liebl	x			x			++
Quercus pubescens Willd	x			x			++
Quercus robur L	x			x			++

Table 17 Economic importance of tree species, place of origin (endemism), and fragility (continued)

Tree Species	Importance			Origin			Fragility
	1	2	3	1	2	3	
Non coniferous							
Quercus rubra L	x			x		x	++
Quercus suber L		x				x	++
Quercus tracica Stev et Ned		x			x		++
Robinia pseudoacacia L	x					x	++
Salix alba L	x			x			+
Salix babylonica L			x			x	+
Salix caprea L		x		x			+
Salix fragilis L		x		x			+
Salix puntandra L		x		x			+
Salix purpurea L		x		x			+
Salix triandra L		x		x			+
Sophora japonica L		x					++
Sorbus aucoparia L							+
Sorbus aria (L) Crantz							+
Sorbus domestica L							+
Sorbus torminalis (L) Crantz							+
Tilia cordata Mill	x			x			0
Tilia platypholios Scop	x			x			0
Tilia rubra DC		x		x			0
Tilia tomentosa Moench	x			x			+
Ulmus minor Mill	x			x			+
Ulmus laevis Pall		x		x			+
Ulmus glabra Huds		x		x			+

Legend

Importance of the tree species
1) Of primary economic importance,
2) Of secondary economic importance,
3) Of lowest economic importance (widely distributed in the parks)

Origin of the tree species
1) Autochthonous,
2) Endemic to the Balkan Peninsula,
3) Introduced from other parts of the world

HUMAN ACTIVITIES IN THE FOREST

Afforestation, the tending of young stands, forest protection and the tending and final cutting of trees are the main human activities in the forests Affores tation has been the main instrument for developing and improving the nation's forestland area In recent years, about 40 45 000 ha have been afforested annu ally (Table 18)

Afforestation policies are elaborated on the basis of the condition of forestlands and the need for the quickest and most effective production of wood and other forest utilities

Table 18 shows data regarding afforestation work over the course of the last decade The data illustrate that about 25% of the entire annually afforested area involves the reconstruction of low value stands i e replacing the existing species composition as quickly as possible with quick growing valuable species About 15% of the annually afforested land involves the con version of waste and eroded bare lands Active inter vention in the process of regeneration and in filling out open canopy stands through afforestation takes place on about 60% of the annually afforested area Priority in afforestation is given to Scots pine, Austrian black pine spruce fir Douglas fir and other conifer ous trees (about 70% of the total), and to oaks, lin dens, birches and others broad leaved species (about 30% of the total)

Forest protection measures include the control of pests diseases, weeds, and forest fires, and protection of the forests from infringement Table 18 shows that pest and disease control using biological preparations is the preferred method There are plans to expand biological control programs, and to investigate other concepts and prognoses for the prevention of damage by pests, diseases, and abiotic factors Also envisioned in fire control programs are special methods of condi tioning forest areas creation of new mineralized me dian strips, proper maintenance of existing strips cleaning of forested sites along railroad lines con struction of a considerable number of fire towers etc The number of fires over the past few years has gone as high as 200 They have devastated areas up to 1000 ha The prevention of unauthorized cutting and graz ing in forested areas has become an important task of the forest enterprises as well as local people, councils and public organizations Checkpoints and mobile forestry guards have been established by each Re gional Forestry Board

The respective Forest Enterprises have the task of regenerating and managing the forests and forestlands with a view to increasing their productivity This means a planned silvicultural program plowing under the canopy with a view toward improving the structure and quality of the soil, taking advantage of natural re generation accelerating the rate of growth of existing

Table 18 Extent of some human activities in the forests in the period 1980-1989

Activities	Area, hectares						
	1980	1984	1985	1986	1987	1988	1989
1 Soil preparation for afforesta tion	36100	29913	30397	29436	35212	28888	32942
2 Afforestation including	47313	39441	39798	40590	46041	46434	45799
on bar lands	7598	7936	7916	8921	7915	6251	6463
on lands after clear cut for reconstruction	14258	9573	9132	9001	10215	10115	9131
for filling out open canopy stands after final felling	25457	21932	22750	22668	27911	30068	30205
3 Simulating of natural forest regeneration	2 2	0 5	1 4	0 4	0 2	0 1	0 7
4 Forestry car of young stands	145 1	125 0	115 1	113 1	108 7	104 2	108 6
5 Pest and disease control in cluding	38 5	121 7	91 9	50 6	57 5	70 9	75 2
with chemical preparations	12 6	10 1	7 7	5 8	7 2	5 4	9 5
with biological preparations	9 0	69 5	47 4	19 2	14 0	17 2	21 9

stands and young stands converting coppices into high stem forests thinnings cuttings to allow for the reconstruction of species composition and final cut ting

Natural forest regeneration is simulated by plow ing under the canopy (see Table 18) preserving seed trees and young growth during felling and timber hauling operations clearing of felling sites, controlling grazing and other practices

Careful forestry can do much for the survival and early growth of new stands (Table 18) Systematic weed control and scarification can solve to a very large degree the problems of moisture conservation and sur vival of the seedlings

Coppice stands that are in a better state with greater density and on better soils, are designated for conversion into high stem forests on a 50 80 year ro tation basis In these stands thinning and other silvi cultural treatments begin in the earliest ages so that the greatest possible number of trees may grow to a size suitable for the production of mine shaft supports girders etc The area of these stands was 784 000 ha in 1990 Thinning and other silvicultural practices in crease productivity, improve the quality of the stands (primarily the high stem ones) reduce the time neces sary for the growth of mature timber, improve the health standards of the forests and their resistance to adverse factors, and aid in soil and water conservation and other functions The basic methods depend on the age of the stands and can involve forest thinning and cleaning selective cutting and the creation of more open spaces

Stands dedicated to the reconstruction of their species composition totalled 608 000 ha in 1990 Their status species composition and productivity are in versely proportional to the quality of their soil and climatic site conditions The problems with these poor value and low productivity stands can be solved only through clear cutting and afforestation using valuable and highly productive species Regeneration felling is applied to mature forests in accordance with their re spective rotation plans This solves the forester's problems of forest regeneration soil conservation and declining increments, and facilitates exploitation through mechanized logging Regeneration felling re quires competent evaluation of each particular site and forest type, and proper setting of priorities In the Bulgarian context the selection of regeneration felling normally gives priority to forest development projects that require the most efficient regeneration of stands, without leading to deterioration of the landscape, and taking into account the ecological functions of the for ests Two basic systems of final cutting or harvest are applied in Bulgaria systems based on natural regen eration (progressive cuttings selective cuttings group selection etc) and systems based on artificial regen eration (clear cutting, group progressive cuttings etc)

Results after the thinnings clear cuts for recon struction of low productivity stands, and final cuttings are given in Table 19 The total yield in 1990 was 4755 m³ This was 71 4% of the volume provided for in the forest management plans and 1 17% according to the total growing stock volume of the forests in the same year

Table 19 Cuttings and timber yield in 1990

Kind of forest	Project/actual report	Annual cutting area				Timber yield (standing) 1000X m³ o b
		With natural regeneration	last phase	with artificial regeneration	Tending felling	
		1000X hectares				
Coniferous	project	3 2	0 7	2 1	56 2	1749
	actual	2 5	0 6	2 0	28 2	1524
Broadleaved	project	15 8	2 1	6 8	82 9	3872
	actual	8 9	1 7	4 8	40 7	2469
For "reconstruction"	project			21 6		1040
	actual			9 4		762
Total	project	19 0	2 8	30 5	139 0	6661
	actual	11 4	2 3	16 2	69 0	4755

ECONOMIC ANALYSIS AND ANALYSES OF THE DEVELOPMENT OF THE BULGARIAN FORESTS

The expenditures in the forestry sector that are not met through cash inflow from direct commercial exchange are compensated for through governmental subsidies Expenditures for implementation of some forest activities in the period 1980 1989 are presented in Table 20

The number of people working in the field of for estry totals 25,160 (20,334 workers) Those who work in logging and in the wood industry number 64,476 (53 682 workers) These data are for 1989 The amount of construction investments in the forestry sector is negligible Bulgaria is an importer of wood and wood products

The value of the forests' ecological functions is de termined on the basis of social expenditures made for the production of environmental benefits and goods from forests Preliminary investigations in Bulgaria (Vassilev and Petkov, 1993) indicate that at present the harvesting of timber has become more than twice as expensive due to the application of environmentally sound forest management regimes and technologies This alone provides evidence that the value of the en vironmental functions of the forests in Bulgaria, which is now recognized by society is at least equal to the profitability of timber harvesting If the government subsidies, which were in place until two years ago are added to the annual value of the environmental func tions, the total environmental value will appear to be more than twice as the profit value of timber harvest ing Under such conditions it is logical to accept that the capital value of the ecological functions of the for ests in Bulgaria is approximately twice as high as the value of forestland and tree resources, and amounts to approximately 33% of the total value of the country's tangible assets

Table 20 Expenditures, labor force, and construction investments in the period 1980 1989

	Units	1980	1984	1985	1986	1987	1988	1989
Expenditures								
Simulating of natural forest re generation	th leva	115	44	148	42	46	62	103
Forestry care of young stands	th leva	8728	9037	8389	8607	8702	9267	9773
Pest and disease control	th leva	651	1181	1170	1445	1535	2018	2075
Labor force								
People working in the field of forestry	persons	17771	16721	16335	24261	25846	26782	25160
including workers	persons	14484	13437	13038	19538	20521	21694	20334
Construction investments								
Investments	mil leva	8 6	10 8	13 5	8 7	9 0	6 7	4 1
Percentage of the investments in the forestry branch	%	0 1	0 1	0 1	0 4	0 1	0 1	0 0

Table 21 Trade balance (+ = import, - = export) of wood and wood products

Wood and wood products	Balance (+ imports exports) 1000X m³ equivalent in round wood
1 Round wood	+1555
2 Mine wood (props)	+31
3 Wood pulp and paper	+1283
4 Wood base panel particle board, fiberboard	65
Total	+2804

The development of the Bulgarian forests in the period 1955 2035 has been analyzed for this paper Statistically reliable data for the years 1955 1985 were used (Central Statistical Bureau 1962 1967 1978, 1988) The future development of the forests was determined through the computerized Model of Forest Lands (Bojinov 1988) In the Model of Forest Lands the natural processes in forests are simulated and concepts about the future management of these forests are expressed in numbers

These estimates and concepts, which were jointly determined by a team of scientists and experts in the field of forestry, involve the potential of forest sites to produce timber the natural/artificial regeneration ratio, the conversion of coppice forests into high stem forest, the reconstruction of some broad leaved forests of low productivity, the establishment of two storied stands thinnings the future composition of tree species in conformity with probable changes in the environment improvement in the protective, water conserving and other special functions of forest and material, technical financial, and human resources

The changes in the main characteristics of the forests in the period 1955 2035 are presented in Table 22

As regards species composition the proportion of coniferous species is expected to increase considerably (Table 22 line 1*) The total area under conifers is expected to increase from 441 400 ha in 1955 to about 1700 thousand ha in 2035, mainly as a result of reforestation of poor sites that are now occupied by tree species of low value and productivity (i e , stands of the 'for reconstruction" class) and afforestation of bare ground

The increase in tree resources during the period under investigation is impressive From 214 4 million m^3 in 1955, they reached 344 8 million m^3 in 1985, and are expected to exceed 470 million m^3 by 2035 (Table 22, line 2 1) – thus attaining an increment of 137 m^3/ha in the same year This increase in volume is due mainly to the enormous growth potential of widely established young mainly coniferous forests (Table 22, line 2 1*), as well as activities that have already been carried out and that have resulted in improvements in the state of the forests

The total afforested area of our national forest lands is unlikely to rise much It is expected to increase from 3153 3 thousand ha in 1955 up to 3443 3 thousand ha after 2015 when there will be no more bare grounds suitable for afforestation within the forest lands (Table 22, line 1) The mean annual increment (Table 22 line 3), after a decrease in 1965 is expected to be about 10 million m^3 by 2035, or about 3 m^3/ha by this same year, when the increment will be accumulated in growing stocks of assorted structures of higher quality The future annual cut is predicted to be about 9 million m^3 of standing timber (Table 22, line 6 1) including about 6 million m^3 from the main cuttings (Table 22, line 4) and about 3 million m^3 from thinnings (Table 22, line 5) The increase in the total amount of harvested timber by the end of the period of investigation is expected to be due to the increased harvest from thinnings Statistical data on the nature of harvesting (Table 22 lines 6 2 6 3) serve to characterize two periods in the past Until the 1970s timber harvests had been increasing i e the percentage of annual cut of the total timber volume had been 3 61% and 3 31%, and of the mean annual increment 118 2% and 137 1% in 1955 and 1965 respectively Even though the average age of the forests was comparatively young (about 35 years) for the period of investigation, the above figures indicate a considerable exceeding of the "normal" cut on a 100 year rotation i e an annual cut of 2% of the volume or 100% of the increment After the 1970s a tendency toward incomplete utilization of forest tree resources is observed By 1985, the percentage of the annual cut amounts to 1 63% of the total timber volume and only 63 3% of the mean annual increment

The present statistical characteristics of our forests reveal the need for an enormous amount of work in thinning the young, mainly coniferous stands, in converting coppice stands suitable for such purposes into high stem stands over an area of 784,000 ha in reconstructing stands of low value and productivity over an area of 608 000 ha and replacing them with high stem stands of suitable composition Solving these problems will require the application of various forestry and organizational technologies The general approach to solving these problems involves investments of credit for building forest roads and facilities for converting under sized stands of oak (mainly Turkey oak) and poplar for increasing the production of seedlings in nurseries and for improving the effectiveness of afforestation and reforestation work

At present, one can hardly estimate the degree to which the necessary work is going to be undertaken Any predictions given the conditions of economic collapse that have affected all branches of industry in the transition from a centralized to a market economy should be accepted with a large degree of uncertainty due to the unspecified structure and functions of forest management and the lack of up to date forest legislation This uncertainly also pertains to the data on future developments presented in this work But by understanding the concepts upon which this work is based the goals on which foresters in Bulgaria have to a considerable degree reached consensus, can be achieved These goals are the permanent reproduction of forest resources the steady harvesting of timber and the preservation and complete utilization of the special functions of forests In this sense, the direction presented here is the most expedient and favorable for the development of the forests in Bulgaria If development is diverted in a certain direction away from this one the degree of such deviation could be ascertained

Table 22 Development of Bulgarian forests in the period 1955-2035

Year	1955	1965	1975	1985	1995	2005	2015	2025	2035
1 Afforested (woody) forest area (thousand hectares)	3153 3	3144 3	3228 1	3320 2	3361 1	3402 2	3443 3	3443 3	3443 3
Available data are on coniferous forest	441 4	722 6	936 6	1098 2	1266 3	1447 7	1635 4	1673 8	1695 3
2 Growing stock's volume (thousand cubic meters)									
2 1 Total thousand cubic meters	214361	252191	274626	344752	375992	407798	432491	449691	471404
Available data are on coniferous forest	68776	86819	95315	123305	159219	199891	240481	265483	280991
2 2 Per 1 hectare (cubic meters)	68 0	80 2	85 1	103 8	111 9	119 9	125 6	130 6	136 9
Available data are on coniferous forest	115 8	120 1	101 2	112 3	125 7	138 1	147 0	158 6	165 7
3 Mean increment									
3 1 Total (thousand cubic meters)	6552 4	6079 2	7069 3	8879 8	9400 0	9709 8	9829 3	9775 8	9820 9
3 2 Per 1 hectare (cubic meters)	2 08	1 93	2 19	2 67	2 80	2 85	2 85	2 84	2 85
4 Yield from main fallings (thousand cubic meters)	5960 0	6680 4	5004 9	4202 0	5610 8	6277 1	5960 0	5662 3	5862 9
5 Yield from thinnings (thousand cubic meters)	1780 9	1656 1	1412 4	1423 0	2024 6	2274 8	2868 0	3061 9	3091 4
6 Total yield (standing)									
6 1 Volume thousand cubic meters	7741 8	8336 5	6417 3	5625 0	7635 1	8551 9	8828 0	8724 2	8954 3
6 2 Rate from the growing stock's volume (%)	3 61	3 31	2 33	1 63	2 03	2 09	2 04	1 94	1 90
6 3 Rate from the mean increment (%)	118 2	137 1	90 8	63 3	81 2	88 1	89 8	89 2	91 2

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Wild Medicinal Plant Resources in Bulgaria and Recommendations for Their Long-term Development

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INTRODUCTION

The medicinal plants of Bulgaria have long pro vided efficient remedies for many diseases Many pro vide substances that are of great practical value to man and that cannot be replaced with synthetic substitutes

According to the classification scheme of the World Health Organization, adopted in 1978 in Ge neva medicinal plants comprise three groups 1) plants that are used directly for treatment, 2) plants that are used to produce galenical preparations (including home preparations), and 3) plants that serve as the raw material for commercial processing of pure substances for remedies or for the production of biologically active products that are processed into medicines

In Bulgaria an average of 6,000 tons of herbs are gathered annually most of which represents natural plant resources The increased interest in and con stantly expanding use of the medicinal plants clearly raises questions about the state and capacity of their populations and of the phytocenoses in which they oc cur

In most European countries the reserves of these natural resources are highly depleted or the collecting of herbs from their natural habitats is unprofitable Needs are met either by the cultivation of medicinal plants or through import, mainly from the Balkan countries – which accounts for the increased interest in Bulgaria as a source of herbs In addition these herbs have been used more widely in phytotherapy and in folk medicine over the last several years in Bul garia At present about 15% of the herbs sold are used to answer domestic needs As a result of this and other anthropogenic factors reserves of rare valuable medicinal plants have either been strongly reduced or destroyed There is even a real danger that some spe cies in Bulgaria s plant genetic fund will go completely extinct

This report tries to estimate objectively the pres ent condition of the natural medicinal plant resources and the influence of anthropogenic factors on them On the basis of well grounded scientific criteria prog noses for their development are offered and sugges tions made about ways to use them without impeding their stable existence

In working on this estimation of Bulgaria's me dicinal plant resources we bore in mind that this is a very difficult and complex task The complexity is due mainly to the fact that many of the changes in the condition of medicinal plants that have been induced by anthropogenic influences defy final definition This has become especially difficult in the last three years, as many commercial firms involved in the collection of herbs have appeared So far, control of their activities has been difficult On the other hand, a realistic, sci entifically based assessment of the condition of the populations of the different species, and of the differ ent influences upon them, has still not been conducted Mapping of the basic resources is only in an early stage and concerns mainly the threatened species

Despite these difficulties, the team did its best to deliver a realistic estimation of the state of the re sources, using available references as well as the in formation about the herbs gathered and sold by the "Bilkocoop" cooperative over the last ten years

CHARACTERISTICS OF THE MEDICINAL PLANTS

It is difficult to state with precision the total num ber of plants that are used as medicinals in Bulgaria By summarizing data from folk medicine and from phyto chemical, pharmacological and therapeutic re search, some authors have determined that 750 (21%) of the 3567 species of vascular plants known in our flora are used for medicinal purposes According to other sources the number ranges between 250 and 300 species and is determined by the needs of phytother apy of the export trade and of the pharmaceutical in dustry

To specify the total number of the medicinal spe cies, we used the list of the cooperative enterprise 'Bilkocoop" and of the National Pharmaceutic Ad ministration These two enterprises monopolized, until recently, the trade in medicinal plants The number of herbs included in this list is 336 taken from 248 spe cies (Table 1) Of these 244 are vascular seed plants and 207 (85%) belong to our wild flora 37 (15%) are introduced species and are grown in the country as edible, economic, and ornamental plants A few of the wild plants are not gathered from their natural habitats (for either protective or economic reasons) but are cultivated instead

In systematic terms the wild medicinal plants be long to 68 families Outstanding because of their high numbers are Asteraceae (27 species) Lamiaceae (14) Rosaceae (15), Apiaceae (13) and Fabaceae (8) Other important families, represented by fewer spe cies are Liliaceae (6), Boraginaceae, Ranunculaceae and Solanaceae (5 each), Rubiaceae, Papaveraceae and Brassicaceae (4 each) and a great number of

families containing 1 3 species

Table 1 lists different types of complexes and groups of medicinal plants This method is used in the specialized literature whenever two or more allied species are not only morphologically and chorologically related but have common medicinal properties When they are gathered and enter the economy they are distinguished only with difficulty and the active components[1] are mixed

BIOLOGICAL TYPE AND PROPAGATION

Forty nine percent of the medicinal plants are perennial herbaceous plants (Table 1) Annual species are the second most common biological type (19%), followed by shrubs (15%) and trees (11%) Biennial species comprise the smallest group (6%), some of these depending on ecological conditions may also be annuals or perennials The high percentage of perennials allows for the use of several active components from one plant

Medicinal plants propagate mainly through seeds and spores but a vast number of the perennials (over 72%) also reproduce vegetatively This gives them a number of advantages when compared to other plants in terms of their preservation and restoration Despite these advantages however this group is the most threatened The reserves of many of these plants within the country are limited and many are characterized by critical declines in the number of individuals in their populations

DISTRIBUTION

Based on their distribution in Bulgaria the wild medicinal plants can be divided into three groups (see Table 1) Group I which includes widespread species (found in 7 to 20 floristic regions), contains 85% of those listed Group II includes those which are found in 4 to 6 floristic regions, usually under specific ecological conditions, and contains 10% of the species Plants in Group III (only 5% of the species) occupy local ecological niches in 1 to 3 floristic regions

The altitudinal distribution of the wild medicinal plants is rather irregular This reflects the variety of ecological conditions resulting from differences in elevation the character of the rock substrate and topography, and (last but not least) anthropogenic influences The highest proportion of species (92%) are found in the belts of the xerothermic oak woods, mesophilic and xeromesophilic oak and yoke elm, and beech and coniferous woodlands The remaining 8% are found in open woodlands and other vegetation types in the high mountains (see categories 5 and 6 in Table 1) Forty percent of the discussed plants are edificators and dominants in the natural phytocenoses in our country Many of the medicinal plants (22%) are weeds and ruderal species which grow mainly in the lowlands and in the mountains up to 1500 m above sea level

CULTIVATION

Thirty eight species of Bulgarian wild medicinal plants are cultivated (Table 1) Twenty four are used mainly as ornamental species for landscaping and town gardening and only secondarily as a source of active medicinal agents The other 14 cultivated species include *Leucojum aestivum Artemisia santonicum Glaucium flavum Rosa canina Ruta graveolens Verbascum pseudonobile, Atropa belladona, Valeriana officinalis* Despite this success the active components of many of these species are still gathered in their natural habitats Some are exported in high tonnage volumes and are of basic importance to export trade

Legend for Table 1

Vertical disposition in Bulgaria

1 hexotermic oaks (0 700m altitude)
2 mesophytic and hexomesophytic oaks andyoke elms (700 1000m)
3 beech woods (1000 1500m)
4 coniferous woods (1500 2000m)
5 open woodland in high mountains (2000 2500m)
6 high mountain vegetation (2500 2925m)

Biological type designations

a annual
b biannual
p perennial
h shrub
t tree
0 secondary usage as herbs

Table 1 Cultivated Species of Wild Medicinal Plants

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7/ 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
EQUISETOPHYTA											
EQUISETACEAE											
Equisetum arvense L	p	1 4	+			+	+				
POLYPODIOPHYTA											
ASPIDIACEAE											
Dryoptens filix mas (L) Schott	p	1 4	+			+	+				
ASPLENIACEAE											
Asplenium trichomanes L.	p	1 4	+			+	+				+
Phyllitis scolopendrium (L) Newm	p	1 4		+		+	+				
POLYPODIACEAE											
Polypodium vulgare L	p	1-4	+			+	+				+
PINOPHYTA											
CUPRESSACEAE											
Juniperus communis L	h t	1 4	+			+		o		+	
Juniperus oxycedrus L.	h	1 3		+		+					
Juniperus sabina L.	h	3 5		+		+		o			
EPHEDRACEAE											
Ephedra distachya L	h	1		+		+	+				
PINACEAE											
Pinus sylvestris L	t	3 4	+			+		o		+	

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
MAGNOLIOPHYTA											
AMARYLLIDACEAE											
Glanthus nivalis L	P	1 3	+			+	+	o	-		+
Leucojum aestivum L	p	1	+			+	+	+	-		+
ANACARDIACEAE											
Cotinus coggygria Scop	h t	1 2	+			+		o	-	+	
APIACEAE											
Anethum graveolens L	a	1 2			+	+		o	-		
Angelica pancici Vand	b p	2 4		+		+			-		+
Angelica slyvestris L	b p	1 2	+			+			-		
Apium graveolens L	b	1			+	+		o	-		
Carum carvi L	b	2 4		+		+		o	-		
Coriandrum sativum L	a	1			+	+			+		
Cuminum cyminum L	a					+			+		
Daucus carota L	a b	1 2	+			+		o	-		
Eryngium campestre L	p	1 2	+			+			-		
Foeniculum vulgare Mill	p	1				+		o			
Heracleum sibiricum L	b	1 2	+			+			-		
Laser trilobum (L) Borkh	p	1 3		+		+			-		
Levisticum officinale Koch	p					+			+		
Pastinaca sativa L	b	1 3	+			+		o	-		
Pimpinella anissum L	a					+			+		
Pimpinella saxifraga L	p	1 4	+			+			-		
Petroselinum crispum (Mill) Hill	p					+			+		

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
APOCINACEAE											
Vinca minor L	p	1 2		+		+	+	o			
ARACEAE											
Acorus calamus L	p	1			+		+				
Arum maculatum L	p	1 4	+			+	+				
ARALIACEAE											
Hedera helix L	p	1 4	+			+	+	o			
ARISTOLOCHIACEAE											
Aristolochia clematits L	p	1	+			+	+				+
Asarum europaeum L	p	1 3	+			+	+				
ASCLEPIADACEAE											
Periploca graeca L	h	1			+	+	+				
ASTERACEAE											
Achillea clypeolata Stoj et Stef	p	1 4	+			+	+				+
Achillea millefolium complex	p	1 4	+			+	+				+
A collina Beck											
A cnitmifolia Waldst et Kit											
A millefolium L											
Arctium lappa L	p	1 3	+			+					+
Artemisia absintium L	p	1 4	+			+	+				
Artemisia alba Turra	a	2 3				+	+			+	
Artemisia annua L	a	1 2	+			+					
Artemisia pontica L	p	1 3			+	+	+				

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
Artemisia santonicum L	p	1		+		+	+	+			
Artemisia vulgaris L	p	1 2	+			+	+		-		
Bellis perenis L	p	1 3	+			+	+	o			+
Carduus acanthoides L	b	1 2	+			+					
Calendula officinalis L.	b					+			+		
Carlina acanthifolia All	b	1 4	+			+			-		
Centaurea cyanus L	a	1 2	+			+			-		+
Chamomilla recutita (L) Rausch	a	1 2	+			+		+	-		+
Cichorium intybus L.	p	1 2	+			+			-		+
Cnicus benedictus L	b	1 3							-		
Helianthus annus L.	a					+			+		
Helichrysum arenarium (L) Moench	p	1		+		+	+		-		
Hieracium pilosella L	p	1 4	+			+	+				
Inula helenium L.	p	1 2	+			+	+		-		
Onopordum acanthium L	b	1 3		+		+			-		
Petasites hybridus (L.) Gaertn	p	1 4		+		+	+		-		
Silybim marianum (L) Gaertn	b	1 2		+		+		+			+
Solidago virga aurea L.	p	3 6	+			+	+				
Tanacetum vulgare L	p	1 4	+			+	+				
Tagetes erecta L	a					+			+		
Taraxacum officinale complex	p	3 6	+			+					+
T bessarabicum (Hom) Hadn Mazz											
T laevigatum (Willd) DC											
T officinale Web											
T serotinum (Waldst et Kit) Poir											

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

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			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
Tussilage farfara L	p	1 3	+			+	+				+
Xeranthemum annuum L	a	1 2	+			+				+	
BERBERIDACEAE											
Berbens vulgaris L	h	1 2		+		+	+	o			
BETULACEAE											
Betula pendula Roth	h t	1 4	+			+	+	o		+	
Corylus avellana L	h t	1 4	+			+	+				
BORAGINACEAE											
Alcanna tinctona (L) Tausch	p	1		+		+					
Buglossoides purpurocaerulea (L)I M Johnson	p	1 2	+								
Lithosperum officinale L.	p	1 4	+						-		+
Pulmonaria officinalis L.	p	1 6	+			+	+				
Symphytum officinale L.	p	1 3	+			+	+				
BRASSICACEAE											
Armoracia rusticana (Lam) Medic	p					+	+		+		
Brassica nigra L	a	1	+								+
Capsella bursa pastoris (L) Medic	a	1 4	+			+					+
Nasturtium officinalis R Br	g	1 3	+			+	+				
Sinapis alba L	a					+			+		
Sinapis arvensis L	a	1 3	+			+				+	
CANNABACEAE											
Cannabis sativa L	a					+			+		

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Humulus lupulus L	h	1 2	+			+	+	o			
CAPRIFOLIIACEAE											
Sambucus ebulus L	p	1 4	+			+	+			+	
Sambucus nigra L	h	1 4	+			+	-	o	-		
Viburnum opulus L	h t	1 3	+			+			-		
CARYOPHYLLACEAE											
Herniaria glabra L	a p	1 3	+			+	+				
Herniaria hirsuta L	a p	1 3	+			+	+				
Saponaria officinalis L	p	1 2	+			+	+				
Stellaria media (L) Vill	a	1	+			+			-		
CHENOPODIACEAE											
Chenopodium bonus henricus L.	p	2 4	+			+	+				+
Chenopodium botrys L.	a	1 2	+			+					
CONVOLVULACEAE											
Concolculus arvensis L	p	1 3	+			+	+				
CORNACEAE											
Cornus mas S	h t	1 3	+			+					+
CRASSULACEAE											
Rhodiola rosea L.	p	4 6		+		+	+				+
Sedum acre L.	p	1 4	+			+	+				
CUCURBITACEAE											
Bryonia alba L	p	1 2	+			+	+				+

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

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Cucumis melo L	a					+			+		
Ecbalium elaterium (L) A Richt	p	1	+			+	+				+
CUSCUTACEAE											
Cuscuta europaea L	a	1 6	+			+	+				
DIOSCOREACEAE											
Tamus communis L	p	1 3	+			+	+				
ERICACEAE											
Arctostaphylos uva ursi (L.) Spreng	h	3 5	+			+	+			+	
Vaccinium myrtillus L	h	3 4	+			+	+			+	
Vaccinium vitis idaea L	h	2 4	+			+	+			+	
FABACEAE											
Astragalus glycyphyllos L.	p	1 4	+			+	+				
Galega officinalis L	p	1 3	+			+	+				
Genista tinctoria complex	h	1 3	+			+					
G depressa M B											
G ovata Waldst et Kit											
G tinctoria L											
Glycyrhiza glabra L	p	1	+			+	+		+		
Laburnum anagiroides Medic	h					+			+		
Melilotus officinalis (L) Pall	a	1 2	+			+			+		
Ononis spinosa complex	h	1	+			+					
O arvensis L											
O repens L											

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

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O spinosa L											
Phaseolus vulgaris L	a					+			+		
Robinia pseudoacacia L	h t					+			+		
Sophora japonica L	h					+		-	+		
Trigonella coerulea (L) Ser	a		+			+					
Trigonella foenum graecum L	a				-	+			+		
Trifolium pratense L	p	1-4	+			+	+				
FAGACEAE											
Castanea sativa Mill	t	1 2			+	+				+	
Quercus species diversa	t	1				+			-	+	
Q cerris L											
Q dalechampii Ten											
Q robur L											
GENTIANACEAE											
Centaurium erythraea Rafn	a b	1 3	+			+			-		
Gentiana asclepiadea L	p	3 6	+			+	+		-		
Gentiana cruciata L	p	1 6	+			+	+		-		
Gentiana lutea L	p	3 6		+		+	+		-		
Gentiana punctata L	p	4 6		+		+	+				
GERANIACEAE											
Geranium macrorrhisum L	p	1 5	+			+	+		-		+
Geranium sanguineum L	p	1-4	+			+	+				

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Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
HIPPOCASTANACEAE											
Aesculus hippocastanum L	t	1			+	+		o		+	
HYPERICACEAE											
Hypericum perforatum L	p	1 4	+			+	+				
IRIDACEAE											
Iris florentina L	p					+	+		+		
Iris germanica L	p					+	+		+		
LAMIACEAE											
Betonica officinalis L	p	2 4	+			+	+				
Galeopsis speciosa Mill	a	1 4	+			+					+
Lavandula angustifolia Mill	h					+			+		
Leonurus cardica L	p	1 2	+			+	+				
Marrubium vulgare L	p	1 2	+			+					+
Melissa officinalis L	p	1 3	+			+	+	+			
Mentha piperita L	p					+	+		+		
Mentha pulegium L	p	1 4	+			+	+				
Ocimum basilicum L	p					+	+		+		
Origanum majorana L	a					+			+		
Origanum vulgare L ssp vulgare	p	1 4				+	+				
Origanum vulgare L ssp hirtum (Link) Ietswaart	p	1 3	+			+	+				
Rosmarinus officinalis L	p					+			+		
Salvia officinalis L	h					+			+		
Salvia tomentosa Mile	h	1 2			+	+					

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
Satureja hortensis L	a					+			+		
Satureja montana L	p	1 2			+	+				+	
Sideritis scardica Griseb	p	1 2			+	+	+				+
Teucrium chamaedris L	h	1 3	+			+	+				+
Teucrium polium L	h	1 4	+			+	+		-		+
Thymus species diversa	h	1 6	+			+	+				
LILIACEAE											
Allium ursinum L	p	3 6	+			+	+				+
Asparagus officinalis L	p	1 2	+			+	+				
Colchicum autumnale L	p	3 6	+			+	+				
Convallaria majalis L	p	1 3	+			+	+	o			
Nectaroscordum siculum (Uccria) Lindley	p	1 2		+		+	+		-		
Veratrum lobelianum Bernh	p	3 6	+			+	+				+
LINACEAE											
Linum usitatissimum L	a					+					
LORANTHACEAE											
Viscum album L	h	3 4	+			+					
MALVACEAE											
Althaea officinalis L	p	1 2	+			+	+	+			
Malva sylvestris L	a b	1 3	+			+					+
MENYANTHHACEAE											
Menyanthes trifoliata L	p	1 4		+		+	+			+	

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
MORACEAE											
Ficus carica L	h					+	+		+		
Morus nigra L	h					+			+		
OLEACEAE											
Fraxinus ornus L	h	1 3	+			+				+	
Syringa vulgaris L.	h	1 3	+			+	+			+	
ORCHIDACEAE											
Orchis species diversa	p	1 4	+			+	+				
O laxiflora Lam											
O maculata L											
O mascula L											
O morio L											
PAEONIACEAE											
Paeonia peregrina Mill	p	1 2	+			+	+				
PAPAVERACEAE											
Chelidonium majus L	p	1 3	+			+					
Fumaria officinalis L	a	1 2	+			+					
Glaucium flavum Crantz	a	1 2	+			+		+			
Papaver rhoeas L	a	1 2	+			+					
PLANTAGINACEAE											
Plantago lanceolata L.	p	1 4	+			+					+
Plantago major L	p	1 4	+			+					

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			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic retions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
POACEAE											
Agropyrum repens (L.) P B	p	1 4	+			+	+			+	
Cynodon dactylon Pers	p	1 2	+			+	+		-	+	
Zea majus	a								+		
POLYGONACEAE											
Bistorta major Gray	p	2 4	+			+	+		-		
Persicaria hydropiper (L.) Spach	a	1 3	+			+					
Polygonum aviculare L.	a	1 3	+			+			-		
Rumex alpinus L.	p	4 5	+			+	+		-	+	
PRIMULACEAE											
Anagalis arvensis L	a	1 2	+			+					
Cyclamen hederifolium Ait	p	1	+			+	+		-		
Primula veris L.	p	1 4	+			+	+				+
RANUNCULACEAE											
Adonis vernalis L.	p	1 3	+			+	+				
Clematis vitalba L	h	1 4	+			+	+				+
Consolida regalis Gray	a	1	+			+					
Helleborus odorus Waldst et Kit	p	1 3	+			+	+				+
Hepatica nobilis Mill	p	1 4	+			+	+				
RHAMNACEAE											
Frangula alnus Mill	h	1 4	+			+					
Paliurus spina christi Mill	h	1	+			+				+	

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
ROSACEAE											
Agrimonia eupatoria L	p	1 3	+			+	+				
Alchemilla vulgaris complex	p	3 6	+			+	+				
A alpina L											
A arvensis L											
Crataegus monogyna Jacq	p	1 3	+			+					+
Cydonia oblonga	p					+			+		
Filipendula vulgaris Moench	p	1 3	+			+	+				+
Fragaria ananassa Duchesne	p					+	+		+		
Fragaria vesca L	p	1 4	+			+	+				+
Geum urbanum L	p	1 3	+			+	+				+
Laurocerasus officinalis M J Roemer	h	1 3	+			+					+
Malus sylvestris Mill	h	1 3	+			+	+				
Potentilla erecta (L) Rauschel	p	1 6	+			+	+				+
Potentilla reptans L	p	1 4	+			+	+				+
Prunus avium L	h	1 4	+			+					
Prunus spinosa L	h	1 3	+			+				+	
Rosa alba L	h					+			+		
Rosa canina complex	h	1 4	+			+		+			
Rosa damascena Mill	h					+			+		
Rubus coesius L	h	1 4	+			+	+				
Rubus idaeus L	h	1 4	+			+	+	o		+	
Sorbus aucuparia L	h	1 4	+			+					

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
RUBIACEAE											
Galium aparine L	p	1 3	+			+	+				
Galium odoratum (L) Scop	p	1 4	+			+	+				+
Galium verum L	p	1 4	+			+	+				
Rubia tinctorum L	p	1 2		+		+	+		-		
RUTACEAE											
Ruta graveolens L	h	1		+		+		+	-		
SALICACEAE											
Salix alba L	h	1 2	+			+	+			+	
Salix purpurea L	h	1 4	+			+	+				
SAXIFRAGACEAE											
Ribes nigrum L	h	4	+			+		+			
SCROPHULARIACEAE											
Digitalis lanata Ehrh	b	1 4		+		+					
Euphrasia officinalis complex	a	1 4	+			+					
E officinalis L											
E rostkoviana Hayne											
Linaria vulgaris L	p	1 2	+			+					
Verbascum nobile Vel	a	1 3	+			+		+			
Verbascum phlomoides L	b	2 4	+			+		+			
Verbascum thapsiforme Schrad	b	3 4	+			+					+
Veronica officinalis L	p	1 5	+			+	+				

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
SOLANACEAE											
Atropa belladonna L.	p	1 4	+			+		+			
Datura stramonium L.	a	1 2	+			+					
Hyoscyamus niger L.	a	1 2	+			+					
Physalis alkengi L.	p	1 3	+			+	+				
Solanum dulcamara L.	p	1 2	+			+	+				
TILIACEAE											
Tilia cardata Mill	t	1 3	+			+		o			+
Tilia platyphyllos Scop	t	1 4	+			+		o			+
Tilia tomentosa Moench	t	1 4	+			+		o		+	
URTICACEAE											
Urtica dioica L	p	1 4	+			+	+			+	
Urtica urens L	a	1 4	+			+				+	
VALERIANACAE											
Valeriana officinalis L	p	1 4	+			+	+	+			
VERVENACEAE											
Verbena officinalis L	p	1 2				+					
VIOLACEAE											
Viola odorata L	p	1 2	+			+	+				
Viola tricolor L	a	1 4	+			+					

Table 1 Cultivated Species of Wild Medicinal Plants (continued)

Taxonomy	Biological type	Vertical disposition in Bulgaria	Distribution in Bulgaria			Reproduction		Cultivation		Participation in vegetation	
			Wide Distribution (7 20 floristic regions)	Limited Distribution (4 6 floristic regions)	Local Distribution (1 3 floristic regions)	Generic	Vegetative	Bulgarian Species	Foreign Species	Edificators	Dominants
VITACEAE											
Vitis vinifera L.	h					+	+		+		
ZYGOPHYLLACEAE											
Tribulus terrestris L.	a	1 2	+			+	+				
JUGLANDACEAE											
Juglans regia L.	t					+			+		
TROPAEOLACEAE											
Tropaeolum majus L.	a					+			+		

Legend

Vertical disposition in Bulgaria
- 1 hexotermic oaks (0 700m altitude)
- 2 mesophytic and hexomesophytic oaks and yoke elms (700 1000m)
- 3 beech woods (1000 1500m)
- 4 coniferous woods (1500 2000m)
- 5 open woodland in high mountains (2000 2500m)
- 6 high mountain vegetation (2500 2925m)

Biological type designations
- a annual
- b biannual
- p - perennial
- h shrub
- t tree
- 0 secondary usage as herbs

PROTECTION

Forty seven (23%) of the wild medicinal plant species discussed in this report were under some form of protection as of 1992 Fifteen of these (32%) are strictly protected and the use of 32 species (68%) is restricted (Table 2) Twenty one additional medicinal plant species are protected and the use of 9 others is restricted but these have not been gathered for commercial and industrial purposes in the last few years

ESTIMATION OF THE MEDICINAL PLANT RESOURCES

In characterizing the state of medicinal plant resources it is necessary to analyze the degree of exploitation pressure and the quantities of plant materials that are taken from the natural habitats of the different species over definite periods of time The quantities that can be gathered and initially processed in the country depend on two basic factors the extent of the biological reserves and of the reserves being exploited for each species and the need for the plant materials they supply

We lack, for several reasons well grounded scientific data about the reserves of available medicinal plants and the appropriate levels of exploitation for most of the species Detailed reserve studies that have yielded actual results have been conducted on only a limited number of plants *Acorus calamus Arcoto staphyllos uva-ursi*, *Ruta graveolens*, *Origanum vulgare* ssp *hirtum* That is why at this stage, an estimation of medicinal plant resources can only be performed with the help of data on the quantities of the plant resources gathered and bought between 1980 and 1990 in the Central Cooperative Union A total of 182 active components of medicinal plants were annually purchased during this period This does not include data on plant resources that were bought for only a year or two

These active components may be classified in morphological terms as follows Radices (roots), Rizomata (rootstock) Tubera (corms) and Bulbus (bulbs) – 31 Folia (leaves) – 30 Herbae (stems) – 73, Flores (blossoms and inflorences) –4, 2 Fructus (berries) – 13 Cortex (cortex) – 7 Semina (seeds) – 2, Diversae (other) – 3

Table 2 Species Under Protection or Regulations Restricting Their Use

Species	1941		1961		1989		1991		In Red Book
	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	
Acorus calamus L					+		+		
Actaea spicata L		+							
Adianthum capillus veneris L	+		+		+		+		+
Adonis vernalis L						+		+	
Aesculus hipocastanum L			+						+
Alchemilla vulgaris complex						+		+	
Alchemilla mollis (Buser) Rothm					+		+		+
Alium ursinum L		+							
Alkanna tinctoria (L) Tausch		+			+		+		
Althaea officinalis L		+				+		+	
Anacamptis pyramidalis (L) L C Rich	+				+		+		
Anagalis arvensis L		+							
Angelica pancici Vand						+		+	+
Aquilegia nigricans Baumg	+				+		+		+
Arctostaphyllos uva ursi (L)Spreng		+			+		+		+
Artemisia alba Turra								+	
Artemisia lerchiana Weber					+		+		+
Artemisia pontica L		+				+			+
Artemisia santonicum L		+						+	
Asparagus officinalis L								+	
Asplenium trichomanes L						+		+	

Table 2 Species Under Protection or Regulations Restricting Their Use (continued)

Species	1941		1961		1989		1991		In
	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	
Atropa bella donna L		+				+		+	+
Berberis vulgaris L						+		+	
Betonica officinalis L								+	
Bryonia alba L		+							
Calamintha officinalis L		+							
Calluna vulgaris (L) Hull					+		+		+
Carex arenaria		+							
Carlina acanthifolia All		+				+		+	
Castanea sativa L					+		+		+
Centaurium erythraea Rafn		+				+		+	
Cetraria islandica L Ach								+	
Cnicus benedictus L		+				+		+	
Colchicum automnale L						+		+	
Convallaria majalis L		+				+		+	
Cystoseira barbata(Good et Vood) Ag								+	
Cytisus nigricans		+							
Daphne mesereum L		+							
Dictamnus albus L		+							
Digitalis lanata Ehrh		+							
Drosera rotundifolia L	+				+		+		+
Dryopteris filix mas (L) Schott		+							
Ephedra distachya L	+				+		+		
Eringium maritimum L		+			+		+		+
Frangula alnus Mill		+				+		+	
Galanthus nivalis L					+		+		+
Galega officialis L		+							
Gentiana asclepiadea L		+							
Gentiana cruciata L		+							
Gentiana lutea L	+			+	+		+		+
Gentiana pneumonanthe L		+							
Gentiana punctata L		+		+	+		+		+
Geum rivale L		+							
Glaucium flavum Crantz						+		+	
Glycyrrhiza glabra L		+	+		+		+		+
Gratiola officialis L		+							
Gypsophilla paniculata L		+				+		+	
Helichrysum arenarium (L) Moench						+		+	
Hepatica nobilis Mill		+				+		+	

Table 2 Species Under Protection or Regulations Restricting Their Use (continued)

Species	1941		1961		1989		1991		In Red Book
	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	
Hyppophae rhamnoides L	+		+		+		+		
Hyosciamus niger L		+							
Hyssopus officialis L	+					+		+	
Ilex aquifolium L	+		+		+		+		+
Inula helenium L		+				+		+	
Juniperus oxycedrus L						+		+	+
Juniperus sabina L		+	+		+		+		+
Lamium album L		+							
Leucojum aestivum L						+		+	+
Lycopodium clavatum	+								
Menianthes trifoliata L	+				+		+		+
Nuphar luteum L	+		+		+		+		+
Nymphaea alba L	+		+		+		+		+
Orchis globosa L		+			+		+		+
Orchis militaris L		+	+		+		+		+
Orchis papilionaceae L		+	+		+		+		+
Orchis provincialis Balb		+			+		+		+
Orchis sp		+				+		+	+
Origanum vulgare L ssp hirtum						+		+	
Paeonia peregrina Mill						+		+	
Paeonia tenuifolia L					+		+		+
Periploca graeca L	+								
Phyllitis scolopendrium (L) Newm		+				+		+	+
Physalis alkekengi L		+							
Platanthera bifolia (L) L C Rich		+							
Potentilla anserina L		+							
Pulsatilla halleri (All) Wild					+		+		+
Pulsatilla pratensis (L) Mill		+			+		+		+
Pulsatilla vernalis (L) Mill					+		+		+
Primula veris L		+						+	
Rhibes nigrum L					+		+		+
Rheum raponticum L	+		+		+		+		+
Rhodiola rosea L						+		+	
Rhubia tinctorum L						+		+	
Ruscus aculeatus L								+	
Ruta graveolens L		+			+		+		+
Salvia tomentosa Mill						+		+	
Sedum acre L								+	

Table 2 Species Under Protection or Regulations Restricting Their Use (continued)

Species	1941		1961		1989		1991		In Red Book
	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	Protected	Restricted use	
Sideritis scardica Griseb		+			+		+		+
Taxus baccata L	+		+		+		+		+
Valeriana officinalis L		+				+		+	
Verbascum pseudonobile Stoj et Stef								+	+
Vinca minor L						+		+	

Table 3 presents data about the average and ex treme quantities of active components of medicinal plants gathered between 1980 and 1990 The table in cludes information about the number of years during which the gathering of specific active components was unrestricted in Bulgaria The table also includes in formation about trends in the uses of medicinal plant materials (i e export domestic, commercial, industrial uses and uses in the food industry) This mechanism was used to meet greater demands for export and (to a lesser degree) in the domestic market

In our analysis of this period we avoided the pro blem of annual fluctuations by identifying six groups of active plant components based on the average amount of plant materials gathered and bought

Group 1 – quantities up to 1000 kg
Group 2 – quantities from 1000 to 5000 kg
Group 3 – quantities from 5000 to 10 000 kg
Group 4 – quantities from 10 000 to 50 000 kg
Group 5 – quantities from 50 000 to 100 000 kg
Group 6 – quantities above 100 000 kg

Group 1 includes 48 active plant components that are destined to meet the needs of the domestic market The low average quantities reflect limited national re serves and, more rarely low demand Nine active components in this group are obtained from protected plants It is interesting that some of them – Tubera Salep Cortex Berberidis Folium Meyanthidis, Folium Scolopendrii Herba Asplenii – have on several occa sions been opened to unrestricted gathering and still the quantities bought have been low Though there is brisker demand for some of these plant resources the capacities of the habitats where they occur do not al low for their use in quantities greater than the average for this period The number of active components whose average quantities are influenced by limited demand or low purchase prices independent of the export demand is relatively high Opportunities exist to gather these in higher average amounts

Group 2 includes 52 active plant components Many are sold through two or three outlets Thirteen are taken from protected plants Meeting the need for them is impossible given the present state of their populations For species like *Ruta graveoles Frangula alnus Althaea officinalis* and *Origanum vulgare* ssp *hirtum* the exploitation of natural reserves is unrea sonable, since they can be successfully cultivated Ef fective enforcement of restrictions on gathering is nec essary for *Primula veris Betonica officinalis*, *Leucojum aestivum*, *Sedum acre*, *Carlina acanthifolia* and *Col chicum automnale*

The third group includes 25 active plant compo nents They are taken in high average amounts due mainly to the fact that they are exported and supply only minimal quantities to the domestic market Eight of the plants from which they are taken are protected Continued use of these herbs will require on the one hand, that they be successfully cultivated and on the other, that exploitation of natural reserves be more limited than in the past (i e lower than the average quantities bought during the 1980 1990 period) After *Arctostaphyllos uva ursi* was placed under protection, gathering was banned and effective control of its populations is now necessarv At the same time this group also contains herbs derived from ruderal and weed species that can tolerate gathering beyond the average for this period

Forty four herbs are included in the fourth group only four of which are obtained from protected plants They are gathered in relatively large amounts, but re strictions on their gathering during the next few years is urgently needed

Groups 5 and 6 include 8 and 6 active compo nents respectively As has been mentioned some are cultivated while others have adequate reserves for their exploitation (*Urtica dioica Equisetum arvense Artemisia absintrium*) If properly used the productive potential of these reserves can be maintained for a long period of time

Table 3 Quantities of Medicinal Plant Active Components Gathered 1980 1990

Herbs Legend * = components produced from species under re stricted usage regime	Average amount gathered and bought up from 1980 1990	Extreme quanti ties gathered and bought up	Designated for unlim ited gathering (# of years)	Trading lines			
				Export	Drugstor es	Pharmaceuti cal industry	Food in dustry
GROUP I QUANTITIES BELOW 1 000 kg							
Tubera Salep *	116	382	7		+		
Radix Artemisiae vulgaris	181	958			+		
Radix Bryoniae	98	455			+		
Radix Pimpinellae	129	341		+	+		
Radix Polypodii	97	352	7		+		
Radix Sambuci ebuli	97	585			+		
Radix Saponariae	349	1 959			+	+	
Radix Tami communis	118	365	2		+		
Cortex Berberidis *	178	576	4		+		
Cortex Viburni	189	499			+		
Folium Convallariae *	146	394				+	
Folium Hederae	881	2 701	5				
Folium Menyanthidis *	412	1 196	1		+		
Folium Sambuci nigri	217	1 326					
Folium Scolopendrii *	80	350	2				
Folium Syringae	343	1 881		+	+		
Folium Visci albi	877	4 941	3	+	+		
Fructus Berberidis *	747	2 583	2	+	+		
Fructus Ecballii	120	393			+		
Fructus Paliuri	773	3 697		+	+		
Semen Lithospermi	32	128		+	+		
Herba Achilleae clypeolatae	210	490			+		
Herba Aristolochiae	329	1 335		+	+		
Herba Artemisiae vulgaris	117	624			+		
Herba Asperulae	759	2 598	5		+		
Herba Asplenii *	354	702	4		+		
Herba Astragali glychyphylli	729	3292			+		
Herba Cnici benedicti *	49	3292			+		
Herba Cuscutae	78	78			+		
Herba Galeopsidis	79	702			+		
Herba Gallii aparini	286	1,755			+		
Herba Genistae tinctoriae	508	1 833			+		
Herba Hederae	174	498	1		+		
Herba Linariae	769	5 651		+	+		
Herba Malvae	191	741			+		
Herba Menthae pulegium	150	1 444			+		
Herba Potentillae reptans	304	2 716			+		

Table 3 Quantities of Medicinal Plant Active Components Gathered 1980 1990 (continued)

Herbs Legend * = components produced from species under re stricted usage regime	Average amount gathered and bought up from 1980 1990	Extreme quanti ties gathered and bought up	Designated for un limited gathering (# of years)	Trading lines			
				Export	Drugstor es	Pharmaceuti cal industry	Food in dustry
Herba Saponariae	172	1 169			+	+	
Herba Tanaceti	343	1 858			+	+	
Herba Teucrii polii	509	1 755			+		
Herba Violae odoratae	117	285	2		+		
Herba Urticae urensis	168	405			+		
Flos Althaeae *	431	2,365		+	+		
Flos Belidis	11	69			+		
Flos Crataegi	164	602	1	+	+		
Flos Farfarae	70	590			+		
Flos Fillipendulae vulgaris	169	1 298		+	+		
Flos Onopordii	369	3 404			+		
Flos Rhoeados	205	706	1		+		
GROUP II QUANTITIES FROM 1 000 to 5 000 kg							
Radix Angelicae	2 984	12 309	1				
Radix Bella donnae *	4 505	15 541	1				
Radix Betonicae	2 271	14,951		+	+		
Radix Bony henrici	3 160	5 665	9		+		
Radix Carlinae *	3,454	8 205		+	+		
Radix Genanii sanguinei	1 525	4 961		+	+		
Radix Primulae *	2 156	5 823		+	+	+	
Radix Saponariae	349	1 959	2		+	+	
Rhizoma Filicis maris	1 377	6,293		+			
Rhizoma Hellebori	1 944	20 653					
Rhizoma Veratri	1 484	15 637	1	+		+	
Cortex Betulae	2 078	3 832	1	+	+		
Cortex Corylli	4 092	13 483			+		
Cortex Frangulae *	1 401	3 832	3	+		+	
Folium Altheae *	4 799	12 419		+	+		
Folium Plantaginis lanceolatae	2 702	11 784		+	+		
Folium Plantaginis majoris	6 106	42 851	4				
Folium Pulmonariae	4 938	12 326	2	+	+		
Folium Stramonii	4 232	8 548	2			+	
Folium Verbasci	4 475	16 055		+			
Fructus Alkekengi	1 170	2 628	2	+			
Fructus Corni	1 579	3 127			+		
Fructus Myrthylli	1 026	3 917	3	+	+	+	+
Fructus Sambuci nigri	2 737	6 679		+	+		+
Fructus Sorbi	1,276	3 585	3	+	+		

Table 3 Quantities of Medicinal Plant Active Components Gathered 1980 1990 (continued)

Herbs Legend * = components produced from species under re stricted usage regime	Average amount gathered and bought up from 1980 1990	Extreme quanti ties gathered and bought up	Designated for un limited gathering (# of years)	Trading lines			
				Export	Drugstor es	Pharmaceuti cal industry	Food in dustry
Semen Colchici *	3 330	7 529	3	+			
Herba Alchemillae *	2 768	5 291	4	+	+		
Herba Artemisiae vulgaris	4 436	8 756				+	
Herba Asparagi *	1 251	13 328			+		
Herba Eryngii	1 150	3 035		+	+		
Herba Chelidonii	4 478	11 102	4	+	+		
Herba Gentianae cruciatae	1 153	2 905			+		
Herba Filipendulae	1 225	4 117		+	+		
Herba Hieracii	1 899	5 698	6	+	+		
Herba Leucoji *	1 632	9 056				+	
Herba Lithospermi	3 316	8 346		+			
Herba Myrthylli	3 003	18 840		+	+		
Herba Origani heracleotici *	4 899	12 126	1		+		
Herba Polygoni avicularis	4 674	25 506		+	+		
Herba Polygoni hydropiperis	3 966	8 657			+		
Herba Rutae *	2 448	11 336	5	+	+	+	
Herba Sedi acri *	1 332	5,755		+	+		
Herba Solidaginis	4 008	5 946					
Herba Stellariae	4 008	5 945		+	+		
Herba Urticae	2 635	7 477			+		
Flos Achilleae clypeolatae	1 457	4 527			+		
Flos Chamomilleae mund	5 048	7 081			+	+	
Flos Cyani	3 801	8 784		+	+		
Flos Filipendulae mund	4 550	8 973	6	+			
Flos Malvae	3 202	8 877		+	+		
Flos Paeoniae *	4 995	6 984		+			
Flos Verbasci	2 601	4 534			+		
GROUP III QUANTITIES FROM 5 000 to 10 000 kg							
Radix Althaeae *	9 672	56 227		+	+		
Radix Cichorii	5 544	2 054		+	+		
Radix Inulae *	6 773	12 190	2	+	+		
Radix Paeoniae *	6 747	25 888		+			
Folium Corryllı	5 987	30 552	2	+	+		
Folium Fragariae vescae	6 156	2 575	2	+	+		
Folium Lichen Cetrariae *	8 895	26 685		+	+		
Folium Myrthilli	7 059	24 563	2	+	+	+	
Folium Salicis	7 624	41 431	1	+	+		
Folium Uvae ursi *	9 725	29 117	4	+	+	+	

Table 3 Quantities of Medicinal Plant Active Components Gathered 1980 1990 (continued)

Herbs Legend * = components produced from species under re stricted usage regime	Average amount gathered and bought up from 1980 1990	Extreme quanti ties gathered and bought up	Designated for un limited gathering (# of years)	Trading lines			
				Export	Drugstor es	Pharmaceuti cal industry	Food in dustry
Herba Bella donnae *	6 019	16 088	2	+		+	
Herba Betonicae	6 806	26 919		+	+		
Herba Bursae pastoris	6 519	16 497		+	+		
Herba Cichoricae	6 801	37,942		+	+		
Herba Gallegae	7 900	28 968	1	+	+		
Herba Herniariae	6,858	12 283		+	+		
Herba Hyperici	8 434	28 105		+	+		
Herba Leonuri	9 467	20 495		+	+	+	
Herba Melissae	6 078	23 809		+	+		
Herba Taraxaci	8 434	27 545	2	+			
Herba Teucrii chamedris	8 936	23 824	1	+	+	+	+
Herba Violae odoratae	7 493	22 242		+	+		
Flos Primmulae *	6 916	14 089	9	+	+		
Flos Tiliae officinalis	6 900	15,878	5	+	+		+
Cystoseira barbata *	7 940	76 428		+	+	+	
GROUP IV QUANTITIES FROM 10 000 to 50 000 kg							
Radix Althaeae mund *	30 544	56 227		+	+	+	
Radix Bardanae	27 746	28 536	5	+	+	+	
Radix Ononidis	39 884	82 246	6	+	+	+	
Radix Rumici alpini	10 582	23 777		+	+	+	
Radix Taraxaci	18 182	40 427	8	+	+	+	
Radix Urticae	46 499	72 778	2	+	+	+	
Rhizoma Petasitidis	11 267	51 690	1	+			
Cortex Fraxini	18,532	66 327		+		+	
Cortex Salicis	15 197	89 399		+	+		
Folium Bella donnae *	13 470	27,423	3	+	+	+	
Folium Betulae	45 579	72 934	2	+	+		
Folium Cotyni	22 126	66 472	1		+	+	
Folium Crataegi	35 612	137 751	2	+			
Folium Malvae	13 694	36 261	4	+	+		
Folium Rubi idaei	20 247	49 958		+	+		
Folium Rubi fruticosi	42 520	72 961	3	+	+		
Folium Symphyti	12 303	22,269	2	+			
Folium Tiliae	16 134	90 050	1	+			
Folium Evernae	42,784	173 751		+			
Fructus Maly sylvestris	32,411	77 342		+			+
Fructus Pruni spinosae	17,520	77 163	3	+			
Herba Adonidis *	12,710	19 973	1	+	+	+	

Table 3 Quantities of Medicinal Plant Active Components Gathered 1980 1990 (continued)

Herbs Legend * = components produced from species under re stricted usage regime	Average amount gathered and bought up from 1980 1990	Extreme quanti ties gathered and bought up	Designated for un limited gathering (# of years)	Trading lines			
				Export	Drugstor es	Pharmaceuti cal industry	Food in dustry
Herba Agrimoniae	13 100	44 501		+	+	+	
Herba Chamomillae	11 054	28 368		+	+	+	+
Herba Euphrasiae	22 332	44 892	2	+	+		
Herba Fumariae	20 135	55 719	3	+	+		
Herba Marubi	17 497	90 978		+	+		
Herba Meliloti	15 267	50 998	2	+	+	+	
Herba Millefoli	43 585	115 205	2	+	+	+	
Herba Nasturcii	10,723	14 102	1	+	+		
Herba Origani	11 233	25 968	4		+		+
Herba Saturejae montanae	12 575	57 970		+	+		
Herba Serpylli	40 891	111 930	2	+	+	+	+
Herba Tribulix terrestris	30 888	162 958					
Herba Verbenae	10 524	38 203	1	+	+		
Herba Veronicae	43 052	75 819	3	+	+		
Herba Vincae minoris *	11 819	44 125	9		+	+	
Herba Visci albi	34 724	102 071	1	+	+		
Folia Farfarae	22 958	42 223		+	+	+	
Flos Consolidae	13 328	35 526	4	+			
Flos Millefoli	18 331	34 371		+	+		
Flos Sambuci nigri	11 401	16 138	6	+		+	
Flos Sambuci mund	16 175	31 566	7	+	+		
Flos Tanceti	37 362	77 136			+	+	
GROUP V QUANTITIES FROM 50,000 to 100 000 kg							
Rhisoma Graminis	50 814	185 751	2	+	+	+	
Rhizoma Valerianae *	81 163	148 059	7	+	+	+	
Folium Mellissae	50 329	93 253	1	+	+	+	+
Fructus Crataegi	76 898	310 828		+	+	+	
Herba Equiseti	94 819	291 099	2	+	+	+	
Herba Hyperici	56 919	145 513	3	+	+	+	
Herba Urtici mundatae	77 113	219 972		+			+
Flos Crataegi cum folia	76 898	310 828	4	+	+	+	
GROUP VI QUANTITIES OVER 100 000 kg							
Folia Urticae	316 469	378 809	2	+	+	+	
Fructus Rosae	1 146 018	22 329 371		+	+	+	
Fructus Sambuci ebuli	272 596	1 272 898		+			+
Herba Absinthii	109 196	228 977		+	+	+	+
Flos Chamomillae	136 321	248 600		+	+	+	+
Flos Tilliae	162 955	270 867	8	+	+		+

MANAGEMENT OF THE MEDICINAL PLANT RESOURCES IN BULGARIA

The purposeful use of medicinal plant resources in Bulgaria and the collection of their active components in industrial quantities began after World War I, mainly in response to the demand for them in Germany During the 1930s collecting developed more and more actively and the export of plant medicinal materials became the main factor influencing the scale (i e number of species and quantities) of this activity The increase in scale is well illustrated by the data on the amount of herbs exported In 1934, 8244 kg were exported, by 1939 this had increased some 8700% to 721,000 kg

Until 1947 the picking, purchasing, processing, and selling of the herbs was organized by a small number of private firms and cooperatives This structure remained unchanged until the political and economic changes in Bulgaria after 1944 took place For a short time (1947 1955) the government monopoly on gathering buying cultivating and processing of the medicinal and aromatic plants was held by the National Pharmaceutic Administration – the "Department of Medicinal Plants "

In 1955 the monopoly was given to the Central Cooperative Union and its branches the consumer cooperatives, the cooperative unions and the specialized enterprise "Bilkocoop ' This administrative structure functioned actively until 1990, when the government's monopoly was broken up The "Bilkocoop cooperative carried out the main part of these activities It oversaw the whole process of organizing, governing and monitoring the gathering and production of herbs These functions encompassed such basic tasks as studying the demands of the domestic and foreign market working out annual plans for gathering and buying medicinal plant materials from the herb gathering regions and for processing the materials production of saplings for the cultivated medicinal plants and so forth

The other functional units of the Central Cooperative Union were the Cooperative Unions and the Consumer Cooperatives The Cooperative Unions organized the allocating and marketing of the medicinal plant materials that were bought and processed by the Consumer Cooperatives in the corresponding region The boundaries of the herb gathering regions matched the boundaries of the administrative regions The Cooperative Unions had central stores where the herbs were collected baled, and packed in conventional wrapping Through a system of regular and interim control posts, the Consumer Cooperatives dealt with the buying and initial processing of the plant materials The gathering of the materials from the natural habitats was performed by herb gatherers (either as individuals or in teams)

Beyond the Central Cooperative Union and its departments the departments of the Committee of Forests (or, as it was formerly known, the Committee for Forestry and Forestry Industry) and the separate chemical and pharmaceutic enterprises also played roles in the management of medicinal plant resources The organization of labor and the functional links between the separate branches were analogous to those of the main structure

In addition to exploiting the natural reserves these branches and departments organized different activities connected with the preservation of the medicinal plants in the separate regions and in the country as a whole It was with their help (mainly through the efforts of the 'Bilkocoop" Cooperative) that the mapping of the medicinal plants in Bulgaria, studies of the state of the resources, and explorations of the potential for cultivating the rare and threatened medicinal species were able to begin

Due to the lack of funds, results of these studies were obtained for only a limited number of species, and the "Chorological Atlas of the Medicinal Plants in Bulgaria" is still awaiting printing This is why the chorological and ecological details of many plants from the Bulgarian flora as well as the potential for restoration of the exploited species were not taken into consideration in the past As a result great quantities of biomass were removed every year from the same habitats which in turn led to the overexploitation of many valuable medicinal species

The biologically inexpedient exploitation of medicinal plant resources has continued in our country even after the adoption of a free market economy In addition to the existing structures of the CCU and the Committee of Forests, mentioned above a great many private firms have actively joined in the gathering buying and marketing of plant materials Thus, for a variety of reasons the possibilities for managing the functions of all sectors (private state and cooperative) have been seriously diminished

ANTHROPOGENIC IMPACTS ON MEDICINAL PLANT RESOURCES

The economic exploitation of wild medicinal plants affects the state of their natural reserves and their reproductive capacities The stress of continuous exploitation makes them vulnerable to different aspects of human activity which on the whole have had negative results

The greatest impacts are from industrialization urbanization, road construction and the accumulation of industrial and transportation related waste products These activities destroy medicinal plant habitats Soil pollution – a result of the inappropriate exploitation of soils – and the introduction of chemicals in farming operations are other factors aggravating habitat conditions The application of artificial fertilizers and chemicals for crop protection affects a large group of medicinal plants whose natural zones of distribution are the plains and mountain foothills – regions that are intensively farmed These medicinal plants are mostly anthropophytic – weed and ruderal species such as

Papaver rhoeas Centaurea cyanus and *Sambucus ebulus*

The sharp change in ecological conditions caused by logging fires, the plowing of natural herbaceous plant communities and alterations in the hydrological regime of habitats has the most grievous consequences for the plants The populations of many hydrophytic species (*Leucojum aestivum*, *Acorus calamus*, *Menianthes trifoliata Mentha* sp , *Orchis* sp) were seriously affected by the drainage of swampy and marshy regions along the large rivers (the Danube Maritsa and Tundzha) along the Black Sea coast and in the central parts of the country over the last several decades Some of these plants are entirely extinct while others have lost their significance as sources of industrial quantities of medicinal agents

Changes in the original vegetation as a result of irregular silvicultural activities – especially wholesale and partial logging and the creation of coniferous mono cultures often using species alien to the natural flora of the country – have had consequences that are both negative and long lasting The violation of the structure of the communities leads to their decline in terms of both quantity and quality, affecting the medicinal plants within them

Afforestation of non forest regions and plowing and cultivating of plains and pastures radically change the habitat conditions for the medicinal plants in these areas whose populations then either diminish or disappear completely

Excessive grazing also affects the composition and reproduction of medicinal plants At present medicinal forb species are either growing fewer in number or disappearing from pastures while the presence of ruderal species is increasing

Mass tourism ski resorts and construction in the mountains with all their negative consequences influence the phytocenoses and their medicinal plant constituents

The reserves of medicinal plant resources are also strongly affected by the way their habitats are exploited One basic reason behind their decline is disturbance to the reproductive potential of the populations Reproductive potential depends on two factors the specific biological features of the individual species and the type and quantity of active plant components gathered The wrong manner of gathering the lack of a restoration period the exhaustion of the populations damage to normal sexual and vegetative reproduction – all can lead to the reduced capacity of natural habitats to serve as reserves To address this problem traditional herb gathering practices with their characteristic features of economic and social efficiency will need to be combined with measures for the protection of the environment and its resources

LEGISLATION AND PROTECTIONAL APPROACH TO THE PRESERVATION OF MEDICINAL PLANTS

Historical analysis of the legislation indicates that the medicinal plants in the period of their extensive application in folk medicine were treated as part of the natural vegetation of the country and their use was subject to the general laws for environmental protection

According to the 1936 law on national environmental protection (*Official Gazette* 59/1936), the Ministry of Agriculture and Public Property had the right "to ban forever or for a definite period of time the large scale gathering of herbs and flowers from definite regions "

The increasing amount of wild medicinal plants gathered, mainly for export, made it necessary to prepare in 1941 a specialized Law on Medicinal and Aromatic Plants (*Official Gazette* 149/1941), and Regulations for the Application of the Law on Medicinal and Aromatic Plants (*Official Gazette* 20/1942) These acts regulated "the breeding, use, growing, distribution, and preservation of the herbs in the country " defined the rights and duties of those who were professionally engaged in this activity, and established the terms of reference of the different government institutions concerning use and protection training of specialists, and the control of gathering The objectives of these regulations were to create conditions and train specialists for the long term use of the medicinal plants to provide an occupation for part of the population, and to make Bulgarian herbs competitive on the foreign market

The plants that came under the regulations of the law were listed and placed in several categories plants the gathering of which was absolutely forbidden (15 species), plants that could be gathered up to a certain amount or within definite regions (6 species) plants that could be sold on the domestic market but were banned for export (42 species) and plants that could be gathered without restrictions (121 species) Herbs cultivated in Bulgaria and aromatic plants were listed separately The protectionist approach is evident in the working out of this law forbidden or restricted use is a prerequisite and necessary step toward the preservation of the medicinal plants and their reserves Now fifty years later analysis of the list shows that all the fully protected species and more than half of those under restriction (including those whose export was banned and seven of the species listed for unrestricted gathering) are still either strictly protected or under a restricted use regime (Table 2)

The Law on Medicinal and Aromatic Plants remained in force until 1947 After that the preservation and use of medicinal plants followed the texts of the general laws and acts (i e decrees decisions regulations) Thus a biological resource that at the outset of

its active exploitation was given both a biological and a socioeconomic appraisal and was protected with a specially created law was later used rather ineffi ciently due to social and economic conditions

After the 1960 Decree on National Environ mental Protection (*Izvestia* 74/1960) was adopted Or der #761/1961 of the Principal Department of Woods gave protected status to 59 vascular species Thirteen of these were medicinal plants In addition two other medicinal species were placed under a restricted use regime

When the 1967 Law of Environmental Protection (*Official Gazette* 47/1967) was adopted, it became the basic act pertaining to the preservation of medicinal plants The regulations of this law forbade "the gath ering of herbs, forest berries, mushrooms, seeds, etc in quantities and in a way that leads to their destruction or impedes their reproduction Individual species of valuable herbs berries, and other plant species are placed under a special management regime for their protection and cultivation " At present the general re sponsibility for enforcement of this law rests with the Ministry of Environment The Committee of Forests is responsible for the use of medicinal plants within the forest lands, which came under the regulations of the Law of Forests

The "Basic Trends in the Protection Cultivation, and Rational Use of the Medicinal Plants in the Peo ple's Republic of Bulgaria" played an important role among the acts regulating the protection and use of the major medicinal plant resources They were enun ciated by the State Council in 1977, and a special pro gram was passed by the Council of Ministries (Resolution 193 27 X 1977) with a separate section on the "Protection and Enhancement of the Quality and the Quantity of the Medicinal Plant Resources " It as signed the major activities and duties to various state departments and public organizations that were di rectly or indirectly involved with the preservation of these resources The coordinating functions were as signed to the Council on Medicinal Plants an immedi ate subordinate to the Council of Ministries

In 1987 the functions of this Council were de volved upon the National Centre for Phytotherapy and Folk Medicine, which after passage of Resolution #10 became responsible for official policy on the protec tion cultivation and rational use of the medicinal plants The vague legal status of this body did not al low it to assume an effective oversight role Never theless with the active participation of this center, an act for the restricted use of medicinal plants was worked out by the Committee for Environmental Protection in 1989 It served as a basis for Regulation #719/1989 (*Official Gazette* 50/1989) of the Committee for Environmental Protection which placed 31 me dicinal plant species under restricted use They were not totally excluded from economic use but their an nual rate of exploitation was strongly tied to the state of the habitats and the minimum demand for plant materials, mainly to meet the needs of the domestic market The Ministry of Environment was assigned responsibility for controlling the use of medicinal plants placed under restriction

A subsequent act rescinding the previous one was Regulation #973/1991 of the Ministry of Envi ronment (*Official Gazette* 107/1991) which remains in force It involves 41 wild medicinal plant species Re strictions on the use of certain medicinal plants have been preserved Economic uses of some cultivated species and species in need of strict protection have been banned A three year period has been desig nated for the cultivation of another 14 species, after which it will not be permitted to gather them from their natural habitats At the end of the term, the re stricted use regime will be reinstated only for those species whose biological peculiarities or ecological demands hinder their cultivation The aims of this act are to enhance the interest of producers in cultivating medicinal plants and to meet the needs for active plant components from cultivated areas as a basic means of preserving these species

As noted above protection of medicinal plants in Bulgaria began in 1961 when 59 plant species 13 of which were medicinal plants, were placed under pro tected status Since 1989, the number of protected vascular species has been 330 under Regulation #718/1989 of the Committee for Environmental Pro tection (*Official Gazette* 56/1989) Twenty nine of these are medicinal plants This regulation bans the cutting, picking gathering, eradication and scientific collection of these species destruction of their habi tats their transportation and selling abroad and the gathering of their seeds bulbs and other reproductive parts The use of a limited number of species is al lowed for scientific research and for improved cultiva tion Species rare in Bulgaria (*Rheum raponticum Glycyrrhiza glabra, Sideritis scardica Ruta graveolens*), species whose populations have reached critical levels as a result of continuous intensive exploitation (*Gentiana punctata, G lutea*) or species whose habi tats have been harmed by human economic activity (*Acorus calamus Orchis papilionaceae, O militaris*), as well as species whose populations propagate irregu larly as a result of some biological or reproductive pe culiarity (*Arctostaphyllos uva ursi*) are all placed under protection Their use is entirely forbidden

The restricted use regime together with the strict protection of species and special habitats, are the main methods for preserving wild medicinal plants The re stricted use regime is adopted in order to improve habitat conditions for medicinal plants that are eco nomically valuable but that are not found in economic quantities It is comprised of rules for the use of natu ral habitats in a manner that protects them from ex haustion and destruction It includes measures to monitor and control the state of the habitats and the natural quantities gathered, to enact occasional bans on exploitation in certain habitats, to control exports, etc

In addition to their direct economic value, the medicinal plants are biologically valuable for the genetic information they contain (and which is concretely revealed in their economic qualities) The actual preservation of the genetic diversity of these species in their habitats is exercised through the different categories of protected areas Protection may be granted to separate populations plant communities, and complexes of ecosystems The area of the protected areas ranges from several tenths of a hectare to thousands of hectares The effectiveness of protection is proportional to the size of the territory, it is greatest in the natural reserves and national parks The purposes of the protected areas are to preserve typical environmental conditions to limit or (in some circumstances) even eliminate the human presence and to minimize the anthropogenic influence

The management regimen of protected areas may be rigid with a total ban on any activity In other categories of protected areas only activities that may harm the populations may be banned (e g building, geological research quarrying changing of the hydrological regime herb gathering grazing hunting) The genetic resources of the medicinal plants from protected areas may be used only as selection material or for a direct introduction into cultivated plants

Beyond the reserves and national parks medicinal plants are also preserved in 49 other protected areas (a total area of 817 5 ha) that were designated specifically to preserve the habitats of medicinal plants (*Leucojum aestivum Paeonia peregrina Glycyrhiza glabra, Galanthus nivalis, Juniperus communis Sideritis taurica Inula helenium Primula veris*) The exploitation of medicinal plants for economic purposes is forbidden in these areas except for those created for the preservation of *Leucojum aestivum* In these areas not only the genetic resources but also economic resources are being protected This mode of territorial protection with a management regime consistent with the peculiarities of the plants and their most efficacious use and propagation will probably become even more important in the future as a means of guaranteeing their steady long term development

The genetic resources of the medicinal plants are also preserved in specialized collections of live plants and seeds One hundred and fifty nine representatives of the Bulgarian flora are included in the live collection of medicinal plants in the Botanical Garden of the Bulgarian Academy of Sciences Thirteen are under a special use regime and are partially exempt from gathering The seeds of many of these species (78%) are offered for sale to different scientific organizations and botanical gardens through Delectus Seminum

Another fact deserving of attention is the preparation and publication of the Bulgarian *Red Data Book* which includes 38 medicinal species (out of 763 plants listed) It does not have the force of a regulation but it is an expression of the public s ecological conscience and provides a basis for the active protection of the species included within it

From this review of the legislative basis of, and approaches toward, environmental protection, we can draw the conclusion that under Bulgaria's present social and economic conditions it is impossible to use monitor or preserve effectively the medicinal plants on the basis of regulations They do not possess the necessary range or power and cannot create an orderly system of organizing this traditional Bulgarian industry under the new economic situation The medicinal plant resources occupy a special position in Bulgaria's economy For that reason, there is an urgent need for a specialized law to direct their use and protection The Ministry of Environment is working to develop such a law which is expected to be taken up by the Council of Ministries in 1993

RESOURCES DEVELOPMENT FORECAST

Bearing in mind the general state of the medicinal plant resources, the present social and economic situation in Bulgaria and the expectation that the specialized law for conserving medicinal plants will be soon passed, we can make an approximate forecast for the development of the resource

During the next several years, the slow and general aggravation of the ecological state of the environment will continue with all the attendant negative consequences for medicinal plant habitats To some extent these consequences will be compensated for by the natural adaptive abilities of the populations, and it is possible to minimize them through appropriate measures so that they will not affect considerably the general economic resources of the habitats The restitution of private arable lands and reconstruction of agriculture lie ahead Restitution of forest lands is also being planned In addition the manner of exploitation of part of the lands will most probably change as well Some meadows will be plowed which will destroy the habitats of some medicinal plants

After the restitution of the land to its owners the interest in the cultivation of medicinal plants as a source of income for the population will increase The exploitation of wild medicinal plants will probably decrease due to the greater efficiency offered by cultivation However, it is necessary to stimulate this process by supplying the respective authorities with appropriate lands (mainly from the municipal and national forest funds), with information and technologies for cultivation and with seeds and saplings New technologies for the cultivation of rare and vulnerable species will relieve their habitats of economic exploitation and will enable their natural populations to propagate and expand The wild populations will provide genetic material The cultivated medicinal plants will also be the preferred source for the pharmaceutic industry due to their higher

degree of homogeneity and their higher quality The breaking up of the medicinal plant monopoly will at tract investments and lead to increases in the produc tion of remedies from plants

The amount of the herbs consumed depends largely on the demand of the foreign market The quality of Bulgarian medicinal plants is remarkable in terms both of the content of biologically active sub stances and their low prime cost As a result there is a great demand for them on the foreign market In the future exports will probably amount to about 10 000 tons per year The percentage of cultivated plants will increase as a result of growth in both the number of plants cultivated and the variety of plant materials produced

Since the human conscience changes very slowly, the consumer attitude toward medicinal plants is most likely to remain intact for a long time to come Un employment turns many people with little ecological understanding and a lack of necessary knowledge and skills to the gathering of herbs This process will gradually abate with the stabilization of the country's economy and with the passing of the civil legislation

MEASURES FOR THE EFFECTIVE PRESERVATION AND RATIONAL USE OF MEDICINAL PLANT RESOURCES

The preservation and rational use of the medici nal plants requires a system of legislative, administra tive technological educational, scientific and other measures to maintain the balance between the activi ties of man and the ecological conditions for the de velopment of these resources These measures will se cure not only the preservation but also the recovery and augmentation of the natural medicinal plant re sources

These measures concern mainly the medicinal plants under the restricted use regime and the species gathered in high quantities

First the preservation and the rational use of wild medicinal plants requires the mapping of the actual habitats of the species under greatest demand The *Chorological Atlas of the Medicinal Plants* does not es timate the reserves of these species Therefore it is necessary to begin mapping procedures which gives priority to the most threatened and most heavily ex ploited species The next stage must include studies of the state of their natural reserves and measurements of their areas the materials in store the state of their populations and their capacity for exploitation Stud ies of the ecological and biological peculiarities of the plants and their normal development will enable us to organize activities for the optimization and expansion of their habitats and reserves This aspect is especially effec tive in the case of plants strongly affiliated with certain ecological conditions and hence difficult to cultivate For some species semi cultural methods can be ap plied to their natural habitats

One of the most effective ways of preserving natu ral reserves of valuable medicinal plants and of sup plying the pharmaceutical industry with quality mate rials is the large scale cultivation of wild plants an area in which good work is already being done and good results have been achieved The cultivation of the plants reveals the great advantages of this method a homogeneous material is gathered from the culti vated areas, which ensures more efficient processing mechanized growing and gathering of the active plant components is possible only those populations, forms and sorts highest in productivity are used, enhancing the profitability of the plants and planning of the an nual material yield is made possible For these rea sons work along these lines must continue and ex pand Regulation #973/1991 of the Ministry of Envi ronment proposes the cultivation of another 11 me dicinal species now under a restricted use regime by the end of 1994

The adoption and observation of flexible laws to govern permissible exploitation, to allow for the peri odic rest and recovery of habitats and to set basic rules for gathering (consistent with the specific fea tures of the individual species) is exceedingly impor tant to the preservation and use of the medicinal plants They need legal regulation

A law should be passed that would regulate the use of and promote the preservation of medicinal plants in Bulgaria Its most important features would be definition of the requirements for qualified herb gatherers and herb merchants, creation of a governing system on all levels, improvement of the monitoring infrastructure, stimulation of the cultivation of wild medicinal plants and establishment of a specialized fund for activities connected with the preservation of the genetic resources and natural reserves of medicinal plants

These proposed measures will prove effective only if they are combined with a comprehensive educa tional program that improves the general state of eco logical knowledge and promotes awareness of medici nal plants as a valuable and vulnerable natural re source

NOTES

1 The term "active components" (or "active plant components") is an approximate translation of the Bulgarian term "droga" (буака) which has no direct equivalent in English It refers to the actual parts of the medicinal plants that are employed in treatments The term "bilka" (буака), meaning "herb " is sometimes used as well, and is being adopted in the forthcoming new legislation on medicinal plant resources

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Plant Genetic Resources and Their Management in Bulgaria

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SUMMARY

The Bulgarian flora includes many local varieties and wild relatives of cereals forage grasses legumes and temperate fruits Due to its geographical situation and climatic and edaphic variability Bulgaria is also a secondary center of diversity for most of the cultivated plants introduced from other centers of origin Over many ages environmental conditions and selective pressures in Bulgaria have allowed an enormous diversity of tomatoes peppers beans tobacco melons and water melons corn, and other crops to develop

The importance of plant genetic resources for the development of Bulgarian agriculture was first recognized at the beginning of this century The collection study conservation and use of the existing genetic diversity began in this period, focusing at first on local populations of bread and durum winter wheat beans and the basic vegetable crops These were given priority due to the major role they play in providing livelihoods for the Bulgarian population Bulgarian scientists quickly realized the importance of the ideas of the Russian scientist Vavilov and active studies of the local plant resources began in the early thirties A Department of Plant Introduction and Plant Resources was created within the Institute for Plant Genetics and Breeding in Sofia

In 1978 the National Institute for Plant Genetic Resources was founded in Sadovo allowing scientists to undertake more detailed field and laboratory studies to characterize the germplasm and to conserve it through long term storage The collection of local cultivated plants and their wild relatives has had priority in the last several years Most accessions are characterized according to international descriptor lists The information is being computerized and made available for use The publication of catalogs and inventories now allows people who need this information to locate it more easily The research program is directed toward the conservation of germplasm as a way of preserving genetic diversity Specimens with characters valuable for the breeding programs – for example resistance to drought, cold disease and other stress factors – are being conserved in the collections

This report gives information about the accessions of local crops and their wild relatives from different floristic regions of the country It also includes conclusions regarding gaps in the national program for the conservation and use of germplasm Endemic species and varieties requiring special attention are noted Attention is also given to areas rich in species diversity that should be studied in greater detail and included in the national network of protected areas These areas should receive special protected status as areas devoted to *in situ* conservation In view of global climatic changes and other changes that will inevitably occur in agriculture some local species are being seen as potential new crops A new scheme to manage plant genetic resources in response to social and economic changes in the country is proposed

HISTORICAL REVIEW

A national network of Agricultural Experimental Stations and Universities began to be built immediately after the liberation of Bulgaria from Turkish rule The research programs followed in the experimental stations included studies on the improvement of the more important economic crops Thus at the end of the last century and into the beginning of this century the conscientious and purposeful study of the plant germplasm in Bulgaria began

K Malkov (1906) described local wheat varieties and began research on their improvement That same germplasm later became – in fact remains – part of the genetic composition of modern varieties Bulgaria is a primary center for many cereal and grass and legume forage species The importance of the country as a secondary diversity center for other plants introduced from distant geographic regions very quickly became evident Such is the case for example with the rich diversity of local bean accessions described by Gradinarov (1939) and local pepper accessions described by Popov (1940) These two papers are still important works in the field

Intensive collection and evaluation of local varieties began in the 1920s and 1930s The adaptations of these varieties to local edaphic and climatic conditions was highly appreciated as was the necessity of their use in breeding programs However the lack of facilities for preservation of collected materials and most important the lack of a general national policy for the management of plant genetic resources led to the dispersal of most of the collected material

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The collaborative work of D Kostov and the well known Russian geneticist N I Vavilov presented an important opportunity for Bulgaria Most of Kostov's research and educational activities were devoted to exotic germplasm and its importance in transferring certain characters and qualities to the cultivated plants After his return to Bulgaria Kostov spent most of his time trying to build up a Department for Plant Genetic Resources in the Central Experimental Institute for Agriculture Thus was created the first centralized body for plant genetic resource management The department would later be expanded as part of the Institute for Breeding and Genetics, but its work initially emphasized the introduction of germplasm from other countries

From this period until 1982 there were no facilities for the long term storage of the accessions This led to their frequent regeneration With the continuous increase of the collections and the lack of suitable preservation facilities the period between successive regenerations became longer and most of the accessions were extensively damaged

In 1977 the Department for Plant Genetic Resources moved to Sadovo where together with the Agricultural Experimental Station and the Experimental Station for Variety Maintenance, it became part of a new large scale center for plant genetic resources The Bulgarian government and the United Nations Food and Agriculture Organization (FAO) through a collaborative project of the United Nations Development Programme provided the necessary conditions for research in the field of plant genetic resources A seed storage facility for the long term preservation of the accessions with equipment for the study and evaluation of the accessions, was built This allowed the research program to improve considerably Priority species have since been identified and a plan for systematic collecting missions in the country developed

For 20 years Bulgaria has been an active participant in the United Program of the East European Countries directed by the Central Experimental Institute for Agriculture (VIR) in Saint Petersburg In the Scientific Council of the program problems concerning working methods are discussed Commissions are established and descriptor lists for some of the most important crops created The participating countries cooperate in organizing expeditions to collect valuable germplasm Results from these studies are periodically published

Bulgaria has participated in the European Cooperative Program since its inception and has taken part in the ECP s effort to create a crop network Our country is also a member of the FAO Commission for Plant Genetic Resources After the creation of the Institute at Sadovo Bulgaria adopted an open policy concerning its plant genetic resources During this period Bulgaria has collaborated with the International Centre for Agricultural Research in the Dry Areas (ICARDA) the International Board for Plant Genetic Resources (IBPGR), and the United States and other countries

A number of steps have recently been taken to improve the management of plant genetic resources in Bulgaria An important study of the collections has been initiated A catalog of the accessions in long term storage was published Records of newly received accessions are published annually A data base comprising the results of accession evaluations has been created and is at the disposal of the users The data base will be used to create catalogs and to participate in international data networks as they are created

MAJOR GAPS IN KNOWLEDGE

Although the program of field and laboratory evaluation of accessions has been more active over the last 10 years it is satisfactory only for local varieties Thorough information about the wild relatives of culti vated plants is lacking, as are (even more importantly) evaluations of bioclimatic characteristics and of resistance to winter, cold conditions, and economically important diseases and insects For some species and varieties it is important to know their capacity for improving soil fertility, their ability to grow on acid soils and soils of low productivity, and their other soil protection capabilities

In the case of legume species, only seeds have been collected The failure to collect the specific root bacteria characteristic for each species and habitat is an omission As a result, regeneration and cultivation of some of the most promising species has been difficult

We lack knowledge from prebreeding studies on the best and most effective methods for transferring genes responsible for the expression of desirable characters and qualities Neither have studies evaluated the possibility of distinguishing spontaneous interspecies hybrids that could be used as natural bridges in breeding programs

Methods of pollination control when regenerating accessions and their influence on narrowing the genetic base of populations of cross pollinated plants have also been inadequately studied Expansion of these studies will make it possible the choose the most suitable method for each species

Information is lacking on the potential for cryopreservation of pollen tissues and whole plant parts both of vegetatively propagated plants and of seed propagated plants that are difficult to preserve by orthodox methods

The use of *in vitro* techniques of preservation has been studied only for a few species (potatoes vines chrysanthemum) Little is known about the influence of *in vitro* preservation conditions on the genetic integrity of the accessions

Another gap is the use of Restriction fragment length polymorphism (RFLP) analysis for the study of different species Though isozyme and storage protein analysis has been undertaken in the last few years to

determine the diversity and duplication of accessions the information is still inadequate

Another basic gap is the lack of research on *in situ* conservation sites – especially as concerns the size of the populations within them the relations of the species they contain and the influence of the local climatic and edaphic factors

Up until now collections have been created to distinguish certain characters, but in the future attention should be given to the separation of genetic sources as donors of specific characters

ASSESSMENT OF PRESENT CONDITIONS

The importance of plant germplasm for the success of breeding programs, for the development of modern agricultural systems and for the status of ecological conditions has become more greatly appreciated For the last few years – since the establishment of the Institute for Plant Genetic Resources in 1978 – clearly defined priorities for the study of plant genetic resources have been followed Attention is again being paid to the exploration of local plant diversity A program defining the collecting missions for the period 1978 1988 was created Expeditions were constantly active in the field with the goal of enriching the collections and preserving existing biological diversity

Because of structural changes in agriculture and the constant adoption of new crop varieties the diversity of local varieties of maize wheat, chick pea, lentil, barley, apples, pears, plums tomatoes, pepper, onion and other crops was doomed to vanish as their acreage became more and more limited Many interesting plants, including some very rare species and some wild forms endemic to Bulgaria are now dangerously decreasing and even vanishing due to promiscuous gathering by amateurs, tourists, and herb collectors without corresponding effective measures to assure their propagation and preservation

The foundation for the organized and scientifically based collection and study of plant genetic resources in Bulgaria was laid in 1939 by the aforementioned D Kostov In the early 1960s the Department for Plant Genetic Resources organized seven expeditions, allowing a certain proportion of the species and varietal diversity of local forms to be collected Priority in the collecting missions was given to local forms of field vegetable, and fruit crops These old local ecotypes had developed important regional advantages due to the long period of selection and primitive breeding Their characters and qualities made them valuable as donors in the breeding programs Some of them may eventually be used widely in agriculture either directly or after a certain period of prebreeding

In the case of cereal and legume species attention was directed toward old local varieties and populations of garden and field beans maize lentil broad beans, vetch wheat, rye, and oats Other old local forms were found in the vegetable group – tomatoes, cabbage cucumbers, watermelons melons pumpkins spices, and others Special attention in this program was paid to the horti cultural regions around Gorna Oryahovitsa and Tirnovo In the Blagoevgrad district Kyustendil, Strandzha Sakhar, and Loudogorie, efforts focused on collecting the diversity of garden, field, and binding beans For diversity of watermelons and melons collecting work focused on the regions around Pleven, Vidin Razgrad, Shumen, Yambol, and Svilengrad In the cooperative and private gardens researchers looked for old local varieties and clones of seed and stone fruit varieties vines and nut bearing species Special attention was given to the "spur" type accessions those characterized by slower growth earlier fruit formation differential ripening, good taste and other horticultural qualities including the length of preservation under normal conditions, and superior resistance to diseases and insects

The second priority in these expeditions was the collection of local wild or semi wild plants possessing useful qualities and characters including high content of valuable compounds cytoplasmic male sterility capacity to restore soil fertility high degree of disease and insect resistance and resistance to extreme meteorological conditions

Three types of expeditions have been carried out complex, specialized, and individual One specialized expedition undertook to review and collect the diversity of fruit species in the areas of the Rila Rhodope, and Strandzha Mountains, the Stara Planina from the western border to Cape Emine on the Black Sea, and the afforested belts of northeast Bulgaria and the mountainous regions of Malashevska Konevska Osogovska Ograzden, Belasitsa, and Pirin Another specialized expedition reviewed and collected the diversity of wild vines and old local varieties along the southern Black Sea coast the rivers Kamchia Ropotamo, and Veleka in the Strandzha region the Petrich Sandansky region Konevska Osogovska, Ograzhden Belasitsa, and Pirin Mountain A third specialized expedition encompassed the cereals legumes, and ornamental plants in the Rhodope Mountains, along the Black Sea coast in the Sredna Gora, and in Strandzha Sakhar region

Three collecting groups were formed to gather local varieties over the whole territory of Bulgaria Their attention was directed more toward areas along the boundaries and in the sub Balkar settlements where varieties have changed much more slowly

For financial reasons this program was not fully completed Over 2 300 accessions were gathered during its active collecting phase In the case of the fruit species the accessions were only marked and a very insignificant part of them (mainly the walnuts) were collected The collected materials were subject to complex study for identification and agronomic evaluation These data provided a basis for card indexing areas deserving of more detailed study

for *in situ* conservation of the wild relatives of the cultivated plants

The complex study of the collected *Aegilops* accessions indicated that they were highly unique Some of the *Aegilops triaristata* showed resistance to powdery mildew and brown and yellow rust Most of the *Ae biuncialis Ae ovata*, and *Ae triuncialis* accessions are resistant to brown rusts Some of the *Ae triaristata* and 70% of the *Ae ovata* accessions are resistant to yellow rust Complete immunity to powdery mildew was shown in all *Ae triaristata* and *Ae ovata* accessions and 50% of the *Ae biuncialis* accessions Complex field resistance to the above mentioned diseases was evident in 7 accessions of *Ae ovata*, 3 accessions of *Ae triaristata* and one accession of *Ae triuncialis*

The collection of forage legumes includes seed legumes (pea, vicia, vetch lupine) and annual and perennial legume grasses (clover, alfalfa sainfoin and others) All cultivated species of this collection have relatives in the Bulgarian flora That is to say Bulgaria is one of the centers of diversity for the above mentioned forage legume species

Most widely represented in the wild flora of the Trans mediterranean zone (the plain and semi mountainous part of southern Bulgaria) is the family Fabaceae followed by Compositae and Gramineae (Stoyanov 1922 1930) Within the Fabaceae, the genus *Trifolium* has the highest species diversity (55 species) In the Trans mediterranean zone from 0 to 600 700 m a s l , the most widespread group is the annual clovers (31 species), which are very well adapted to the dry climatic conditions of southern Bulgaria

The Bulgarian flora offers significant possibilities for new forage species, not only as initial breeding material for our own agricultural use but also for that of other countries Together with ICARDA (based in Syria) the Institute of Food and Agricultural Sciences (IFAS based in Gainesville Florida, USA) and the AMGRC (based in Adelaide Australia) collecting missions for legume and cereal forage grasses were conducted in 1988 1989 1990 and 1992 As a result, *ex situ* collections of *Trifolium Medicago*, *Vicia* and other legumes were established

The gradual study of these collected materials and their ecological plasticity (especially among the annual species) has revealed their important potential as forage genetic resources This potential falls into several categories

1 Species suitable for dry conditions especially stony and hilly areas that cannot be irrigated Alfalfa a basic forage in Bulgaria does not do well under dry conditions and its use in dry areas and periods is not advisable The dry climate especially during the last few years oblige us to use the wild plants best adapted to these conditions as a contribution to solving the forage problem Thus it can be said that the historical process of transforming wild plants into cultivated ones continues and will continue as long as the plant genetic resources in nature exist

2 Species and forms suitable for eroded soils In addition to alfalfa clover and sainfoin species of the genus *Astragalus* could be used They have creeping stems and are suitable for slopes

3 Forms and species suitable for unfertile soils and for improving soil fertility

4 Species suitable for initial breeding material (alfalfa white and red clover vetch lupine)

Difficulties related to germination seed formation and regeneration and reproduction exist for some of the wild species Research is now being directed toward the identification of accessions that germinate more easily have better seed formation and are easily adapted to environmental conditions

The predominant local cereal grass accessions are those of the species *Dactylis glomerata Festuca rubra Lolium perenne Bromus inermis Phleum pratense* and *Poa pratensis* Old local accessions of the legume crops maize sweet sorghum broom corn bean and fruit species can still be found There are 850 local maize accesions in long term storage One thousand and thirty three accessions of durum wheat collected in the early 1960s from the southeast and southwest part of Bulgaria are being preserved The best represented group is the legume crops with a total of 1954 local accessions

Many of the local tomato pepper melon bean and pumpkin accessions are being used in breeding As a result of a complex study valuable accessions of tomatoes with high dry matter content biologically active substances and resistance to economically important diseases have been identified Two new tomato varieties Vihren and Trapezitsa have been created based on local germplasm Through individual selection in populations of the collected garden beans the varieties Trakiyski and Ilinden have been created They are characterized by early maturity high productivity and tolerance to bacterial diseases

In the last few years breeding lines developed in different breeding programs have been enlisted in the national gene bank Very often these possess certain characters and can be used as genetic sources

The diversity of relatives of the fruit crops is great Endemic species typical for some of the floristic regions are to be found here also The genus *Pyrus* L (pears) is represented by *P pyraster* Burgsd , *P amigdaliformis* Will , *P eleagrifolia* Pall *P communis* Jacq , and *P sativa* or *P communis* subsp *sativa* Stiy et Stef In addition to *P eleagrifolia* a subspecies *bulgarica* typical for the southern Black Sea coast the slopes of the eastern Stara Planina Mountains and Strandzha Moun tain, has been established It is resistant to drought and cold and is suitable as a genetic source for stock breeding

A great diversity of clones of local varieties exists They differ in terms of growth strength, form and size of fruits taste and structure of fruit flesh maturity rate disease resistance and other characteristics The *Malus* Mill genus (apples) is represented in the Bulgarian flora by *M sylvestris* Mill *M dasyphylla* Borkh , *M praecox*, and *M domestica* or *M pumila* var *domestica* Schneider The genus *Prunus* (cherries, apricots peaches, plums) is best represented and is found throughout Bulgaria Most of the collected and card indexed accessions are of *P spinosa* L , *P cerasifera* Shrh *P institia*, and *P domestica* L The genus *Cerasus* Juss is represented by *C mahaleby* (L) Mill , *C avium* (L) Moench *C fruticosa* (Pall) G Woron and *C vulgaris* Mill

The genus *Amygdalus* originated in southwest Asia and North Africa, from which different varieties of *A communis* were introduced long ago It is grown in small gardens alone or with vines as well as in single plantings in yards and along roads Its density is greater along the Black Sea coast in northeast Bulgaria on the Danubian plain, and in the eastern Stara Planina Mountains

Significant areas of forestland were planted with seeds of *Juglans regia*, Persian (or English) walnut, in the period 1950 1965 These plantings represent an extremely fortunate circumstance for the collection of valuable genetic material for this species

A great diversity of tree and bush type hazelnut *Curlus avelana* exists in the mountainous areas

During the last several decades, fruit production in Bulgaria was collectivized and large orchards were created in which only a few varieties of a given species were grown This fact placed before us the problem of accepting and realizing a program to collect study, and protect the old local varieties According to that program active collection activities were carried out throughout the country These activities were directed mainly toward regions affected by industrialization tourism active wood cutting, and other pressures

In accordance with the areas of distribution of the different fruit species and the specialization of the research centers several *ex situ* collections were created for the apples pears, cherries morellos, and peaches at the Fruit Growing Institute in Plovdiv, for apricots at the Apricot Experimental Station in Silistra, for plums at the Plum Experimental Station in Dryanovo, and for almonds and peaches at the Experimental Station at Pomorie

An inventory program for the fruit tree collections has been carried out in several stages development of a passport and evaluation form to gather information on incoming varieties filling in of information gaps and the computerization of collected information in the so called National Register and card index Nine hundred and eighty varieties are enlisted in the National Register As the planned program is realized it offers the possibility of creating a National Information Bank for the country's existing fruit species genetic resources, with constant updating of the National Register and centralization of the work on these resources Unfortunately, this work has been hindered due to financial difficulties and remains incomplete Only 120 nut accessions have been collected in the *ex situ* collection The rest are marked, and the financial prospects are such that they may be collected in the next few years

The gene bank in Sadovo maintains three types of collections from the point of view of conservation short term storage, an exchange collection, and long term storage The accessions for long term storage are kept in the basic collection In short term storage are the accessions that are being studied regenerated, or reproduced In the exchange collection are the accessions intended for international exchange

The technology for long term storage is based on the ability of most species to sustain dehydration and cooling with temporary slowing or termination of physiological processes, thus slowing down the very process of aging The first experiments in long term storage began at the National Institute for Plant Genetic Resources in 1981 After three years of testing, a technique suitable for 192 species of cultivated and wild plants was adopted This involves storage in hermetically sealed glass vessels and, in the last few years, in special three layered folio envelopes Storage is carried out at 18°C after an initial treatment of the prepared accessions at 8°C and 0°C (to eliminate the hydrothermal effects of quick cooling) During the storage period the temperature in the chambers, the hermeticity of the package the seed humidity, and the viability of seeds are controlled Checks of the accessions are performed once every 3 4 years Every check includes measurement of the temperature of the seeds and dehermetization in a drying chamber Information about the storage program is computerized

Results from control checks of more than 6,000 accessions are positive With the exception of several accessions, no lowering of seed viability was detected over a period of 10 years There are currently 25 831 accessions in long term storage

The management of data and documentation of plant genetic resources is connected to the computerization of the passport and evaluation information The passport information is relevant for plant resources that arrive at the institute through international exchange, collecting missions and exchanges with Bulgarian breeding institutions Each of these files includes passport data characteristic of the different plant accessions in accordance with international classifications Data from the characterization and evaluation of the accessions in the field goes into the evaluation data files for the different crops These data files include information on 60 80 characters depending on the crop

HISTORICAL, PRESENT, AND POTENTIAL THREATS

The constant threats to the survival of the plant genetic resources of Bulgaria are associated mainly with human activities and global scale changes in the climate and the soils At the beginning of the century the plowing of pastures and meadows the draining of swamps, and the clearing of woods had a strong influ ence In some areas over concentration of cattle brought about abnormal conditions for the regeneration of some species limiting the size of their populations
and even leading to their extinction

Intensive agriculture and the constant pressure from new varieties gradually pushed out the old local varieties Pressure was first exerted upon the wheat barley, and maize varieties that were grown on larger areas The process was speeded up by the collectivization and consolidation of land after World War II and reached its apex in the period 1950 1965

Intensive development along the Black Sea coast also disturbs the environment and threatens some delicate plant communities including some with rare species that are relatives of cultivated plants The building of roads makes even the most remote parts of the country more easily accessible to cars and people For many years industrial quantities of herbs have been collected from their natural habitats, without care for their regeneration Pastures are improperly used in the same way

Gradual climatic changes pose a potential threat to Bulgaria's plant genetic resources Global warming and frequent droughts over the last ten years have contributed to the expansion of dry areas into zones where some of the rare species belong Some species have disappeared in the last 10 years In particular the species in the family Fabaceae are extremely sensitive

Increased soil acidity is another great problem, as it hampers the symbiotic relationship of plants and nitrogen fixing azotobacter The drying out of the Mediterranean type vegetation along the rivers of south Bulgaria brought about the disappearance of binding vegetation especially the wild vines When whole forests are cut – a phenomenon that still occurs – unique *Prunus* species are destroyed With the restitution of the land orchards and vineyards are being destroyed some of which harbor old local varieties The same mistake was made when these lands were first collectivized In many places however mainly in the foothills and mountainous regions, small gardens with old varieties still remain

Storage itself if it is not performed properly can be a potential threat and lead to a loss of genetic diversity This should be kept in mind when new technologies for long term storage are considered When suitable conditions for long term storage are lacking frequent and improperly conducted regenerations pose a potential threat to genetic diversity

RECOMMENDATIONS

In order to provide more efficient management of plant genetic resources it is advisable that a National Council for Plant Genetic Resources be established Its duty should be to define a total conservation policy based on priority principles addressing all problems connected with the collection study conservation, and use of plant genetic resources for breeding and other purposes

There should be, connected with the National Council working groups for the different crops that carry out projects concerning the collections These groups should include as members the national curators from the Institute in Sadovo breeders botanists and representatives of non governmental organizations

Following the example of other countries the assistance of non governmental organizations in attracting the attention of farmers, gardeners students and others for participation in the collection and preservation of germ plasm should be more actively sought

A special effort should be made to draw the attention of farmers from different parts of the country to the need for regeneration of old local varieties and even for the propagation of some of them on larger areas The non governmental organizations could be in charge of the informational activities bringing in funds and sponsoring conservation activities

To improve conditions for *ex situ* conservation of seeds in the gene bank drying conditions should be improved and provisions made for safer packing

For better conservation of the vegetatively propa gated and fruit species a National Repository affiliated with the National Institute for Plant Genetic Resources in Sadovo should be built up

It is important to secure financial means to develop cryopreservation techniques in the next few years

More attention should also be paid to *in situ* con servation through serious study of several unique ar eas Special attention should be given to the medicinal plants, and a thorough agronomic study should be un dertaken to determine the potential for their cultiva tion outside the natural habitats An extension pro gram focusing on the protection of biodiversity and social and economic development should be created for the people in these areas

In order to implement a complete program for bio diversity protection, it is also important to have a system of modern information technology This is a key factor in the conservation and use of plant genetic resources

Table 1 State of the Collection

	Crops	Total No of Access	Access in Long Term Storage	No of Eval Access	No of Domestic/Local from total access
	1	2	3	4	5
1	Cereals	18 155	16 689	11,074	2 297
	Bread wheat	5 749	5 355	4,380	67
	Durum wheat	1 675	1 491	1 290	1 033
	Triticale	662	618	60	
	Barley	3 386	3 386	1 275	49
	Maize	3 155	3 268	1 804	850
	Oat	1 340	1 244	1 311	12
	Sorgo	736	589	168	29
	Millet	157	97	80	
	Rye	315	278	306	7
	Rice	98	43	49	
	Wheat sp	503	268	230	
	Aegilops	379	52	121	250
2	Food and forage legumes	9 264	4,345	3,314	1 954
	Forage pea	1 942	313	400	41
	Pea	781	111	781	15
	Soybean	917	689	80	
	Vetch	1 218	1 013	150	390
	Lentil	381	195	237	23
	French bean	1,500	388	780	1 250
	Dry beans	1 120	520	228	152
	Faba bean	543	459	518	25
	Chick pea	238	203		26
	Lupin	136	68	90	2
	Other sp	478	386	50	30
3	Forage grasses	1 049	596	306	702
	Alfalfa	411	127	61	151
	Clover	522	18	72	223
	Sainfoin	170	50	63	20
	Dactylis	236	211	51	218
	Brome grass	62	59	50	3
	Other perennial	265	181	72	87

Table 1 State of the Collection (continued)

Crops		Total No of Access	Access in Long Term Storage	No of Eval Access	No of Domestic/Local from total access
1		2	3	4	5
4	Oil and industrial crops	3 013	2,354	1,733	109
	Sunflower	577	313	421	42
	Raps	283	235	260	2
	Sesame	150	116	145	
	Flax	1,057	943	467	
	Tobacco	151	141		
	Brown nut	322	241	320	
	Poppy	123	123	120	
	Beta	36			36
	Others	360	242		29
5	Vegetables	4,274	1 638	3 425	1 165
	Tomatoes	713	484	682	174
	Pepper	615	110	464	264
	Cucumbers	1,014	274	960	10
	Water mellon	255	93	45	158
	Mellon	273	68	128	244
	Salad	480	224	410	2
	Cabbage	412	65	385	6
	Squash	312	122	117	260
	Other sp	418	198	234	47
6	Flowers	1,034	219	638	50
	Temperate fruits	1 950		719	523
	Wine grapes	2,050		1 000	268
	TOTAL	40 729	25,831	22 209	7 068

Table 2 Wild Relatives of Cultural Plants in Bulgaria

Crops	Genus	Wild Species	Important Species
Lupine	*Lupinus*	3	*angustifolius* albus**
Lentil	*Lens*	2	*ervoides* nigricans**
Chickpea	*Cicer*	1	*montbretii**
Pea	*Pisum*	1	*elatius**
Grass pea	*Lathyrus*	27	*sativus cicera hirsutus*
Vetch	*Vicia*	32	*sativa grandiflora pannonica incisa* narbonensis tenuifolii pisiformis villosa ervilia*
Alfalfa	*Medicago*	16	*varia falcata caristiensis* rhodopea** lupulina polymorph arabica orbicularis rigidula minima*
Clover	*Trifolium*	55	*pratense repens hybridum frag ferum medium pannonicum alpes subterraneum resupinatum nigscens vesiculosum retusum* incarnatum hirtum canstantinopolinum**
Sainfoin	*Onobrychis*	9	*arenaria lasiostachia gracili*
Sweetclover	*Melilotus*	5	*albus officinalis*
Other legumes	*Ornithopus Lotus Astragalus Glycyrriza Coronila*	46	*O compressus L corniculatus G glabra* C varia*
Grasses	*Dactylis Lolium Bromus Poa Festuca Arrena therum Phleum Alopecurus Agropyron*	78	*D glomerata L perenne B inermis F rubra F pratense P pratensis Arr elatius Ph pratensis Al pratensis Ag pectinatum*
Wheat	*Triticum*	1	*aegilopoides var aegilopoides var boeoticum*
Goatgrass	*Aegilops*	9	*ovata triuncialis cylindrica speltoides comosa biuncialis*
Elymus	*Elymus*	1	*sabulosus*
Rye	*Secale*	2	*rhodopeum** silvestre*
Oat	*Avena*	9	*fatua*
Beta	*Beta*	2	*trigina maritima*
Raps	*Brasica*	1	*rapa alba*
Sinapus	*Sinapus*	5	*nigra alba*
Other oils	*Cartamus*	3	*lanatus*
	Camelina	5	*sativa*
	Crambe	4	*maritima*
Carrot	*Daucus*	3	
Lettuce	*Lactuca*	9	

Legend

* rare species ** endemic plant

Table 2 Wild Relatives of Cultural Plants in Bulgaria (continued)

Crops	Genus	Wild Species	Important Species
Onion	*Allium*	28	*schoenoprazum proliferum cepa var aggregatum victoorialis atropureum nigrum multibulbosum cyrilly ursinum atroviolaceum ampeloprasum scorodoprasum rotundum sphaerocephalon margaritaceum gutatum amethystinum oleraceum rhodopaeum flavum vebu pacloscianum carinatum cirrkozii*
Mint	*Mentha*	7	*viridis nigricans*
Lemon balm	*Melissa*	1	*officinalis*
Valerian	*Valeriana*	1	*officinalis*
Lavender	*Lavandula*	3	*vera*
Plums	*Prunus*	4	*divaricata spinosa, cerasifera insititia domestica*
	Cerasus	4	*mahaleb avium fruticosa vulgaris*
	Amigdalus	4	*sativa vebu nana*
Apple	*Malus*	4	*silvestris, dasyphylla praecox domestica (pumila)*
Pear	*Pyrus*	5	*pyrastar, communis amygdaliformis elaea grifolia sibs bulgarica nivalis sativa*
Medlar	*Mespilus*	1	*germanica*
Nut	*Juglans*	1	*regia*
Chestnut	*Castanea*	1	*sativa*
Grape vine	*Vitis*	1	*sylvestris*
Blackberry	*Rubus*	11	*idaeus*
Strawberry	*Fragaria*	3	*vesca*
Rosa	*Rosa*	23	*canina*
Hops	*Humulus*	1	*lupulus*

Legend

* rare species **- endemic plant

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Preservation of Livestock Genetic Resources in Bulgaria

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INTRODUCTION

Animal breeding has ancient roots in Bulgaria Although our country is relatively small in territory it is characterized by a great diversity of livestock species This reflects the particular breeding conditions of different regions In addition, the ethnographic traits and traditions of the people in the different regions have played an important role This geographic and cultural diversity is a crucial prerequisite for the development of farm animals typical for each region differing not only by choice of breed but quite frequently by choice of species as well

The persistence up to the present of such a large variety of livestock could be related to the fact that animal breeding was one of the basic occupations of the population for centuries As a consequence, various breeds of cattle sheep, goats buffaloes pigs fowl horses and other domestic animals have been preserved and are being bred within the country

FORAGE BASE AND LIVESTOCK BREEDING TECHNIQUES

The arable land in Bulgaria totals 4 649 979 hectares 83% of which consists of fields, 7% natural meadows and 7% perennial plants The remaining area is occupied by artificially cultivated pastures Of the total area of arable land 1 955 413 hectares are used for forage production 47% for fresh forage and 53% for corn forage In addition there are 2 035 000 hectares of uncultivated natural pastures located mainly in the mountainous and semi mountainous districts The use of these grass lands is extensive and the amount of forages cropped is limited Basically these areas are used for free pasturing of sheep and for cattle breeding

The artificial pastures are owned by state farms and occasionally by research units Research related to grassland areas is carried out mainly by the Institute of Mountain Agriculture and Animal Science near the town of Troyan The entire program of research and development for grassland maintenance and farming is concentrated there

With the exception of some local beef farms, cattle are raised without using free pastures Grassland farming is more typical for in raising sheep and goats The breeding of other species – mostly fowl and pigs – is concentrated in large breeding units close to the larger cities Fifty nine percent of the pigs and 40% of the fowl are bred on such farms

STRUCTURE AND NUMBERS OF LIVESTOCK

Data on livestock numbers by species over the last 5 6 years are presented in Table 1 The major decline in livestock numbers during the last two years is due to the ongoing process of land restitution and reorganization For example, the total number of cows has recently declined about 22% although their number in the private sector had increased 52% by the end of 1992 The trend is similar for other farm animals

Table 1 Total number of farm animals in Bulgaria by 1 October 1992

Animal species	Total	Total compared to 1987 total (%)	Female animals of reproductive age
Cattle	1 113 949	33 9	526 980
Sheep	5,079 938	76 1	3 821 094
Swine	3 214 339	37 5	283,393
Goats	599 836	+22 0	470 424
Water buffalo	23 273	17 2	12,626
Poultry	24 198 600	51 4	10,291 150

GENETIC RESOURCES OF LIVESTOCK

Efforts to conserve the genetic resources of local breeds involve primarily state owned farms and experimental research stations Concern about the preservation and development of these breeds led to the establishment of the National Service for Selection and Reproduction in Animal Breeding (NSSRAB), supervised by the Ministry of Agriculture This state unit has branches in all major regions of the country It includes six stations for artificial insemination located in Sofia Sliven Varna, Veliko Turnovo, Shoumen and Pleven

Indigenous Cattle Breeds

The Grey Iskar and Rhodope Short Horned are of interest among cattle breeds for some unique genotypes that have been discovered by researchers The Grey Stepland is an indigenous cattle breed that has spread to neighboring Balkan countries

The **Rhodope Short Horned** is the smallest representative of this species in Europe These animals are descended from the craniological type *Bos Taurus Brachiceros* However some particular characters indicate that it closer to peat cattle than to cultured brachiceros breeds This breed represents the last remnants of the pre historic cattle in Europe Along with the Albanian South Montenegrian Ilirian, and Georgian Brachiceros cattle it originated in Asia

The Rhodope Short Horned is distributed throughout the western and middle Rhodope Mountains and also in the southern and eastern Rhodopes These are forest lands 1800 m above sea level The animals are small and their height at withers is about 97 cm The coat color of this breed varies from light to dark brown some can even be found with black coats The horns are thin, soft, and crumbly, pale with dark tips and about 15 cm in length The hooves are dark and strong Body weight varies between 160 and 220 kilograms Newborn calves weigh 14 6 kilograms on average The milk yield of cows is between 966 and 1133 liters with 4 5 to 4 6% fat (34, 27) The animals are not particular about farming and feeding conditions In the summertime they feed on grasslands and in winter mostly on hay and forest leaf forage (35)

Table 2 Total number of cattle in aboriginal breeds by 1 January 1993

Breed	Area of distribution	Number	Ownership
Grey Iskar cattle	Dragana	75	Private sector
	Troyan	6	State sector
	Shumen	30	State sector
	Chiflika	20	State sector
Total Grey Iskar		131	
Grey cattle	Grudovo	30	State farm
	Studena Svilengrad	50	State farm
	Ustrem	100	State farm
		50	Private sector
Total Grey cattle		230	
Rhodope short horn cattle	Khamzovo Smolyan	80	State sector
	Smolyan	70	State sector
Total Rhodope short horn cattle		150	
Total number of aboriginal cattle		511	

Genetic research on transferrin and erythrocytic antigens (Table 3) (6 7) shows that the frequencies of transferrin types Tf A and Tf D of this breed are close to those of the Brown Brachiceros breeds in Germany and Switzerland In addition the very rare transferrin allele Tf F has been discovered in this breed This allele is found in almost no European cattle breeds, but is found, though rarely in local Asian and African strains The presence of the Tf F allele allows us to confirm the hypothesis of other researchers (4) that this breed originated in Asia

The **Grey Iskar** is a local cattle breed related to the Grey Stepland breed which has spread to other parts of Europe The craniological class of animals of this breed is between *Bos T Primigenius* and *Bos T Brachyceros* which distinguishes it from the Grey Stepland (6) Traditionally the Grey Iskar Cattle was distributed in north central Bulgaria by the Iskar Vit Osam Skat and Rositsa River valleys (35) At present the limited number of animals of this breed are located mainly near the town of Sevlievo A few are kept on private farms The coat of the Grey Iskar breed is grey of different shades The muffles and eyelids are black Horns are U shaped pale with black tips The body is proportionate, with strong legs Its height at withers is about 115 120 cm Its body weight is between 300 and 350 kilograms Calves at birth weigh about 20 22 kilograms The average milk yield is 1200 1300 liters with 4 1 to 4 2% fat In herds with better farming conditions, milk yields may reach 1947 2648 9 liters (39 24 35) The length of the lactation period is 256 282 days Animals of this breed show resistance to unfavorable climatic conditions and diseases

The Grey Iskar breed has been an object of genetic research on different blood serum components albumins transferines hemoglobin amylase, etc Some of the more interesting results are presented in Tables 4 5 6 and 7 The hemoglobin alleles in this breed differ significantly from the widespread European cultivated breeds, with very low values of Hb B allele frequency (9 36) The presence of Akp D allele is rare and has attracted the interest of geneticists In analyzing these results, it is worth noting that, as with the Rhodope Short Horned, the transferrin allele Tf F is found in the Grey Iskar breed These studies prove the unique genetic status of the breed when compared to other European cattle breeds

Table 3 Transferrin allele frequency in the Rhodope short horn cattle

Number of test animals	Allele frequency					Reference
	Tf A	Tf D	Tf E	Tf F	Tf B	
124	0 230	0 710	0 046	0 020	–	Makaveev, 1966

Table 4 Albumin allele frequency in the Grey Iskar cattle

Number of test animals	Allele frequency		Reference
	Alb A	Alb B	
184	0 636	0 364	Makaveev 1980

Table 5 Hemoglobin allele frequency in the Grey Iskar cattle

Number of test animals	Allele frequency		Reference
	Hb A	Hb B	
275	0 984	0 016	Makaveev 1970
189	–	0 071	Makaveev 198

Table 6 Alkaline phosphatase allele frequency in the Grey Iskar cattle

Number of test animals	Allele frequency			Reference
	Akp F	Akp S	Akp D	
190	0 161	0 818	0 021	Makaveev 1980

Table 7 Transferrin allele frequency in the Grey Iskar cattle

Number of test animals	Allele frequency					Reference
	Tf A	Tf D	Tf E	Tf F	Tf B	
215	0 404	0 448	0 146		–	Makaveev, 1965
373	0 417	0 458	0 115	0 010	–	Makaveev, 1970

Indigenous Sheep Breeds

In numbers and diversity the local indigenous sheep breeds and strains in Bulgaria significantly exceed other farm animal species (Tables 8 and 9) In contrast with cattle sheep breeds are distributed throughout the many different districts of the country – in lowlands, semi mountainous, and mountainous regions Some of the breeds (e g , Pleven Black Face and Sakarska), although valuable as a specific genetic resource, will not be described in detail, since they are not threatened with extinction

Indigenous Sheep Breeds in Lowlands and Semi-Mountainous Areas

The **Karnobatska** sheep breed is a local strain of the Red Brown sheep that has been bred in Eastern Bulgaria for ages It is supposed that this breed's origins have much in common with those of the Tzigay sheep and Asia Minor sheep breeds (33) At present there are 650 Karnobatska ewes bred on a state owned farm

The animals of this breed are small and compact, with well built bodies Rams have heavy whorled horns, while ewes are polled Their fleece is mostly red and brown and very rarely pale Their height is 50 55 cm, their length about 60 cm The body weight of ewes averages 31 kg of rams 38-40 kg The body weight of newborn lambs is about 3 kg Karnobatska is a dual-purpose breed, with equal emphasis placed on its production of meat and wool The meat possesses good eating qualities, since it is fattened only on open grazing lands Fleece weight is about 2 4 kg, exceeding all other indigenous sheep breeds in the country Staple length is 18 cm Average milk yield per ewe varies between 40 and 50 liters for 150 days of lactation Milk fat is 8 4 8 97% casein – 3 98%, lactose – 5 47% Studies of hemoglobin alleles show that animals of this breed have the very rare allele Hb A with a frequency of 0 07 (9)

The **Copper Red Shoumen** breed is distributed mainly in northeastern Bulgaria in regions with moderate continental climate conditions from 0 to 800 m above sea level Representatives of this breed are medium-to-large, with an average body weight of 43 45 kg Their bodies are compact, with an average height of 59 cm and length of 64 cm (3, 31) The fleece is rusty-red, though individuals with black coats can be found Ewes are polled rams have twisted horns They usually have a well covered body and legs free of wool Twining rate is about 25-30% The milk yield per lactation period is 48 liters on average, with 7 32% fat Wool production per ewe is about 2 6 kg (16) The results of polymorphic analyses of blood serum proteins are shown in Table 10 (12, 13) The presence of some alleles – Tf G Alb F, Alb S, Alb W – is rare compared to the available allele pool in the Balkans

The **Starozagorska** breed is the most typical of the indigenous sheep bred in the Bulgarian lowlands It is found in valleys around the city of Stara Zagora, peculiar for their moderate continental climatic conditions It is supposed that the breed developed by crossing Tzigay and Zackel sheep The animals are large, the body weight of mature ewes is up to 60 70 kg The weaning weight of lambs is 4 3 kg The height is 64-65 cm the length about 70 cm The fleece is white Sheep of this breed have an elongated head, sagging ears long neck, and levelled back The face, belly, and legs are free of wool (31) Milk yield is 165 liters, with 6 09% fat and 5 92% proteins (2) Wool production is about 3 7 kg (31) Due to its high productivity and adaptability to local conditions, the Starozagorska breed is used to improve crosses with cultivated sheep breeds Genetic research (22) indi-

Table 8 Productive lines in sheep breeding according to the number of animals

Productive line	Relative share (%)
Thin fleece	43 5
Semithin fleece	18 1
Tsigai	23 4
Milk	13 4
Meat	0 2
Aboriginal breeds	1 3

Table 9 Number of sheep of aboriginal breeds by 1 January 1993

Breed	Area of distribution	Number	Ownership
1	2	3	4
Black head Plevenska	Pleven	10300	Public sector
	Pleven	6000	Private sector
	Dobrich	800	Public sector
	Russe	700	Public sector
	Sliven	500	Public sector
	Stara Zagora	500	Public sector
	Vratsa	9000	Public sector
Total Black head Plevenska		27800	
Karakachanska 12	Lovech	450	
	Smolyan	200	
	Sofia	200	
	Shumen	140	
Total Karakachanska 12		990	
Starozagorska 3	Stara Zagora	1200	Public sector
Sakarska 15	Stara Zagora Haskovo	2400	Public sector
Kotlenska 8	Sliven	680	Private sector
	Kotel	300	Private sector
Total Kotlenska 8		980	
Replyanska 11	Vidin	1300	Public sector
	Michailovgrad	1600	Private sector
Total Replyanska 11		2900	
Copper red Shumenska 2	Shumen	430	Private sector
Bresnishka 7	Bresnik	490	Private sector
Marishka 4	Plovdiv	350	Private sector
Dabenska 6	Plovdiv	370	Public sector

Table 9 Number of sheep of aboriginal breeds by 1 January 1993 (continued)

Breed	Area of distribution	Number	Ownership
1	2	3	4
Svishtovska 5	Svishtov	240	Private sector
	Pleven	200	Private sector
Total Svishtovska 5		440	
Karnobatska 1	Karnobat	650	Public sector
Strandjanska 9	Sliven	750	Public sector
Tetevenska 13	Teteven	450	Private sector
Staroplaninska 14	Pleven district	800	Private sector
	Sofia district	600	Private sector
Total Staroplaninska 14		1400	
Srednogorska 10	Pirdop, Koprivshtitsa	920	Private sector
Total number of aboriginal sheep		42680	

The **Marishka** breed is found mainly on private farms by the valley of the Maritsa River near the cities of Plovdiv and Pazardzhik Three hundred and fifty individuals of this breed are registered They are multi purpose animals, with an emphasis on meat, wool, and milk Average milk yield per lactation is 120 liters The wool is semi-coarse, white, levelled, and lustrous Average fleece weight is about 2 4 2 8 kg Sheep of this breed are large, long legged and light shouldered with a long body light bone system, and strong hooves Rams and ewes are polled Ears are large and sagging Their height is about 65 cm Average body weight is 40 kg Twining rate varies between 16 and 30% (37, 31)

The **Svishtovska** breed is found mainly on private farms located in the lowlands between the rivers Danube Yantra, and Osam A moderate continental climate is typical for these regions According to some studies (30) this breed is an intermediate strain between the Tzigay and Zackel breeds The Svishtovska sheep is one of the largest indigenous breeds in Bulgaria Animals are 68 cm high and 70 cm long Body weight is 42-44 kg The body is well covered with white wool Very often the face, poll, ears and legs are black or spotted The animals have strong muscular body constitution and are resistant to hard climatic and feeding conditions Milk yield is comparatively high 90 100 liters with 8 2% fat Fleece weight ranges up to 2 7 kg Ewes mature early and lambs gain weight rapidly

The **Dabenska** sheep breed is found throughout the lands around the town of Karlovo At present this breed numbers 370 animals, bred on a state owned farm The animals are large 65 67 cm high and 68 70 cm long Body weight is 40 kg (20) The body is well covered with wool This sheep is typically long in the tail Ewes mature late, while lambs gain weight slowly The wool is semi coarse and well levelled Fleece weight is 2 5 kg Milk yield is high – 94 liters (20) Results of blood polymorphic analyses are presented in Table 10 (23, 10)

The **Breznishka** sheep numbers about 500 It is bred on private farms near the towns of Breznik, Radomir and Tran Animals are medium to large with black spots around the eyes and nose Legs are white, black, or spotted and the tail is long Ewes are polled, while rams are sometimes horned Average body weight is 40 kg, and height 60 cm Milk yield of ewes is about 110-150 liters Fleece weight is 2 0 2 6 kg and the wool is semi-coarse Results of blood polymorphic analyses are shown in Table 10 (1)

The **Kotlenska** sheep breed is found in the semi mountainous regions of the eastern Stara Planina Animals are medium to large with strong bodies The body is well covered with wool, which is relatively short but well levelled and milder than in mountainous sheep breeds Wool production is 2 3 3 0 kg Milk yield is low 40 liters per lactation Individuals of this breed are very adaptable The Kotlenska breed differs from other sheep breeds located on the Balkan Peninsula by the frequency of some alleles of the transferrin and albumin polymorphic systems (11 13) This breed is a carrier of some very rare alleles albumin Alb T and transferrin Tf

Indigenous Sheep Breeds in Mountainous Areas

The **Strandzhanska** sheep breed is found through-

Table 10 Polymorphous erythrocytic enzyme and protein systems and allele frequencies

System	Allele	Allele frequency by breed			
		Copper red Shumenska	Bresnishka	Kotlenska	Dabenska
1	2	3	4	5	6
Hemoglobin	Hb A	0 354	0 209	0 149	0 117
	Hb B	0 646	0 791	0 851	0 823
Catalase	Cat F		0 211	0 583	
	Cat S	0 823	0 789	0 413	
Diaphorase 1	Dia 1A		0 546	0 598	
	Dia 1B	0 413	0 454	0 413	
Diaphorase 2	Dia 2A		0 587	0 404	
	Dia 2B	0 413	0 413	0 596	
Carboanhydrase	Ca F		0 014	–	
	Ca S	0 596	0 986	1 000	
X protein	X A		0 258		
	X a		0 742		
	X X	0 285		0 211	
	X x	0 715		0 789	
Arlysterase	EsA +			0 263	
	EsA			0 737	
Alkaline phosphatase	Akp B			0 442	
	Akp O			0 558	
Glutathione	GSH H	0 474			
	GSH R	0 526			
Albumin	Alb F	0 010		–	
	Alb S	0 051		–	
	Alb V	0 909		0 848	
	Alb W	0 030		0 130	
	Alb T	–		0 022	
Transferrins	Tf E	–		0 016	0 016
	Tf A	0 091		0 221	0 199
	Tf B	0 212		0 284	0 309
	Tf C	0 551		0 337	0 111
	Tf D	0 010		0 079	0 365
	Tf M	0 015		0 005	–
	Tf G	0 121		0 058	–

a body weight of about 30 kg Height is 50 54 cm Lambing weight is 3 0 3 5 kg Twining rate is very low The wool is coarse and fleece weight is 2 1 kg (38) Pure bred animals are raised on state farms in the Sliven re gion The valuable genetic resources of the Strand zhanska breed are often used in crosses with other sheep breeds in the region in order to improve their adaptability and endurance

The **Srednogorska** sheep breed is raised by private farmers on the slopes of the Sredna Gora and Stara Planina Mountains near the town of Pirdop This is a small sheep breed with a body weight of 35 38 kg Body height is 60 65 cm and body length 59 62 cm Animals have compact, well built bodies Ewes are polled, rams have nicely whorled horns Lambing weight is about 3 kg Over 70% of the population has pale wool containing some red fibers The face, ears and legs are usually black Individuals with white red spotted wool occur rarely Wool is mild and fine compared to other indigenous breeds but with very low fleece weight (1 3 kg) Milk yield of ewes is 45 47 liters with 8 09% fat Fertility is low – about 90 100% – although ewes have unusual maternal abilities (37 31)

The **Replyanska** sheep is typical of the coarse wool breeds It is found in the western part of the Stara Planina Mountains The Replyanska breed is relatively small with a compact and vigorous body Extremely tenacious ani mals, they are very well adapted to mountainous farming and feeding conditions Body weight is 34 kg on average Height is 58 cm and length about 65 cm Over 95% of the animals have white fleece The whole body including the belly and legs is well covered with wool The wool is coarse with varying qualities Fleece weight is about 2 0 2 2 kg Milk yield is 90 100 liters per lactation Re sults of studies of the polymorphic erythrocyte enzyme and protein systems are shown in Table 11 (1)

The **Karakachanska** sheep breed is found through out the mountainous areas of Bulgaria The number of purebred individuals of the indigenous Karakachanska sheep breed is very small In different parts of the country there are larger numbers of crosses with other breeds In the past the breed was one of the most wide spread in the Balkans Animals are small vigorous, strong boned and short legged lively, and resistant to unfavorable climatic and feeding conditions and diseases Hooves are hard Rams have long, heavy whorled horns The head profile is bowed Face ears legs and nose are black The greater part of the population has pigmented wool – grey to black sometimes brown Wool is predominantly coarse Fleece weight is 1 5 2 5 kg Body weight of the ewes is 25 30 kg, of the rams 40 45 kg Body height of the animals is about 57 cm Body length is 62 69 cm Belly legs, poll and face are covered with wool Milk yield is 40 55 liters with 6 5 8 0% fat The allele frequency of some polymorphic systems of Karakachanska sheep breed are presented in Table 11 (1, 8)

Indigenous Pig Breeds

The **Eastern-Balkan** (Iztochno Balkanska) pig breed is located in the mountainous areas of eastern Bul garia It belongs to the group of small European primitive pig breeds with short pricked ears This local breed ori ginated from the domesticated European pig (*Sus Skrofa Domestica*) At later stages in its development this breed was obviously influenced by Asian pig breeds (*Sus Skrofa Palustris* Rutt) as well Proof of this hypothesis lies in the short legs and levelled back of the individuals (32)

These pigs are raised in herds in the forests The ba sic food are pannages Animals are virtually free of dis eases and can reach 15 16 years of age Anatomically the pigs of this breed are similar to wild boars The head is very big with elongated muzzle, having a slightly bowed nose and short strong frontal bones The profile length of the skull is about 31 5 cm and the width of the frontlet is 9 8 cm There are 7 cervical vertebrae 14 thoracic (with 14 pairs ribs), 5 lumbar 4 sacral, and small knitted caudal vertebrae Animals are of medium size At the age of 3 years carcass length is 110 120 cm and height is 70 80 cm Within the natural environment its body reaches its maximal weight of 80 120 kg weight at age three Occa sionally one finds animals as large as 180 kg in body weight The body is compact with heavy strong shoulders short neck, slightly bowed up back, and a skewed rump The coat is sleek over the whole body Under stress it will raise hard bristles on its back Ears are short pricked and move easily

The most prevalent coat color is black (which is dominant) but there are individuals with spotted and very rarely white coats Sows farrow twice per year The gestation period is 112 days Average litter size is 4 to 7 piglets, but sometimes reaches 10 Sows have un usual maternal abilities The suckling period lasts about 3 months In terms of meat production capacity the pigs of the Eastern Balkan breed defer to those of the contempo rary cultivated breeds Slaughter analyses show significant contents of intramuscular fat and low (32%) carcass meat yields

Investigations of stress resistance using the Hallotane test (21) showed that only 7 2% of the treated group had a positive reaction This provides evidence for the claim that pigs of this breed have extraordinary adaptive abili ties Research on blood group antigen composition has shown a significant difference when compared with other pig breeds In this breed one can find two very rare blood group antigens – Bb and Lf (5) Other studies (28 14) confirm that the Eastern Balkan pig differs from other big breeds in its transferrines amylase 6 phosphogluconate dehydrogenase and phosphohexisomerase One study (6) discusses the discovery of phosphohexisomerase allele PHI C on the basis of which the presence of genotype AC – not common in any other pig breed – is determined These results are confirmed in another work (15) that also indicates that there are two unique genotypes of this

Table 11 Polymorphous erythrocytic enzyme and protein systems and allele frequencies

System	Allele	Allele frequency by breed		
		Replyanska	Staroplaninska	Karakachanska
1	2	3	4	5
Hemoglobin	Hb A	0 400	0 208	0 202
	Hb B	0 600	0 792	0 798
Catalase	Cat F	0 323	0 329	0 360
	Cat S	0 677	0 671	0 640
Acid phosphatase	Acp A	0 414	0 657	0 548
	Acp B	0 586	0 343	0 452
Diaphorase 1	Dia 1A	0 786	0 517	0 615
	Dia 1B	0 214	0 483	0 385
Diaphorase 2	Dia 2A	0 432	0 347	0 245
	Dia 2B	0 568	0 653	0 755
Carboanhydrase	Ca F	0 005	–	0 014
	Ca S	0 995	1 000	0 986
X protein	XA	0 390	0 308	0 337
	Xa	0 610	0 692	0 663
Arlysterase	EsA +			0 130
	EsA			0 870
Alkaline phosphatase	Akp B			0 293
	Akp O			0 707
Glutathione	GSH H			0 709
	GSH R			0 291
Albumin	Alb A			0 020
	Alb B			0 030
	Alb C			0 740
	Alb D			0 210
Transferrins	Tf A			0 200
	Tf B			0 110
	Tf C			0 180
	Tf D			0 460
	Tf E			0 050

breed AC and AB All of these studies prove that the Eastern Balkan pig is unique in terms of genetic diversity and is of extraordinary interest for preserving as a valuable genetic resource

Indigenous Local Buffalo Breeds

The **Bulgarian Mediterranean Buffalo** is a local breed It origins can be traced to the Wild Asian Buffalo (*Bubalos Arnee*) There are over 23,000 buffaloes spread throughout the lowlands of southern

and northern Bulgaria The present population was developed by crossing the local Mediterranean breed with breeds imported from the Indian subcontinent As a consequence the number of purebred animals of the local buffalo breed is limited to 1 or 2% of the whole population Small herds are bred in some state farms near the town of Shoumen while larger ones are raised in the private sector mostly in the northern part of the country

The Bulgarian buffalo is a large animal 570 kg in body weight with strong bone structure and well deve loped muscularity Its height at withers is about 130 cm The coat is black or brown black Its horns are long, heavy, and grey black in color The age of first calving of buffalo heifers is about 36 38 months Pregnancy lasts 315 days (58) Calving weight is about 34 kg Milk yield is between 1500 and 1700 liters with 7 4 7 7% fat (3, 19 17) Lactation period is 263 days

Research on the characteristics of buffalo milk were carried out in the immediate aftermath of the Chernobyl disaster in 1986–1987 Compared to the other treated milks (dairy cattle, sheep and goat) buffalo milk was found to have had the lowest rate of radioactive contamination (519 Bq/l) These studies also showed that buffalo milk had the lowest content of such radionucleotides as Iodine 131, Cesium 137, and Cesium 134 (3)

CONCLUSIONS AND POSSIBILITIES FOR THE PROTECTION AND UTILIZATION OF THE LOCAL INDIGENOUS LIVESTOCK BREEDS IN BULGARIA

In conclusion it is worth emphasizing again the large variety of genetically valuable local livestock breeds in Bulgaria Some belong to rare genotypes that are increasingly important resources in the effort to preserve genetic diversity within different populations of farm animals One way to preserve this precious genetic resource is to design and apply a program for the development and improvement of small populations of farm animals and for the promotion of gene banks There are some *ex situ* programs that emphasize deep freezing of semen and embryos This has been applied mainly in breeding cattle and buffalo breeding and is practiced for the most part in the Research Institutes where the neces sary equipment and experts are available

Most of the local indigenous animal breeds are under the control of the National Service for Selection and Reproduction in Animal Breeding (NSSRAB) Although such animals are bred mainly on state owned farms the problems involved in protecting local breeds often stem from the fact that some of them belong to private farmers

Preservation is also becoming complicated by the fact that these animals have lower productive capacities than the cultivated breeds which makes raising them less competitive In this situation reasonable financial support and preferences for the private owners of local breeds will be indispensable The need for such support is even more pronounced due to the fact that much of this livestock is located in the so called 'hard' regions in the mountainous parts of the country

By preserving the genetic resources of the indigenous local breeds of farm animals, we will retain options for future use of their valuable adaptations in developing animal husbandry suited to these ecologically distinct regions of Bulgaria

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The Preservation of Autochthonous Breeds of Domestic Animals in Bulgaria

Jordan Danchev

OVERVIEW

Have sufficient measures been taken to preserve – and is the general public around the world aware of the importance of – the traditional local breeds of domestic animals? At first glance these might not appear to be very necessary or urgent questions Do we really need to preserve the aboriginal species that accompanied our forefathers during the Stone Age? How can these animals with their haggard appearance compare with their smooth and well fed heirs in modern animal husbandry? Few people are aware of the truth in this matter

This paper seeks to interpret in understandable language the real reasons and qualities that make preservation of the local breeds of domestic animals so urgent It aims to turn the readers' attention to this priceless biological resource and to explain how our contemporaries continue to be neglectful of this resource, filling the pastures of the world with several elite breeds and reducing the natural habitats of the aboriginal breeds

Everyone and in particular the wealthy countries and people must be convinced that the future rests on this reserve of genetic and species diversity These breeds must find a place in real life and not merely be preserved in refrigerated conditions and in small feeble populations Conditions of passive conservation must be transformed to ensure their active use and self preservation

INTRODUCTION

The friendship between *Homo sapiens* and some of our quadruped co inhabitants of the planet Earth began long ago, at the dawn of the Mesolithic era, and proved to be a very important step in mankind s development The domestication and taming of wild breeds was a monumental development equal only to the discovery of fire and marked the boundary between the old and middle stages of the Stone Age For over fifteen millennia domestic animals have been faithful companions and helpers of humankind They have provided food milk and meat Their warm hides have offered protection from the winter cold They have become a part of daily life They have been faithful assistants in the struggle to grow a handful of grain and during the long exhausting marches to conquer new lands Without them the success of human culture would have been unimaginable

Domesticated and tamed in different regions of the world over thousands of years, the various populations of animals have adapted themselves exceptionally well to climatic, organic topographic and other conditions and individual characteristics in these regions In this way, almost unnoticed and under the constant influence of man, the primitive local breeds of domestic animals were created

Today unfortunately these local autochthonous (i e , indigenous) breeds are leaving their habitats just as imperceptibly and are disappearing forever This process can be observed all over the world In the developed countries local breeds if they have not yet disappeared have become scarce Many other countries seem to be moving in this direction trend Despite growing awareness of the need to preserve aboriginal species the workings of primary economic principles are forcing livestock raisers to adopt highly selected and "productive" hybrids

THE SIGNIFICANCE OF AUTOCHTHONOUS FORMS OF DOMESTIC ANIMALS

1 Conservation of genetic and species diversity

All growth and development involves the overcoming of difficulties, which if not taken into account can ultimately cause restriction and failure The question to be asked is how long can the domestic animal survive? Is it not time to put an end to the mad rush for over production? Are we not already close to the limits of genetic engineering of some particular species and is there not in the unstoppable rush for over production a danger of destroying organisms? The thoughts of Commoner (1972) on the development of industrial style agriculture are still valid for all animal rearing 'All production both industrial and agricultural should be reorganized to turn away from more and more production dictated by desires for more profit and should adopt ecological requirements as its basis "

Carried away by the desire for genetic perfection the modern master of domesticated species has begun to receive the first danger signals The "subjects" have

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begun to suffer from new unknown diseases and are not protected against common ailments, from which indigenous species almost never suffer The process of reproduction is not always successful for this reason it is frequently necessary to discard highly selected and expensive types Animals adapt with difficulty to local ecological circumstances This often proves fatal dur ing the acclimatization of highly productive breeds to new geographic conditions Cultivated species usually rely on food resources provided by man and are par ticularly sensitive to terrain and pasture conditions Intensive breeding combined with stationary feeding and limited movement, creates conditions for low quality production in terms of taste and hygiene Apart from this, high quality production requires maintenance of a well balanced and high quality diet There are many countries in the world where this is not possible

The exhaustion and erosion of many modern breeds is already evident and sooner or later it can be expected to worsen It is becoming more and more clear that the 'new fresh blood" of the indigenous spe cies is required to halt this process The possible limitations of selection (selection plateau) need to be overcome but unfortunately such conclusions are not yet common knowledge among ordinary farmers whose main aim is to increase production In this manner conditions are created for the loss of the ge netic and species diversity of indigenous breeds and their irreversible removal from the natural evolution ary chain, in which indigenous breeds occupy a strate gic position between their wild relatives and their modern highly productive counterparts

What in fact are we losing? First of all, their high level of vitality demonstrated in their excellent adapt ability to local ecological conditions their high degree of resistance to disease their reproductive success (including the complete survival of offspring), their ab solute suitability to breeding conditions and their ac commodation to different types of feed As the fruit of the eternal harmony within nature, they are very hardy, with well developed and proportioned bodies and lively temperaments Apart from their role in solving present day problems the living "genetic bank" of indigenous forms of domestic animals has a par ticular strategic role in meeting the inevitable and un predictable requirements of the future These forms will certainly be important in terms of production of high quality food use of non traditional feedstuffs in husbandry adaptation to changing environmental conditions inherited resistance to new diseases, food production in extreme conditions and other factors affecting the future of agriculture

2 Development of resistance and the use of eco logical methods in producing food resources and other raw materials

The population crisis awaiting our planet, how ever optimistically one approaches it, cannot be ig nored It is difficult, even impossible to foresee all the vicissitudes of the future, but when all is said and done a planet of finite dimensions can be home only to a fi nite number of people At the moment there is enough room and until recently no one has specified what the maximum human population might be But as the world fills up with people, their first require ment – for food – remains The statistics of the United Nations Food and Agriculture Organization (FAO) are indisputable In 1980 mankind's total protein re quirement was approximately 4 2 million tons Only twenty years later by the year 2000 this figure will have risen by 50%

The attractive alternatives of plankton soup and seaweed steaks are still perhaps a long way off for our generation, but we have already seen sausages and other foods made of soya and other substitutes for natural meat Does this mean that the human race is being prepared for the unenviable fate of vegetarian ism? Amino acids are found in their best combina tions in meat The great culinary qualities of this irre placeable product are reflected in thousands of differ ent recipes all over the world It would be difficult to imagine the existence of the human race without this priceless gift of nature

At the end of the day what is the nature of the problem? Too many people? Too many animals? Too much meat? Do we not have sufficient modern breeds at hand? All we have to do is to decide High production of large numbers of animals requires stable feeding mainly with grain Purely and simply the growing number of modern animals are beginning to compete for food with the growing population of the planet and in the future this competition will increase progressively More of the cultured breeds of domes tic animals are indeed reared in a confined environ ment those that do go out to graze are becoming more and more choosy in terms of their pasture require ments Consequently any increase in the number of animals of modern breeds will lead to an increase in their requirement for grain which could in turn cause famine within the human population

At the same time, the extensive mountain semi mountainous forest, and other pasture lands which in the past were inhabited by many animals, are becom ing overgrown with weeds The organic proteins that were formerly transformed by domestic animals into valuable animal produce now lay covered with snow and rot uselessly This gives food for thought Would it not be possible to link the increase in numbers of cattle to the pasture land for which man has no par ticular nutritional use – for example the hard grasses (e g *Nardus stricta*) that are found in all the high mountain pastures and that are not accessible to the cultured breeds?

This gives rise to another question to what type of animal could we turn? There is only one answer the indigenous forms of domestic animals and hybrids produced by cross breeding This is where modern man should turn his attention – toward the selection of animals that are well adapted to natural pastures, to zones unsuitable for traditional agriculture and to the

use of the nutritional potential that is not in competi tion with human needs

In contrast with modern cultured species the primitive forms of domestic animals are adapted to use coarse forages of low nutritional value and to use pasture resources more completely In this respect, they are closer to their wild relatives That which cows do not eat the sheep will gather and that which is of no interest to either is of great interest to pigs

From an ecological point of view, an important precondition for pastoral husbandry is that the number of animals should correspond to the carrying capacity of the pasture in order to avoid exhaustion and ero sion of the pasture lands and competition with wild species Today however, instead of intensive grazing we are more likely to speak of intensive weed growth The reduction in the number of sheep is beginning to worry ecologists In this case we are concerned not so much with the decline of sheep products but with the significance of sheep for the protection of pasture and grazing land from undesirable changes

However strange it may seem only sheep are ca pable of taking action against such phytocenotic changes These four legged lawn mowers are much more efficient than any machine do not require petrol, require hardly any maintenance and work completely automatically from morning until night – including Sundays and other holidays The action of sheep hooves as well as their excrement is of significance for the vegetation by softening and fertilizing the soil This can indisputably enrich and regenerate degraded ecosystems

Often the opposite is true when we cordon off an area of mountain pasture then the pasture can be de stroyed It has often been observed that as some grass types begin to dominate others disappear and new ones appear The composition of the flora changes and becomes atypical for the locality A typical exam ple is the diversity of grasses in the forest regions of our country where we face a particular dilemma What status should be given to refugia and species centers of origin? If these are granted the status of re serves and protected areas then this will eventually mean growth toward a climax community In many cases the forest's natural community will become es tablished in the area of the grass phytocenosis and the genetic variety of endemic flora may be lost The so lution would be to maintain a definite regime of forest management or some other form of intervention – moderate grazing or mowing and cutting which would guarantee humidity and light conditions

From time immemorial one of the most important applications of the domestic animal has been to pro vide food for man The domestication of some varie ties of wild animals – or to be more precise the herding of them to areas with more reliable food sup plies – caused a demographic explosion during the Neolithic In the course of just one millennium, the human population of the earth increased more than 16 times, from approximately 5 million to 80 million

It is completely natural that from then until now domestic animals have come a long way along the path of development both in morphological and in physical terms, as well as in their relation to the quantitative and qualitative criteria of their productivity However many of the productive qualities of the local species of domestic animals are even now of interest and moreover allow them to compete favorably under modern husbandry conditions The meat and milk of these animals is valued more highly, and in the future will be even more valuable because of their excellent nutritional taste, and hygienic qualities

It is well known that the feed for these animals consists mainly of grass from pasture land and that they rarely need to be given additional feed Their typical habitat includes mountainous and semi mountainous regions where anthropogenic activity is as a rule less prevalent, the air and water are less pol luted, and existing pollution is usually less below per missible limits Thus, the people who consume prod ucts from these animals, as the last link in a given ecological chain will receive less (or perhaps no) car cinogenic or radioactive agents, heavy metals, and other modern poisons In fact the environmentally conscious methods under which they are reared guar antee high quality products

Buffalo milk in Bulgaria is recommended as a dis ease preventive and is prescribed in the case of certain specific ailments that are difficult to treat (e g leuke mia cancers and bowel disorders) Goats' milk is a wonderful substitute for human breast milk because it is richer than other milk and is easily digested and as similated by the human organism it is given to small children and the sick Sheep and buffalo milk are used in the production of high quality full fat milk products which also have high dietary and medical value Re searchers have proven a link betwee ı the rich and unique composition of the amino acids of milk from local cows in the Rhodope Mountains in Bulgaria and the longevity of the local people The milk from the local breeds of sheep is still processed in old dairies situated in the mountains Not only are their special milk products unknown in the modern commercial milk industry but the dairies themselves and the life around them are unique historical attractions It is not difficult to see why the meat from these animals is preferred The ways in which it is used locally are not only valuable as culinary achievements but as colorful parts of the local folklore It is hardly necessary to speak about the attractive qualities of all these various products which reflect the primacy and the strength of nature

One of the basic products of sheep is wool The quality and quantity of wool from local breeds is sig nificantly lower than that of the fine fleeced special ized wool breeds The value of the wool from local breeds is always however, greater than that of wool from the highly selected breeds Other qualities of the

wool of the local sheep also are of interest Recently the world wool market has taken a sharp and unex pected turn moving away from the merinos and to ward the primary, coarse and natural fleece of their primitive relations Some people insist that this is purely a fashion trend while others believe it to be connected to the boom in the production of artificial wool by the chemical industry Perhaps the reason lies in the natural and lasting colors of natural wool and the economy in the use of dies

Despite this shift the sale of coarse and semi coarse naturally pigmented wool on international mar kets is limited While some countries with advanced husbandry do not have the ability to create fashionable colors, since the local breeds of sheep have long been forgotten countries where the indigenous breeds still exist have at their disposal a wide range of colors For example there are about twenty local breeds of sheep in Bulgaria and the natural coloration of their wool varies from pure white to reddish brown to black Be cause wool from these animals has long and well formed fibers it is used by craftsmen in the production of blankets and rugs of great artistic value The local animal breeds are also a good source of strong and long lasting hides for the leather industry

The splendor and the strength of the wild ox has for centuries tantalized the eye of man The acute need for a powerful helper forced our forefathers into a desperate struggle with this horned beast Man won this struggle For millennia this powerful beast un ceasingly toiled before the plow and the cart, provid ing man with bread and prosperity Man made friends with the horse much later than with other domestic animals in all probability for culinary needs This led to the horse assuming an enormous role in history mainly as a means of transport and as part of the workforce A similar fate befell the black buffalo of the Asian marshlands Its tractive strength did not es cape the attention of our forefathers

The technical genius of the same men managed to break the monopoly of domestic animals in agricul tural work transport and communications Only ves tiges remain today of the past hegemony of these do mestic animals Despite this in certain regions of the world – especially in mountainous areas and in the lesser developed countries – the heirs to the ox horse and buffalo continue to be irreplaceable assistants in the work of the farmer It goes without saying that these are typical representatives of the indigenous do mestic fauna which are used not only for their primary products but also for work Today practically no one would predict the return of the plow and the cart, but the exhaustibility and the increase in the price of mod ern sources of energy is forcing many poor people in the world to look backwards

When speaking about indigenous forms of do mestic animals and their significance, it would be wrong to ignore their role in the creation of rituals in mankind's daily life To the rich palette of human ex istence the aboriginal animals have added and con tinue to add many nuances and primary colors Their disappearance would deprive civilization of its natural diversity

3 Knowledge of evolution, domestication, and natural and artificial selection

From time immemorial humanity has been insep arably linked with various species of domestic animals There is no doubt that this is why many archaeologists have for over a century tried to obtain information about the daily life and culture of ancient peoples by identifying the retrievable bone matter of animal ori gin At the same time, man's curiosity rose with regard to the mystical origins of his eternal companions, the domestic animals This in its turn gave rise to the study of the history of domestic animals In a rela tively short period of time, scientific activity in this area has won support As a result, various theories and hypotheses have been propounded about the pos sible forebears of both the ancient animals and the modern representatives of primitive domestic fauna and about the time place and conditions of their do mestication

Despite the tireless work of many researchers over a period of more than one hundred years, there are still many interesting unresolved questions con cerning the taming and domestication of wild animals and subsequent domestic forms The primary factors that drove man at the end of the Stone Age into his unequal struggle with ferocious wild animals are still unexplained Did they have a social economic or rit ual significance? Which species of animal dominated? Was man at that time herbivorous or omnivorous? Was it hunger or religious fanaticism that drove him to overcome his fear and instinct for self protection and to enter into hand to hand combat with the wild beasts? Many scientists believe that the main reason was food Why then did man begin the process of domesticating the dog? Can we really believe that the wolf or the jackal were the most harm less and vulner able neighbors of our forefathers? If mankind was ruled by culinary needs and relied on large quantities of meat then obviously neither the taste nor the quan tity would have been the primary reason

The dispute over the historical priority of crop ag riculture or animal husbandry has been carried on for over a century The currently prevailing opinion is that animals were domesticated only when there was the possibility of providing minimal quantities of food Consequently we can presume that agriculture came first i e that human life was already established in settlements This begs the question of how the no madic way of life evolved and persisted – a question that clearly remains Despite advances in archaeologi cal dating it is still impossible to answer with complete certainty the questions of where, when, and how the various domestic animals appeared If we are certain that the domestication of certain species began in Central Asia, we might not regard seriously the ar chaeological discovery of new centers of breed forma tion in Africa or Europe in the future Such a discov

ery would direct questions in a completely different direction

But in paleontology we still cannot distinguish with complete certainty the bone matter of domesticated animals from that of wild animals One of the methods is to classify bones according to size For example in the case of the cow, bones that fit within certain limits can be identified as belonging to the wild ox (*Bos primigenius*) all smaller bones are considered to belong to domestic cattle This would be very simple if researchers had not also discovered bones of the ancestral domestic cattle – the short horned long headed domestic cattle of the Brachyceros and Longifrons breeds Moreover there is authentic evidence of their survival to the present day (as with for example the Brachyceric cattle in Georgia the Rhodope Mountains and elsewhere) Scientists who initially believed in a single lineage in the origin of domestic cattle have been obliged to admit the possibility of multiple lineages Some researchers presume that the Brachyceric cattle originate from a more ancient wild ox which in all probability was a close relative of *Bos Primigenius* If this is the case then we inevitably arrive at a dilemma how do we differentiate the bones of the mini wild ox from those of the domestic cattle? The bone matter of both is classified as smaller than that of *Bos Primigenius*

This scientific research has contributed to the development of archaeology For example the transition from (or boundary between) the Paleolithic and the Mesolithic in archaeology has been identified as the beginning of domestication – that altruistic act through which our forefathers by subjecting the surrounding wild animals to their will achieved one of the greatest feats in cultural development

Therefore one more reason exists for the preservation of indigenous breeds of domestic animals their significance as authentic material whose place in archaeology and the history of domestication is irreplaceable Society cannot allow the destruction of these unique domestic breeds, created by nature and man over the millennia and left to our care and protection We preserve ancient monuments and works of art but allow ourselves such uncaring attitudes toward these antique artifacts which are some of the few remaining items of material evidence of the skill and nobility of our forefathers We all love our history Who would not want to know more about our forefathers their daily life, culture enemies, and friends? Who would not like to delve into a past enshrouded in mystery? Are we then entitled to treat these witnesses to the past still living here and there around the world so carelessly?

The preservation of local forms of domestic animals has another ecological aspect In zoological systems the concept of breed does not have a taxonomic significance but is closely connected with the concept of zoological species There is a very close link between the concept of breed and the taxonomic unit of subspecies (into which some researchers place them) In the case of both wild and domestic animals, geographical variety can lead to a multitude of forms within one and the same zoological species as a result of selection In the case of wild forms this is termed natural selection in the case of primitive breeds, both natural and artificial selection, and in the case of the cultured breeds artificial selection This is why, when we preserve indigenous breeds of domestic animals that are threatened with extinction we are in fact preserving threatened subspecies of a wild species

This is also important in terms of the preservation of these ancestral animals Some of the wild forefathers of the domestic animal species have disappeared Others have found their place in the various categories of the red data books of endangered species Up until now attempts to restore these extinct species have always begun with the most primitive forms of the relevant breed of the domestic species

AUTOCHTHONOUS FORMS OF DOMESTIC ANIMALS IN BULGARIA

Despite its relatively small territory, Bulgaria possesses among its large mammals a rich diversity of autochthonous domestic breeds There are a total of thirty seven three breeds of cattle, one breed of ox twenty breeds of sheep one breed of goat, three breeds of pig, six breeds of horses and three breeds of dog

1 Cattle and Ox

Within Bulgaria there are three recognized forms of domestic cattle the Local Grey and its offshoot the Iskar Grey, selected mainly for productivity and the Rhodope Shorthorn As is well known, the Rhodope breed is a representative of the brachyceros type of cattle and the Grey is a result of prolonged cross breeding between the brachyceros type and a primigenius type This crossbreeding has taken place with varying degrees of intensity and continuity in different places in Bulgaria the result of which in the recent past has been a rich diversity of combinations It has been established that in regions lower on the mountains where forage conditions are better, larger and more productive primigenius types are predominant The opposite is also true the influence of the smaller, less productive brachyceros type increases with altitude

The average live weight of Grey Iskar cows is 390kg Average milk yield is 2500 2600 liters, with a maximum of 6928 9 liters The fat content in the milk is on average 4 2% with a maximum of 5 7% They are exceptionally hardy and strong In addition to milk these animals are used to provide tractive power (up to the age of 15 or 20 years) They are bred mainly in the region of the rivers Iskar, Vit Osam and Rositsa, from whence the breed received its name Unfortunately the population of this breed has declined from 74,152 in 1957 to just 281 today Put another way, Iskar cows in 1957 represented 7 1% of the

cows in the country and today represent practically nothing

In terms of morphological features Local Greys are similar to Iskar Greys but are smaller and signifi cantly less productive On the other hand, they were once widespread throughout Bulgaria In 1957 they numbered 429,975 or 41% of the cattle in the country Today the Local Greys are on the brink of extinction

As suggested by its name the Rhodope Shorthorn evolved in the Rhodope Mountains Together with the Albanian and Southern Montenegran cattle the Rho dope cattle is the last remnant of the prehistoric brachyceric cattle in Europe It was domesticated over 8,000 years ago and is also referred to as the Thraco Illyrian Brachyceros Small in size, they are capable of using any type of mountain pasture Their average live weight is around 220 kg Their average milk yield is between 1100 1200 liters with a maximum of 2623 li ters The fat content in the milk is on average 4 5%, with a maximum of 5 9% Comparisons among all the local and improved breeds of cows in Bulgaria show that the Rhodope Shorthorn breeds are second only to the Bulgarian Red Cows in production per 100 kg live weight Moreover they live 2 3 times longer than the highly selected breeds and can produce offspring and milk into advanced age They are practically immune to illness and have excellent adaptive capabilities In the winter when food is scarce they usually lose about 20% (50 kg) of their body weight but regain it in less than one month in the spring by grazing In 1961 52 956 were alive They now number less than 250 in the entire Rhodope Mountain range

It is well known that the domestic ox originated in Indo Asia Its appearance in Europe and Bulgaria has not been fully explained either historically or in terms of the direction of migration According to some data sources the domestic ox came into Europe with the Saracens from North Africa via Italy in 595 A D Other data indicates that it appeared in Italy at the same time as a present to Agalulf, the king of Lom bardy from the Avarian khan (the Varians were a semi nomadic people of Turkish origin, originating from Central Asia) According to other information the ox appeared in the Balkans with the Proto Bulgarians in 679 A D One of the earliest historical documents in which the ox is mentioned is the famous Sulemankyoi manuscript On one of the marble col umns in the palace of Pliska there is an inscription of the peace agreement between khan Omurtag and the Byzantine Emperor in 814 AD wherein it is men tioned that khan Omurtag had insisted on the receipt of two oxen for each prisoner freed In general the appearance of the ox in Bulgaria still remains a mys tery

While the wild ox is 180 cm high and weighs 1 1 5 tons the domestic ox is about 50 cm smaller (about 130cm) and only one third the weight (about 500 kg) It's coat is red and quite thin The domestic ox is characteristically sensitive to cold and heat Its milk is very rich in nutritional qualities and is recommended both prophylactically and medicinally for serious ill nesses It is very rich and high in fat content (about 10%) The number of oxen in Bulgaria peaked at 467,872 in 1905 Today this valuable animal is threat ened with extinction

2 Sheep and Goats

No other domestic animal can compete with the sheep in terms of the variety of consumer products it has supplied to the human race for millennia This small valuable animal has spread throughout the world in a wide variety of forms The climatic condi tions in Bulgaria were favorable for the development of sheep breeding even in prehistoric times In the re cent past, the population of these domestic animals in Bulgaria has consisted of pure indigenous forms, which are relatively numerous despite Bulgaria's small size The local forms of sheep have varying morphological features, associated with the specific ecological condi tions in the regions where they are located Accord ingly the names of the local breeds are linked to the names of the regions in which they are found The more typical forms of primitive autochthonous breeds are examined here

Karakachan Sheep

This sheep of the nomadic Karakachan and Kut sovlas tribes existed widely in Bulgaria until the late 1950s All researchers who have written on the subject have come to the same conclusion – that the Karak achakan sheep is the most typical and most primitive representative of the coarse wool type of sheep in Bul garia It is relatively small but has an exceptionally lively temperament It is hardy and highly mobile, ca pable of covering long distances in search of pasture or during the seasonal migrations of the Karakachan people It is very resistant with great vitality, and is exceptionally adaptable to local ecological conditions It is practically immune to illness and regularly pro duces offspring They require minimum care and are famous for their adaptability to available food They require practically no supplemental food during the winter except during the most severe snows when they cannot find pasture They have a very strongly developed flocking instinct and individuals are rarely known to graze apart from the main body of the flock The average weight of the ewes is around 35 kg Lambs weigh around 25 kg and rams 66 kg Despite their small size, their milk yield during their lactation period is about 40 liters with 6 5 8% fat content Their wool weighs on average 2 5 kg with a maximum of 3 5 kg and the wool yield is about 60% During the summer the Karakachan people lived in the Rhodope Rila, Pirin, and Stara Planina Mountains with their flocks and in the winter migrated to the coastal pas tures of the White Sea and Black Sea At the begin ning of the century there were about 330 000 500 000

Karakachan sheep and according to some sources even more This number decreased to 158 896 by 1957 Today there are less than 2000

Bukyovets Sheep

Another representative of the coarse wool sheep in Bulgaria is the Bukyovets breed which was very wide spread in northwest Bulgaria, particularly in the western part of the Danubian plain and in the valleys of the rivers Ogosta and Tsibritsa These typical local sheep were found in the villages of Bukyovets Hurlets Glozhene, Butan Sofronieveo Hairedin Kozlodui, Vulchedrum Yakimovo and others It was extremely well suited to the severe climatic conditions of the re gion (from 35?C to +35?C) relying only on pasture It was practically immune to illness and regularly pro duced offspring It is also disappearing

Svishtov Sheep

In the recent past in the region of Pleven and Svishtov in the Danubian plain along the rivers Yan tra Osam and Rositsa and on the plateaus between the rivers, there was a breed of sheep typical of this region called the Svishtov Sheep Characteristic rep resentatives of the population could be seen in Svish tov Karamanovo Vardim, Gorno Ablanovo, Bulgar sko Slivovo Oresh and other villages The Svishtov Sheep is one of the larger autochthonous forms of sheep and is typical of the coarse wool breeds found in the plains It is white in color, and very resistant to extremes of temperature (which in its native region are the most extreme in the whole of Bulgaria) It is able to find food even in the summer months when the grass of its habitat has dried up Its population in 1957 was 698 075 Today it has declined to no more than 300

Replyanska Sheep

This sheep is a typical representative of the coarse wool sheep widespread in the western parts of the Stara Planina, Svetinikolska Planina Chiprovska Planina, and the mountain regions of Belogradchik and Montana The center of the habitat of this sheep is the village of Replyana from which it took its name It is relatively small mobile and resistant It is mar velously suited to its habitat in the broad mountain and high mountain pastures and meadows

Copper red Shumen Sheep

The habitat of this sheep in northeast Bulgaria stretches from the Black Sea in the east to the foothills of the eastern Stara Planina in the south and em braces the eastern part of the Predbalkans the valleys of the Kamchia and Provadia rivers, and the whole of the Ludogor plateau It takes its name from the town of Shumen and from its copper red color

Karnobat Sheep

Along the low southern slopes and foothills of the eastern Stara Planina south of the line between of Yambol and Elchovo, with a center in the former Karnobat region the historically famous Karnobat sheep was raised Of all the local forms of sheep known in Bulgaria the Karnobat sheep was probably the most famous and widespread Its wide popularity was due mainly to the high quality of its products There was no other lamb or mutton more delicious than the meat of the sheep and lambs of the Karnobat region The wool was also much sought after It was the only soft wool available in Bulgaria directly after the liberation from the Ottoman Empire The Karno bat and the Copper red Shumen sheep are almost identical in their origins and in their morphological and productive features In 1957 the population num bered 878,582 Today there are only about 1000 left

Pirdop Sheep and Panagurishte Sheep

In the broad pastures of the former Pirdop region on the slopes of the Stara Planina and the Sredna Gora the specific ecological characteristics and eco nomic conditions of the past contributed to the crea tion of a local form of sheep called the Pirdop In the furthest northwest part of the Thracian lowlands in the foothills of the Sredna Gora along the river Luda Yana there was a breed of sheep called the Panagur ishte Sheep Its habitat embraced the villages of Pa nagurishte Strelna Buta, Popintsi, Banya, Poibrene Oborishte and Koprivshtitsa Its meat was used to make the famous Panagurishte Pasturma and its wool was used in the famous Panagurishte carpets The Pirdop and Panagurishte sheep are also sometimes known as Srednogorski They are also disappearing

Sofia Breznishki Sheep

In the southwestern part of Bulgaria mainly in Sofia, Breznishki Trun, Radomir Samokov, and Ikhti man, the Sofia Breznishki sheep was once wide spread Today they number 526 and are also on the verge of extinction

Starazagora Sheep

The most typical sheep of the plains of South Bul garia is the Starazagora Sheep Its habitat stretches from the southern slopes of the Stara Planina in the north to the line between Yambol and Elchovo in the east and in the south and the west merges with the habitats of the other varieties of white south Bulgarian sheep – the Plovdiv Purvomaiski and Maritsa The Starazagora sheep is the largest and most productive of the autochthonous sheep described here From a

total population of 1,060 296 in 1957 their numbers have been reduced to 5000 It can still be seen in its habitat

Black-headed Pleven Sheep

Among all the local breeds of sheep this is the most productive Its habitat lies between the Danube in the north the foothills of the Stara Planina in the south the Osam River in the west and the Iskar River in the east Agriculture in this region is well devel oped which has contributed much to its continued breeding It is the only local form whose population numbers in the tens of thousands

Rila Monastery Sheep

The softest wool of the local breeds is provided by the Rila Monastery Sheep It was bred only in the Rila Monastery where its population varied between 2000 and 10 000 animals It disappeared about 1960

There are other autochthonous forms of sheep in Bulgaria that exist as small isolated populations and that have not become widespread These include for example the Kotlen Teteven and Dulben sheep They have not been the object of separate research There are also a number of other popular breeds in cluding the Srednorhodope Strandzha, Sakarska and Maritsa Sheep whose habitats are accordingly situated in the Rhodope Strandzha and Sakhar Mountains and the basin of the Maritsa River Unfortunately, their populations have been greatly reduced

Autochthonous goats in Bulgaria belong to no specific breed but differ in morphological features They are classified according to size and the form of their horns Bezoarov with relatively long flat and curved horns Vintorog with massive and spiral horns, Priska with massive horns with a single smooth curve As is well known the goat is the least particular ani mal in terms of its food and its ability to digest cellu lose is shared only by the camel Goats milk has high dietary and medicinal qualities Because it is closest in composition to mother's milk it is very suitable for children and the ill Unfortunately the number of goats has been seriously reduced in the recent past

3 Pigs

According to research there were three autoch thonous breeds of pig in Bulgaria in the recent past the Klepoucha (curved ear) Pravoucha (straight ear), and East Balkan They remained out to pasture all year long

The local Klepoucha Pig was usually dirty white in color with occasional black or speckled individuals They were widespread throughout Bulgaria About fifty years ago the primitive Klepoucha pig was com mon in the regions of Botevgrad Berkovo Elin Pelin Trun, Kustendil and Blagoevgrad It is now believed to be extinct

The Pravoucha pig was known to exist before the liberation from the Ottoman Empire and shortly after wards It was small and similar to a wild boar and shared the same ancestry as the Klepoucha It had a relatively short head and small straight forward pointing ears Both the Klepoucha and the Pravoucha disappeared from Bulgaria long before they could be studied

In the recent and distant past, in almost all of eastern Bulgaria (with the exception of the extreme northeast) there was a primitive autochthonous form of pig It was more similar in its morphological fea tures to wild than domestic pigs It was known under many names – the Kamchiska the Smyadovska the Rizhska After studies by Khlebarov in 1920, it was given the name Eastern Balkan, despite the fact that most of its population in the past and now is to be found in the Strandzha region It is usually black The upright bristles on its spine are longer than those on the rest of its body and create a comb along its back The Eastern Balkan pig lives in herds that wander the forests year round Its main foods include oak and beech acorns roots plants worms insect larvae and insects and wild fruit In 1961 the population was 139 644 Today there are no more than 500 individu als

4 Horses

During the first survey of domestic animals car ried out in Bulgaria in 1892 there were 343,944 horses Undoubtedly, most of these were local breeds Until then and for a long time afterwards (1929 when the first paper on the classification of the separate forms of local horses was published) only one type of local breed was recognized After this paper appeared several additional academic papers were published in a relatively short period of time They specified the characteristic differences among horse populations in different regions based on research into their external features and adaptations to specific ecological conditions over a long period of time in a particular geographical region As a result of this re search we are now aware of the existence of several indigenous forms of horses most of which have either already become extinct or are on the verge of extinc tion The horse population in Bulgaria in 1957 totaled 100 751 They are now reduced to no more than a tenth of this in the whole country

Deliorman (Ludogora) Horse

As indicated by its name this horse was a charac teristic inhabitant of Deliorman and is considered a typical local lowland horse It was usually chestnut in color with a clearly marked black line along its spine For hundreds of years it was reared in herds, which wandered the forests and pastures year round, forag ing for themselves A special feature of the Deliorman

Horse was its remarkable adaptability It was ex tremely robust as a work horse or saddle horse Its fame reached beyond the borders of Bulgaria It was one of the most sought after horses in the Balkan peninsula and the Ottoman Empire It too has disap peared

Staroplanina Horse

Along the whole of the Staroplanina mountain range with the exception of the eastern branches and the valley of the Kamchia River there was from time immemorial a primitive pack horse, adapted to the lo cal mountain conditions known as the Staroplanina horse Individual horses may still be found in some of the more isolated villages and hamlets mainly in the central part of the Staroplanina mountains where they continue to serve as a means of transport of goods and people Such horses have been observed in the vil lages of Cherni Vit Divchoto Litakovo and other villages The Staroplanina horse is chestnut in color but is frequently roan, black or grey It has a charac teristic long mane on its forehead and neck and is cov ered in tufts of long, thick and coarse hair It has a short low body with a voluminous belly It also is on the verge of disappearing

Riloplanina Horse

In the northern and the western parts of the Rila, Predel and part of the Pirin Mountains in the regions with a well developed forestry and tree felling indus try, the Riloplanina Horse was widespread Its habitat was broad meadows and pastures The production and trade of wood allowed for the supply of large quanti ties of grain from the productive parts of Bulgaria The conditions under which these horses developed were very different from those of the Staroplanina horses despite the fact that both regions are moun tainous This was a larger horse and was particularly hard working with great tractive strength It is now considered extinct

Karakachan Horse

This horse is one of the most typical of the local primitive breeds, due mainly to the very conservative traditions of animal breeding among the wandering Karakachan people The nomadic Karakachan people kept their sheep out to graze year round constantly migrating back and forth between summer and winter pastures During this migration they travelled with their whole families and all of their worldly goods It was natural therefore that they should use horses spe cially bred for this purpose All of the Karakachan animal husbandry practices were based on a single principle the production of consumable products based purely on natural resources The only source of food available to the horses all year long was pasture It is a relatively small horse that, due to its very mus cular body, always looks well fed It is characteristi cally chestnut in color, less frequently grey, black or roan It typically has a long, thick mane on its fore head and neck and a long tail sometimes reaching down to the ground In 1958 the last Karakachan horses were forced out of their habitat, as a result of which their numbers are seriously reduced They are now threatened with extinction

Kamchia Horse

The Kamchia horse is in fact a variety of the Staroplanina horse The morphological differences between them are due only to the specific ecological conditions of the Kamchia valley This horse is the tallest and largest of all the known primitive local forms of horse It has also disappeared

Rhodope Horse

This horse was considered a variety of the Staro planina horse It was slightly smaller and slimmer It was of course, widespread in the Rhodope Mountains where in the more isolated villages individuals it can still be seen

5 Dogs

In Bulgaria the dog appeared at the beginning of the Neolithic accompanying the earliest settlers in the territory Man soon realized that a domesticated wolf could be useful as more than just a source of food – as a hunters' friend or as a faithful guard, the two most ancient canine professions These features are domi nant in some of the autochthonous breeds of dog in Bulgaria

Bulgarian Deliorman (Ludogora) Hunter

It is believed that even about four thousand years ago the Thracians and Illyrians hunted with such dogs Some people believe that it is the best of all hunting dogs The Deliorman hunting dog is coal black in color sometimes with a white spot on the head It possesses a very strong sense of orientation and a good sense of smell and is very robust It is not officially registered as a breed and no sur vey has been made of its population in Bulgaria One of the reasons for the reduction in the number of these dogs is its export to neighboring Balkan countries

Baraka

Another of the Bulgarian hunting dogs is the Baraka It is dirty grey to rusty brown in color and has hunting qualities similar to those of the Deliomen hunting dog It is found mainly in southern Bulgaria the Rhodope Mountains and Strandzha It is also dis appearing

Karakachan Dog

This is a massive well proportioned dog, whose appearance radiates strength and respect Possessing courage and dignity combined with calm and loyalty it has been the friend and guardian of ancient and modern people Its fur varies in length and so the breed has two types – short haired (with fur length of up to 6 cm) and long haired It is black, grey, and brown in color with varying nuances of ginger yellow and tiger It is frequently speckled, spotted and sometimes white Male dogs weigh about 40 50 kg, and females about 35 40 kg The height of the males is a minimum of 63 cm and of females 60cm Its head is proportionate to its overall appearance its ears short and small, its nose large and always black Its neck is short and powerful and its tail long and furry Its moves in a characteristically bouncing manner It never admits defeat It either wins or dies The forced elimination of Karakachan dogs from the mountains is one of the main factors threatening it with extinction Another contributory factor is the lack of any standard and any elementary knowledge of the morphological features of the Karakachan dogs amongst the people who still own them uncontrolled inter breeding with non typical types the destruction of female animals, and the general lack of interest in the conservation of this valuable dog They can be still found in the more isolated villages of the Rhodope Rila Pirin Stara Planina, and Strandzha Mountains and elsewhere

CONSERVATION STATUS AND THE RED REGISTER OF AUTOCHTHONOUS FORMS OF DOMESTIC ANIMALS

Research into changes in the populations of the indigenous domestic animals in Bulgaria over the past 30 35 years has revealed their sharp decline Some have already disappeared and the remainder are threatened with extinction to varying degrees Based on this research a *Red Register* of autochthonous do mestic fauna of Bulgaria has been created and catego ries for classifying the various forms have been devel oped These categories have already been used to classify various autochthonous forms and to describe their conservation status The following categories have been established

1 ***Extinct types*** those that can no longer been found in Bulgaria

2 ***Disappearing types*** those for which the numbers are in such decline that their survival is in doubt even if urgent measures are taken this category includes types that are likely to have disappeared

3 ***Threatened types*** those that are in direct danger of extinction if negative factors continue to affect them this category includes types with small populations or whose populations have begun to decline rapidly

4 ***Potentially threatened types*** those that are not yet in danger but whose populations in the recent past have been large are now considerably re duced and if trends continue are in danger of being re classified as threatened this category in cludes forms that have been in the previous cate gory, but for which measures have been taken to increase their numbers above critical minimum levels

Seven types of domesticated animals have been examined for the *Red Register* – cattle, ox, sheep, goat, pig, horse and dog Among these 37 autochthonous types are recognized in Bulgaria Local diversity is greatest among the sheep 54% of which are indige nous to Bulgaria and least among the ox and the goat (only one type each) Of the 37 autochthonous forms of domestic animals 6 have already disappeared 12 are disappearing, 16 are threatened with extinction, and 3 are potentially threatened (see Appendix 1) All the autochthonous forms of domestic animals are endemics to Bulgaria or the Balkans About 29 of them are Bulgarian endemics the Local Grey cattle the Grey Iskar cattle the East Balkan Pig, the Local Goat the Barak Hunting Dog, all the types of horses and all the types of sheep apart from the Karakachan Sheep The Karakachan Sheep Horse, and Dog and the Deliorman Hunting Dog are Balkan endemics The Rhodope Shorthorn cattle is an Eastern European endemic widespread in the past from the mountains of Georgia to the Rhodopes and the Macedonian and Serbian mountain regions and as far as some regions of the Carpathians and the Alps The Klepoucha and Pravoucha Pigs are European endemics They were bred in Serbia and Macedonia and have the same ori gins as the European wild pig The Rhodope Short horn Cattle and Karakachan Sheep which have re tained their primitive features and qualities, can be considered post glacial relicts

MEASURES FOR THE CONSERVATION OF THE AUTOCHTHONOUS FORMS OF DOMESTIC ANIMALS IN BULGARIA

Intensified breeding of commercial breeds has had serious effects on local types of domestic animals which as a rule are less productive Undoubtedly, the increased import of highly selected breeds and the complete ignorance and undeserved lack of interest in local forms have contributed to their decline There is a real danger that more of them will disappear forever

In order to avoid this fate, the Bulgarian govern ment in the last 15 years has formed breeding popula tions of these autochthonous domestic animals How ever the formation of these small closed populations may be resulting in an increase in their inbreeding co efficient and the gradual disappearance of the existing genetic mutability This is why various steps are ur gently needed to preserve these valuable genetic re sources Local people must be interested in the

breeding and rearing of these animals, and encouraged through direct subsidy of the price of products from these animals Special reserves are needed to breed and rear them under natural conditions An alternative would be the cryopreservation of the gametes and embryos of these animals A gene bank of this type is soon to be established in Bulgaria A pioneering achievement in this area recently took place in the Rhodope Mountains where the embryos of a Rhodope Shorthorn Cow were successfully frozen

Above all, however, it is necessary to examine this problem in all its international aspects, and to attract the interest of reliable financial sources in conservation efforts As a general rule, the autochthonous forms of domestic animals have disappeared or declined in many of the rich, developed countries and are still preserved in the poorer or developing countries Paradoxically, the richer the country, the fewer the autochthonous breeds, and vice versa It is well known that the developed countries have developed highly selected, high productivity herds, at the same time, they have lost the prototypic breeds The developed world is increasingly dominated by a few elite breeds, which are spreading their influence through the other countries, including the habitats of the aboriginal breeds – habitats that are growing smaller every year The richer countries profit from the sale of elite breeding material and do not realize that somewhere in the world a local breed is disappearing as a result At the moment, however, it should be understood that these highly productive, record-breaking varieties, which can be found in many of the pastures of the world, have been irreversibly impoverished by the loss of genetic resources Frozen sperm and embryos and the small and feeble enclosed populations of autochthonous breeds, which have been specially preserved for their genetic potential, are often no longer in a position to help They have degenerated due to long term artificial rearing and close inter-breeding and have long ago lost the genetic qualities of a stable population

For this reason, the richer, more developed countries must develop conservation programs and begin to finance projects to preserve the autochthonous forms of domestic animals in other countries A global overview of this problem is needed, national and continental boundaries should be ignored for the sake of the good of mankind In addition to the development of large live populations of "aboriginal" animals, funds are needed for other extremely important projects, including serious educational programs to communicate the importance of the problem and advertising campaigns to provoke a healthy interest in nature It would be easiest and most practical to begin with small, high profile demonstration projects to provoke imitation

Of course, it is most important that the richer countries become convinced of the need to plug this new, dangerous ecological "hole" – one that may be, in its own way, equal in size and significance to the hole in the ozone layer

Appendix 1 Classification of local breeds in Bulgaria according to degree of threat

1 Extinct types

Rila Monastery Sheep
Local Klepoucha Pig
Local Pravoucha Pig
Deliorman Horse
Kamchia Horse
Rila Planina Horse
East Balkan Pig
Karakachan Horse
Stara Planina Horse
Rhodope Horse
Karakachan Dog
Barak Hunter

2 Disappearing types

Grey Iskar Cow
Rhodope Shorthorn Cow
Local Ox
Svishtov Sheep
Sredna Gora Sheep
Duben Sheep

Appendix 1 Classification of local breeds in Bulgaria according to degree of threat (continued)

3 Threatened types

Karakachan Sheep
Replyan Sheep
Shumen Sheep
Karnobat Sheep
Pirdop Sheep
Sofia Breznik Sheep
Bukyov Sheep
Panguirshte Sheep
Strandzha Sheep
Sakhar Sheep
Maritsa Sheep
Sredna Stara Planina Sheep
Kotlen Sheep
Teteven Sheep
Local Goat
Bulgarian Deliorman Hunting Dog

4 Potentially threatened types

Local Grey Cow
Pleven Blackhead Sheep
Stara Zagora Sheep

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Status of the Populations of Wild Animals Subject to Economic Use in Bulgaria

Velichko Velichkov and Lubomir Profirov

I WILD ANIMALS SUBJECT TO HUNTING

Introduction

The wild animals subject to hunting are called, for short, game The first Law on Hunting in Bulgaria dates from 1880 and was thereafter amended in 1904, 1907 1910 1926 1948 and 1982 The Law on Hunt ing and Game Husbandry that is currently operative dates from 1982 (published in *State Journal No 91* from 20/11/ 1982) It is based on the state ownership not only of game but of forests and agricultural lands, in Bulgaria

The areas suitable for game breeding and sport hunting are divided into hunting regions The smallest of the hunting regions is about 2 000 ha and the largest about 20 000 ha Hunting of all kinds of wild animals in nature reserves and other protected areas is prohib ited At present there are nearly 2600 hunting areas in Bulgaria The area suitable for development and prac ticing of hunting totals 10 293 962 ha

The right of hunting belongs to adult Bulgarian citizens and members of the Union of Hunters and Fishermen in Bulgaria who have passed an examina tion and hold a hunting license and a permit for hunt ing arms

The Committee of Forests carries out state policy in the field of game husbandry (Art 13 al 1 of the Law on Game Husbandry) The Committee of Forests and its subdivisions (the State Forestry Boards) manage and make use of nearly 16% of the hunting areas in the country, mostly in the state forests More than 90% of these hunting regions are reserved for foreign hunters The remaining 84% of the hunting areas are managed and used for hunting by the Union of Hunt ers and Fishermen in Bulgaria (formerly the Bulgar ian Hunting and Fishing Union) These areas are also subject to international hunting tourism but it is a small scale activity

Eight game breeding farms with a total area of 41 000 ha are under the direct supervision of the Committee of Forests The animals bred there are subject to selection for the international hunting en terprises From these farms the wild animals are taken to different places with suitable habitats but deficient in game

The Committee of Forests, the Regional Forest Directorates and the State Forestry Boards are all state bodies (Figure 1) Their functions are described in other papers in these proceedings The Hunting Council at the Committee of Forests works without salary and assists the President of the Committee in decision making In cases where the President of the Committee does not agree with the proposals of the Hunting Council, the problems are submitted to the Council of Ministers for resolution

The Union of Hunters and Fishermen in Bulgaria is a public organization The hunters in the country number 88 000 organized into 2,500 local groups or chapters In most cases, each group manages one hunting region On average, 20 30 hunting and fishing groups constitute one association There are 132 hunting and fishing associations in Bulgaria, all of which are members of the Union of Hunters and Fish ermen, which has its main office in Sofia

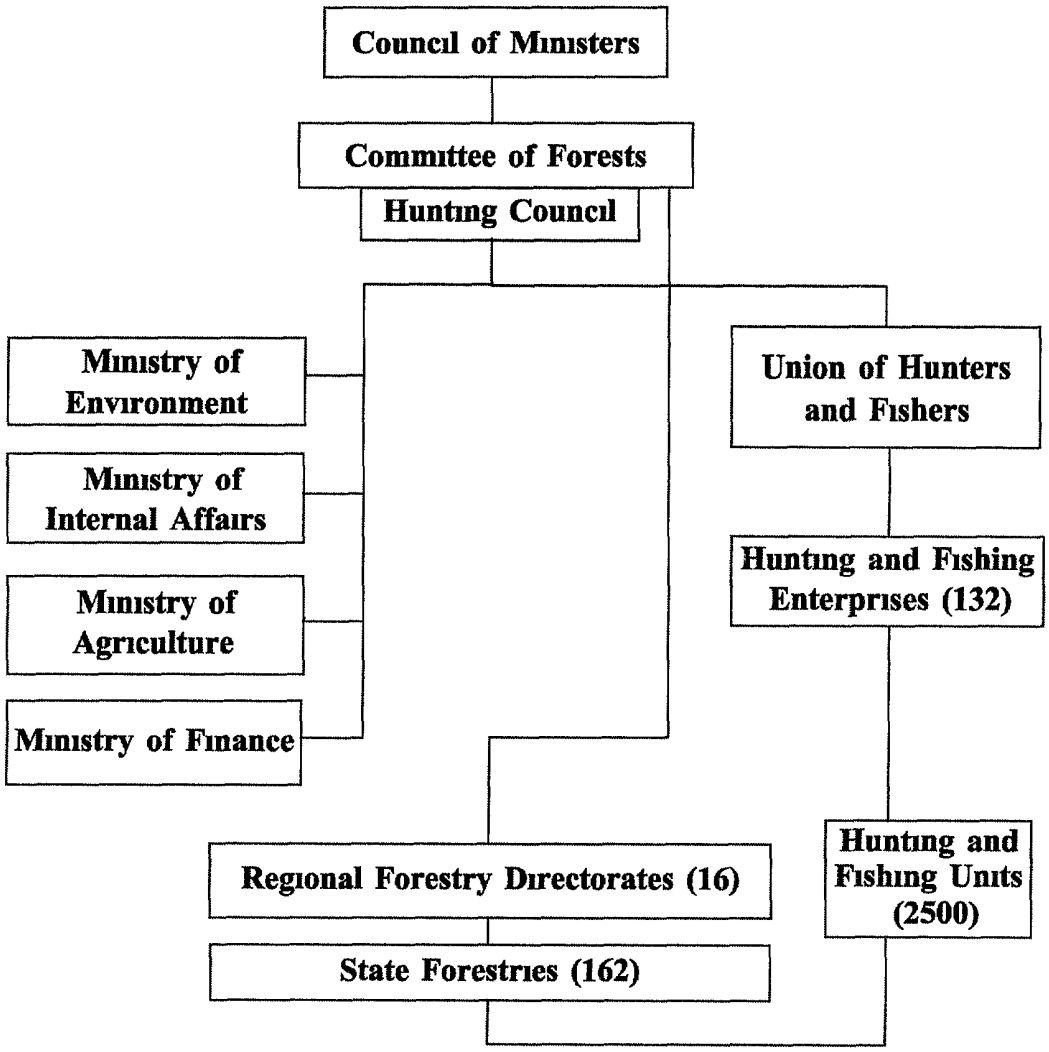
Management of Game Populations

As a result of the conversion to a market economy and of changes in the ownership of land and forest property the operative Law on Hunting and Game Husbandry is no longer operable A new draft Law on Hunting and Game Protection is being been prepared based on principles used in the European Hunting Legislation, including leasing relations and agree ments between land and forests owners and game us ers, voluntary membership of hunters in their organi zations, with a right to hunt after passing an appropri ate examination before a state examining committee, linking of the practice of hunting to the true cost of the game and consideration of the status and use of game resources and the carrying capacity of their habitats in order to ensure sustainable development of the populations and protection of different species

The first hunting husbandry development plan was drawn up in 1931 by the Ivan Sokachev, who was Secretary of the Hunters Union at the time

In Bulgaria a special method is used to define the productivity of habitats for the wild species subject to hunting (Dragoev and Petrov) The game animals in Bulgaria are both indigenous and mig atory Indige nous species are these that live within the territory of the country throughout the year The migratory spe cies are birds that visit Bulgaria during their migration period between summer and winter habitats, or that come to Bulgaria during their breeding season

Hunting Enterprise Management Structure



Every spring, a census of the populations of indigenous game species is taken (except for the predatory animals) On the basis of the census results the year's population growth and habitat capacity is ascertained and a management plan is drawn up divided according to the hunting regions and the activities needed to maintain the density of the wild animals The plan is summarized before the Committee of Forests and ratified by the President of the Committee

The terms for hunting of the different species are defined in the license application form On the suggestion of the Hunting Council, the President of the Committee of Forests can modify the hunting terms and prohibit the hunting of certain species, depending on the biological status of the game and the state interests

Status of Game Populations

The main factors influencing the number of wild animals are a) changes in habitats due to anthropogenic activities (drainage of marshlands clearing of forests, cultivation of large monocultures, etc), b) intensified hunting and overuse leading to the exhaustion of populations and other problems and c) environmental pollution, including the misuse of pesticides in agriculture and forestry, and losses during mechanized harvesting operations

Table 1 provides data on the status, population sizes, population trends and hunting seasons for the principal game mammal and bird species in Bulgaria In addition several species have been introduced in Bulgaria

- The European aurochs (*Bison bonasus*) is bred in the area of the State Hunting Area o the town Preslav In 1992 there were 92 individuals This species reproduces well but there are no area suitable for its natural existence and development

- The Tibetan yak (*Poephagus grunients*) was im ported from Mongolia about 15 animals inhabit Vitosha Mountain and the Rhodopes This spe cies does not have the potential for widespread breeding for hunting purposes Individual speci mens from these species are shot by foreign hunt ers

- The fallow deer (*Cervus dama*) was also intro duced into Bulgaria from German during the pe riod 1900 1904 It is now well adapted to local conditions It reproduces successfully and pro duces good trophies It successfully defends its young against predatory animals and can be seen easily across nearly the entire country

- Attempts to introduce the mouflon (*Ovis ammon*) began in 1940 1941 However, this and several later attempts were unsuccessful due to the lack of suitable habitats In 1967 1973 and 1976 mou flons were imported from Czechoslovakia and Hungary and since then have been maintained in enclosed areas There thev have reproduced suc cessfully and produce good trophies Beyond the enclosed areas their populations have increased little due to the great losses they sustain from wandering foxes, dogs, jackals and wolves As much as 80% of their young are taken by foxes during the first 1 2 month after their birth

- In 1978 in the Rila and Pirin Mountains 23 Al pine capricorns (*Capra ibex Pall*) from Switzer land were set free In the spring of 1986 this herd included 34 individuals

Attempts have been made to introduce other species as well, but thev were unsuccessful

One species that before 1968 did not exist in the Bulgarian fauna is the raccoon dog (*Nyctereutes pro cyo noides*) It can now be found throughout the country although its population is limited Every year about 10 individuals are shot It is a highly adaptable species It is native to the Far East but through artifi cial introduction has spread all over Europe It has come into Bulgaria from Romania

Over the last 30 years the number of jackals (*Canis aurens*) has increased significantly In the past this species was found only in southern Bulgaria in the region of Strandzha Mountain

Analysis of data (Table 2) on the spring popula tions of game animals over the last 40 years shows that the large hoofed mammals (e g red deer roe deer wild boar and mouflon) have increased greatly The main reason for this increase has been the creation of large areas of monocultural cultivation in northern Bulgaria (for corn sunflower, wheat, and other crops) These provide highly suitable habitat and abundant nutritional resources for these species for the greater part of the year

In the past, increased hunting pressures, and in particular the increased use of hunting dogs has sharply reduced the number of roe deer and red deer In response, the state created nearly 30 special hunting areas where hunting by the public was absolutely pro hibited These hunting areas have played an impor tant role in allowing game to resettle adjacent areas and thus in increasing the reserves of game animals

Every year the state spends about 10 15 millions leva for game protection supplemental feeding, and for artificial breeding and improvement activities

Hunting Impacts and Administration

Table 2 presents spring census data and the level of exploitation for game species are based on official accounts However, the level of exploitation reflected in this data differs substantially from the actual level of use The first author has taken part in the country wide game census for 17 years and can confirm that the data about the established number of game are true with an admissible error of +/ 15% He can af firm however that the number of game formally ac counted as shot declined by 300% for the roe deer and wild boar and by more than 1000% for the red deer The reasons are mainly poaching and the conscious concealing of game shot by hunters The Law on Hunting and Game Husbandry from 1982 obligates hunters to deliver to the state 50% of the big game that is shot for which they are paid

Hunting in Bulgaria at this time is nearly free of charge The average monthly salarv in Bulgaria is about 1200 leva the annual fee for membership in the hunters' organization is 70 leva, the state tax is 30 leva and the tax on hunting arms is 20 leva for a total of 120 leva The number of hunters is thus limited not by economics but by administrative requirements Ac cording to Article 4, al 3 of the Application Regula tion of the Law on Hunting and Game Husbandries, each hunter requires an average hunting area of 110 ha Until 20 25 years ago, hunters were interested only in game meat Little attention was given to tro phy hunting In the past the owners of land and for ests did not receive any revenues from those using the local game resources In 1991 Ordinance No 137 of the Council of Ministers from 12/07/1991 was issued establishing rents per ha of hunting area The higher rent is 3 leva per ha hunting area inhabited by red deer the lower is 0 50 leva per ha for areas inhabited by rabbit partridge and rock partridge (this pertains only to the forest area) In agricultural lands hunting is still free of charge

Table 1 Hunted Species of Mammals and Birds Status, Population Size, Population Trend, and Hunting Season

Scientific Name	Migrant Status	'Bern App	Washington ' App	Status in Bulgaria	Pop Size X1000	Pop Trend	Hunting Sea son 1992
1	2	3	4	5	6	7	8
a) Mammals							
1 *Cervus elaphus* Red Deer	R	III			28 3	+	1 09 31 01
2 *Cervus dama* Fallow Deer	R	III			7 0	+	1 09 31 01
3 *Capreolus capreolus* Roe Deer	R	III			121 2		1 05 31 10
4 *Rupicapra rupicapra* Wild Goat	R	II		CD	1 9	=	m1 09 31 04 f1 10 31 01
5 *Ovis amon musimon* Mouflon	R	III		V	3 9	=	m1 09 30 04 f1 10 31 01
6 *Sus scrofa* Wild Boar	R	III			48 9	+	1 06 31 01
7 *Lepus europaeus* European Hare	R				628 1		1 10 31 12
8 *Sciurus vulgaris* Red Squirrel	R	III					1 11 28 02
9 *Martes foina* Marten	R	III			30 40	+	1 11 28 2
10 *Putorius putorius* Polecat	R	III			15 28	=	1 10 30 09
11 *Meles meles* Badger	R	III			40 60	=	1 10 30 09
12 *Nyctereutes procyonoides* Raccoon Dog	R					+	
13 *Canis lupus* Wolf	R	II	II		0 4 0 5	+	1 10 30 09
14 *Canis aurens* Jackal	R				7 5 10 0	+	1 10 30 09
15 *Vulpes vulpes* Red Fox	R					=	1 10 30 09
16 *Felis silvestris* Wild Cat	R	II	II		8 20	=	1 10 30 09
b) Birds							
17 *Columba palumbus* Wood Pigeon	P				200 500	+	15 08 31 12
18 *Streptopelia turtur* Turtle Dove	M	III			200 500	+	15 08 31 12
19 *Streptopelia decaocto* Collared Turtle Dove	R				100 300	+	15 08 31 12
20 *Coturnix coturnix* Quail	M	III			500 750		15 08 30 09

Table 1 Hunted Species of Mammals and Birds Status, Population Size, Population Trend, and Hunting Season (continued)

Scientific Name	Migrant Status	Bern App	"Washington App	Status in Bulgaria	Pop Size X1000	Pop Trend	Hunting Sea son 1992
1	2	3	4	5	6	7	8
21 *Scolopax rusticola* Wood Cock	P	III			0 02 0 03	=	15 08 20 02
22 *Anas platyrhynchos* Mallard	P	III			15 20	+	1 09 13 01
23 *Anas penelope* Pigeon	M	III			0 12 0 2	+	1 09 31 01
24 *Anas clypeata* Shoveler	M	III				=	1 09 31 01
25 *Anas querquedula* Garganey	M	III			0 1 0 2	=	1 09 31 01
26 *Anas crecca* Teal	M	III			0 04 0 08	=	1 09 31 01
27 *Anas acuta* Pintail	M	III			0 02 0 04	=	1 09 31 01
28 *Aythia fuligula* Tufted Duck	M	III				=	1 09 31 01
29 *Fulica atra* Coot	P	III			1 2	+	1 09 31 01
30 *Anser albifrons* White Fronted Goose	M	III				+	1 09 31 01
31 *Perdix perdix* Partridge	R	III		CD	454		1 10 31 11
32 *Alectoris graeca graeca* Rock Partridge	R	III		V	10		1 10 30 11
33 *Alectoris chucar* Rock Partridge Chucar	R	III		CD	55		1 10 30 11
34 *Phasianus colchicus* Pheasant	R	III		V	91 5		1 10 31 01
35 *Phasianus mongolicus* Pheasant	R	III		CD	133		1 10 31 01
36 *Tetrao urogallus* Capercaillie	R	III		V	1 98	=	25 04 15 05
37 *Pica pica* Magpie	R				1000	+	1 10 30 09
38 *Corvus corone* Hooded Crow	R				150	+	1 10 30 09
39 *Garrulus glandarius* Jay	R				500 700	=	1 10 30 09
40 *Corvus monedula* Jackdaw	R				500 1000	=	1 10 30 09

Legend for Table 1

Migrant Status
R = Main population resident
M = Main population has regular seasonal migrations
P = Park of the population has regular seasonal migrations

'Bern Appendix" = Appendix of the Convention on the Conservation of European Wildlife and Natural Habitats

"Washington Appendix" = CITES

Status in Bulgaria
V = Vulnerable
CD = Care demanding

Population size x 1000
For mammals, the figures refer to winter population size after hunting and before breeding
For birds, the figures refer to breeding population size

Population trend
The overall trend in Bulgarian population size from 1952 is given for resident species
For migrant bird species trends from 1981 are given
+ = increasing
= decreasing
= = stable

Hunting season
The column gives information on the range of the open and licensed hunting season

Table 2 Indigenous game species subject to spring censusing

Game species	Spring reserves			Use			
	1952	1982	1992	1934	1952	1982	1992
1 Red deer	1430	15890	28370	no	no	299	2138
2 Fallow deer	n q	4020	6990	no	no	30	202
3 Roe deer	9500	134060	121160	596	2121	5378	8506
4 Mouflon		2630	3870	no	no	5	83
5 Wild boar	1147	39670	48880	269	71	7292	11394
6 Wild goat	880	1580	1870	no	no	no	39
7 Brown bear	n a	858	796	no	16	no	30
8 European hare	885750	890000	683070	203170	116960	102700	48050
9 Partridge		580400	453880	202800	19247	45284	60420
10 Rock Partridge	1320100	70800	54460	37330	1346	7690	
11 Rock partridge		17300	10040				7260
12 Capercaillie	1390	1830	1980	49	20	10	17
13 Pheasant	3000	140000	91500	54	no	52500	58950
14 Pheasant (mong)		312250	133280			122600	

Notes
Plans for hunting of these species are developed based on census results The census is conducted by the Committee of Forests and by hunters The first census was undertaken in 1952

Artificial Propagation

In the last fifty years the populations of small game animals (e g rabbits partridge and rock partridge) have progressively declined The main reasons are changes in their habitats the introduction of chemicals and mechanization in agriculture and (last but not least) poaching

During the period 1961 1989 the Union of Hunters and Fishermen and the Committee of Forests actively bred game under artificial conditions and released it in hunting areas The main species subject to artificial breeding and release were pheasant, rock partridge (chukar), and sheldrake The average production per year of these species was for pheasants, about 700 000 for rock partridge (chukar), about 25 000 and for sheldrake about 150 000 This mode of game husbandry and management eases the hunting pressures on big game and other species

The economic crisis that began in 1989 has led to a sharp drop in the artificial breeding and release of game birds The enforcement of hunting regulations has diminished, creating conditions for increased poaching and hunting pressures in general

Threatened and Vulnerable Game Species

The threatened and vulnerable indigenous species are the wild goat capercaillie rock partridge, and pheasant

The number of capercaillie and wild goat is under 2000 Their habitats are to a great extent the same and are located in the higher elevations – over 1200 m above sea level in the Rhodopes, Rila Pirin and Stara Planina Mountains The capercaillie has already abandoned its habitats in the Stara Planina Populations of wild goat and brown bear in the Stara Planina are separated from those in the Rhodope Rila, and Pirin Mountains The capercaillie and wild goat are located in hunting areas under the direct control of the Committee of Forests Shooting of these species is restricted but the limited area of their habitats and to a certain extent other factors (including poaching) restrict their ability to disperse to other habitats

In areas granted to the Union of Hunters and Fishermen roe deer and wild boar are shot actively in groups with dogs from September 1 to December 31 This greatly affects the wild goat and capercaillie which cannot tolerate such disturbance leading them to abandon permanently these habitats These species have little tolerance in general for humans and this fact makes them particularly vulnerable

The rock partridge is widespread in the valley of Strouma River and in the Stara Planina Mountains In the past this species was very numerous but due to unexpected changes in its nutritional base its number has decreased Its typical habitats of small cornfields are no longer planted under wheat, and this impedes its subsistence

The pheasant is an indigenous species Its habitats are associated with the humid dense forests The Dolna Topchia Reserve in Tundzha River valley has been designated specifically to protect the pheasant The generally dry climatic conditions in recent years has affected its habitats significantly In addition the extensive introduction and reproduction of alien pheasant species and subspecies in nature has led to cross breeding This has impeded conservation of the genetically distinct indigenous pheasant species Some farms are established exclusively for the breeding of pheasants under artificial conditions Southern Bulgaria in particular has been designated for the introduction of the pheasant *Phasianus colchicus*

Migratory Species

Migratory species are an important resource for Bulgaria Every January, a winter census of water loving birds is conducted at the main winter grounds in Bulgaria The average numbers in the different areas are shown in Table 3 In 1990, the first research was conducted on species nesting in Bulgaria but migrating south in the winter (e g , the turtle dove and quail) and on wandering, migrating, and indigenous species (such as the wood pigeon and collared turtle dove) Not all kinds of migratory and water loving birds are threatened In the last ten years the number of white fronted geese wintering in Bulgaria has increased from 100,000 to 187,900 The exploitation of migratory species is regulated and appropriate hunting restrictions established, including the number of hunting days allowed and the average bag allowed per day In addition, hunting is prohibited in Atanassovo Lake and Srebarna Lake reserves and in Shabla Lake protected area There is, however, no general management plan The Union of Hunters and Fishermen does not prepare statistical accounts of the birds shot The data provided by the bodies of the Committee of Forests are tentative

Animal Damage

There are several indigenous bird species that are to a certain extent damaging and subject to control The meat of these species is not edible Most important are the magpie (approximate total number – 1 000 000 approximate number shot – 700,000) and the hooded crow (approximate total number – 100 000 150 000 approximate number shot – 30 000 50 000) Although the jackdaw and the jay are present in great numbers they are not subject to hunting since the damage they cause is insignificant

Table 3 Total Number of Waterfowl at Main Wintering Grounds in Bulgaria (January 1992)

	Site	Number		Site	Number
+ *	Atanassovo Lake	5,030	+	Ovcharitsa Lake	33 950
+ *	Durankulak Lake	27,020		Piasachnik Reservoir	6 140
+	Bourgas (Vaia) Lake	35,390	+	Shabla Lake	101 470
+	Malko Sharkovo Resevoir	1 720	+ *	Srebarna Lake	45 150
+	Mandra Lake	23 920		Trakietz Reservoir	620

Legend + Sites included in BirdLife International's list of the Important Bird Areas in Europe
* Sites included in the list of the Ramsar Convention

Predatory Mammals

With the adoption of Order No 1023 from 31/12/ 1992 the Ministry of Environment declared the brown bear a vulnerable and protected species Only aggres sive bears are allowed to be shot The number of predators depends directly on the population dynamics of the prey species After 1960 for example the populations of the red fox, marten jackal, and wild cat boomed allowing these species to expand their ranges The effects can be seen in the hunting statistics In 1934 for example, two martens were shot in 1980 more than 6 000 The number of red foxes shot in 1934 was 11 000, in 1980 71,000 In the 1970s the jackal was a protected species and could be seen only in southeastern Bulgaria, it has since spread out all over the country has a significant impact on ungulate populations The number of jackals shot has increased more than 10 times since 1984 1985 and has now reached 4 500

The increase in the populations of these species is related to the number of game animals that are bred under artificial conditions and release into nature More than 850,000 birds (45 days old) have been re leased into the hunting regions In the first 1 2 months, a great many of them fell prey to predatory animals because they do have the natural instincts of wild animals and cannot take care of themselves There has been a boom for example, in the reproduc tion and propagation of the marten in the developed parts of the country In certain years, as many as 10,000 are shot

Although bounties have been offered for every specimen shot and their furs have attracted high prices, hunting pressures have not significantly influ enced the density of predatory animals Data on the number of red foxes and martens shot in 1991 are not reliable since there was no bounty at the time and many that were shot were not counted There are no threatened predatory species with the exception of the brown bear, which has been protected since 1 January 1993 The wolf badger and wild cat are protected under the Bern Convention but are not in any real danger The number of wolves is the smallest The total Bulgarian population is about 450 500 in the spring and remains connected to populations in Tur key Greece Yugoslavia, and Romania It has a large range and not currently in danger of being genetically isolated The populations of the badger and wild cat are in stable equilibrium, suggesting the need for con tinued restrictions on hunting

Table 4 Hunting of Predatory Species

Species of mammals of prey	Use by year			Species of mammals of prey	Use by year		
	1934 35	1980	1991		1934 35	1980	1991
1 Wolf	263	107	205	6 Badger	1 935	11,624	1 119
2 Jackal	211	2 676	2,513	7 Wild cat	1 122	4 621	1 528
3 Red fox	11 080	71,564	6 392	8 Raccoon dog	n a	n a	n a
4 Marten	2	6,324	2,335	9 Brown bear	12	n a	30
5 Polecat	3 107	12,083	2,070	10 Hooded crow and magpie		956 449	n a

Economic Evaluation of the Wild Animal Resource

The total amount of biomass (spring 1992) of wild animals is estimated as follows

Indigenous species (spring)	10 058 700 kg
Spring species (winter period)	675,600 kg
Predatory animals (spring)	338 700 kg
Total	11 073 000 kg

The wild boar shows the greatest increase per year (about 1 280 000 kg) followed by the red deer (500 000 kg) and the European hare (700 000 kg) It is estimated that about 66% of the annual growth in game meat is taken by hunters, the remaining 34% represents losses after hunting and during the winter Winter losses among the large hoofed mammals are 5 10% mainly due to predation Among the par tridges rock partridges and pheasants winter losses amount to more than 30% in the autumn reserves after hunting In drawing up hunting plans, the losses after hunting and during the winter have to be taken into account The level of use must allow for the conserva tion of optimal game stocks for each separate region and species

According to official statistics, hunters obtain about 1,024,000 kg of game meat, concealed and un reported game accounts for another 720,000 kg for a total of 1,740,000 kg (Table 5) This total is obtained from about 84% of the country's territory In areas managed by the Committee of Forests, another 300,000 350 000 kg of meat are obtained and ex ported The total value of game meat is estimated at 91,800,000 leva ($7,344,000) (Table 5) Fur revenues are estimated at 2,181 800 leva ($258,600) (Table 6) Because enforcement capabilities are insufficient, it is impossible to estimate the true value of trophies ob tained by members of the Union of Hunters and Fish ermen and other hunters in Bulgaria The economic value of trophies obtained by Bulgarian hunters is probably small since current prices are insignificant when compared with international prices However about 75 000 000 leva ($3,000,000) are obtained as revenue from hunting trophies through international hunting tourism The total economic value of game thus amounts to approximately 168,981 800 leva ($10 592 600)

Table 5 Amount of obtained game's meat price and cost

	With skin with out plucking (kg)	Price (levs)	Cost (levs)	Price ($)	Cost ($)
Union of hunters	1 740 000	45	78,300,000	3 60	6,264,000
Committee of forests	300 000	45	13,500,000	3 60	1 080 000
Total	2 040 000	45	91 800,000	3 60	7,344 000

Table 6 Obtained furs

Animals of Prey	Number	Price (levs)	Cost (levs)	Price ($)	Cost ($)
Red foxes	10000	130	1300000	12	120000
Martens	2000	130	260000	18	36000
Wild cats	1200	60	72000	8	9600
Wolfs	100	13	1300	10	1000
Polecats	2000	23	46000	8	16000
Jackals	2500	105	262500	8	20000
Badgers	1000	23	23000	7	7000
Subtotal	18888				
Rabbits	70000	3	210000	0 70	49000
Total	88800		2181800		258600

Table 7 Areas Suitable for the Main Species of Game, with Potential Stock and Take

Game species	Suitable area (ha)	Potential stock (number)	Potential take (number)
Red deer	1 925,400	19 000 23,000	5 500 6 000
Fallow deer	422 000	6 500 7 300	1 900 2,200
Roe deer	5 712 000	150 000 216,000	52 000 65 000
Wild boar	3 800 000	19 000 26 000	18,000 25 000
Rabbit	8 178 000	920 000 1 100,000	150 000 220,000
Partridge	5,337,000	580 000 900,000	70,000 90,000
Pheasants	1,472,000	220,000 280,000	80,000 130,000

Table 7 provides data on the amount of territory suitable for the breeding of important game species as well as the potential stock and take of these species

Conclusions and Recommendations

In the last 25 years the number of red deer, wild goat, and other wild hoofed mammals has increased to the point where they have begun to cause serious damage to forests, tree plantations and crops Up un til now the damage inflicted on forests by red deer and roe deer have not been taken into account In ad dition the State Insurance Institute has paid out be tween 10 and 15 million leva in damage claims result ing from the effects on farm cultures of wild boars The Union of Hunters and Fishermen did not assume responsibility for damages and had no interest in sup porting the game reserves in accordance with the available natural habitat resources

With the reality of the shift toward a market economy and different patterns of land ownership, the structure of the agriculture will change The existing territories of large scale monocultures reaching 1500 2000 ha in size will be parceled out Areas under dif ferent crops will be smaller and the diversity of crops greater These changes in the structure of agriculture will bring about changes in wildlife habitat Areas in habited by red deer roe deer and wild boar will be reduced however, the same habitats will improve for partridge rabbit, pheasant rock partridge quail and other small game species

As can be seen from this report the existing structures for the control and management of game re sources can not guarantee the protection and sus tainable exploitation of the populations of wild animals and their habitats In practice only one sector – comprised of the Union of Hunters and Fishermen in Bulgaria and the Committee of Forests – is making use of the game resources State control of the re sources belongs to the Committee of Forests which is at the same time an important user of these resources The municipalities and owners of lands and forests do not participate in the management and use of the game As a result, land owners lack economic incen tives for and often interest in protecting and taking advantage of game

Imperfections in legislation reflecting the pecu liarities of the economic system of the last 45 years have resulted in the spending of significant state funds to increase the amount of game but at the same time have allowed this natural resource to be used for free by a limited group of men More than 2/3 of the in crease in game was used without any account The system did not allow for well grounded deci sion making in the management of game populations Instead of a system of wildlife management that al lowed for a balanced allocation of resources and op portunities the result has been immense enclosed ar eas of between 100 6 000 ha with high densities of stocked game

The National Assembly should develop and adopt a new Law on Hunting and Game Protection It should introduce strong controls on, and strict ac counting for, the use of all game species, including mi gratory birds and waterfowl

II MANAGEMENT OF OTHER ANIMAL RESOURCES

Vipers

According to Art 2 Para 11 of the Nature Pro tection Law (1967), natural resources are to be pre served and wisely used Special ordinances issued by the Minister of Environment set the conditions with respect to the wise use of given animal species or groups of species of commercial interest These ordi nances aim to guarantee the survival of the species by ensuring the rational use of part of its population

As an example, Ordinance No 107 of 21 Febru ary 1991 (published in *Gazette No 24* of 1991) sets forth the conditions under which vipers (*Vipera am modytes*) shall be used The ordinance specifies the period of the year during which vipers may be col lected, purchased, or sold (1 May 30 September), the

minimum length at which vipers may be collected for commercial use (50 cm), and other restrictions It also specifies the manner and order in which snake farms may be established the geographic distribution of snake hunting export quotas and other conservation provisions

The viper (*Vipera ammodytes*) occurs throughout the Balkan peninsula Our country's population is approximately 100 000 individuals The species is distributed in the plains and semi mountainous areas up to 800 m a s l , although they may be found occasionally at 1100 to 1200 m a s l The population is most dense in parts of the country encompassed by the former administrative districts of Kardzhali Haskovo Yambol, and Bourgas Populations of secondary importance may be found in the former districts of Stara Zagora Vratsa Blagoevgrad Montana and Vidin The approximate frequency of the species in optimal habitats in some of the above mentioned areas is 1 snake per 0 2 ha this being the highest figure recorded for the country so far There are no detailed studies on the numbers distribution, and population dynamics of the species

The viper is listed in Appendix II of the Bern Convention as a species requiring strict protection throughout Europe However when ratifying this convention Bulgaria claimed certain reservations with respect to the species in view of its high numbers in the country

After the publication of the previously mentioned ordinance in 1991 the Regional Inspectorates of the Ministry of Environment granted permission to 10 snake farms to operate within the country, allocating them a quota of 1121 snakes to be collected for commercial purposes In 1991 1071 snakes were actually collected

Regarding the commercial interest in snakes two entirely different trends have emerged with respect to the establishment and operation of snake farms On the one hand a total of 46 new farms have been set up and registered by the court at the beginning of the snake hunting season These farms were permitted to collect a total of 4035 vipers (about 4% of the country's estimated population) By the end of the 1992 season 10 companies declared that they were closing down due to the many difficulties encountered in trying to dispose of the venom The total number of legally kept snakes at regular farms was 3381 the allocated target quota was 1534 individuals short Table 8 shows the number of vipers used by snake farms in different parts of the country

At two of the farms the number of vipers kept at the time of inspection exceeded the allocated quotas for 1991 and 1992 In the Sliven region where the largest snake farm in the country operates the quota for 1991 was exceeded by 630 vipers For this reason the farm was penalized and no quota was allocated to it for 1992 About 40 snakes were confiscated from illegal farms in Varna and Shumen and given to legally registered snake farms in the same region since the season was unfavorable for releasing the vipers back to the wild According to regulations, newborn vipers should be released back to the same area from which their parents were taken in order to prevent the sub species within the country from mixing The large number of newborn vipers declared by the owners of some farms is due to the fact that during the period when collecting the vipers is permitted, collectors have caught a large number of pregnant females If the conditions in captivity are good these females may give birth to up to 6 young snakes Release of new born vipers back to the wild is strictly required, as the young cannot survive if they are kept together with the adults in shared cages

Table 8 includes no data on snakes confiscated from illegal snake farms and then released into appropriate habitats For example in the city of Plovdiv alone 220 vipers were confiscated from a private snake collector who kept them under very poor conditions After the snakes were seized, they were released

One "milking" of a snake produces about 100 mg of liquid venom, which in turn produces about 10 mg of dry venom Snakes can be "milked" on average about 20 times each season, thus a single viper will produce 2000 mg liquid or 0 2 g dry venom Theoretically, a snake farm with a total of 3281 vipers will produce about 650 g of dry venom each season For the legally registered farms the overall quantity produced per season varies between 20 g and 50 g, a fact that poses certain difficulties in terms of finding business partners from abroad who will purchase such small quantities The price, according to pharmaceutical catalogs, is 230 USD per g The overall production of viper's venom in 1992 has been evaluated at 149,500 USD

Until now viper's venom has been used primarily by the National Center for Parasitic and Contagious Diseases, based in the city of Sofia to produce antivenom Domestic needs for venom and antivenom are considered satisfied for the next 2 or 3 years and the National Center will not be purchasing new quantities The National Center for Parasitic and Contagious diseases is also the body authorized to issue certificates for venom quality However, this power was also vested lately in the Higher Institute of Veterinary Medicine in Stara Zagora and the Medical Academy in Plovdiv

The purchase price for snakes has changed in recent years In 1989 it was 3 to 5 leva for a good sized viper in 1990 it was 20 leva and it has recently jumped to 200 leva

Conservation problems with respect to this species might be summarized as follows

1 In the past (until about 3 years ago) vipers were frequently been killed as a result of innate resentment and fear of snakes among local people This was especially true for the venomous species

2 The habitats of this species which cover a large portion of the semi mountainous landscape have

Table 8 Vipers (*Vipera ammodytes*) kept at snake farms in different regions of the country

Region	No of farms	Quota		No of snakes at the end of 1992	Difference from 1992 quota	No of new born snakes	No of snakes that died
		1991	1992				
Bourgas	2	50	250		250	-	
Varna	5	30	405	272	133	95	5
Veliko Tarnovo	5	150	550	383	167	203	11
Vratza	1		250	30	220	*	*
Vidin	1		80	-	80		
Pernik	1		150	148	2	436	1
Pleven	1		60	57	3	*	2
Plovdiv	6		330	277	53	248	11
Sofia	2	200	170	103	67	*	5
Sliven	6	406	220	1011	(+385)	*	*
Stara Zagora	5	100	580	221	359	*	*
Yambol	4	-	360	260	100	*	*
Haskovo	4	60	430	430		508	*
Shumen	1	50	100	189	(+ 40)	50	*
Ruse	2	75	100		100	*	*
Total	46	1121	4035	3381	1534	1540	41

Legend

* **no information submitted by the particular farm**

been considerably changed by the introduction of intensive agriculture At present the species is most abundant in places that are largely un changed by modern agricultural technology

3 European wild animal dealers, and particularly owners of terraria show a growing interest in our snakes and have been an instrumental factor be hind their illegal export Until quite recently many Czech Polish, Hungarian, and German herpetologists (both amateurs and professionals) were checked and searched at the border Many were found trying to smuggle large numbers of vipers and other non venomous snakes, most of which do not occur in Central and Western Europe

4 During the next 2 to 3 years the commercial in terest in vipers will remain at about the same level as in 1992

We may assume that the following developments will take place insofar as the use of snakes as a re source is concerned

- snake farms will gradually become larger as the smaller ones go bankrupt
- trading companies will appear on the local mar ket to purchase venom produced in the country and sell it on the international market and
- the probability of higher export quotas will be di rectly connected to the use of the venom for pur poses other than the production of antivenom levels of antivenom production are likely to re main unchanged domestically as well as interna tionally

No other member of our reptile fauna besides vi pers are of commercial interest Twenty one species are protected by law and keeping these species in cap tivity is prohibited The consumption of tortoises still occurs in some of the southern parts of the country but this practice is illegal and wherever such consum ption is discovered the culprits are severely punished according to existing legislation Keeping reptiles in terraria is not a popular hobby There is, however, a society of pet lovers called "Exotika ' and a section of this society called "Terraristika " that unites the lovers of snakes and other reptiles

Snails

Two species of snails of commercial interest occur in Bulgaria the edible snail (*Helix pomatia*) and the garden snail (*Helix lucorum*) The edible snail has a lighter body color and rougher body surface

Our country s geography climate soils, and terrain have enabled snails to become distributed almost throughout the country In general, the edible snail occurs less frequently than the garden snail, mostly outside of developed areas and on mountain slopes The highest numbers and population densities of snails can be found in valleys and semi mountainous areas of 600 to 1000 m a s l More rarely the edible snail can be found and on south facing slopes up to 1200 m a s l Snails form pairs immediately after hibernation depending on when the earliest relatively warm rains begin in the spring Breeding partners exchange sperm and then proceed to lay eggs in the moist soil This natural hermaphroditism ensures high biological productivity of the species

The use of snails as a resource was first regulated by Ordinance No 222 of 24 March 1982 of the Chairman of the former Committee for the Preservation of the Natural Environment This ordinance was published in *Gazette No 31* of 1982 According to this ordinance the breeding period of snails (from 1 April to 10 May) was closed for snail hunting The edible snail is included in Appendix III of the Bern Convention and as such commercial collection is banned during its breeding season In addition to the ordinance noted above there are other restrictions on snail collection introduced by the body issuing permits to purchase commercial quantities of snails One of these restrictions concerns the minimum size of the snail shell the diameter must exceed 28 mm smaller snails must be releases back into the wild

Collection of statistical data on the commercial use of snails began in 1982 after the previously mentioned ordinance was published and enforced Table 9 provides a summary of these data No special research has yet been conducted on the population size and numbers of snails in this country The only exception is the study of Totomanov (1973) in which the quantity of purchased snails for the period of 1963 1970 is shown for 4 main regions of the country

From Table 9 one can clearly see that during the first 5 years the sole purchaser of snails in Bulgaria was the Central Cooperative Union and its 28 district subdivisions Since 1987 the Forest Committee through its district directorates and forestries throughout the country has exploited this resource mainly for export abroad through the foreign trade company 'Murgash In 1989 another foreign trade company 'Bulgarplodexport joined the business of commercial snail collection and export by purchasing snails from forestries

The state enterprises which operated until 1990 as the sole collectors and exporters of snails have started to privatize in two ways by setting up many small private firms or companies of limited liability, and by acquiring economic independence from the Central Cooperative Union and the Forest Committee (thus becoming free to export snails for their own profit) This trend was especially pronounced in 1992 when the number of companies established in these ways reached 38 A total of 800 tons of snails were allowed to be collected and exported in 1992 this amount being parcelled out in shares of 5 10 tons each to some of the newly established companies The small size of these quotas however forced these companies to integrate in order to better organize the export trade In violation of the legal requirements and with no quota allocated to it the company "Kurtovo Konare" purchased and processed 242 tons above the 800 tons allocated to all companies in Bulgaria for 1992 The company in question was prosecuted

Table 10 shows the territorial distribution of snail use for 1989 and 1990 In view of the incredible increase of the number of companies collecting and exporting snails during the last two years such information was impossible to compile for 1991 and 1992 Districts where snails are consistently purchased in great quantities are the Sofia district and city (31 4% and 30 7% respectively of the total for the country for the last two years) followed by Lovech (14 2% and 20 9%), Plovdiv (15 9% in 1989), and Pazardzhik (11 3% in 1989) On the whole, the purchasing of snails is not evenly distributed over the country, but is greater in regions where snails are traditionally gathered or consumed as food In some districts namely Bourgas, Sliven, Yambol, and Targovishte, there was no commercial use of snails despite their presence in these territories

The purchase price of snails has varied in the following manner over the last several years in 1987 it was 0 50 1 00 leva per kg, in 1990, it jumped to 2 80 leva, in 1991 it increased to 7 8 leva per kg If we assume that the export price of cooled snails (i e , without further processing) is about 1 USD then in 1992 the companies have made from the export of 1042 tons of snails an income of 1,042,000 USD For the period 1982 1992 the country has been exporting an average of 745 tons per year, which works out to an annual income of 745 000 USD

The main importers of snails are Greece Cyprus Turkey, and more recently Germany and Sweden (which however, require processed snails) The country suffers a loss in the exporting of unprocessed snails (which are cooled only) At present snails are processed in a factory owned by the "Kurtovo Konare" company in Plovdiv and in the town of Berkovitsa Some of the companies, such as "Lordjina" in Sofia, have attracted new investments and have imported Swedish technology for the production of canned snails for export under much favorable terms

With respect to this resource we can expect that its use will remain at the level of 750 900 tons per year

Table 9 Resource Use of the Two Species of Snails in Bulgaria (Tons per Years)

Year	Central Cooper Union	Forest Committee (Murgash)	Bulgarplod export	"Agros" Interpred"	Other companies	Total Number of companies	Total quantity of snails
1982	725		-			1	1725
1983	1050					1	11050
1984	740					1	1740
1985	675	-				1	1675
1986	650				-	1	1650
1987	465	37				2	2502
1988	408	120		-		2	2528
1989	300(+140)	260	152	80(+31)	8(+13)	6	6800(+184)
1990	383(+32)	93	201	22(+31)	20(+4)	6	6719(+67)
1991	229		155	39(+7)	279	13	13702(+7)
1992	198	87	100		415	38	381042(+80)

Note Quantities in parentheses are for snails produced from specially prepared areas (i e , snail "farms")

Table 10 Quantities of Snails Purchased by Commercial Companies for the Period 1989 1990 (tons per year per district)

District	1989	1990	District	1989	1990
Blagoevgrad	16	4	Pernik	12	5
Veliko Tarnovo	7	16	Pleven	3	13
Varna	21	-	Plovdiv	121	38
Vidin		3	Ruse	70	26
Vratza	8	22	Silistra	-	10
Gabrovo	15	44	Smolian	5	2
Kardzhali	16	6	Sofia city	93	133
Kiustendil	21	8	Sofia district	172	50
Lovech	120	125	Stara Zagora	10	2
Montana	39	32	Dobrich		6
Pazardzhik	99	21	Shumen		31

The Ministry of Environment has proposed that the quotas be distributed centrally and on a tender basis in order to reduce the number of companies participating in the tender and provide better export conditions for the winners Control over the quantities purchased and exported will be much more efficient as well

Our recommendations may be summarized as follows

1 Extend the ban on purchasing snails until 20 May in order to provide the best conditions for laying eggs

2 Stimulate the purchase of snails in districts where there has been no commercial use of the resource until now

3 When auctioning tenders priority should go to processed and canned products thus ensuring fuller employment and higher income from the exported product

Government Decree No 137 of 12 July 1991 imposes a government tax of 1 lev per kg of snails (and 10 leva per individual snake) levied by the Regional Forests Directorates or by the Committee of Forests itself The same decree provides an indemnity to be paid for each kilo of snails and 20 leva for each individual snake damaged or destroyed by hunting or collecting We strongly recommend that these taxes and damages be increased and paid into a new fund with the Ministry of Environment Since both kinds of resources are mainly distributed either within human settlements (snails) or in agricultural lands, there is no reason why the Committee of Forests should collect these taxes and indemnities Neither is there any reason why the Committee of Forests should consider the use of these particular resources as a by product of forest activities only The funds thus raised can and should be directed to financing special studies on the numbers and population dynamics of the snakes and snails so that their use may be better and more wisely organized in the future

Frogs

The marsh frog (*Rana ridibunda*) is subject to commercial use This species is distributed ubiquitously in the country with the exception of the higher mountainous regions It prefers standing water bodies, riversides marshes etc The breeding season is April May The female lays between 5 000 and 10 000 eggs thus providing for a very good reproduction rate given suitable habitats and living conditions

Until 10 or 15 years ago frogs were used at the rate of 80 to 100 tons per year for the whole of the country Main areas of for the commercial collection of frogs were the rice paddies in the districts of Plovdiv and Pazardzhik As most of these rice pads have been abandoned in recent years due to wsater deficits (and later to the rising price of irrigation water), frog production has dropped drastically to a mere 20 to 40 tons per year The export price varies between 3 and 4 USD per kg

There is no special ordinance to regulate the use of this resource Companies that collect and export frogs are instructed only to begin the hunting season after May 30 The marsh frog is included in Appendix III of the Bern Convention with the requirement that no disturbance should take place at breeding sites and during the breeding season

In view of the high reproductive potential of frogs and the availability still of quality refuges for frogs there is no direct threat for the time being to marsh frog populations It is important however that suitable water bodies be designated as breeding sites for frogs and adequately protected

Sea Snails

The only species of sea snail of commercial value in Bulgaria is the Rapana sea snail (*Rapana tomasiana*) It was unintentionally brought to the Black Sea by high sea merchant vessels from the Sea of Japan in the 1950s Eggs of the Rapana sea snail probably stuck to the underwater parts of ships and thus brought into the Black Sea In its native range – the eastern Pacific coast and the Sea of Japan – the numbers of the Rapana sea snail have been drastically depleted by over exploitation In the Black Sea, the snail has no natural enemies (such as sea stars), and so in the beginning the species' population boomed Rapana sea snails feeds mainly on Black Sea mussels and the mussel banks along the Black Sea coast have suffered considerable damage from the snail

There is no special ordinance regulating the use of sea snails The only restriction requires that snails be collected manually by skin or scuba divers In this manner given favorable weather conditions some divers have managed to collect up to 5 tons per day

The purchase price for sea snails is 180 USD per ton for Grade I snails (snails of individual weight over 200 g) and 120 USD for Grade II snails (individual weight less than 200 g) Two companies have exported a total of 37 tons the export price varying between 150 and 300 USD per ton for Grade I and II snails respectively Commercial revenues thus amounted to 8 325 USD for 1991

In 1992 the interest in exploiting Rapana sea snail resources increased and the Ministry of Environment issued export permits to five more companies Exports were contracted with Turkey at a stipulated price of 450 to 500 USD per ton of raw product Under these conditions, exports totalled about 750 tons, bringing an income of 356,000 USD No taxes were levied for the use of this resource State earnings were limited only to the export taxes

Our estimation concerning this resource is that there will be a considerable decrease in Rapana sea snail numbers in the coming years, and the species is going to gradually lose its commercial value, especially if hunters keep on collecting the snails manually Something similar has already been observed in Turkey, which purchases Rapana sea snails from Bulgaria, processes them and exports the processed product to Japan Some of the Bulgarian companies are looking for possibilities of processing the snails domestically and exporting the product directly to Japan We recommend that a tax be levied for the commercial use of this resource

Species Included in the Washington Convention (CITES)

Bulgaria ratified the Washington Convention (also known as Convention on International Trade in Endangered Species or CITES) on 16 april 1991 The text of the Convention was published in *Gazette No 6* of 1992 A total of about 70 species in the Bulgarian

fauna are included in the Convention Appendices Until now only hunters' trophies of bear, wolf and wild cat have had any commercial value as a resource and an object of trade in the sense of the Convention The state of these species' populations and the extent of their commercial use are provided in Section I of this report In 1991 the number of hunting trophies from bears that were exported and accompanied by the required CITES documents were 7 to France 1 to Canada and 1 to Germany In 1992 Bulgaria exported in the sense of this Convention the following hunting trophies 1 bear to Austria 3 bears to Spain and 1 wolf to France

Imports according to the stipulations of the Convention also included 20 species of plants produced from seeds in the Botanical Garden in London U K

With respect to exotic species, reexport of the following species of parrots from Singapore through Bulgaria to Hungary has taken place *Psittacula longi cauda* – 20 individual *Lorius garrulus* – 10 individuals Four pairs each of two additional species of parrots – *Cacatua sulphurea* and *Cacatua alba* – were also imported into Bulgaria

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Status and Assessment of Bulgarian Fish Resources

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SUMMARY

Bulgaria although relatively deficient in water re sources, has sufficient water to support an important fish industry Fishing as a means of livelihood is de veloping intensively along the Black Sea coast and the Danube River and along the valleys of the larger riv ers the Maritsa Iskar, Vatcha Mesta Strouma Vit Kamchia, Chaia Tundzha and others Many hydro technical projects (large medium and small dams) de signed to produce energy and/or to provide flood con trol have been built during the last several decades These provide good conditions for natural and artifi cial fish breeding and for relatively intensive fish ex ploitation There is a well developed network of spe cialized fish farms in which the main species of com mercially important fresh water fish in Bulgaria carp (*Hypophthalmichthys molitrix* (Val) and *Ctenopharyn godony idella*) and trout
are bred and cultivated

The aim of this report is to describe on the basis of existing information the state of the country's ich thyo fauna and to estimate its importance as an eco nomic resource for commercial fishing, fish farming and recreational fishing Estimates of the fish re sources of Bulgaria are provided for the Black Sea, the specialized fish farms the reservoirs and the Danube and other rivers The dynamics and present state of fish resources are considered stressing the trend to ward permanent deterioration of water quality and the diminishing of water stocks in the main water basins and watersheds

STATUS AND ASSESSMENT OF FISH RESOURCES ALONG THE BULGARIAN BLACK SEA COAST

The specific hydrological and hydrochemical re gime of the Black Sea is characterized by a clear stratification with two main layers (1) a superficial productive layer with oxygen present down to a depth of 140 160 m and (2) beneath this to the sea bottom (maximum depth 2245 m) a zone high in hydrogen sulphide rendering the waters lifeless It is a typical example of a land locked basin that has been inten sively influenced by anthropogenic activities over the last 20 25 years Pollution of the Black Sea with phos phates nitrates pesticides heavy metals oil and oil products from the inflowing rivers (83 mil ton suspen sions annually) and from coastal sources, is well documented As a result of pollution, the processes of eutrophication have advanced quickly phytoplankton blooms and the accumulation of organic matter in the bottom sediment and in the pelagic zone occur widely These negative phenomena, and the spread of the abundant ctenophore *Mnemia maccradyi* (or *Mne miopsis)* which was introduced from the northwest Atlantic by ship ballast water in the 1980s, directly and indirectly influence the status and dynamics of the fish resources

The recorded volumes of commercial catches provide to a great extent an accurate sense of the dy namics of the fish populations In the Bulgarian Black Sea waters, their volumes varied in the period 1959 1992 between 2 900 (1990) and 19 800 (1981) t (Table 1) These figures do not correlate directly to fluctuations in the abundance of resources, since catch volumes are also directly dependant on the market, the development of fishing gear and other trends in the development of the fishing sector For example the development and employment of trawling equipment has had a significant effect on the Bulgarian Black Sea fishery Pelagic trawls which increased quickly in the early 1970s resulted in significant increases in the vol ume of the catches Decommissioning the trawlers and selling fewer to foreign companies have had an opposite effect The trawling fleet was reduced from 20 units in 1988 to 11 units in 1992

Sprat (*Sprattus sprattus*)

Sprat is the most abundant commercial fish It is of boreal origin with local vertical migrations to the coast It has a comparatively short life span of 4 5 years Most important are the first two age groups, which usually include 90 92% of the total population Because sprat spawn in the open sea from October to March the eggs and larvae are less negatively influ enced by *Mnemia maccradyi* the biomass of which is very low in the same period Sprat is caught mainly by trawlers on virtually a year round basis as well as by trap nets from April to June Then after the spawning period ends, the species enters the coastal waters to feed The mean size of sprat is 9 10 cm (in length) and 5 g (in weight) (Table 2) In the last 15 years the mean length appears to have declined

Table 1 Annual fish catch in the Bulgarian part of the Black Sea during the period 1959 1992

Year	Thousands of tons	Year	Thousands of tons	Year	Thousands of tons	Year	Thousands of tons
1959	5 1	1968	3 6	1977	10 1	1985	16 7
1960	8 4	1969	3 6	1978	12 0	1986	12 8
1961	4 3	1970	3 1	1979	15 1	1987	12 0
1962	3 8	1971	3 6	1980	17 9	1988	8 1
1963	3 8	1972	3 9	1981	19 8	1989	8 6
1964	4 5	1973	5 0	1982	17 3	1990	2 9 (est)
1965	5 5	1974	7 5	1983	13 4	1991	2 7 (est)
1966	3 4	1975	8 6	1984	15 5	1992	3 9 (est)
1967	4 4	1976	9 9				

Table 2 Mean measurements of the sprat (*Sprattus sprattus*)

Absolute length			Individual Weight		
Year	Quarter	Average Length (cm)	Year	Quarter	Average Weight (g)
1978 88	I	10 20	1990	I	4 90
	II	9 56		II	3 75
	III	9 53		III	4 47
	IV	10 12		IV	4 25
1989 91	I	8 85	1991	I	3 50
	II	9 42		II	4 52
	III	8 80		III	4 53
	IV	9 07		IV	4 09
1992	I	8 69	1992	I	3 67
	II	8 80		II	4 73
	III	8 73		III	4 05
	IV	9 22		IV	4 54

The catch of sprat provides some 95% of the total Bulgarian Black Sea catch The total biomass of the sprat undergoes annual fluctuations depending on the survival of the new generations and the size of the re cruitment class The biomass is assessed by trawler hydroacoustic survey and by analytical methods (mainly VPA or virtual population analysis) A 1982 instrument assessment determined that the sprat bio mass in the western part of the Black Sea was in the range of 170 200,000 tons The assessment along the Bulgarian Black Sea coast was as follows

Year	Thousand Tons
1984	24
1985	69
1986	77
1987	21
1988	74
1990	27

These figures especially for 1984 and 1987 are con sidered to be underestimates

Horse mackerel (*Trachurus mediterraneus ponticus*)

The horse mackerel is a Mediterranean species that winters in the southwest part of the Black Sea and the Bosphorus pre strait area In spring (May) it mi grates for feeding and reproduction to the northwest part of the Black Sea The autumn migration to the wintering areas takes place in September October The life span is about 10 12 years though in catches the first four age classes dominate The average length depends on the volume of the recruitment the domi nant generations in the age composition generally range between 11 15 cm It is caught by trawler and trap net The Bulgarian catch which has ranged be tween 35 t (1968) and 2200 t (1974) includes only a small part of the stock The larger part of the catch has been taken by Turkey (up to 65,000 t in 1979) and Russia (up to 22 000 t in 1972) The Romanian catch has reached a maximum of 2 200 tons Assessments of utilization of the species come close to the values of the optimum allowable yield, corresponding to a total biomass of 100 400 000 tons Due to the seasonal character of the fishery (May June and September October) and peculiarities of the spring autumn mi gration Bulgaria utilizes about 1 2% of that stock Over the last 5 years the catch has sharply decreased due to the negative influence of *Mnemia maccradyi* (tons)

1988	1677	
1989	1101	
1990	164	
1991	55	(estimate)
1992	55	(estimate)

Anchovy (*Engraulis encrasicholus*)

A warm water highly abundant species it has a life span of 4 5 years and a mean length of 11 13 cm It winters along the Anatolian coast and in spring (May) migrates to the northern regions of the Black Sea A relatively small portion of the stock comes to the Bulgarian coast even in years of high stock Stock assessments are usually given separately for the two halves of the Black Sea and are determined by infor mation obtained from experimental fishing with pe lagic trawls (thousand tons)

West Black Sea	East Black Sea
40 300	36 264

In the last 5 6 years the anchovy stocks have sharply declined to the point that the species has now almost lost its commercial significance The causes are the negative influence of *Mnemiopsis* and over fishing in the Turkish fishery in the winter

Turbot (*Scophthalmus maeoticus*)

This carnivorous demersal (near bottom) species has a relatively long life cycle (12 14 years), an aver age length of 55 58 cm, and an average weight of 3 7 kg It migrates vertically in the winter to a depth of 80 90 m (November) and during its reproductive phase to a depth of 10 40 m (May) The Bulgarian annual catch over the last several decades has been as follows (tons)

1925 1934	39
1935 1954	110
1955 1977	294
1978 1980	93

The total biomass of the stock (VPA) ranges between 430 (1977) and 1710 (1962) tons The recruitment of the stock begins to decline if the commercial stock fall below 300 tons Such a decrease was registered in the late 1980s and led to a 5 year fishing moratorium put into effect by Bulgaria Russia and Romania There were indications of a stock recovery in the first two years of the moratorium (1989 1990) but an invasion of Turkish fishing vessels into Bulgarian waters caused heavy damage that has been difficult to overcome Information from a bottom trawling survey in January 1992 indicated a commercial biomass of 100 tons

Black Sea shad (*Alosa pontica pontica*)

A bathypelagic anadromous fish, the Black Sea shad has a 7 year life span an average length of 24 26 cm, and an average weight of about 220 g Living in the Black Sea, it enters the Danube for spawning (April May) The 3 4 age groups dominate The Bulgarian annual catch from the Black Sea are in the range of 6 440 t and are determined by the fluctua tions in abundance and by hydrometeorological con ditions in April May The biomass of the species ranges between 1 8 11,000 tons (VPA) The main share of the catch is caught by Romania and Russia in the mouth of the Danube In the last 5 years the stock has declined due to river pollution and the construc tion of dams and other hydrotechnical structures

Pontic whiting (*Odontogadus merlangus euxinus*)

A boreal demersal species with a life span of 6 8 years mean length of 16 cm and mean weight of 25 30 g It is an important link between benthic fauna and the larger predators It has been only partially ex ploited as there is no tradition of marketing it In the last 10 years the catch has reached 10 12 000 t mainly by Russia and to a degree Romania In the 1980s the stock for the whole basin was assessed at 30 35 000 t with 3 4,000 tons on the Bulgarian shelf

Picked dogfish (*Squalus acanthias*)

Dogfish grow up to 150 cm in length and 3 7 kg in weight over a life span that reaches up to 20 years The catches are taken primarily by trawl and bottom long lines There is no basis for a real assessment of the stock though the catches in recent years have in creased due to the market demand 3 4 000 t for the basin as a whole and approximately 100 200 t for the Bulgarian shelf

Gobies (Family Gobiidae)

The species of this family are not dominant in the annual catch Annual changes of the latter are as fol lows (tons)

1940 1960	90 180
1961 1990	24 90

These figures reflect the substantial reduction of gobie populations in the coastal lakes Until 1960 the catches in the Bourgas Lake were in the range of 30 115 tons per year The situation was similar at Varna Lake which was subsequently influenced by in creases in pollution and salinity after the second canal between the sea and the lake was built

In the sea the dominant species are *Neogobius melanostomus* and *Mesogobius batracnocephalus* (their local names are strongil' and "lihnus") which are caught by both commercial and recreational fishers Approximately 80% of the sea catch (up to 30 40 tons annually) consists of strongil a continuous spawning species with a long reproductive cycle Since 1990, a prohibition on spring fishing of gobies (45 days during their reproductive season) has been put into force Assessments of the stocks (there are 21 species in the Bulgarian waters) have not been conducted Recently eutrophication and oxygen deficiency have continu ously diminished the stocks of gobies

Other species important for the fishery are the mullets (Mugilidae) blue fish (*Pomatomus saltatrix*) silverside smelt (*Atherina mochon pontica*) and other fish of secondary importance Bonito (*Sarda sarda*) and mackerel (*Scomber scombrus*), of utmost signifi cance in the early 1970s are now rarely caught

The summarized data demonstrate that since 1985 sprat has been the most important species for the Bulgarian fishery, accounting for up to 95% of the commercial catch The Bulgarian catch also includes horse mackerel and Black Sea shad (about 2 5 3 0%) and other minor species As a basis for comparison, the following are data for the species composition in the commercial fishery in the period 1931 1971 (the "clean sea period)(%)

sprat	10 7 57 0
bonito	1 0 32 9
mackerel	10 4 27 3
horse mackerel	10 0 17 3

The differences are considerable and illustrate the sub stantial changes in the composition of catches, caused mainly by the eutrophication of the Black Sea

In addition to national legislation, the Black Sea fishery is regulated by the International Commission for the Application of the Agreement for Fishing in the Black Sea in which Bulgaria Romania and the Black Sea countries of the former Soviet Union par ticipate Every two years the Commission holds its meeting It sets no quota limitations, but determines regulations for minimum allowable fish size for fishing of each commercial species, for by catching at non standard lengths, for minimum mesh size etc For the period 1 January 1989 to 31 December 1993 a moratorium on turbot fishing was established The political changes in the Eastern European countries disrupted the functions of the Commission and it now serves mainly as a means of exchanging fishery and scientific information At present Bulgaria is trying to reestablish the previous relations so that a new text of the Convention can be elaborated Turkey has been continuously invited to join the Commission and is ex pected to do so

Bulgaria has taken measures to restrict the harm ful effects of certain fishing activities on the fish re sources and on marine ecosystems in general In 1991 for the first time a prohibition was put into place re lated to the use of bottom trawlers In previous years trawlers caused irreversible damage not only to the fish stock but to the whole benthic biocoenosis In 1992 all types of trawler fishing were forbidden within the 3 mile coastal zone along the north part of the Bulgarian coast and in the 1 mile zone south from Cape Emine Authorities are expected to adopt other regulations for the protection of fish resources and to carry out activities to compensate for the decrease in fish stocks by stimulating the development of mariculture In general the main issue in the protec tion and recovery of the Black Sea fishery resources remains protection of the marine environment from further pollution and the adoption of measures to im prove the ecological state of the whole watershed ba sin

STATUS AND ASSESSMENT OF MARICULTURE AND AQUACULTURE RESOURCES ALONG THE BLACK SEA COAST

Along the Bulgarian Black Sea coast mariculture is still in a premature state of development The In stitute of Fish Resources at Varna and the Fisheries Institute at Bourgas planned and implemented bio technologies (involving two options with and with out net sleeves) for the cultivation and processing at sea and ashore of mussels (*Mytilus galloprovincialis* Lmk) Two mussel farms were built at Sozopol (IRP 25 planned annual production capacity 200 300 t

live weight) and at Nessebar (the Black Sea Fishing Co Ltd planned annual capacity 300 400 t) Both farms are being used far below their actual potential

In the 1970s the Fisheries Institute at Bourgas experimented with cage cultivation of steelhead trout (*Salmo gairdneri*) and kisutch (*Oncorhynchus kisutch*) at Sozopol In the Experimental Station at Pomorie the Fisheries Institute carried out research and development on hibernation (in a greenhouse) and fattening (in the Pomorie Lagoon from spring autumn) of mullet fry (1+) capturing the 1 year fish in autumn (annual harvest 10 20 t dominant species *Mugil saliens* and *M cephalus*) In addition the Experimental Station at Pomorie conducted tests on the propagation of Black Sea shrimp (*Palaemon adspersus*) and Black Sea flounder (*Platychtys flesus*) Phytoplankton and zooplankton were used for feed In 1992 due to deficient state investments research at the Pomorie Station ceased

Private companies are interested in the development of commercial mussel culture Mussels (*Mytilus gallo provincialis* Lmk) are still the main species of interest to emerging farmers In this respect bi and polyculture with algae or fish are also a tempting subject of research and development Also worthy of attention are the combination of traditional fishing (trap nets recreational fishing) and mussel culture and the establishment and exploitation of artificial reefs

Private companies are also interested in commercial cultivation of salmonid species such as *Salmo salar S gairdneri*, and *O kisutch* However numerous problems financing legal aspects (e g permission for sea concessions) the environmental effects of introduced species other risks from introductions etc are still under discussion and remain to be solved Turbot (*Scophthalmus maeoticus*) is also of utmost interest as a potential candidate for cultivation due to its high marketing demand and the damage that natural stocks have suffered In 1991 Bulgaria joined the Mediterranean Regional Aquaculture Project (MEDRAP II) of the UNDP/FAO The main activity of the project is to form networks for information training and research on aquaculture and the environment The Fisheries Institute at Bourgas is the National Coordinator of MEDRAP However for Bulgaria to participate effectively in MEDRAP II a number of organizational technical and financial problems need to be overcome

Though promising results have been achieved and private mariculture initiatives have expanded aqua/mariculture development in Bulgaria is still influenced primarily by the general socioeconomic development of the country in the context of integrated coastal activities Mariculture is a means for recovering and augmenting the fishery resources and for employing the coastal population through better use of the fish processing capacities that are available but currently under exploited The mariculture facilities of Bulgaria that have already been established could serve as a stable promising prerequisite for developing mariculture along the coast The capacities and facilities of the IRP 25 (the former Fisheries Institute) include

The Mussel Culture Farm at Sozopol (IRP 25 Co Ltd Bourgas, Bulgaria the former Fisheries Institute)

- A marine farm for suspended mussel culture (*Mytilus galloprovincialis* Lmk), 2 miles from the shore, in the vicinity of the town of Sozopol (5000 inhabitants), by an island
- "Long line" systems for 5000 collectors (5 m long)
- Production cycle 9 10 months
- Harvesting season February May
- Ashore farm buildings a quay, laboratory rooms utility buildings water supply electrification and heating installations
- Personnel 4 people (2 biologists)
- Three boats Production transported to Bourgas (35 km to the north) for processing (canning and freezing IQF) Shells used for chicken fodder

The Mariculture Experimentation Station at Pomorie (IRP 25 Co Ltd Bourgas Bulgaria the former Fisheries Institute)

- Ashore 0 6 ha working area Canal connecting the sea and the lagoon
- Lagoon 250 ha 0 8 1 2 m deep
- Earth ponds 2 ha, 0 8 1 0 m deep
- Open tanks 45 pcs, 30 50 cubic m 0 8 1 8 m deep (mountable)
- Covered nursing tanks 67 pcs 1 5 3 0 cubic m round and rectangular, incubating department equipment for phyto and zooplankton food production
- Laboratories chemical ichthyological hydrobiological, ichthyopathological (not completely equipped)
- Supplementary installations water supply from the sea, lagoon, and drilling Salinity 15 30% Water temperatures max 26 27° C (outdoor) min 0 (10) C (outdoor indoor 8 10° C Water purification installations
- Pomorie 30 000 inhabitants, 20 km north of Bourgas
- Bourgas 250 000 inhabitants district center

STATUS AND ASSESSMENT OF RESERVOIR, SPECIALIZED FISH FARM, AND DANUBE RIVER RESOURCES

Bulgaria's water resources are relatively scarce though in terms of area the potential of the fresh waters is considerable Their cadastral area is approximately 700 mil m 300 mil m^2 of artificial water basins are in good condition for commercial fish exploitation with natural and artificial breeding for industrial and recreational fishing The area of specialized fish farms is approximately 37 mil m^2 with ponds for artificial breeding and rearing of freshwater fish

Good conditions exist for semi intensive fish farming in some reservoirs for artificial propagation raising fattening and catching of valuable fish species In some reservoirs fish species have been introduced for commercial fishing and for specialized fish farms These operations are still state or limited ownership companies with state property The decisions affecting privatization of the fish culture sector are still pending Most reservoirs are not suitable for commercial fish ery since they lack technical equipment Those reser voirs are used for recreational fishing and their fish re sources reproduce naturally A few are artificially stocked from time to time

The reservoirs that support fishing activity have various hydrographic hydrochemical hydrobiological, and fish farming peculiarities They vary in area and volume and occupy different climatic zones The forms of fish exploitation on them differ as well

The share of reservoirs larger than 5 mil m³ is the largest These are classified as large reservoirs 61 3% of the total reservoir area of the country The average sized reservoirs have an area of 2 5 mil m , their share of the total is 9 5% Reservoirs smaller than 2 mil m comprise 28 2% of the total dam lake area Reservoirs suitable for intensive fishery activity include 37 6% of the total in the country The re maining part of the reservoir potential is used for en ergy production water supply irrigation farming hy dromelioration commercial and recreational fishery, and other activities

In 1989 12 455 t of fish were caught in these wa ters The Danube catch added 360 tons The most im portant species were carp (8011 tons 64 36%) phy tophages mainly *Hypophthalmichthys molitrix* (Val) (2815 tons 22 60%) trout (1099 tons 8 82%) and other species (530 tons 4 26%)

In the Danube catches the following species were dominant carp (*Hypophthalmichthys molitrix*) perch *Carassius carassius* (L), *Abramis brama* L *Scardinius erythrophthalmus* the Danube barbel and chub Catches of sheetfish and sturgeons have declined In the 1940s the Danube catch was several times larger even in the 1950s and some later years the catch ex ceeded 1500 tons Several factors have contributed to the sharp decline of the fish stock and catch including industrial pollution sewage pollution and destruction of the wetlands along the Danube (the last being sources for good catches and areas for natural fish re production and recruitment for the fish stock of the river A large portion of the natural fish spawning ar eas have been destroyed Commercial construction (especially hydrotechnical developments) along the riverbanks took away sand and other material from the river bottom disturbing natural migration routes Sturgeon (Fam Acipenseridae) migrating from the Black Sea to breed in the Danube were heavily af fected as was the Black Sea shad (*Alosa pontica pon tica*, also called 'karagyoz')

As a result of the socioeconomic and political changes in the country after 1989 and in particular the disturbance of agricultural activity production of fry and fingerlings and of fish for human consumption has sharply decreased Last year fish production was 6 8000 tons A precise figure cannot be given since the system for collecting statistical information has been disrupted At the same time production expen ditures have quickly increased (i e prices of fodder electricity water pharmaceuticals etc) and the mar ket demand for fish has decreased There are a num ber of difficult questions concerning the ownership and management of the fish ponds, the restoration of private land ownership and the shift to a market economy that affect the processes of privatization in this sector

The serious decrease in production of fry and fin gerlings of basic commercial fish species also involves other factors the labor intensive nature of the opera tions, high risk factors (e g the water supply prob lem) quality demands the heavy losses caused by the abundant fish eating bird *Phalacrocorax carbo* (L 1758) The status and potential (i e the availability of suitable fresh waters for propagation and cultivation) of the freshwater fish in Bulgaria are illustrated in the Tables 3 4 and 5

The present situation in the country is not favor able for building new fish farms Fish production would considerably increase if better use were made of existing fish ponds and reservoir waters The potential for developing existing resources is demonstrated by the following assessments

a) The existing 37 mil m² of pond fish farms (average production 0 15 0 17 kg/m) could pro duce 5500 6000 t and better management could produce more than 0 20 kg/m
b) Small and average sized reservoirs with a total area of approximately 115 mil m² and an average production of 0 075 0 085 kg/m² could produce a total of 8500 10 000 tons of fish
c) Larger reservoirs with a total area of 190 mil m² could produce an average of 0 0065 0 0085 kg/m and 1250 1700 tons

Under optimal conditions, then the fresh waters of Bulgaria could potentially produce 15000 18000 tons Such quantities could satisfy consumer demand for freshwater fish while producing a share for export to the European market Bulgarian trout is well appreci ated in some European countries and can compete in quality with the fish of many other countries Carp is exported mainly to Greece where the demand is higher than in other European countries

To satisfy the need for freshwater farming pro duction 40 46 million fry and fingerlings are required They could be obtained from the hatcheries ponds and fish farms of the country In some of the large dams, fish cultivation in net cages could be carried

Table 3 Specialized basin fisheries (fishbreeding basins/thousands of square meters)

District	Total	Including	
		Carp	Trout
1 Bourgas	2 455	2,440	15
2 Haskovo	3,132	3 130	2
3 Plovdiv	6,746	6,530	216
4 Sofia	2 921	2,800	121
5 Varna	1,173	1,165	8
6 Lovech	7,269	7,240	29
7 Montana	2 855	2,825	30
8 Razgrad	10 855	10 855	-
Total	37,406	36,985	421

Table 4 Available water reservoir fund used for fishbreeding and fishing of freshwater fish usable surface area of reservoirs (millions of square meters)

District	Total	Including		
		Small	Medium	Large
1 Bourgas	50 9	14 3	-	36 6
2 Haskovo	51 4	6 7		44 7
3 Plovdiv	43 4	13 9	4 6	24 9
4 Sofia	17 4	8 5	4 0	8 5
5 Varna	56 5	6 5	3 6	46 4
6 Lovech	38 3	12 2	8 9	17 2
7 Montana	31 6	15 7	3 3	12 6
8 Razgrad	16 5	11 7	4 8	
Total	306 0	85 9	29 2	190 9

Table 5 Freshwater fish production in Bulgaria during 1989 (in tons)

District	Total	Including by species			
		Carp	Herbivorous	Trout	Other
1 Bourgas	2486	1792	432	112	150
2 Haskovo	1611	1331	250		30
3 Plovdiv	2850	1648	602	608	92
4 Sofia	812	316	209	254	33
5 Varna	283	156	80		47
6 Lovech	1674	1048	418	125	83
7 Montana	806	473	317		16
8 Razgrad	1833	1247	507		79
Total	12455	8011	2815	1099	530
Percent (%)	100 00	64 32	22 60	8 82	4 26

out although a lot of machinery is required to use this method The quality of the pellet fodder remains one of the important issues in freshwater fish production Bulgaria does not produce fodder of the required quality and the high price of imported fodder is a barrier to the expansion of commercial farming activities

STATUS AND ASSESSMENT OF THE RIVER FISH RESOURCES

The fish resources of the rivers in Bulgaria are of interest primarily for recreation Some of the larger rivers the Maritsa, Tundzha, Iskar, and Kamchia supported commercial fisheries up until World War II Commercial fishing then moved to the coastal fish populations and the fish resources of the rivers are no longer of commercially significance

Trout occupy the most important place among the river fish (*Salmo trutta morpha fario Salmo irideus* Gbb) They are found in the trout zone of the rivers over 800 m above sea level where the average slope of the riverbed is over 28% The findings presented below were obtained through an ichthyological survey of 26 rivers (Table 6) The ichthyologic material was collected according to methods described by Mahon et al (1979) Penezak (1981) Penezak et al (1981, 1982 1984), Lobon Cervia and Penezak (1984), and Zalewski (1983) The abundance was determined in accordance with the methods of Zipin (1956, 1958) Seber and Le Cren (1967), and Seber and Whole (1970) The biomass estimate was arrived at through the application of the formula of Mahon et al (1978)

The beds of the rivers in these studies consist mainly of gravel and stones The rivers are approximately 10 40 cm deep reaching 60 80 cm in pools The riverbanks are covered with coniferous and mixed forests and deciduous shrubs In general there are no large water plants

Table 6 Mean numbers and biomass of river trout (*Salmo trutta fario* L) in the major water basins

Water basin of river	Rivers where sport fishing is permitted		Rivers where sport fishing is banned	
	Numbers/ha	Biomass (kg/ha)	Numbers/ha	Biomass (kg/ha)
1 Vucha	831	72 527	3051	185 738
2 Chaya	270	28 167	1185	70 980
3 Mesta	1382	56 236	2290	91 211
4 Strouma	981	34 737	1490	41 297
5 Vit	1180	40 465	2413	89 280
6 Iskar	199	7 617	463	14 537
Total	807	39 958	1815	82 174

The oxygen content of the water is usually over 8 mg/l pH is 6 8 7 4 total hardness is 1 53 6 30 German degrees oxidation is 1 8 2 5 mg/l The mean annual temperature of the water is 4 8O C With few exceptions trout is the sole fish species living in rivers in these zones In some of the rivers under investigation, individual specimens of the mountain barbel (*Barbus meridionalis petenyi* Henkel) leshanka (*Phoxinus phoxinus* L) and glavoch (*Cottus gobio* L) could be caught but they are very scarce and do not influence the trout populations There is little or no industrial or sewage pollution in the trout zone

The state of the stock depends primarily on the recreational fishery The populations investigated in most of the rivers are natural and self reproducing The influence of artificial breeding is very small and is felt mainly in limited parts of the rivers In many river sections, the conditions for natural reproduction, conservation and recovery of the populations remain good Table 6 illustrates that the abundance and biomass of trout in the rivers where recreational fishing is permitted are about half that of the rivers where fishing is prohibited An indirect conclusion can be made that the fishery rivers can potentially accommodate at least twice as many fish but that their complete exploitation will damage natural reproduction, fish populations would have to be artificially cultivated to allow them to increase in abundance up to the optimum

In addition to trout many other native species live in the Bulgarian rivers Dominant species include chub, mountain barbel Maritsa barbel and Krim barbel

The abundance and biomass of the ichthyofauna in the Bulgarian rivers (3 main fishing areas) are shown in Table 7

The share (%) of valuable species in the rivers (3 fishing areas) also is presented in Table 7

The abundance and biomass of the dominant valuable species living in those fishing areas are shown in Table 8

Table 7 Abundance (#/ha) and biomass (kg/ha) of ichthyofauna and percentage of abundance and biomass represented by valuable fish species in the internal rivers of the three major water basins

	Water basin	Abundance (#/ha)	Biomass (kg/ha)	% represented by valuable species	
				Abundance	Biomass
1	River Danube	33,000	295	61	75
2	Black Sea	78,250	271	19	55
3	Aegean Sea	1 344	139	49	80

Table 8 Abundance (#/ha) and biomass (kg/ha) of dominant valuable species in the internal rivers of the three major water basins

	Water basin	River mullet (*Leuciscus cephalus*)	Black barbel (*Barbus meridionalis petenyi*)	Maritea barbel (*Barbus cyclolepis*)	Crimean barbel (*Barbus tauricus*)
		Abundance/Biomass			
1	River Danube	4,600/77	6,830/96		
2	Black Sea	79 700/125			4,020/13
3	Aegean Sea	1,780/51		3 280/67	

Table 9 Abundance (#/ha) and biomass (kg/ha) of ichthyofauna and percentage of abundance and biomass represented by valuable fish species in the internal rivers of Bulgaria

	River	Abundance (#/ha)	Biomass (kg/ha)	% represented by valuable species	
				Abundance	Biomass
1	Mesta	6,640	143	40 28	83 42
2	Strouma	24,904	278	61 50	82 78
3	Arda	8,785	117	45 52	73 00
4	Vit	26 724	258	68 00	88 00
5	Palakaria	39,288	332	51 00	65 00
6	Zlatna Panega	2 339	50	63 49	72 38
7	Fakiyska	51,057	223	20 38	55 16
8	Sredetska	157 537	392	17 12	45 20

The abundance and biomass of the fish populations in some of the major Bulgarian rivers are indicated in Table 9

Table 10 shows the abundance and biomass of the dominant fish species in the same rivers

(Note in Tables 8 and 10 the abundance (individuals/ha) is indicated in the numerator and biomass (kg/ha) in the denominator)

It must be stressed that the Zlatna Panega River is heavily polluted along its whole length The Strouma River is contaminated in different parts of its course along 60 km there are no fish The Vit River in the sector below Pleven, has no fish for 70 km Such is also the state of the Sredetzka River below the town of Grudovo (Sredetz)

CONCLUSION

As a conclusion to this report it should be pointed out that there is no complete well defined and precise

Table 10 Abundance (#/ha) and biomass (kg/ha) of dominant valuable species in the internal rivers of Bulgaria

River	River mullet (*Leuciscus cephalus*)	Black barbel (*Barbus meridionalis petenyi*)	Maritea barbel (*Barbus cyclolepia*)	Crimean barbel (*Barbus tauricus*)
	Abundance/Biomass			
1 Mesta	690/79		2,290/66	
2 Struma	4,055/63		3,900/61	
3 Arda	590/12		3,640/75	
4 Vit	2,660/56	12,670/156	-	
5 Palakaria	11,000/154	6,665/96		
6 Zlatna Panega	150/20	1,160/37		
7 Fakiyska	9,400/98			1,540/12
8 Sredetska	15,000/153			6,500/14

evidence about the present state of the fish resources of the freshwater basins and along the Bulgarian Black Sea coast This is due to the lack of systematic, coordinated research about the status and dynamics of the ichthyo-fauna as a resource Much systematic research is carried out by the Institute of Fish Re sources at Varna (for the Black Sea), the former Fisheries Institute (now IRP 25 Co Ltd, for maricul ture), the Institute of Freshwater Fish Culture at Plovdiv (mainly regarding freshwater commercial culture, including state fish farms), and certain centers for applied research within the Council of Hunters and Fishermen (regarding water basins for recrea tional fishing, mainly rivers and reservoirs) Some scientific data are also available through the Institute of Zoology and the Institute of Oceanography of the Bulgarian Academy of Sciences and the Biological Faculty of the University of Sofia, though their research is more biologically than resource (i e , stock) oriented

The main problem is a lack of linkages and a coordinating unit to harmonize the efforts of the many highly specialized and competent scientists, to stimu late and encourage their activities, and to summarize scientific results in a useful and applicable form for commercial conclusions and recommendations This need is even more urgent now than in the past due to the long term effects on fishing and fish culture of the former state monopoly, which caused heavy exploita tion of the resources while not caring about their protection, reproduction and recovery

Despite the high levels of pollution found in most water basins of Bulgaria, the freshwaters provide large volumes of food with high nutritive, dietary, and pharmaceutical value The society and the state need to pay attention to the potential noted above, and to create favorable conditions for the development, re production recovery, augmentation, and rational ex ploitation of the fish resources of Bulgaria

RECOMMENDATIONS

As a result of the analysis in this report it can be concluded that the state of Bulgarian fishery resources is critical (unsafe), and that serious measures are re quired to improve their natural and artificial rearing, conservation, and monitoring On this basis, some recommendations can be identified the accomplishment of which will contribute to the reinforcement of the resource base as a whole and to improvements in the present state of fish resources as well

1 Improve the laws and other legislative acts affecting the fisheries in order to retain the fish re sources

1 1 Elaborate a new Fishery Law and convey it to the Prime Ministry (Cabinet Council) and also to the Parliament by the end of 1993

1 2 Improve the operating laws and other legis lative acts for commercial utilization, protection, reproduction, and control of fish re sources through statements of the Cabinet Council and the other responsible institutions by the end of 1993

1 3 Prohibit all types and kinds of trawling and dragged fishing equipment and installations in the 3 mile coastal zone of the Black Sea to avoid disturbance of the sea-bottom benthic biocoenoses at the productive depths

1 4 Prohibit in stages all types of fishing activity in individual sections of the rivers and at the same time take measures to improve the conditions of natural fish reproduction, artificial fish rearing, protection, and control

1 5 Introduce a system of licenses for persons engaged in commercial fishing on the Black Sea, the Danube, and inland water basins

1 6 Prepare quota limitations for the commercial fishery and a system to enforce them
1 7 Pursue international agreements for fishing on the Danube and Black Sea by attracting the attention of Bulgarian and international non governmental organizations
Re examine the Agreement for the Fishery in the Black Sea and involve all the Black Sea countries in it

2 Other measures and actions connected with the protection and reproduction of fish resources

2 1 Stimulate development of mariculture along the Black Sea coast by creating and building up installations for the rearing of mussels mullets salmon and other species
2 2 Stimulate private fish farming during the pri vatization process by creating private and co operative fish farms, and effective exploi tation of the reservoir waters for fish produc tion
2 3 Conduct an inventory and classification of the freshwater resources suitable for fish farm exploitation (for commercial and recreational fishing and for fish farming) Each water ba sin should be divided into commercial and recreational fishing zones and zones should also be established to protect fish reproduc tion through legislative regulation of their utilization, management and conservation
2 4 Create a register of all permanent fishing grounds along the Black Sea coast and the Danube and provide for their rational exploi tation through regulation legal protection conservation and control
2 5 Stimulate selection activities (genetic breed ing) in fish farms to ensure that all fish pro ducers receive acceptable fry and fingerlings
2 6 Exploit all possibilities for the acclimatization of some new fish species to the Bulgarian climate and determine the suitability of cor responding water basins with the aim of in creasing fish production, diversifying the as sortment of fish in the country and achieving positive ecological effects
2 7 Carry out activities to limit the harmful ef fects of the invasive *Mnemiopsis* ctenophore on Black Sea resources
2 8 Take measures to re establish procedures for gathering fishery statistics with a view to ward ensuring full and exact information on the state of the fish resources by species and their present degree of commercial exploita tion

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Soil Cover, Land Use, and Soil Degradation in Bulgaria

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BULGARIA'S SOIL COVER STRUCTURE

Soils are classified and mapped on the basis of a number of properties – the kind thickness and ar rangement of the soil horizons (or layers) and their color texture structure reaction, consistency and mineralogical and chemical composition – as well as moisture and temperature regimes Soils tend to form a continuum on the earth's surface, as one usually grades gradually into others The boundaries or limits of the range of one kind of soil define that soil Soils are defined and classified in this way so that we can remember their significant properties organize our knowledge of them and show relationships among them and between them and their environment

The factors influencing soil formation – parent material biota climate topography – vary in space and over time At any one moment we observe a complex mosaic of soils on the earth's surface Inter actions among the factors are constrained in space, re sulting in intricacies far beyond simple descriptions of cause and effect (Arnold and Wilding, 1991)

The structure of the Bulgaria s soil cover is very complicated An adequate explanation of its evolution requires an understanding of factors beyond those presently affecting its formation Current soil forma tions are the result of natural changes from the Plio cene up to the present, of neotectonic processes and of human land use practices

Soils can be grouped in different ways depending on the soil characteristics used in classifying them and on the scale of the map on which the soil cover is shown

Eleven orders of soils are designated in the Soil Taxonomy (Soil Survey Staff 1975) They are be lieved to include all existing soils of the Earth Eight soil orders – Alfisols Aridisols, Entisols Histosols In ceptisols Mollisols Spodosols and Vertisols – have been recognized within the relatively small territory of Bulgaria The variations in soil cover structure are complicated by the spatial variability of today's cli matic conditions Five pedoclimatic regimes are rec ognized in the country s territory Frigid Udic Me sic Udic Mesic Ustic Mesic Xeric and Ther mic Xeric (Boyadjiev 1989)

Combinations of the most significant properties of the whole soil and of the soil moisture regimes define 32 great groups of soils (the third level of the Soil Taxonomy) – a sixth of those found in the whole ter ritory of the United States Ninety subgroups (the fourth level of the Soil Taxonomy) are currently rec ognized in Bulgaria – about a tenth of those found in the United States

The soil associations shown in the 1 1 000,000 scale map are composed of several related soil sub groups and similar soil temperature regimes More than 60 types of soil associations can be shown at this scale To describe each type of soil association would require more time and space than is possible here we shall describe only the principal soil cover characteris tics of the major physiographic provinces of Bulgaria

Soil associations 1, 2, 3 5, 6, 7, 8, 9 10 15 26, 27 and 28 are located in the northern part of the Danu bian Plain Typic and Entic Calcixerolls, Calcic, Typic and Entic Haploxerolls, Typic and Entic Haplustolls, Typic Argixerolls, and Mollic Haplustalfs are the predominant soils in these associations They form mainly on loess and loess like deposits on nearly level to gently sloped areas Alluvial terraces and bottomlands are occupied by Aquic and Fluvaquentic Haploxerolls and Haplustolls and Fluvaquentic and Typic Haplaquolls Mollic Halaquepts and Terric, Sapric Terric and Fluvaquentic Medihemists occur on nearly level or depressional parts of the floodplain Ruptic Alfic and Rendollic Eutrochrepts, and Typic Lithic, and Entic Rendolls are formed on clayey resid uum weathered from limestone on the low hills in the eastern part of the Danubian Plain

Soil associations 4 13, 14 16, 17, 18 20 21 24, 25, and 29 occupy the southern part of the Danubian Plain and the Ludogorsko Plateau in the eastern part of the Danubian Plain Vertic, Typic, and Entic Hapludolls, Typic Agriudolls, Typic, Mollic and Al-baquic Hapludalfs, and Entic and Typic Chromuderts and Pelluderts are the predominant soils in these asso ciations These soils are formed on silty and clayey continental deposits on the hilly plain In the river valleys these soils are found in combination with Aquic, Mollic, or Typic Udifluvents Dystric, Rup tic Alfic and Rendollic Eutrochrepts and Entic, Typic, and Lithic Rendolls are formed in silty and clayey re siduum weathered from limestone and siltstone

Soil associations 11 12 19 30 and 66 including Calcic and Typic Haploxerolls Typic Calcixerolls are formed on loess deposits on the Danubian Plain and Typic Haploxeralfs are formed on clayey continental deposits on the Avren Plateau Typic Entic, and Lithic Rendolls are formed in clayey limestone rego liths The river valleys are occupied by Aquic, Mollic and Typic Xerofluvents, and sometimes by Mollic

Halaquepts These associations cover the Black Sea coastal plain

The northern cuesta like foothills of the Balkan Mountains (Stara Planina) are occupied by soil asso ciations 22 23 and 31 Lithic Albaquic, and Aquic Hapludalfs and Lithic Dystric and Ruptic Alfic Eu trochrepts are the dominant soils in these associations Typic and Aquic Udifluvents can be found in the river valleys

Soil associations 32 33, 34 and 36 occupy the highest parts of the Balkan Rila Rhodope Pirin and other mountains Lithic Lithic Ruptic Alfic Ruptic Alfic, and Umbric Dystrocrepts, Entic, Lithic Haplumbrepts, Entic, Lithic and Cryic Rendolls, Entic and Lithic Haplorthods can be found in these moun tain regions Typic and Aquic Udifluvents, and Cu mulic and Fluventic Haplumbrepts occur in the river valleys

Soil associations 37, 38 and 44 occur in the for mer Pliocene lake basins in the western part of the country The soil cover of these areas consists of Typic and Entic Chromuderts and Pelluderts, Aquic Albaquic Lithic and Vertic Hapludalfs

The mountain foothills of the country's southern part are occupied by soil associations 35 40, 60 61 and 62, which consist of Typic Lithic, Ruptic Alfic, and Rendollic Eutrochrepts Typic, Vertic and Lithic Hapludalfs as dominant components and Typic and Aquic Udifluvents as soils in the river valleys

Soil associations 39 and 41 occur in the Strouma River valley The dominant soils of these associations are Typic, Udic, Vertic and Lithic Haplustalfs in the middle part of valley and Lithic Haploxeralfs in the southern part of the valley

The major components of soil associations 47 48 49 and 50 which occur in the Thracian Lowland, are Typic and Entic Chromoxererts and Pelloxererts on the flat areas, Vertic, Typic and Albaquic Haploxer alfs on the nearly level and gently sloped areas, and Typic and Aquic Xerofluvents and Fluventic and Flu vaquentic Haploxerolls in the bottomlands In the central part of the Lowland can be found Aquic and Typic Natrixeralfs and Aeric Halaquepts

Soil Associations 57, 58 and 59 occur in the ba sin and range structures at the southern foot of the Balkan Mountains The soil cover of these basins con sists of Typic Udifluvets and Ustifluvents Fluventic Ustochrepts and Typic and Lithic Haplustalfs in the western basins and Typic and Aquic Xerofluvents and Aeric Halaquepts in the eastern basins

Typic Albaquic, and Lithic Hapludalfs, and Typic Vertic, and Lithic Haploxeralfs are dominant components of soil associations 46 and 55 which occur in the foot hills in the northern and eastern parts of the Thracian Lowland

Soil associations 51 52, 63 64, and 65, which oc cupy both the southern part of the Black Sea coastal plain and the southern part of the Maritsa River val ley have similar soil cover structures Differentiating these associations is the presence of Aquolic and Typic Salorthids near the salty lakes (lagoons) of the Black Sea beach plain

The eastern Rhodope and Strandzha Mountains the Sakhar rolling mountains and hills, and the foot hills of these low mountain systems are occupied by soil associations 54 55 and 67 The dominant soils of these associations are Typic Vertic Albaquic Lithic and Lithic Ruptic Xerochreptic Haploxeralfs and Lithic Ruptic Alfic, and Rendollic Eutrochrepts Typic and Aquic Xerofluvents and Ustifluvents can be found in the river valleys

The southeastern part of Strandzha Mountain is covered by soil association 68 The special compo nents of this association are Ultic and Aqultic Haplox eralfs, which correspond closely to peculiarities of the native vegetation in this area

The highly diverse mosaic of these soil associa tions in Bulgaria provide the best evidence and basis for understanding the natural development and future conservation of biodiversity and genetic resources Soils are not simply a rooting medium for plants and a source of bio production The main features of the environments that existed during the formation and subsequent evolution of soils are reflected and re corded in the properties of the current soil cover An other way of saying this is that soil cover is the product and "memory bank" of biospheric and lithospheric in teractions In short, soil cover records and remembers human activities on the earth's surface (Arnold et al 1990)

LAND USE AND SOIL CONSERVATION PROBLEMS

This section of our report discusses the main agri cultural activities within Bulgaria

Statistical data and 1990 evaluations show that Bulgaria's total territory of 11 1 million ha is divided among agricultural land (6 85 million ha, 61 6%), woodland (3 85 million ha 34 7%), and built up areas (0 4 million ha 3 7%) Industrial enterprises open mines settlements infrastructural systems and other developments occupy 6 6% of the country s total terri tory Inland waters, rivers, ravines, and degraded lands cover 1 5%

The area of cultivated land is 4 6 million ha or 41 8 % of the country's territory Pasture land occu pies 1 5 million ha (13 7%) The cultivated lands are grouped as follows cropland – 3 85 million ha (83 1% of the cultivated area) grassland – 0 19 million ha (10 5% of the cultivated area) and vineyards and or chards – 0 3 million ha (just over 6% of the cultivated area)

The largest areas of cultivated land areas are lo cated in northern Bulgaria (59 01%) The area of cul tivated land in the Lovech and Varna regions are 0 77

and 0 71 million ha respectively, in the Russe region – 0 65 million ha and in Montana – 0 65 million ha The Sofia region notwithstanding its large total terri tory contains the least cultivated land (0 41 million ha)

The area of arable land in 1990 was 217 000 ha below that of 1950, despite the fact that 406 000 ha were added to the arable land fund in the interim The expansion of arable land was due mostly to the plowing of pasture land deforestation, and drainage of the Danubian floodplain During the same period, 290 000 ha of arable land were afforested or turned into pastures 88,200 ha were occupied by reservoirs and canals and 91 100 ha were disturbed by construc tion works A large area of arable land was displaced by open pit coal mining in the eastern part of the Thracian Lowland, and only 3,160 ha were reclaimed

Before the land reform measures of 1946 were adopted most landowners in Bulgaria possessed small sized properties Landowners with properties smaller than 10 ha held over 2 9 million ha, or more than 50% of the total agricultural land area In the 1950s when the cooperative farms were established fields were re constructed to accommodate large scale cultivation disturbing the naturally established field boundary strips that delimited the former properties As a result the natural habitats of many species were disturbed and the corridors connecting agricultural and forest territories broken The accelerated specialization and concentration of agricultural production led to a sud den restriction of species diversity in large territories, reducing the stability of the agroecosystems This led to accelerated soil degradation Intensive fertilization and the neglect of manures in the agroecosystem in creased soil acidification About 7 5% of the arable land area is highly acidic and there is proof that the rate of acidification has accelerated

Soil erosion is the most serious problem in terms of both its significance and its rate Estimates show that 78 3% of the arable land and 15% of the forest land are highly susceptible to water erosion, and 38 9% to wind erosion The total average annual soil loss from all types of land use is estimated at 135 9 million tons Irrigated land requires special measures to reduce erosion rates, 25 3% of the arable lands are under irrigation and 20% are located on slopes with little or no protection against soil erosion

Soil conservation practices are not new for agri culture in Bulgaria From time immemorial contour cropping and drainage furrowing after sowing have been practiced on sloping lands There still exist old terraces reinforced by stone and field boundary strips and over grown with bushes and trees in the moun tainous and semi mountainous regions where grapes and tobacco have been grown over the generations Afforestation to control soil erosion on eroded slopes and reinforcement projects along the banks of torren tial streams date in Bulgaria from the beginning of the 20th century

When large scale agriculture was first organized in the late 1940s and 1950s the field boundary strips were plowed up most of the trees and bushes up rooted and large fields for cultivation formed As a result water and wind erosion began to do unimpeded damage to agricultural land This process was acceler ated by the communist ideology's philosophical thesis – that land, being a natural resource, cannot be held pri vately, but only as public property For the majority of people, this meant that everybody could exploit the land but none were obliged to take care of it

The effects of that unwise agrarian policy arose soon afterwards In less than 25 years, about 10% of the arable land eroded completely and became unsuit able for cropping or afforestation Siltation in the res ervoirs occurred at a rate 5 6 times faster than project expectations Some small ponds built by the coopera tive farms completely silted up in 2 3 years About 20% of field crops were swept away periodically by dust storms Rainstorms formed deep gullies on sloped lands and muddy torrents destroyed not only the field crops but highways railroads, bridges, and residential and utility buildings as well

In the early 1970s, soil erosion was recognized as a national problem of primary significance for the damage it caused to the national economy Govern ment decrees, seeking to organize a campaign for soil conservation were issued The Designing Bureaus in methodological collaboration with research teams planned many erosion control projects for separate watersheds and cooperative farm territories terracing of vineyards and orchards, hydrological and biological reinforcement of torrential streams, construction of pasture complexes, and additional measures to im prove and increase soil productivity

In general these soil conservation projects were planned with a high level of proficiency Research information on expected rates of soil loss and the ef fects of soil conservation measures was used when ero sion control projects were designed However, most of these projects were never completely carried out The Specialized Enterprises that were supposed to execute the projects preferred to undertake only those erosion control projects that were best funded or that the co operative farms preferred For example, measures de signed to partition and orient large fields according to the local relief in the land – strip cropping, buffer strip cropping crop rotations, conservation tillage practices – were neglected The state funds for soil conservation were devoted mainly to hydrotechnical reinforcement of torrential streams terrace construction, riverbed correction small dam construction planting of grasses afforestation and improvements of pasture land (fencing clearing of stones and bushes the filling of small gullies ditch construction sod improvement fertilization etc)

According to a 1987 Agricultural Ministry report the funds laid out at that time for the National Long Term Erosion Control Program protected about 20%

of the lands exposed to erosion Though not very high even that percentage is suspicious because the whole program of erosion prevention was never completely fulfilled Moreover erosion control structures once completed were not maintained and began quickly to deteriorate many terraces have been damaged water collection ditches have broken grassed land has not been protected from excessive grazing and so forth

As previously mentioned a large part of the coun try's best land suffers periodically from wind erosion The significance of the problem has been established and is generally acknowledged, but nothing has been done to protect soils except to research and design projects Lately, shelterbelts to protect fields have not been planted due to funding shortages On irrigated land,
lack of interest has been the main factor preventing the application of erosion control tillage, crop rota tions, and other agronomic techniques for erosion control (Rousseva et al 1992)

With the radical changes taking place in the country's economy, it is difficult to predict how soil conservation will progress in the future It is logical to expect that soil conservation problems will decrease after land reprivatization occurs It is also logical to hope that these land use changes will have a favorable impact on biodiversity

INDUSTRIAL POLLUTION OF SOILS

The chronicle of industrial soil pollution begins in the early 1960s, when large scale industrialization be came more evident in Bulgaria This period saw the construction of plants for ferrous and non ferrous met allurgy, lignite coal power production, crude oil proc essing large scale chemical synthesis metal process ing, and cement production

The first signs of environmental distur bance appeared at this time (Raikov 1984) They be came more concretely and dramatically apparent in several locations during the 1970s (MOE, 1991, Raikov et al , 1988 Dilov and Petrov 1987) How ever definite and precise data on these effects were classified as so called "state secrets" during the 1980s

A system for routine soil pollution monitoring has now been organized It is based on a limited number of indicators that describe the typical pollutants emit ted within the country s territory Heavy metal and ar senic emissions from several production activities fly ash from power plants, and dust from cement produc tion undoubtedly have negative effects on both soil productivity and the quality of agricultural products Other phenomena being monitored include secon dary soil acidification due to acid precipitation, fluo rine dust pollution, secondary soil salinization, and pollution of soils near oil refineries Acute damage to vegetation shortly after irrigation with waste water containing organic chemicals and acids, and single in cidents involving chlorine, sulphur oxides and nitro gen oxides have been recorded accidentally

Heavy Metal Pollution of Soils

The soil chemical and agronomic aspects of heavy metal pollution have been studied at some length The most regularly occurring metals are copper zinc lead, and cadmium Other heavy metals – nickel chro mium mercury – have been found at significant levels only rarely Their heavy concentrations are usually related to oremining or are concomitant emissions of the main pollutant (copper zinc and lead)

Almost all heavy metals accumulate primarily in the surface soil layer and slightly in the lower soil hori zons This is due to the high reactibility of humic matter and the clay colloids This is illustrated by data from Tchuldjian (1989)

Bulgarian soils are low in organic matter and relatively high in clay Clay minerals are highly reac tive with different pollutants and the heavy metals in particular Their behavior in the soil is controlled by soil acidity Consequently, different forms of heavy

Depth (cm)	0 28	41 51	71 81	94 104	122 132	161 171
Copper (ppm)	456	36	30	29	38	42

metals occur according to their availability to plants across the whole range of soils from slightly alkaline calcareous to strongly acid podzolic soils Likewise industrial emissions and deposits range from alkaline to strongly acid Thus, pyrometallurgical lead zinc emissions of dust contribute to soil alkalinity But copper pyrometallurgy emits excessive sulphur oxides that acidify the soil The most mobile forms of the heavy metals which retain their toxicity in the soil so lution occur in relatively high concentrations in the acid soils and in lower concentrations in the calcareous soils

Although the amount of heavy metals available to the plants provide a more precise definition of the up per limit of phytotoxicity and/or of the permissible lev els of occurrence in food and forages, the total metal content level is still accepted as a measure of risk In Bulgaria this depends on soil acidity (pH) In accor dance with that, limits for Ac, Pb Zn and As soil content have been established and accepted (*State Ga zette 36* 1979) They are presented in Table 1

Limits on permissible levels in food (*State Gazette 39*, 1984) and recommended limits for forages (Dilov and Petrov, 1987) have also been accepted The char acteristic amounts of background concentrations sug gest that soils in Bulgaria contain forms of metal mi cro elements at safe levels When additional soil aci dification occurs, the permissible levels decline and metal concentrations may allow phytotoxicity to occur

Table 1 Permissible levels for lead, copper, and zinc recommended for Bulgarian soils

Permissible level in soil (ppm)	pH of soil in a water suspension (1 2 5)											
	3 5	4 0	4 5	5 0	5 5	5 7	6 0	6 2	6 5	7 0	7 5	8 0
Pb	20	25	30	40	50	60	70	75	80	80	80	80
Cu	15	20	25	40	60	80	120	230	250	260	270	280
Zn	20	30	40	60	90	110	200	300	320	340	360	370

Notes The permissible level for As is 25 ppm

	Recommended levels according to various literature sources											
	Cd	Ni	Co	Cr	Se	Sb	W	Ti	Zr	Sn	Mo	F
ppm	3	50	50	100	10	5	50	5000	300	50	5	800

The total accumulations of heavy metals in the soil are evaluated in accordance with the natural background and/or permissible pollution limit levels Commonly slight pollution of the soil – i e when the content is less then the doubled background level – is acceptable The permissible pollution level defines higher degrees of pollution risk and imposes respective forms of land use limitations, due to the non degradable nature of heavy metal pollutants Detoxifi cation is difficult and has rarely been undertaken at the time the pollution occurs

Sources of Pollution and the State of Their Tech nologies

a) ***Metallurgy***

- Mining and ore dressing of poor ores (Pb, Zc Cu and Fe ores) scattered in the mountainous and hilly regions about 30 small floatation plants py rometallurgical works based on outdated tech nologies

- Lead zinc smelter at Kurdzhaly operating since 1960, air born deposits of Pb, Zc and Cd on highly erodible soils mainly deluvial (stony) and cinnamonic forest soils with shallow profiles, pastures and small tobacco fields on sloped ter rains the total area subjected to pollution is about 3 000 4 000 hectares

- Lead zinc smelter at Plovdiv operating since 1962 capacity about 50 60 000 t Pb/year air born deposits of lead zinc and cadmium upon alluvial meadow soils used for intensive agricul ture irrigated high quality croplands suitable for more than 90 agricultural crops, the Pb Zn, and Cd in the topsoil reach levels of 900 1 000 and 50 ppm respectively the total area subjected to pol lution is about 13 15,000 hectares

- Copper smelter, including floatation and H_2SO_4 fittings at Pirdop operating since 1958, capacity about 100 000 t Cu/year, air born deposits of Cu As, and acids, and lesser amounts of Pb Zn, Cd Mn Se Sb, and Ta deluvial and cinnamonic for est soils with low pH values (3 0 5 0), production in the area consists mainly of fodder grasses, maize wheat and rye with pastures the majority of the soils are severely eroded and others (about 2 000 ha) cannot be farming effluents, strongly enriched with As and heavy metals, run into a river system used for paddy field irrigation amounts up to 800 ppm Cu and 150 ppm As are found in arable soils

- An old smelter producing black copper at the village of Ellyseina operating since 1910, air born deposits and effluents containing the same pollutants and similarly strong acid soils with high erodibility (see above[1]), soils have shallow profiles, occupied mainly by forests, pas tures and small plots of fodder grasses, maize and rye similar amounts of Cu, As, and other toxic elements in soils

- Iron smelter combined with floatation and coking operations, near the city of Sofia operating since 1962, emissions and effluents containing a wide range of pollutants field soils are smolnitsa cin namonic and alluvial meadow soils irrigated and polluted mainly with Pb, Zn Mn and also with Cd and As land is used for stock breeding basic farming and market gardening along the rivers amounts up to 350 ppm Pb and Zn each the problem area subject to restrictions for some crops is estimated at 800 1 000 ha and for vege tables much more

- Iron smelter combined with a steel mill at Pernik operating since 1953 similar to above but smaller, the rate of pollution is lower, land use is strongly attached to stock breeding, affected soils are limited in scale (250 350 ha)

b) ***Irrigation with polluted surface waters***

Nearly all the country s rivers are affected, particularly in their middle and lower reaches The rivers receive effluents from mining ore processing and metallurgy Typically this results in high rates of heavy metal accumulation in irrigated lands The affected area is estimated at between 8,000 and 10,000 hectares The most significantly affected rivers are the Topolnitsa, Teamok, Ogosta, and Arda

c) ***Sewage sludge from town water purification stations***

Sewage sludge contains high levels of heavy metal but considerably less than sludges from the large cities in the western countries As a rule, Cd, Ni Cr and Pb occur in amounts above the permissible limits for sludge applications in soils Bulgaria still experiences problems with sludge processing practices

d) ***Fly ash pollution from steam power plants***

The importance of this source lies in its abundance
– 7 million t/year – and in the chemical composition of the deposition Many microelements and heavy metals occur Ashes poor in CaO often contain heavy metals radioactive elements As, and B in much higher levels than the soils (Minkov 1984, Ministry of Energetics 1985) Some detailed studies have shown that the composition of ash deposits varies greatly depending on the origin of the material (domestic vs import) A large amount of ash has already accumulated – 150

	Metal			
	Mo	As	Ni	Cr
Content (ppm)	14 206	8 1112	27 110	20 105
Mean	55	55	55	71
	Metal			
	Sb	Zn	U	Th
Content (ppm)	1 15	40 149	6 21	14-24
Mean	11	81	12	18

million tons Local ash local problems are very serious The dumps occupy hundreds of hectares of agricultural land and are mostly filled up Some estimates indicate that Bulgaria is the leading country in terms of ash per capita (760 kg) (Ministry of Energetics, 1985)

It has not yet been shown that fly ash deposition rate reduces soil productivity even in areas close to steam power plants with high power production levels (600 800 MW) Soils are heavily polluted only in close proximity to the dumps There are no definite data of the air borne effects on soil acidity However the direct effects on vegetation have been established and are appreciable at the relatively short distance of 3 4 km The most typical effect has been documented in tobacco fields where the quality of the leaves is severely affected Soot pollution has also been established in close proximity to the power plants

There are about 15 steam power plants (200 800 MW) in Bulgaria Most were built between 1958 and 1965, primarily in regions producing a range of agricultural products – grain forage tobacco and vines

e) ***Cement dust pollution***

The cement industry is a large polluter of the environment In 1976, Bulgaria's 6 cement plants emitted a total of 400 000 t of cement dust (Skopina et al 1982) In addition, this production accounts for 15% of the ash 10% of the phosphogypsum, and the total amount of lead slag (Christo et al 1982) In areas near cement plants, extremely important sanitary and hygienic problems appear However cement dust does not always affect the soils in such a way as to reduce soil productivity Results on strongly acid soils are similar to those obtained after the purposeful application of lime For example in a region of light grey forest soils (Typic Albaqualfs), the pH level is 5 3 exchangeable Ca 9 meq/100 g and cation exchange capacity 18 meq/100 g these change, respectively to 7 8 25 meq/100 g and 27 meq/100 g The soil physical and mechanical technological properties improved In addition free carbonates amounting to 3 1% appeared However similar cement dust deposition on calcareous soils contributed to the deterioration of the plant nutrition regime In one example, the free carbonate content reached 17% (Kolchakov and Faitondjiev, 1981)

Cement dust directly affects vegetation A thick deposition crust combined with alkaline toxicity was observed in the Zlatna Panega region Even more complicated situations can be observed when air borne pollutants from different sources are mixed together (as has occurred as Devnya Povelyanovo, Dimitrovgrad and Pernik)

f) Fluoride dust pollution

Though incidental, fluoride dust pollution has been established near the phosphate producing plants at Devnia Povelyanovo and Dimitrovgrad Fluoride toxemia symptoms were described in ruminants allowed close to the plant near Dimitrovgrad in the early 1970s Increased fluorine concentrations have been established in the forage grasses there – enough to induce chronic poisoning Studies of other sources, such as the glass work plants, have not yet been conducted

g) *Soil salinization*

Soil salinization is an indirect effect of industrial pollution Unpurified waste waters emitted in production processes are widely used in irrigation systems Irrigation using waters from the Tundzha Maritsa and Danube Rivers creates a risk of secondary salinization in many localities At the same time the risk of using underground waters for irrigation can be considerably higher

Soil salinization in connection with brine production is typical in the industrial region of Provadiya Devnya in northeastern Bulgaria In this region the incidence of phytotoxicity is readily apparent, affecting a total area of 600 hectares The soils of the region – Typic and Calcic Haploxerolls – are transformed to Aeric Halaquepts (3 4% salts exchangeable Na = 40 70% of the cation exchange capacity of soils) (Kavarjiev, 1985)

LOW PRODUCTIVITY SOILS

Low soil productivity can result from several causes heavy metal accumulations from different sources secondary acidification from acid deposition and nitrogen fertilizers (which results in the increased availability of heavy metals to plants) phytotoxicity, as observed markedly in copper arsenic polluted soils In stances of 100% crop losses have even been observed Significant cases of loss of soil fertility have been observed after eradication of vineyards and the sowing of shallow rooted crops

Health problems have resulted from the ingestion of foods and forages containing toxic elements This is one of the most serious problems facing Bulgarian agriculture especially in areas where soils are polluted with lead and even low levels of cadmium Some regions of the country have high background levels of heavy metals

There have been cases of acute poisoning of ruminants that ingested fodder grasses and silages polluted by air borne deposits Contamination is a particularly large problem on lands used to grow leafy vegetables leafy forages and tobacco

RESPONDING TO SOIL POLLUTION PROBLEMS

It is the general aim of pollution response activities to decrease or modify the consequent effects of pollution on soils and plants in a manner compatible with normal land uses and other forms of human activity To meet this general goal a number of measures are required

Control

A program to control current heavy metal pollution of soils is already in progress Land use restrictions and adaptations of farming practices have also been initiated in several localities that face high pollution risks

Assessment

Some of the measures recommended and/or applied in the past need to be evaluated and modified (by adopting new rules and higher penalties additional prohibitions technical improvements new devices decreased allowable outputs of lead zinc and copper and so forth) At present there is no significant change for the worse in heavy metal pollution of the environment in Bulgaria due to the general decrease in production

Inventory and mapping

Inventory and mapping have been taking place for more than ten years with set purposes according to the sources of pollution At this point, 22 districts out of a total of 28 administrative subdivisions of the country have been mapped at a 1 25,000 scale In addition, a monitoring network has been established to measure trends in heavy metal pollution of soils (Table 2)

Amelioration

The goal of amelioration activities is to respond to pollution problems through an optimal regime of cultivation, fertilization, crop rotation plant protection and other agricultural practices Improvements in soil properties through chemical melioration, enrichment with organic matter and other means are undertaken with a view toward decreasing the availability of heavy metals to plants

Health and emission standards

Health risks and emission standards are checked in particular cases to ensure that they are adequately coordinated

Education and extension materials

As far as we know, there are no widely available publications or handbooks on this issue in Bulgaria A small monograph entitled "Some Problems of the Pollution of Soils" was edited by L Raikov (1984) and published by Zemizdat At present, some development projects involving this issue use literature from abroad

Policy

The goal of policy reforms should be to establish a financial and taxation system that addresses the problems that farmers and others face from pollution sources that builds in effective market mechanisms and that leads to restraints on and/or total cessation of soil pollution

Table 2 Heavy metal pollution of soils

By District	Cu	Zn	Pb	Cd	Ni	Co	Cr	Hg	Mn	As	Total
Plovdiv	+	+	7200	+					-		7200
Sofia District	4700	+	+	+			-		0	4700	4700
Kurdjali	0	<3400	3400	+	+	0	+				3400
Pazardjik	2300		300							400	2300
Montana	260	240	1600		-						1600
Sofia City	0	<1200	1200	+				-	<1200	+	1200
Vidin	500	80	90								500
Pernik	0	<300	300	0		0	0	0	0	<300	300
Haskovo	200*	100	0	0	0	0	0		0		200*
Bourgas	200*	0	0		0	0	0	0	0	+	200*
Targovishte		+	170	0		-				-	170
Vratsa	130	+	+	+					-	<130	130
Stara Zagora	100*	<100*	<100*	0	0	0	0			0	100*
Sliven	100*	<100*	<100*	0	0	0	0	0	0	0	100*
Yambol		<100*	100*	0	+	0	+	0	0	0	100*
Pleven	0	+	100*	0	0	0	0	0	0	0	100*
Razgrad	0	+	100*		0	0	0				100*
Shumen	0	+	100*		0	0	0	-			100*
Gabrovo	<100*	100*	<100*		0	0	0		-		100*
Veliko	<100*	100*	0		0	0	0				100*
Kyustendil	+	<100*	100*	0	0	0				-	100*
Varna	100*	+	+	0	0	0	0	0	0	+	100*
Russe	+	+	100*		0	0	0				100*

Notes

*** = expected polluted area** **= no data available**

+ = data for pollutant concomitant with major pollution **0 = established levels below the admissible limit**

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Section Three
Socioeconomic Aspects of Biodiversity Conservation in Bulgaria

Legal-Sociological Problems of Safeguarding Biological Resources in Bulgaria

Stefka S Naumova

The analysis on the operative legislation and judi cial practice in safeguarding the biological resources in the Republic of Bulgaria discloses purely juridical as pects of this problem of great importance At the same time however, special attention should be paid to another aspect of the problem – its reflection on public opinion the outer expression of which is the as sessment of the psychological adjustment of citizens to the decrees in the field under observation the willing ness of various social groups to participate actively in solving the ecological problems of the country which as is well known are of global significance

Therefore in order that the task set should be carried into effect a special legal sociological study was conducted, the results of which are part of the pre sent report The empiric sociological information col lected is valuable from the point of view of future leg islative decisions as well as with an eye on the practi cal application of the operative legislation

The purpose of the sociological research was em piric sociological information to be collected on the opinions and evaluations of citizens on matters con cerning the ecological situation in the country as a whole and on the affectivity of the operating legisla tion in protecting the biological resources in Bulgaria The research is representative for the country its scope being very wide – the respondents being in gen eral lines, divided into several basic groups, by using a typological excerpt for the citizens who are not jurists (persons working in enterprises polluters and people living in regions ecologically threatened) and the method of the casual proportional selection for the persons jurists as well as for the so called experts (physicians people included in the structures of vari ous state and public organs and organizations directly related to the problems of ecology) and particularly in the regions subject to the investigation in accordance with a typological symptom
– the Kremikovtsi Metallurgic Combinate and the Pet rochemical Plant in Bourgas

Taking into account the excessively dynamic character of nature protection legislation mostly re lated to the quick changes in the former socialist countries (privatization transition to free market economy the new requirements for an altered living standard etc) the method of the investigation and the instrumentarium itself were adapted in such a way that the changes in the social political situation practically being reflected in the nature protection legislation should be compiled with the necessity of getting full objective and reliable information on the topic investi gated at every concrete state of the research

In the questionnaire forms worked out respec tively adapted to collecting information from different respondents (citizens who are not jurists and experts) several blocks of questions were included with the following basic purposes

1 How far the persons interviewed are informed on the condition of the environment (in particular the animal and vegetation massif) sources of in formation reliability of the information, assess ment of the concrete ecological environment right to information on the ecological situation

2 Attitude of the people interviewed to the right to a favorable environment The problem of ecologi cally threatened regions in legal and sociological aspect

3 Relationship of the totality investigated to the problem of evaluating the effect on environment

4 Legal responsibility Attitude to the legal means for protecting the air, waters and soil from pollu tion

The preliminary information collected on the condition of the environment in the Republic of Bul garia (in particular the condition of the animal and plant life) showed that as a result of the large scale "socialist" industrialization of Bulgaria the ecological environment in it is in a very grave condition the soil, waters the air and as a consequence the whole ani mal and plant life, as well as the health of Bulgarians, are far below world standards In many regions of the country irreversible processes which even a perfect legislation cannot stop at present stage are observed (A typical example in this respect is the region around Dolno Ezerovo where animal and plant life have been completely destroyed and where specific diseases caused by the high pollution of the environment have been observed for years especially among the chil dren data supplied by physicians experts show some irrevocable processes in the organism of the rising generation the death rate among them having a very high coefficient in comparison to the data of other countries)

The fact that wherever there is human activity pollution is inevitable has given (and gives) grounds for many scientists and politicians from Western countries to claim that the communist regimes (and in particular the monopoly of state ownership) has noth ing in common with the tragic condition of environ ment that it is simply a result of the development of economy of the priority it has in any society

The analysis of the ecological situation in Bul garia however shows that it has been strongly influ enced by the communist regime which has left us poi soned land poisoned soil air and water Fundamen tally the reasons are two the values of the communist regime and the direct link between the annihilated private property and the drastic effect of this act on environment

The basic value of communism was expressed in the idea that man ought to be governed by the thought of the bright future coming on behalf of which he may sacrifice his health and life (i e live in an unfavorable environment) The attitude to environment was "we can pollute it *today* and when the time comes we shall clean it up " Another value of communism was the conception that man is the master of nature because he is stronger and more powerful than it Dictatorship in social life was transformed into dictatorship over nature In the third place the priority of economics which let to the destruction of one of the greatest hu man values – harmony between nature (animals and plant life) and man

Annihilation of private property and making a cult of the so called socialist (i e state) property is one of the many reasons for the present ecological situa tion a situation which to everybody's regret has not altered up to now, i e after the democratic changes taking place

Heavy industry with its dangerous and harmful consequences for biological organisms has led to the extermination of fertile land pollution of waters and has provoked specific irreparable alterations in the flora and fauna The meager financial means for pu rifying equipment (especially insufficient in the present moment after the economic crisis taking place in Bul garia) for ecologically clean production new technol ogy, etc , accompanied by a really "wild' pseudo privatization cannot be increased through the profit of the enter prises themselves as 90% of it still goes to the state budget and its distribution still remains unclarified In such a situation the whole normative basis *no matter how perfect it may be* from a legislative point of view *cannot bring about effective mechanisms* to solve the problem

Lack of private property with the presence of which the legislation for protection of the environment is in conformity unwillingness to take risks in regard to expensive but effective technologies now again have a pernicious influence on the condition of the air the soil and waters on the whole plant and animal life Legislature is still subjected to voluntaristic thinking to the inertia of the past The process of overcoming the ecological crisis is slow and painful and correct de cisions are hardly expected to be taken soon The data of the research carried out are indicative in this re spect

According to the data of the research the problem of safeguarding environment (in particular the biologi cal resources) has been comprehended by the majority of those interview on the matter The fact that 86 7%[1] of the interviewed citizens who are not jurists pointed out that the present condition of the environment bothers them very much shows that this problem stands in one of the first places of their value system (vis Table 1)

The investigation shows that the citizens have a quite correct idea of the condition of the water soil and air in the populated place where they live or work The results of Table 2 demonstrate this fact

The citizens who are not jurists as well as the ex perts directly connect the safeguarding (or in this case it is more correct to say the pollution) of the air, wa ters and soil with the protection of biological re sources To this question as to how the pollution of the waters soil and air influences biological variety, 86 5% of the interviewed characterized it as 'disastrous " the rest cannot judge All this shows a quite correct comprehension of the problem of the mutual bond of the ecosystems in public conscience the outer expression of which is the analyzed public opinion

Table 1 Does the present condition of the environment worry you?

No	Response	Percent of the total number of people interviewed
1	Yes very much as this is a serious problem	86 7
2	Not mush as there are other more serious problems	11 9
3	I do not consider it to be a serious problem	0 6
4	Another answer	0 8
	Total	100 0

Table 2 What is the condition of the air, water, and soil in your place of residence?

No	Response	Percent of the total number of people interviewed
1	The air is polluted	87 5
2	The water is polluted	72 7
3	The soil is polluted	62 9
4	The air water and soil are pure	3 1
5	I cannot assess the situation	5 5

Note The sum of the percentages exceeds 100 as the possibility of giving more than one answer was provided

The matter regarding the right to favorable (healthy) environment is of interest in view of the topic examined and in the context of the international treatment of the problem 98 2% of the citizens who are not jurists and 97 4% of the jurists share the opin ion that this is one of the fundamental human rights As a whole, the totality examined approves of the Law on Bulgarian Environment introduced in the Constitu tion of the Republic of Bulgaria in 1991 which how ever in accordance with the data on various reciprocal matters, is rather a Law "*on paper ' because nothing has been actually done in practice* The attitude towards the legislative regulation of the right to information on the quality of environment and its influence on health is positive (85 6% of the citizens and 98 6% of the jurists) At the same time, however, the majority of the inter viewed are rather pessimistically disposed towards the measures being undertaken for safe guarding envi ronment as well as towards the activity of the different government and nongovernment organs and organiza tions in this respects This pessimism is evident in the answers given to the questions in the Table 3

Table 3 Do you think the condition of the environment in you place of residence will change in ten years' time?

No	Response	Percent of the total number of people interviewed
1	It will be better	20 0
2	It will be worse	25 8
3	It is difficult for me to answer	4 2
4	Some other answers	45 0

A considerable part of the questions in the inquiry are dedicated to the problem of the influence of envi ronment on people's health (the disrupted balance in use and safeguarding, biological resources included) The experts interviewed are particularly explicit in this respect 64 2% of the interviewed declared that they know of diseases cause by the pollution of water the soil and the air – it should also be noted that 35% of the interviewed *work* in conditions proved to be harmful to health while the rest of them *live* in such conditions

In view of the purposes of the present report it is important to point out that there is a strong populist adjustment expressed in the opinion that the regions in which the ecological environment is strongly aggra vated should be declared to be "zones of ecological calamity," where people should be granted certain privileges – for instance supplying with medicines medical control, priority for rest in regions ecologically clean etc There is not any standpoint clearly ex pressed as to what should be done about productions strongly polluting environment and leading to destruc tion of biological resources 36 4% of the interviewed citizens who are not jurists consider that these produc tions should be cancelled until purifying equipment is supplied 37 7% – that only those economically inef fective should be closed down and 24 2% – that a suitable term of time should be given for building up purifying installations without stopping work In spite of the fact that 70% of those interviewed agree on *limiting* technical and economic development, lowering of the standard of living and reduction of work places respectively if this could contribute to diminishing the risks of disturbing ecobalance and risks to health the

26% of those who take the exactly opposite view can not be neglected This proved once more the com plexity of any hasty conclusion respectively leading to rash decisions laws included

Bearing in mind the specificity of the present study and the special attention directed to the legal protection of biological resources in the Republic of Bulgaria the opinions of the jurists interviewed are particularly valuable, as they give a more thorough picture of the *effectiveness of administering the nature protection legislation*

Of special value are also the opinions of jurists on matters concerning the causes for the pollution of wa ters, the air and the soil *which influence indirectly the destruction of biological resources* on perfecting the control on safeguarding environment, on the norma tive regulation of assessment in regard to influences on environment vis the following tables in this report) on the condition of crime and other ecological infringe ment of the law *on the effectiveness of various other kinds of juridicial responsibilities* in cases of malprac tice of the nature protection legislation

Jurists' opinion on the increase of ecological in fringement of the law is quite polarized as Table 4 shows

As can be seen in Table 4 when the interviewed were given the opportunity to reply with more than one answer more than half of the jurists consider the rea son to be the imperfection of the legal order as well as neglect to the normative regulation or insufficient se verity of the control and legislative organs

A significant part of the jurists interviewed (65 7%) state that the *procedure of assessing influence on environment* (and in particular Art 19 of the Law for Protection of Environment as well as Art 20 of the Law for Protection of Environment) *is too compli cated* The jurists' opinion on the matter of affectivity of the acting legislation is best expressed in every one of Tables 5 6,7,8,9

A part of the jurists consider things to have changed to a great extent after the alteration of Art 32 of the Law for Protection of Environment of 1992 with the introduction of the maximum size of these sanc tions (vis Table 6)

Of course, the matter of how the existing regula tions are being applied is more important The jurists' opinions on that problem are reflected in Tables 4,5,6 7 8,9

In conclusion it may be said that the empirical information collected on the public opinion on prob lems of protection of the environment are a sufficient indicator for the affectivity of the nature protection legislation as well as on the perspectives for over coming the ecological crisis in the Republic of Bul garia

Table 4 Jurists, what in your opinion are the causes for the increase of ecological infringement of the law?

No	Response	Percent of the total number of people interviewed
1	Lack of knowledge concerning the normative regulation	18 5
2	Neglect towards the normative regulation	53 7
3	Defects in the normative regulation	52 5
4	Liberalism displayed by control and legislative organs to offenders of nature protection legislation	61 1

Note The sum of percentages exceeds 100 as the possibility for giving more than one answer was provided

Table 5 Jurists, how do you assess the size of property sanctions against juridical persons offenders of the na ture protection legislation?

No	Response	Percent of the total number of people interviewed
1	They are sufficient in size	8 1
2	They are low in size	88 8
3	They are too high in size	0 0
4	Some other answers	3 1
	Total	100 0

Table 6 Jurists, how do you assess the size of fines imposed on physical and juridical persons, offenders of the nature protection legislation?

No	Response	Percent of the total number of people interviewed
1	They are sufficient in size	5 8
2	They are low in size	89 9
3	They are too high in size	0 0
4	Some other answers	1 3
	Total	100 0

Table 7 Jurists, how do you assess the activity of the juridical organs in enforcing the nature-protection legisla tion?

No	Response	Percent of the total number of people interviewed
1	The show insufficient strictness	55 5
2	The show the necessary strictness	6 7
3	They show exaggerated strictness	0 6
4	No opinion	27 1
5	Some other answers	1 1
	Total	100 0

Table 8 Jurists, what is in your opinion the condition of hidden crime in the field of protection of the environ ment?

No	Response	Percent of the total number of people interviewed
1	High	89 5
2	Low	4 3
3	Did not give an answer	6 2
	Total	100 0

Table 9 Jurists, which of the following directions for perfecting the nature protection legislation do you consider most effective?

No	Response	Percent of the total number of people interviewed
1	Increase the size of the punishment imprisonment	23 5
2	Increase the size of economic sanctions	72 2
3	Others	4 3
	Total	100 0

NOTES

1 This result was obtained at the first probing carried out during the active ecological campaign in the country In the following probings (the last one included having been carried out in view of the present report), the percent of those interviewed declaring strong worry decreased progressively at the expense of an increased number of people interviewed declaring that now there are other, more serious problems

European Nature Protection Law and Its Significance for Bulgaria

James J Friedberg

SUMMARY

Bulgaria is seeking closer relations with the industrialized democracies of western Europe as it emerges as a pluralist mixed economy democracy It has become a member of the economy of Europe and in the process of negotiating an agreement with the European Community Coordination with European legal structures regarding nature protection is therefore timely and necessary

European nature protection law is a relatively new phenomenon It has been developed primarily under two European bodies the Council of Europe and the European Community The most important European nature protection laws are the Berne Convention on the Conservation of European Wildlife and Natural Habitats of 1979 and the European Community Directive on the Conservation of Natural Habitats and Wild Flora and Fauna of 1992 Both measures are of primary importance because of their continental scope, their comprehensive approach to species and habitats their mandatory character and their creation of specific nature protection regimes

The Berne Convention created under the auspices of the Council of Europe, establishes both substantive obligations and an institutional structure for promoting and implementing its goals It requires parties to maintain wildlife populations at levels required by sound ecological and cultural needs Signatory states are obligated to conserve wildlife and habitats in a manner that promotes the in situ preservation of biodiversity Certain species are strictly protected with killing, capture and other destructive acts absolutely outlawed Other species are protected by more limited restrictions Vulnerable habitats of such species are similarly protected A Standing Committee has powers to amend the lists of protected species and habitats if new scientific knowledge dictates

Information is incomplete on the enforcement history of the convention However a 1988 report by the European Parliament found both poor reporting and spotty compliance on the part of member states One of the purposes of the 1992 Habitat Directive was to help remedy this situation

Bulgaria is a signatory to the Berne Convention While it has been ratified by Bulgaria and should therefore be part of its domestic law according to its new constitution it has not yet been published in the State Gazette Consequently, its domestic effect is still problematic

While European Community law is not of course binding on Bulgaria, the European Community's May 1992 Habitat and Wildlife Directive should be of major interest to government officials and environmentalists in Bulgaria since it implements many of the requirements of the Berne Convention

In addition to providing a ready template for new Bulgarian nature protection legislation, the Habitats Directive would be a logical model to adopt in that Bulgaria will eventually need to harmonize its environmental directives with those of the European Community if it is ultimately to succeed in its attempts to join that organization The directive establishes a European ecological network "Natura 2000" comprised of special conservation areas designated by all member states Bulgaria already has protected areas that might be appropriate candidates for this network The directive requires appropriate actions to avoid the deterioration of habitats and disturbance of protected wildlife In addition, environmental assessments are required for any project likely to have significant effects on protected sites The species protection requirements of the directive closely resemble those of the Berne Convention, prohibiting acts harmful to endangered species and regulating the exploitation of wildlife not yet endangered Derogations from the requirements of the directive are strictly limited Because this measure has only recently been adopted it has as yet no enforcement history

While the Berne Convention and the European Community Habitats Directive constitute the most important biodiversity laws due to their comprehensive scope, mandatory standards, and institutional structures it is worth mentioning other more limited pieces of European Community nature protection legislation The European Community Birds Directive is probably the most note worthy Passed in 1979 it was one of the earliest pieces of European scale nature protection regulation While its functions now seem largely subsumed by the broader Habitats Directive its implementation history provides a useful case study Apparently the record of the European states is quite spotty with regard to proper application of this directive Many complaints have been brought before the European Community Commission alleging violation of the Birds Directive The United Kingdom has only listed about 15 percent of the habitats recommended for protection under the directive by a panel of experts Successful opposition by economic interests casts some

doubt on the type of ambiguous but similar habitat designation and protection plans envisioned by the Berne Convention and the Habitats Directive

Other examples of nature protection legislation at the European level include various indirect protection laws for non European species (mostly limitations on trade) certain humane purposes regulation and species specific treaties such as the Bats Convention The Bonn Convention is of special note While international (not merely European) in scope it is examined here at the request of the World Wildlife Fund Signed in 1979 it encourages protection of endangered and less threatened species of migratory animals While of historic importance for its articulation of norms with regard to transborder nature protection, its generally non mandatory language and its relatively narrow scope make it less useful for comprehensive nature protection than the Berne Convention or the EC Habitats Directive

Environmental impact assessment legislation, while not exclusively devoted to biodiversity is of major significance for nature protection Habitats and species will be better protected if developers are rigorously required to identify the impact of proposed projects on wildlife and wildlife habitats In concert with the substantive rules of comprehensive legislation under the Berne Convention and the Habitats Directive the procedural and political leverage of environmental impact assessment is even stronger

Bulgaria is in a position to benefit from the evolution of nature protection law in Europe – i e from the piecemeal approach of previous years to the type of comprehensive approach represented by the Berne Convention and the EC Habitats Directive It is already a party to the Berne Convention, though government officials must have it published in the State Gazette as soon as possible so that it may formally become effective Bulgarian law, as allowed by the Constitution

Bulgaria must also adopt implementing legislation to carry out its duties under the Berne Convention Ideally, this could be consistent with the requirement of the EC Habitats Directive (which itself was promulgated with the Berne treaty in mind) Although not bound by EC law, Bulgaria is seeking membership in the EC Thus, the harmonization of nature protection regulations may might be both politically and environmentally beneficial

Bulgaria should make every effort to develop the expertise and resources necessary to implement the environmental assessment provisions of its 1991 statute, since such impact assessments are valuable aids in the enforcement of substantive nature protection mandates

INTRODUCTION

Bulgaria is seeking closer relations with the industrialized democracies of Western Europe as it emerges as a pluralist mixed economy democratic state It has become a member of the Council of Europe and is in the process of negotiating an association agreement with the European Community Bulgarian leaders hope that this pact will serve as a precursor to full EC membership The advantages of such membership are evident in terms of trade and economic assistance There are other subtle though no less profound advantages in terms of solidifying the democratic nature of the new political order in Bulgaria Harmonizing its environmental regulations with those of Western Europe will be a necessary step in any such hoped for political integration The rest of Europe will insist on this harmonization, both for reasons of environmental quality itself and for the sake of market unification Developing nature protection policies consistent with those of Europe will be part of this broader process [1]

Nature protection is a recently developing field of European law, somewhat newer than other areas of environmental protection such as emissions control or waste management The jurisdictional reasons for this will be discussed below In any event, the embryonic character of European nature protection means that Bulgaria will find itself in a situation with regard to adapting to European biodiversity regulation not unlike that of its Western neighbors In contrast to other areas of environmental regulation such as pollution control or nuclear safety there is room for relative optimism In this area, Bulgaria does not lag far behind its Western counterparts -

THE INSTITUTIONS AND THEIR LIMITATIONS

Prior to the end of World War II there was no significant body of European Law Each European state had its own national laws And certain international laws derived principally from treaties or state practice, governed behavior among all nations, including those in Europe Of course particular treaties might have included only states within Europe as parties or there may even have been certain interstate practices common only to Europe, but such exceptional legal phenomena were considered "regional international law " Only with the advent of post war institutions such as the Council of Europe and especially the European Community did European Law truly emerge Eventually such law would include environmental measures among its areas of competence

The Council of Europe

The Council of Europe includes virtually all the democratic states of Europe – including recent entrants Bulgaria, Hungary, and Poland (Czechoslovakia also gained membership prior to splitting into the Czech and Slovak Republics) Its twenty six members include all twelve states of the European Community [3] The Council is about five years older than the European Community dating to the late 1940s as a post war attempt at European unity

In that pursuit, it had long been overshadowed by the smaller but more powerful EC with its extensive and expanding jurisdiction in economic policy and other matters In a few areas however the Council *has* exercised some meaningful continental law making power Most successfully, the Council is the parent of the European Human Rights system including its convention commission and court More modestly it has served as a forum for the creation of some important environment laws The most important of these especially for biodiversity conservation purposes is the Berne Convention of 1979 on the Conservation of European Wildlife and Natural Habitats discussed below

The Council of Europe is an *inter state* organization unlike the European Community which is a *supranational* body (true governmental powers in defined areas of competence) Thus the Council cannot act other than by the unanimous consent of its members (except within its special human rights institutions) The significance of this for nature protection is that it has almost no capacity to *enforce* compliance with the Berne Convention [4] While the Council can serve as a forum for law creation or even for monitoring compliance, its inter state rather than governmental character deprives it of any real sanctioning power in the event of a breach by parties of their international obligations

Since the Berne Convention is the most comprehensive European nature protection treaty the Council of Europe as its sponsoring and administrating organization occupies a central role in continental biodiversity policy

The European Community[5]

The European Community in contrast with the Council of Europe possesses extensive legislative judicial and executive powers within its areas of competence Thus most of its ongoing administrative activity does not require affirmative unanimous consent of its member states The environment has been treated as one of these areas of competence since the early 1970s However for a decade and a half environmental regulation was based on vague language in the Treaty of Rome (the EC's 1958 constitution) and tied to assertions of market impact with regard to the particular environmental regulations It was therefore questionable at first whether nature protection in the absence of any direct Community wide market effects was within the EC s regulatory ambit [6] That changed with the advent of the Single European Act (SEA) in 1987 Article 130r t inserted in the amended Treaty of Rome by the SEA grants general jurisdiction in all areas of environmental concern – certainly including nature protection Thus it is only in the past few years that the Community has felt empowered to engage in comprehensive nature protection regulation Its principal tool in this regard will be its new Habitat Directive, passed in May of last year but not effective until 1994 by which time all member states will be obligated to have enacted the requirements of the Directive into national law These dates illustrate how slowly the EC legislative process works [7]

Bulgaria is not a member of the European Community Thus it is not bound by the EC Habitat Directive or any piece of Community legislation environmental or otherwise For a number of reasons however Community environmental law should have substantial import for Bulgaria Most obviously Bulgaria wants to become a member of the Community and by adopting EC standards it would both demonstrate fitness for entry and jump start the difficult process of harmonizing laws, which is required of all new Community members Especially if Bulgaria intends to regulate anew in a particular area, consistency with Community norms could save time in later harmonization efforts

The Community is potentially well positioned for regional environmental regulation in a number of ways Consider the present competence and procedures within the EC system The EC Commission is a central institution that can oversee the environmental legislation and practices of members in order to assure compliance with Community rules Thus, there can be control over national governments whose environmental rigor otherwise might be weakened by local interests or other factors The European Court of Justice whose judgments are almost always respected is the ultimate arbiter of disputes regarding EC law Individuals may force examination of a state's activity by a charge of non compliance with environmental standards made to the Commission All such complaints are investigated by the Commission and in fact in recent years the largest number of complaints have related to nature protection issues

The Commission can bring Member States before the Court of European Justice to remedy the failure of Member States to adopt or adequately implement EC directives The Court has no power to enjoin or fine Member State action or inaction but Member States generally abide by the Court s rulings In addition citizens and NGOs can complain to the Commission which then can bring action against a Member State A general enforcement problem however, is that the Commission does not have the power to monitor implementation Citizens and NGOs can bring claims before the European Court of Justice, but only in limited circumstances under Article 173 (allowing for review of the legality of acts of EC institutions on grounds established under that article) and under Article 175 (with regard to an EC institution s failure to act) Citizen complaints are most commonly channeled through the national parliaments Citizens bring matters to the attention of their parliament which then decides whether to bring the matter to the attention of the Commission [8]

The European Parliament has been quite com

mitted to environmental protection for years and as its weak legislative authority increases one may expect stronger environmental regulation In the meantime, it, along with the Commission, serves to publicize in stances of non compliance through its investigative powers and high public profile European govern ments have become used to the idea that some of their sovereignty has been ceded to the Community in ex change for significant shared benefits Consequently, European regional environmental control is not seen as a form of interference but as a way of gaining sup port for local environmental administrators whose po litical leverage is often in need of additional weight [9]

The strengths noted above argue for the environ mental advantages of Bulgaria affiliating as closely as possible with the EC system However, some of the advantages just described are more potential than re alized Significant shortcomings of information, im plementation, and enforcement plague the Community environmental program Directives have not been fully transposed into national law The Commission does not carry out inspections for actual compliance, even in suspected problem areas There is no mean ingful system of sanctions nor is there a comprehen sive set of data even to catalog all these deficiencies Furthermore the unit in the Environmental Director ate (DGXII) responsible for compliance appears to be understaffed and underfunded albeit quite competent and hard working Finally the new European Envi ronment Agency – which although it has no active monitoring or enforcement power may improve the information situation somewhat – is still awaiting es tablishment after years of squabbling over a location for its headquarters [10]

Recent Pan European Environmental Activity

Since the fall of the communist regimes in Central and Eastern Europe there has been a flurry of activity surrounding the goal of bringing the new democracies into the Western environmental fold [11] This present National Biological Diversity Conservation Strategy project can be considered one example of this phe nomenon There have been government to government programs, foundation funded studies and perhaps most significantly a substantial amount of pan European environmental dialogue There are at least three motivations at work inducing the West Europe ans to promote environment goals within the territory of their eastern neighbors First, there is a purely al truistic concern for the environment Second there is the fear of transboundary pollution And third there is an economic concern that the Central and Eastern European economies play by the same rules as their Western counterparts and internalize environmental costs The west does not want a flood of competing Eastern goods made inexpensively due to lax environ mental standards

In April 1993 a pan European Ministers Confer ence is to be held in Lucerne Switzerland Environ mental Ministers from throughout Europe are to be joined by officials from the European Community the Council of Europe and the World Bank to continue efforts that have begun in recent years to promote sound environmental policy for Central and Eastern Europe Representatives from non governmental or ganizations (NGOs) are to attend as observers The European Community has taken the lead on one of the major preparatory steps for the conference formulat ing an Environmental Action Programme for Central and Eastern Europe The plan seems intended as a fairly comprehensive blueprint for all aspects of envi ronmental recovery and protection throughout Central and Eastern Europe

While nature protection is only a minor theme in a February 3 draft of this plan what it says is interest ing and heartening The centrally planned economies that did such a poor job of controlling pollution are given much higher grades on nature protection The central governments that controlled economic devel opment also established nature reserves that gave sig nificant protection to biodiversity If anything privati zation and decentralization may dim this relative bright spot Ironically it could turn out that this is an area where Western Europe may have something to learn from the East It may be propitious for both sides that the EC countries are only now formulating comprehensive biodiversity protection efforts through the Habitats Directive (see below) It appears to be an area where
all of Europe can progress together [12]

COMPREHENSIVE EUROPEAN NATURE PROTECTION REGULATION

Two laws stand out as the most significant pieces of European nature protection legislation the Berne Convention on the Conservation of European Wildlife and Natural Habitats of 1979 ("the Berne Conven tion") and the European Community Council Directive 92/43/EEC of May 21 1992 on the Conservation of Natural Habitats and of Wild Flora and Fauna ("the Habitats Directive") Both laws are of primary im portance because of their continental scope their comprehensive coverage of species and habitats their mandatory[13] character and their creation of significant nature protection regimes

The Berne Convention[14]

The Berne Convention created under the aus pices of the Council of Europe establishes both sub stantive obligations and an institutional structure for promoting their implementation – both of which are innovative steps in the field of international nature protection law The Preamble declares that wild flora and fauna have intrinsic value as part of our natural heritage and should be conserved for future genera tions, and in cases where they are threatened should be given protection

Article 1 proclaims the central aims of the Convention to be the conservation of wild flora and fauna and their natural habitats, with emphasis on vulnerable species and on situations requiring transboundary cooperation Article 2 requires parties to "maintain the population of wild flora and fauna at or adapt it to a level which corresponds in particular to ecological scientific and cultural requirements," with some account being taken of economic and recreational needs The language seems to value conservation above economic concerns and would be significant in that regard Signatory states are obligated under Article 3 to adopt national policies to conserve wild animals plants and habitats with special attention to endangered varieties thus promoting the in situ preservation of continental biodiversity Article 4 gives particular attention to habitats of wild species needing special protection, while mandating habitat protection generally

Chapter III includes Articles 5 9 dealing with the protection of species It is the substantive core of the treaty Article 5 protects flora supplemented by Appendix I listing strictly protected species of which picking collecting cutting or uprooting is prohibited In regard to wild fauna listed in Appendix II Article 6 outlaws deliberate killing, capture keeping destruction or damage to breeding or resting sites disturbance during periods of vulnerability (e g breeding) or destruction or taking of eggs Also prohibited is the possession of or trade in such animals The wolf lynx dolphin and many wild birds are so protected Article 7 requires states to take measures necessary to ensure a slightly less stringent level of protection for vulnerable species listed in Appendix III Limited exceptions to these restrictions are allowed under Article 9 but only if there is no alternative and if the exception will not threaten the survival of the population concerned

Migratory species receive special attention under Article 10 which requires range states to coordinate their protective efforts Article 11 encourages inter alia, the reintroduction of species where appropriate as well as research and interstate cooperation

The Berne Convention has the most ambitious institutional structure of any regional conservation convention Article 13 creates a Standing Committee made up of representatives of all contracting parties, including the EC The Committee monitors the application of the Convention but has no enforcement powers It may make recommendations to parties on measures to implement the treaty proposals for improving its effectiveness and proposals for amending the Convention (which go to the parties for approval unless they involve procedural matters in which case they go to the Committee of Ministers of the Council of Europe) In contrast to the rather difficult and typical (for international practice) means of amending the treaty provisions per se an innovative and simplified mechanism is established by Article 17 for amending the appendices This provides flexibility in adapting the lists of protected species to changed conditions The Standing Committee may adopt such appendix amendments through its own decision by a two thirds majority In this small but significant way the Berne regime has a bit of the supranational flavor more characteristic of the European Community than of the Council of Europe

Information on the enforcement history of the Berne Convention is incomplete The largest block of parties consists of the European Community nations Since the EC has only recently adopted its Habitat and Wildlife Directive, which largely implements the Berne Treaty on a Community level, one might suspect that unilateral national implementation up until now has been spotty Such suspicion is borne out by the European Parliament's 1988 Report on the Implementation of the Berne Convention The report found that poor reporting made it impossible to determine precisely the degree to which the convention's standards had been incorporated into national policy However it was able to identify significant instances of non implementation in a number of EC countries including extensive disturbance of habitats in Great Britain, incomplete protection of species in Spain Greece, and Portugal, and destructive hunting privileges in France [15] In fact the 1992 Habitat and Wildlife Directive seems largely aimed at remedying these shortcomings It is not likely that the story is any more complete or encouraging elsewhere in Europe The new democracies of Central and Eastern Europe such as Bulgaria are only recent adherents to the Convention, so there is no real implementation history In Bulgaria, the treaty has not yet appeared in the State Gazette and so despite ratification and the Constitutional provision giving international treaties direct and superior status in domestic law Berne is not fully law in Bulgaria as of this writing [16]

The European Community's Habitats Directive

While European Community law is not of course binding in Bulgaria the EC's May 1992 Habitats and Wildlife Directive should be of major interest to government officials and environmentalists in Bulgaria and throughout Central and Eastern Europe Since it involves primary level implementation of many of the requirements of the Berne Convention, it offers a legislative structure for the kind of comprehensive national nature protection programs envisioned by that Convention Other reasons for emulating Community environmental policy have been discussed above The Directive does not come into effect until 1994 Since EC states themselves are just now in the process of transposing the Directive into national laws their fresh experience could be valuable to a state like Bulgaria if it seeks to develop similar legislation and implementing procedures

The purpose of the Directive is to help protect biological diversity through the conservation of habi

tats and wild flora and fauna in Europe Measures taken pursuant to the Directive are meant to maintain a 'favorable conservation status" for wildlife and habitats defined in Article 1 as a situation where the population and range of a species is stable or growing and a habitat area is large enough to maintain its population on a long term basis The Directive has two main substantive sections Articles 3 11 on natu ral habitats and Articles 12 16 on the protection of species

Article 3 mandates the establishment of a Euro pean ecological network to be called "Natura 2000," composed of Special Areas of Conservation (SAC) falling under the types of protected territories listed in Annex I or the habitats of species protected under An nex II Each member state must contribute to the Natura 2000 network in proportion to the protected habitats or species found on its territory Article 4 es tablishes procedures for selecting Natura 2000 sites In cases where the Commission favors designation of a site that is resisted by the host state Article 5 provides for a dispute resolution procedure ultimately how ever a state cannot be forced into designation since only a unanimous Council – including the state in question – can impose a decision Article 6 requires states to undertake necessary conservation measures for the SACs to take appropriate actions in SACs to avoid deterioration to habitats or disturbance to pro tected wildlife and to ensure environmental assess ments of any projects likely to have significant effects on sites If such assessments identify likely negative impacts only "imperative reasons of overriding public interest" and a lack of alternative solutions may justify carrying out the project Articles 7 9 deal respec tively with the harmonization of Natura 2000 and the EC Birds Directive financing, and review by the Commission of Natura 2000's performance

The species protection requirements of Articles 12 16 closely track the mandates of the Berne Con vention Article 12 prohibits deliberate acts harmful to endangered wild animal species also prohibited by the Berne Convention and requires each state to establish a system to monitor incidental capture or killing of species in need of strict protection (Annex IVa) Analogous protections for endangered plant species are stated in Article 13 Article 14 regulates the ex ploitation of plants and animals from Annex V where some exploitation is permitted compatible with main tenance of a favorable conservation status Article 15 limits the means of killing or capture with reference to prohibited listings in Annex VI Article 16 is another derogation clause parallel to the habitat derogation in Art 6(4) above It sets similarly strict conditions un der which derogations from species protection may be allowed and requires specific reports from states every two years describing such derogations

The remaining articles deal mainly with admini strative and procedural matters Noteworthy are the monitoring and reporting requirements of the Direc tive Perhaps the Community learned from previous environmental legislation the weakness of setting stan dards in the absence of any mechanisms for deter mining whether they are met Both the rigor of the Directive's substantive requirements and the means provided for keeping track of their implementation give some hope that this may be a new generation of Community environmental law worthy of emulation by emerging democracies like Bulgaria [17]

SECONDARY EUROPEAN NATURE PROTECTION LAWS

While the Berne Convention and the EC Habitats and Wildlife Directive will because of their compre hensive scope, mandatory standards, and institutional structures certainly be the most important European biodiversity laws in coming years, there are other more limited pieces of European nature protection legisla tion

The EC Birds Directive

The European Community Council Directive 79/ 409/EEC of 2 April 1979 on the Conservation of Wild Birds ("the Birds Directive") is noteworthy for a num ber of reasons First it is one of the few and earliest pieces of EC nature protection legislation It was passed in 1979 almost a decade before the Single European Act would give the Community clear com petence in the area of nature protection (see above) A tenuous connection to the Community's economic and social purposes was claimed in the directive's pre amble based partly on the migratory and transborder nature of the protected species However the juris dictional justification was much less apparent than in more market impacting pollution legislation Second and more positively the Birds Directive can serve as a useful model for predicting future implementation ex perience under the more comprehensive but not alto gether dissimilar, conservation program under the Habitats Directive

As does its more ambitious successor on habitats and wildlife the Birds Directive combines prohibitions and limits on activities (killing capture etc) that af fect species with direct mandates to identify and pre serve certain habitats Again in a way similar to the later law its annexes classify species in groups requir ing strict protection and those requiring more moder ate protection Apparently the record of European states is quite spotty with regard to proper application of this directive Many of the complaints brought to the Commission alleging violation of Community envi ronmental norms relate to wrongdoing under the Birds Directive A development project that goes forward in a threatened breeding area would be an example Furthermore, territories that should be classified as de serving of protection are not being so classified A community enforcement official has related that the United Kingdom has only listed about 15% of those habitats recommended for protection by a British panel of experts Opposition of economic interests was

cited as the chief obstacle This casts some doubt on the type of ambitious but similar habitat designation and protection plans envisioned by the Berne Convention and the EC Habitats Directive [18]

Indirect Protection for Non European Species

Some European Community regulation exists that protects species whose natural habitats are outside European territory Examples are laws implementing the Convention on Trade in Endangered Species (CITES), protecting whales restricting trade in ivory, etc These laws are of course important elements in *global* biodiversity programs, but since they do not particularly relate to European flora and fauna and since they tend to have limited scope their existence is only noted here

Humane Purposes Regulation

A few Community nature protection acts do not relate to biodiversity, per se, but to humane treatment An example would be the EC directive outlawing certain leghold traps These laws also are quite narrow in their scope, and while probably valuable for their limited purposes they are not of primary concern in shaping a comprehensive biodiversity program [19]

Bats Convention

In September 1991 a number of European states signed a convention on the protection of bats [20] The EC is not a party to the convention and in fact it is sufficiently obscure that environmental officials at the EC headquarters in Brussels were not familiar with it The treaty's lack of notoriety was reconfirmed in conversations with environmentalists from academic institutions and NGOs It has not been widely published and has not been located in the numerous American sources checked nor in several European sources With its recent signature date (and presumably a later effective date) there is certainly little or no enforcement history With the advent of the Berne Convention and the Habitat Directive one might speculate that such narrow species centered treaties will not be viewed as the most efficient way to pursue broad biodiversity aims

The Bonn Convention

The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) was signed at Bonn Germany on June 23 1979 It is global in scope with signatory parties from various regions of the world Therefore in should correctly be classified as international environmental law rather than specifically European environmental law The EC and many European countries are parties however and the World Wildlife Fund has requested that it be included within the scope of this report

The Bonn Convention, being limited to migratory species, is less comprehensive than the Berne Convention or the EC Habitats directive which cover all forms of wild flora and fauna Furthermore the Bonn Convention lacks the degree of institutionalization of supervision and implementation found in the Berne and EC documents It is reasonable to speculate that such institutionalization is easier on the regional than the global level

The Preamble of the Convention recognizes that wild animals are "an irreplaceable part of the earth's natural system," that each generation holds nature in trust for future generations, and that especially with regard to migratory species cooperation among nations is necessary The preamble also cites the Action Plan of the 1972 United Nations Environmental Conference in Stockholm as a mandate for this treaty [21]

The Convention creates three broad categories of conservation status for migratory species favorable, unfavorable and endangered Appendices list the species covered in the latter two categories [22] The Convention does not generally have a mandatory character using language like "should promote shall endeavor " and "are encouraged" in attempting to further its aims of protection conservation, reclamation of habitats research information exchange etc [3] An exception is the provision that habitat states "shall prohibit" the taking of endangered species

Individual state action and agreements between states, not international enforcement of treaty norms are the chief means articulated in the treaty for implementation of its substantive goals States are urged to protect endangered species directly and immediately Species with unfavorable conservation status should receive protection which may be at a lower level by interstate agreement General guidelines are suggested for agreements without much specificity [24]

While the Bonn Convention is much more an aspirational document than a set of legally enforceable rules, it did represent a historical step forward in 1979 toward the acceptance of a general norm of responsibility for trans border nature protection It might also provide a useful guide for Bulgaria in entering into joint agreements to protect particular migrating species whose ranges are shared with other states However the Bulgarian attorneys who have reported to WWF do not list this convention as one adhered to by Bulgaria [25]

United Nations Economic Commission for European Conservation Code

Last year the United Nations Economic Commission for Europe published a "Code of Practice for the Conservation of Threatened Animals and Plants and Other Species of International Significance ' The term code is somewhat misleading in that a United Nations

of emerging international practice and opinion and therefore the potential basis for establishment of international customary norms In any event the conservation measures suggested by this document would be substantially met by full compliance with the Berne Convention In comparing their provisions, it seems very likely that the Code's drafters had an eye toward the Berne Convention Thus, while not creating new legal tools for the enforcement of nature protection the code does strengthen the argument that a consensus is developing in support of international biodiversity norms

GENERAL ENVIRONMENTAL LAWS

Many environmental protection laws not specifically directed at nature protection may nonetheless have substantial impact on biodiversity For instance, it is obvious that prevention of water or air pollution can have protective effects on habitats and wildlife Consideration of all such environmental laws is beyond the reach of this project Nonetheless there are certain general environmental laws that may have special significance for nature protection and should be briefly discussed

Environmental Impact Assessment

Over the last few decades a number of legal systems have adopted requirement for conducting assessments of environmental impacts for proposed major projects before they may proceed The first such comprehensive statute was the United States' National Environmental Policy Act (NEA), which has been in effect for a quarter of a century More recent examples both germane to our present analysis are the EC's 1988 Environmental Impact Assessment Directive and the section in Bulgaria s 1991 general environmental statute requiring environmental impact assessments Because of their recent vintage neither has a significant implementation history However, such laws should play a meaningful role in nature protection if properly enforced Habitats and species will be better protected if developers are rigorously required to identify the impact of their proposed projects on wildlife and their habitats Both public pressure and the substantive rules of laws like the Berne Convention and the Habitats Directive could compel greater respect for biodiversity [26]

Bulgaria will have to clear significant hurdles however, to successfully employ environmental assessment as a meaningful tool in nature protection First public involvement must be encouraged and well informed so that citizens will have leverage to stop threatening projects This observation follows the American experience under NEA where procedural rights of comment have often allowed political opposition to be mobilized against bad projects Second, Bulgaria must make certain that its substantive nature protection laws give biodiversity a legal line of defense once the assessment process reveals potential harm to nature Full implementation of the Berne Convention requirements would be a major step in this regard Third, sufficient legal and scientific expertise will have to be developed in order to prepare and critique such complex assessments Finally Bulgaria must find financing for the often expensive process of environment assessment – not a trivial issue in economically strapped Central and Eastern Europe [-7]

Environmental Liability Convention

In November 1992 a draft convention on civil liability for damage resulting from activities dangerous to the environment was finalized in Strasbourg under the aegis of the Council of Europe, to which Bulgaria now belongs Among other things, the treaty would allow recovery for environmental damage to property forming part of the cultural heritage or constituting characteristic aspects of the landscape Furthermore environmental groups will apparently have standing to bring legal actions If such a treaty were to become law, it could be an effective additional tool to discourage enterprises from degrading nature Especially in as privatization and decentralization proceed as in Bulgaria such a legal regime might be quite beneficial [8]

PROGRAMMATIC ACTIVITY

While this paper deals with European law and regulation related to nature protection, *non* regulatory activities of the EC and other European and international institutions surely will have an impact on European biodiversity Such programs include PHARE ACNAT, and Natura 2000 In fact there is considerable tendency within the EC to move away from negative regulation by law and toward affirmative programming and economic incentives in its environmental policy [29] In reality both approaches seem necessary and complementary Description of such programs is beyond the charge of this paper, but their significance should be considered by Bulgarian nature protection planners

CONCLUSIONS AND RECOMMENDATIONS

1 Legislation at the European level regarding nature protection got off to a slower start than other forms of continental environmental law largely because it was not initially perceived as being trans boundary in character In recent years that attitude has changed and the international regulation of biodiversity issues is now well accepted

2 Starting in the 1970s, European biodiversity law began to emerge, mostly narrow in scope and limited to certain migratory species Today however, the Berne Convention and the EC Habitats and Wildlife Directive constitute a comprehensive scheme of nature protection for Europe They are the most important European biodiversity laws,

providing mandatory substantive protections for both species and habitats and the structures to enforce such protections

3 There is some concern over the question of whether the individual states of Europe have the political will to carry out their obligations under the Berne Convention and the Habitats Directive Experience with enforcement of EC environ mental directives up until now has shown a sig nificant gap between word and deed

4 Bulgaria is in a position to benefit from the evolu tion of nature protection law in Europe – from the piecemeal approach of previous years to the type of comprehensive approach represented by the Berne Convention and the EC Habitats Directive It is already a party to the Berne Convention, al though government officials must have it published in the State Gazette as soon as possible so that it may formally become effective Bulgarian law as al lowed by the Constitution

5 Bulgaria should adopt implementing legislation to carry out its duties under the Berne Convention Ideally, this could be consistent with the require ment of the EC Habitats Directive (which itself was promulgated with the Berne treaty in mind) Although not bound by Community law Bulgaria seeks membership in the EC Thus, it might be politically as well as environmentally beneficial to have already harmonized nature protection regu lations

6 Bulgaria should make every effort to develop the expertise and resources necessary to implement the environmental assessment provisions of its 1991 statute, since such impact assessments are valuable aids in the enforcement of substantive nature protection mandates [30]

NOTES

1 Friedberg and Zaimov "Environmental Regulation in Restructuring Bulgaria " W V U Regional Research Institute 1992 14 *Human Rights Law Journal* 56 PR Newswire 10/20/92 Nexis Council of Europe, *Natura* newsletter No 3, Nature Conservation in Central and Eastern Europe The Time for Change The Time for Hope "

2 "Environmental Action Programme for Central and Eastern Europe (Preliminary Draft)," p 17 February 5 1993 Prepared for Ministerial Conference, Lucerne, Switzerland April 28 30 1993,

3 *Human Rights Law Journal* Vol 1 2 p 56

4 Although under one of the convention's more progressive provisions the appendices listing protected species may be amended by a two thirds majority of the Standing Committee of the parties See further discussion below

5 For background see "The EC Environmental Proving Ground ' *World Watch* (November/December 1991) 26 33

6 Although the Treaty of Rome does not specifically allow for environmental protection Member States and the European Court of Justice have often found the measures within the purview of Articles 100 or 235, but also within Articles 43 84 and 113 The Bird Directive is an example of the EC taking environmental action under Article 235 of the Treaty of Rome Article 235 allows the EC to take action to attain an objective of the EC not expressly granted by the Treaty of Rome The European Court of Justice called protection of the environment "one of the Community's essential objectives ' which may justify certain limitations on the free movement of goods See Case 240/83 Procureur de la Republique v Association de Defense des Bruleurs d'Huiles Usages [1985] E C R 531 Reference from D Downes and C Wold Center for International Environmental Law

7 Friedberg The Gap Between Word and Deed in European Community Environmental Policy " *Loyola of Los Angeles International Law Journal* 1993 Kramer *Focus on European Environmental Law* Sweet and Maxwell 1992

8 Downes D and C Wold personal communication

9 Note 8 above

10 *Ibid*

11 PR Newswire Oct 20 1992 Nexis

12 See note 3 above

13 By "mandatory " I mean that the language implies an obligatory legal requirement as opposed to aspirational or other non binding language By contrast most provisions of the Bonn Convention fit this latter description The mandatory legal character of a norm is a separate issue from implementation or enforcement which may fail to occur even though the norm is binding

14 See generally Kiss and Shelton, *International Environmental Law* 1991 Also see European Parliament, *Report on the Implementation of the Berne Convention and the Bonn Convention*, 26/9/88, and Synge, "Environmental Agreements at the European Level on the Conservation of Biodiversity, July 1991, The World Conservation Union

15 European Parliament *Report on the Implementation of the Berne Convention and the Bonn Convention*, 26 September 1988 See also Synge, *Environmental Agreements at European Level on the Conservation of Biological Diversity* July 1991 World Conservation Union

16 Working Papers of BSP Bulgarian attorneys Item 14

17 See generally Gammell and Hepburn, "The Habitats Directive " Royal Society for the Protection of Birds, 1992

18 Interview conducted by author in Brussels at headquarters of EC Commission, February 1993

19 Reuters September 13 1991 "European States Agree Measures to Save Disappearing Bats " Nexis

20 Notes from reviewing EC legislation on environment in Brussels February 1993

21 Bonn Convention Preamble

22 Convention Article III

23 Articles II, III IV

24 Articles III IV V

25 Item 14 BSP Bulgarian attorneys' reports For more back ground on the Bonn Convention see Kiss pp 263 266

26 Kramer "The Implementation of Environmental Laws by the European Communities " 34 *German Yearbook of International Law* 25 26 Vol 34 1991

27 Friedberg and Zaimov, note 2 above

28 BNA, *International Environmental Daily*, Jan 26 1993 Nexis

29 BNA *International Environment Daily*, Feb 4, 1993, Nexis

30 I wish to thank the John D and Catherine T MacArthur Foundation and the West Virginia University Regional Research Institute whose support for my ongoing Bulgarian environmental research has provided me the opportunity to develop the background knowledge needed to participate in this project

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Protection of Biological Resources in Bulgaria Under International Environmental Law

David Downes and Chris Wold

I SUMMARY

International environmental law offers useful and important tools for the protection of domestic biologi cal resources International environmental agreements can help support the policies – and the laws necessary to carry out those policies – that will form part of Bul garia's national biological diversity conservation strat egy (NBDCS)

International law has unusual potential in Bul garia because the 1991 Constitution is unusually pro gressive among national constitutions it provides that international treaties ratified by Bulgaria have imme diate force as domestic law and that they prevail over inconsistent provisions of other domestic laws whether or not the government has enacted domestic legisla tion to carry out the treaty obligations While its pre cise legal impact has yet to be determined this con stitutional provision establishes that international envi ronmental law will have an important place in the Bulgarian legal order

This report discusses nine international agree ments or programs to which Bulgaria has or will probably become a party (the "listed agreements")

- Convention on Biological Diversity
- Convention on International Trade in Endan gered Species ("CITES")
- Convention on Wetlands of International Impor tance Especially Waterfowl Habitat ("Ramsar")
- Convention for the Protection of the World Cultural and Natural Heritage ("World Heritage Convention")
- Framework Convention on Climate Change
- Convention Concerning Fishing in the Black Sea
- Convention Concerning Fishing in the Waters of the Danube
- Non legally Binding Authoritative Statement of Principles for a Global Consensus on the Manage ment Conservation and Sustainable Develop ment of All Types of Forests ("Rio Forest Princi ples")
- UNESCO Man and the Biosphere Program ("MAB")

Of these listed agreements, the Convention on Biological Diversity offers the widest range of legal tools for promoting biodiversity conservation CITES the Ramsar Convention the World Heritage Conven tion, and the UNESCO MAB will also provide im portant support for important components of the NBDCS – offering not only legal tools but also inter national recognition, information sharing, and pro grammatic support Less critical but still of some util ity for specific issues are the remaining agreements the climate change convention the Black Sea and Da nube fishing treaties, and the Rio forest principles

Part I is a summary of this report Part II dis cusses general legal principles that are relevant to the implementation of *all* of the listed agreements, and gives a general overview of the relation of domestic and international law in Bulgaria Part III analyzes the Convention on Biological Diversity, and Part IV discusses the other international agreements Parts III and IV assess respectively the general status of the in ternational agreements and their specific status in Bul garia The assessment of the general status is based on direct research and experience Assessment of the status and implementation in Bulgaria of international agreements is based on consultations with Bulgarian lawyers and government officials translations of se lected Bulgarian environmental laws prepared for the NBDCS written reports and responses to questions provided by Bulgarian lawyers, and some secondary sources cited in the text Discussion of each agree ment concludes with recommendations for effective implementation in Bulgaria of the listed agreements focusing on legal measures rather than policy deci sions

II THE NEED FOR LAW TO PROTECT AND CONSERVE BIOLOGICAL DIVERSITY

A The Role of Law

Law is only one of many parts of a strategy to conserve biodiversity in Bulgaria – but it is an essential part The first step perhaps is scientific research in ecology, taxonomy zoology botany and other fields Another step is economic analysis Later but just as important are the creation or reform of institutions,

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and the creation or reform of laws Law is a necessary tool for carrying out a conservation strategy – for making sure that policy truly and consistently implements science and social decisions and for making sure that changes in science, public opinion or social values are reflected in public conservation policy and institutions

One practical implication of this is that any team for developing and carrying out a conservation strategy must include not only scientists economists, and administrators, but lawyers as well From the early stages, the team must consider how scientific findings can be translated into legal mechanisms and structures for institutions – mechanisms and structures that are necessary to continuously translate science into policy, to monitor environmental conditions, to gather public comments, to apply general principles in specific cases, to monitor official and private impacts on biodiversity, and to enforce environmental standards by empowering government officials and citizens to monitor compliance and enforce standards

B The Status of International Law in Bulgaria

International environmental law offers useful and important tools for the protection of domestic biological resources While international authorities have little coercive power to force national governments to implement international law international environmental agreements nevertheless have significant impact, because of the prestige and respect given to international standards and the national and international attention given to the adoption and enforcement of those standards They can also help countries participate in legal systems in which financial assistance is available for implementation The Convention on Biological Diversity Convention on International Trade in Endangered Species (CITES) the Ramsar Convention on Wetlands, the World Heritage Convention, and the UNESCO Man and Biosphere Program (MAB) for instance provide financial and technical support for important components of the National Biological Diversity Conservation Strategy – offering not only legal tools but also international recognition, information sharing, and programmatic support

International law has special potential in Bulgaria, because the 1991 Constitution is unusually progressive among national constitutions it provides that international treaties ratified by Bulgaria have immediate force as domestic law and that they prevail over inconsistent provisions of other domestic laws whether or not the government has enacted domestic legislation to carry out the treaty obligations [1] By contrast the law in most nations is that international treaties require domestic implementing legislation to bring a treaty into effect It has been argued that under Article 5(4) an international instrument overrides not only *pre-existing* domestic laws but also inconsistent domestic laws passed *after* the treaty was ratified

There may however be practical limits to Bulgaria's unique constitutional provision First the Constitutional Court has ruled that a treaty acquires the status of domestic law only after it is both ratified *and published* in the State Gazette [2] Some international environmental agreements have yet to be published in the State Gazette In addition because most international environmental agreements are written in general terms, they must be implemented through more detailed domestic laws that, for instance establish specific penalties for violations of standards This limitation can be overcome by strong enforcement Ramsar, for example, imposes very general obligations on parties Yet although some countries have not enacted implementing legislation, their governments have enforced its obligations against developers

Many international agreements relating to the environment are non binding, such as the Rio Forest Principles and the UNESCO Man and the Biosphere Program and have no legally binding effect under Bulgarian law They may however, have some persuasive effect as evidence of international sentiment wide spread scientific agreement or management practice or in limited circumstances as evidence of customary international law

Despite their limitations, many of the international environmental agreements provide useful tools for advancing parts of a national conservation strategy The Convention on Biological Diversity for instance includes many good general policy principles such as a requirement that every country develop a national biodiversity protection plan In addition it requires the preparation of environmental impact assessments with public participation for government projects that are not now covered by the Bulgarian EIA law, including forestry projects CITES the World Heritage Convention, and Ramsar have strict requirements in specific areas such as international trade in endangered species Bulgaria has recently ratified CITES and must now pass effective implementing legislation

Regional agreements will be very important in the future for Bulgaria Scientifically many species are endemic to the Balkan Peninsula not Bulgaria alone Thus, neighboring countries must cooperate to ensure their protection (Of course the current war in the former Yugoslavia limits the extent to which conservation cooperation can move forward) In addition Bulgaria's desire to move closer to the European Community (EC) creates a strong incentive to harmonize its environmental standards with those of the EC This will be very important in terms of environmental regulations that control industrial activity such as air and water quality standards and may have some importance for nature conservation as well For example this situation provides an incentive for Bulgaria to

join wildlife and nature conservation treaties such as the Berne Convention (to which most western European nations belong)

C The Implementation of International Environmental Law in Bulgarian Domestic Law

Bulgaria has implemented, at least in part a number of the listed agreements through domestic legislation such as the Nature Protection Act of 1967 It is important that implementing laws like any other laws employ the most effective legal mechanisms for carrying out their purposes While some existing environmental laws in Bulgaria do much to accomplish the goals of the listed agreements they often suffer from serious flaws

First, many laws fail to specify clearly the division of authority among the branches of the government In the past this has led to confusion and inefficiency Similarly the relationship between older laws and the newer laws is sometimes unclear

Second under existing laws the penalties for violating environmental regulations are too weak to discourage misconduct [3]

Third, some laws fail to state clearly the criteria for making decisions about protection of the environment

Fourth, many laws fail to include useful tools and procedures for public participation and accountability such as opportunities for citizens to comment on government decisions and proposed policies and regulations freedom of information laws or citizens' rights to enforce environmental laws or to request independent review of government decisions [4] Public participation is important because it enhances the legitimacy of government decisions by demonstrating that decision making is fair open and democratic The government can use public participation to build and demonstrate public support for its policies In addition participation of citizens and NGOs reduces the burden of work on the government, because the public helps to collect organize and analyze relevant evidence For the same reason the quality of information and decision making will be higher because a wider range of relevant evidence and viewpoints is represented and collected and errors in analysis are detected and corrected

Finally another problem is that even where the written environmental laws are adequate, the government in the past has frequently failed to enforce them Violations were ignored and weak penalties (or no penalties at all) were imposed In addition procedures for independent impartial review of administrative decisions – an indispensable mechanism for ensuring accountability and the rule of law – have apparently not functioned properly at least in part because of inadequate training limited funding and a lack of independence on the part of the judiciary

D Fundamental Legal Principles

Several general legal principles are fundamental to implementing a strategy for biodiversity conservation Bulgarian laws date from an era in which the prevailing ideology devalued law At that time, law merely expressed government policy, which was supposed to reflect the will of the people Bulgaria is now shifting to a new legal system in which the will of the people is supposed to *shape* the law which in turn controls and shapes government policy so that it is consistent with the people's will In addition, any system of environmental laws anywhere must be constantly reevaluated in light of changing scientific knowledge

The several basic principles outlined below must be adapted to the cultural, social, and economic conditions in each country or region In essence however, they are fundamental to human rights, democracy and sustainable development, as reflected in international law and in the laws and practices of a growing number of countries around the world These fundamental legal principles help citizens to express their will and to shape and control government policy and action Consequently Bulgaria should implement the following principles as appropriate to the circumstances within Bulgaria

1 Clarify which governmental authority has jurisdiction over certain activities or territories, and delegate exclusive administrative, management and enforcement powers to specific government departments and to specific levels of government (i e national regional or municipal/local)

2 Clarify the relationship of old and new environmental laws explicitly repealing provisions of older laws where necessary to resolve inconsistencies

3 Establish clear criteria for making decisions that affect biodiversity, including

- criteria for decisions whether to protect or to damage biodiversity (e g criteria for deciding whether to cut timber), and
- explicit recognition of biodiversity as a value and benefit that must be considered in any decision that will significantly affect biodiversity

4 Include mechanisms for periodically re evaluating – under clear criteria – standards and rules in light of improvements in scientific knowledge

5 Provide (by reference to administrative procedure law or otherwise) for procedures for the review of government decisions affecting biodiversity by an impartial independent decision maker

6 Provide for public participation in decisions in cluding

- publication of reports on government conserva tion activities
- access to government documents regarding conservation or exploitation of components of biodiversity in response to citizens requests, and
- the right of citizens and non governmental or ganizations (NGOs) to
  - petition the government to take specified actions to protect biodiversity (e g listing of endangered species or declaration of protected area)
  - appeal a government decision affecting biodiversity through the review process described above
  - participate in the development of regu lations implementing environmental laws protecting biodiversity, and
  - help enforce biodiversity protection laws for example by giving them the right to bring "citizens' suits" against violators

Public participation serves several critical pur poses It implements basic principles of democ racy and justice and thus is valuable in and of it self It also improves the quality of evidence and reasoning available to the decision maker by pro viding a wide range of facts and views from all interested parties If specific policy decisions al ways involve public participation the government is able constantly to monitor and respond to changing conditions including scientific condi tions social values and public opinion

7 Strengthen enforcement of standards and rules with stronger fines that are more strictly enforced,

- by giving specific government authorities clear authority to punish violators and
- by improving the impartiality and expertise of courts

III CONVENTION ON BIOLOGICAL DIVERSITY

Although many of the obligations of the Conven tion on Biological Diversity (the "Convention") are very general they cover a wide range of important ac tivities that should be part of any country's biodiversity conservation strategy The Convention is thus very useful as a legal tool for building support to protect biodiversity

Many of the Convention's obligations including those in Articles 5 7 11 and 14 are limited by the provision that parties are obliged to implement them only 'as far as possible and as appropriate " While this language allows parties to implement the Convention flexibly it does not free them completely from any le gal obligation To interpret the language as permitting governments complete discretion would be absurd as it would have the effect of deleting those Articles from the Convention altogether

"[A]s appropriate" is best understood to mean that each party shall carry out the obligation in full but in a manner that is appropriate for each country's social, economic, cultural and physical conditions Unlike climate change or ozone depletion biodiversity loss is not the effect of specific technologies but is due to di verse factors that are related in complex ways to the social cultural, and economic context There is great variation among societies and cultures in the details of the human relationship to biodiversity The term "as appropriate' reflects the parties' understanding that techniques and policies for conservation and sustain able use are not uniform and must be tailored to var ied circumstances

Similarly, "as far as possible cannot mean that a country is excused from performing an obligation merely because it is politically difficult That logic too would make implementation discretionary which would in effect remove the obligation from the Con vention The more reasonable interpretation is that countries are excused from performing an obligation if it is literally impossible, for instance if biodiversity is found within territory that is occupied by a foreign power or if science has not yet identified a threatened species that should otherwise be covered by protective legislation as required by the Convention [5]

The Convention's obligations will be legally binding as soon as Bulgaria ratifies it and it enters into force [6] In the meantime Bulgaria will be developing an action plan for implementation of the Convention The NBDCS and this implementation plan are closely related and indeed should be identical in many re spects While some of the Convention's requirements are at least partly satisfied by existing legislation full implementation – like full implementation of the NBDCS – will require the revision of some existing laws and probably the creation of some new ones

A Planning and Decision Making

Major Obligations

The Convention requires each party to create a national plan or strategy for the protection of biodiver sity, Art 6(a) Each country must also integrate biodi versity protection and sustainable use of biodiversity into relevant sectoral or cross sectoral plans, pro

grams and policies Art 6(b), and into national decision making, Art 10(a) Examples of relevant sectors are fisheries mining, forestry, agriculture, military, land use planning, and transportation

Parties are also required to provide for environmental impact assessment (EIA) of 'proposed projects that are likely to have significant adverse impacts on [biodiversity] with a view to avoiding or minimizing such effects " The EIA should "allow for public participation in such procedures" as appropriate Each party must also provide for assessment of the environmental consequences of "programs and policies" likely to have significant negative impacts on biodiversity Art 14

General Status

As of early 1993 about a dozen countries have begun development of national strategies for the conservation of biodiversity Relatively few countries include explicit consideration of biodiversity in a wide range of policies and programs but many countries provide for general assessment of the environmental impact – which should include impact on biodiversity – of many government activities and at least some private activities with the potential for significant environmental effects Frequently these procedures include public participation The legal norm of environmental assessment, including public participation, is also recognized in the Convention on Environmental Impact Assessment in a Transboundary Context done Feb 25, 1991, 30 I L M 800 (1991)

Status in Bulgaria

The project for which this report is prepared launches the development of Bulgaria's national strategy for the conservation of biodiversity With assistance from the U S Agency for International Development, and through the offices of the U S based Biodiversity Support Program the Bulgarian Ministry of Environment held an interdisciplinary workshop to discuss this and other reports prepared by a team of scientists lawyers and administrators in Sandanski 12 20 March 1993

Bulgaria's Environmental Protection Act of 1991 provides for environmental assessment of a number of categories of economic activities with the potential for significant environmental impact [7] An EIA must be conducted whether the activity is to be carried out by the public or the private sector The public has the right to participate in the process and may appeal the government s decision to the courts The government shall prevent or stop activities found through the EIA to have a "negative environmental effect As of early 1993 the EIA procedure has been used twice in both cases to evaluate large dams [8]

Recommendations

1 In general, the term "environment" should be defined by statute or regulation, or interpreted by government policy or judicial decision to explicitly include biodiversity

2 An EIA should be mandatory for forestry projects or policies involving the cutting of timber (Annex 2 to the EPA, listing types of projects for which EIAs are required, does not include such projects or policies), because forestry projects or policies are likely to have "significant adverse effects" on biodiversity

3 An EIA should be mandatory for any project that could have a significant impact on protected areas rich in biodiversity (this could possibly be done through regulations issued under EPA Art 20(2))

4 All relevant policies and programs and their implementing legislation – including, for instance the forestry law and agricultural land protection law – should explicitly consider the value of biodiversity in decision making

5 Incentives should be provided to encourage private parties to conserve biodiversity (e g tax credits for landowners who conserve rather than develop natural habitat) and regulations developed that are appropriate for privately owned lands

B Identification, Monitoring, and Research

Major Obligations

The Convention requires parties to

- identify ecosystems, species, and genomes important for conservation and sustainable use of biodiversity, using the criteria listed in Annex I (including, for example richness of variety, uniqueness, social or economic importance threatened or associated with key biological processes) Art 7(a) and Annex I
- monitor the status of biodiversity components to determine priorities for conservation Art 7(b)
- identify and monitor activities possibly harmful to biodiversity Art 7(c)
- maintain and organize data gathered under Art 7(a) (c)
- establish and maintain programs for scientific and technical training in the activities described in Art

7(a) (d) and promote research that contributes to those activities

General Status

While there is substantial research underway around the world the general sense is that much more must be done as ecological and taxonomic knowledge is so very limited Indeed, the need for financing such activities in developing countries was one of the major motivations for the negotiation of the biodiversity con vention

Status in Bulgaria

The NBDCS itself will outline what is necessary to carry out Article 7 of the treaty

Recommendations

1 The strategy will outline necessary policy meas ures The legislation or regulations to implement them, once they have been established, should be fairly simple

C Measures to Protect Biodiversity

Major Obligations

Avoid Injury to Biodiversity Parties must take measures to control the causes of significant injury to biodiversity Art 8(l) and must also adopt measures to avoid or minimize adverse impacts on biodiversity (e g , sustainable forestry practices to avoid excess de struction regulation of mining to avoid contamination of waters and resulting loss of aquatic biodiversity) Art 10(b)

Establish Protected Areas Parties must establish a system of protected areas and must take measures to promote environmentally sound development in areas adjacent to protected areas "[W]here necessary " they must develop uniform guidelines for selection and management of those areas Art 8

Manage and Protect Biodiversity for Conservation and Sustainable Use Both within and beyond pro tected areas parties must manage biological resources to ensure their conservation and sustainable use They must promote the protection of ecosystems natural ha bitats and maintenance of viable species populations in natural surroundings They must also develop laws to protect threatened species or populations Art 8

Restore Damaged Ecosystems and Threatened Spe cies Countries must take measures to rehabilitate and restore ecosystems and promote the recovery of threatened species Art 8 Such measures must pro vide for assistance to and participation of, local populations Art 10(d)

Ensure "Biosafety " Countries must take steps to con trol the risks of use and release of genetically modified organisms (GMOs) likely to have adverse impacts on biodiversity [9]

Control Alien Species Countries must take steps to prevent introduction control or eradicate alien species that threaten biodiversity Art 8(h)

Create Conservation Incentives Countries must create incentives for the conservation and sustainable use of components of biological diversity Art 11 In addition, each country is to encourage cooperation between government and the private sector in devel oping methods for sustainable use of biological re sources Art 10(e)

Educate the Public Countries must promote and encourage public understanding of biodiversity con servation through the use of media and through edu cation Art 13

Protect and Apply Traditional Knowledge and Con servation Practices Countries must maintain tradi tional knowledge and practices that help to conserve and sustainably use biodiversity, must apply (in coop eration with them) such traditional knowledge and practices, and must encourage equitable sharing of their benefits Art 8(j)

General Status

These provisions range over a w de and varied set of activities and policies Some countries have made progress on one or more of them, but no country has dealt adequately with all of them

Status in Bulgaria

Bulgaria's geographic position at the border of the European temperate continental steppe and Mediter ranean zones, together with its rich microclimatic vari ety and hydrographic complexity and other factors have led to a great variety of wild flora and fauna [10] Bulgaria also contains genetic resources important for many cultivated plants – including tomatoes, beans tobacco melons, corns cereals forage grasses leg umes and fruits – and has been termed a secondary center of diversity for many cultivated plants with other primary centers of origin [11]

In general the MOE has the authority to "guide and control the preservation of the biological diversity and natural ecosystems [and] declare the protected spe cies and territories " EPA, Art 24 Under Article 15 of the Constitution the government must "ensure the pro tection of the environment the conservation of living nature in all its variety, and the sensible utilization of the country's natural and other resources " The MOE's spe cific duties and powers in this area are described in the Nature Protection Act of 1967

Avoiding Injury to Biodiversity This general requirement has been implemented in part through the EIA provisions of the EPA (described above) Laws governing protected areas, hunting and fishing and endangered species discussed below also carry out this requirement to some extent However, not all laws that affect biodiversity acknowledge the need to avoid injuring it, and laws that acknowledge the need to avoid injury do not always include effective mechanisms for avoidance

Establishing Protected Areas Under current laws, the MOE is authorized to establish protected areas by an order published in the State Gazette after consulting with other interested government authorities [12] The MOE regulates activities in all protected areas, including private lands within them Arts 24 26 Although citizens and NGOs may propose the declaration of protected areas to the government, Art 23 there are no procedures for public participation in decisions about protected areas Protected areas covered 2 05% of the country's territory in 1990 [13]

The Nature Protection Act of 1967 (NPA) establishes uniform guidelines for two categories of protected areas *Nature Reserves* comprise areas which (a) have plants and animals that are remarkable and scientifically valuable or are threatened with population decline or extinction, or (b) places whose terrain has permanent significance for science Reserves shall be preserved in their natural state and all activities within the reserves that disturb their original natural character are forbidden NPA, art 16 Scientific research and activities to protect the natural biota are permitted [14]

National Parks are areas which have remarkable natural aesthetic scientific, cultural or health value and in which recreational and tourist use and other economic activities are permitted NPA, Art 17 The MOE designs a management plan tailored to each national park [15] Other categories of protected areas under the NPA Arts 18 20 are "natural landmarks "places with typical landscape," and "historical places "

Management and Protection for Conservation and Sustainable Use The NPA provides for protection of plant and animal species that are in danger of extinction or are scientifically or economically valuable Arts 15, 16 21 Article 9 provides for the regulation of gathering of wildflowers and useful and edible plants In 1990, 330 higher plants were under strict protection and 31 medicinal plants were subject to limits on use several hundred animals species are protected under the NPA and 122 species are subject to use limits [16]

A number of other environmental laws including those on forestry hunting and fishing air water and soil pollution and agricultural practices relate to biodiversity For instance, the Reserve Law State Gazette (D V) No 91 1982 authorizes the Committee on Forests and the Bulgarian Hunting and Fishing Union to regulate hunting with the goals of increasing game populations and maintaining ecological balance Art 1 Similarly the Fish Enterprise Act of 1982 includes among its goals the increase of species variety and maintenance of biological balance, and regulates fishing accordingly

Restoration of Ecosystems and Threatened Species The government has begun to reintroduce *Lynx lynx*, which has gone extinct within Bulgaria [17] The government has also attempted to restore ecosystems through remediation of water pollution aimed at reversing eutrophification, and reforestation of historically deforested areas [18]

Ensuring "Biosafety" Control of the risks of use and release of GMOs is not currently a serious concern in Bulgaria There have been few if any GMO releases within Bulgaria and future releases are not expected Officials in the MOE knew of no plans within the government to develop biosafety regulation

Alien Species Under the NPA, Art 11, new wild animal species may be introduced into the country only with the approval of the Bulgarian Academy of Sciences On the basis of information provided it appears that no measures have been taken that deal specifically with the introduction of alien flora

Public Education The EPA, Art 11 requires authorities to publicize information on the environment by means such as the mass media It does not specifically mention biodiversity

Conservation Incentives and Traditional Knowledge and Conservation Practices From the information provided it appears that there are no laws specifically addressing these issues

Recommendations

1 In any nature conservation law specify precisely which government authority (which ministry, and which level, local/municipal regional, or national) has the regulatory authority over a protected area (this would require revision of Art 5 of the draft protected areas act (DPAA))

2 Specify the criteria to be used for selecting all protected areas within the protected areas system, and the criteria for selecting the level of protection [19]

3 Establish procedures for public participation in decisions about whether to designate protected areas – including the level of protection and the creation of management plans (the DPAA includes such procedures for creating but not for "de listing" areas, Art 8 and for national park

management plans but not for nature reserve management plans, Arts 20 23(2))

4 Establish procedures for public participation in decisions whether to classify species as endan gered, and in decisions about the extent of legal protection for a species where alternatives are possible

5 If necessary enact laws to control the introduction of alien species and to acknowledge conservation practices based on traditional knowledge

6 To ensure protection of genetic diversity of culti vated plants or wild relatives

- specify that biodiversity is defined to include the genetic diversity of cultivated plants or wild rela tives, so that such diversity is considered in the rationale for establishment of protected areas

- ensure that any size limitation on such pro tected areas is based on science (e g , floral ge netic diversity can often be conserved by pro tection of very small parcels of land, which might justify exceptions to the proposed mini mum size of 150 hectares for nature reserves in DPAA Art 15(2))

7 Establish strict penalties for all violations (the DPAA does not specify all penalties, penalties specified under NPA, art 37 appear to be weak, and the extent to which they are superseded by the EPA is not clear)

8 Develop laws for carrying out policies to protect biodiversity outside of protected areas including regulation of private lands [20]

9 Provide for incentives to private parties to con serve and sustainably use biodiversity Such in centives to private owners will be increasingly im portant as privatization progresses At the same time, the government should avoid adopting per verse disincentives that discourage conservation (e g , laws in some countries prohibit the sale of traditional seeds unless they are among a limited number of commercial varieties)

D Measures to Protect Biodiversity - *Ex Situ* Con servation (Article 9)

Major Obligations

The Convention includes the general obligation to take measures for *ex situ* conservation (that is conser vation outside of the natural habitat) of biodiversity components, especially those for which the party is the country of origin Art 9 In particular countries must establish and maintain facilities for conservation of and research on biodiversity components i e 'gene banks" or "seed banks" (storage centers for germplasm of domesticated crops or botanical gardens) In addi tion parties must take measures for *ex situ* recovery of threatened species

General Status

Approximately fifty countries have established fa cilities for long term storage of "plant genetic re sources," principally covering the genetic diversity of major food crops and their relatives [21] Twelve of the International Agricultural Research Centers linked through the Consultative Group on International Agri cultural Research, have collections of plant genetic re sources Erosion of genetic resources held in such storage facilities is a worldwide problem Further more, collections of crop genetic resources are far from complete and are especially weak for minor crops [22] *Ex situ* conservation of the genetic resources of trees and domesticated animals is even less ade quate Finally most countries have yet to explore the potential for using economic incentives to encourage conservation of biodiversity on private lands which could be a useful complement to *ex situ* conservation of crop genetic diversity by the public sector

Status in Bulgaria

The National Institute for Plant Genetic Re sources at Sadovo has facilities for long term storage of germplasm

Recommendations

1 Pass laws implementing policies for *ex situ* conser vation of genetic diversity These could include incentives, such as tax credits or low interest loans, to encourage farmers to establish and maintain gardens of traditional crop varieties or herds of traditional animal breeds (see Recom mendation 9 under Part III D above) In many countries non governmental initiatives have con tributed significantly to *ex situ* conservation

E International Relations

Major Obligations

Technology Transfer Under the Convention par ties must "provide and/or facilitate" transfer to other parties of biodiversity protection technology and bio technology that uses genetic resources Transfer to developing country parties (and perhaps to source countries of biodiversity generally) must be "under fair and most favorable terms," while providing for

"adequate and effective protection of intellectual property rights" In practice, any party to the treaty should negotiate terms to make sure that other parties that obtain its genetic resources give it at least some access to any biotechnology developed from its genetic resources

Rules on Access to Biodiversity Each party should ensure that biodiversity within its jurisdiction is available to other parties on "mutually agreed terms," and conversely that any biodiversity it obtains from other countries is obtained on mutually agreed terms In either case, it should provide for "fair sharing" of biodiversity's benefits – i e compensation for its use or transfer of technology based on it

Financing of Convention The Convention requires parties to establish a multilateral fund – financed by developed countries – to help developing countries meet their obligations The Convention permits "countries undergoing the process of transition to a market economy" to decide whether to voluntarily assume the obligations of developed countries to contribute to the multilateral fund Art 20(2)

International Information Exchange and Scientific and Technical Cooperation Countries must (1) facilitate exchange of information on biodiversity conservation and sustainable use, including technical scientific and socio economic research and training and surveying programs Art 17, and (2) promote international cooperation on technical and scientific research, training, and institution building Art 18

International Communication on Risks Countries must make regional, multilateral, or bilateral arrangements with other nations for notification consultation and exchange of information on activities within their jurisdiction that may significantly injure areas beyond their jurisdiction Art 14 In particular countries must provide for immediate notification of other states that would be potentially affected in cases of imminent grave danger to areas outside national jurisdiction that originate within national jurisdiction Also countries must establish joint contingency plans with other nations where appropriate for emergency responses to grave and imminent dangers to biodiversity Finally each party must ensure that any person within its jurisdiction who releases a genetically modified organism (GMO) into another party's jurisdiction provides the second party with all information on risks that is required by the first party's law [23]

International Liability Countries are obligated to study the issue of state liability (including compensation and restoration) for transboundary damage to biodiversity Article 14(2)

Reporting Countries must report to the Conference of the Parties on measures taken for the conservation and sustainable use of biodiversity Art 26

General Status

Countries are still analyzing the meaning of these provisions of the Convention and are still developing their positions In addition, international proceedings are underway to clarify the meaning of these provisions [24]

Status in Bulgaria

Bulgaria like other countries, is still analyzing the Convention and developing its position International information sharing and cooperation will be particularly important for the many plant and animal species (many of which are endangered) that are endemic to the Balkans, for migratory birds, and for ecosystems affected by activities in neighboring countries [25]

Recommendations

1 Ratify and publish the Convention in the State Gazette by October 1993 (in time for the first inter governmental meeting)

2 Analyze implications of the Convention's provisions on international relations for Bulgaria and participate in continuing international discussions

3 To increase the efficiency and quality of analysis and participation, consider the possibility of cooperation – through information sharing or development of similar policy positions – with other countries in situations similar to Bulgaria (i e countries in transition, developed countries with relatively high biodiversity, countries with moderate amounts of native crop genetic diversity countries with significant scientific and technical expertise but limited financial resources),

4 To the extent possible (in light of political turmoil and economic problems) discuss regional cooperation for the protection of regionally endemic species and migratory birds with neighboring countries

IV OTHER LISTED INTERNATIONAL ENVIRONMENTAL AGREEMENTS

A The Convention on International Trade in Endangered Species (CITES)

Any national strategy for the conservation of biological diversity must consider the effects of international trade in flora and fauna For some countries the most important issue will be pressure to export

domestic flora or fauna For others the biggest problem will be the pressure to import foreign wildlife products In either case CITES is a powerful tool for the control of trade that harms species of flora or fauna in danger of extinction

Major Obligations

CITES regulates international trade of species listed on three appendices It contains no restrictions on domestic trade, and contains no habitat protection provisions The appendices determine the type of regulation and the type of trade that is permitted As a result the debates at the Conferences of the Parties focus on whether to list "downlist" (i e move from one list to another), and delist species

- *Appendix I* species are those that "are threatened with extinction and are or may be affected by trade ' Art II This list includes the African elephant, black rhino, and Monkey puzzle tree

- *Appendix II* species are those that "although not necessarily now threatened with extinction, may become so unless trade in such specimens of such species' is strictly regulated It also includes species that look like other listed species or parts of them and which must be listed to avoid confusing customs inspectors and to protect the listed species

- *Appendix III* species are those that a party identifies as being subject to regulation within its jurisdiction for the purpose of preventing over exploitation due to trade

Appendix I species are subject to both import and export permits Before an importing country can issue an import permit for a specimen of a species it must determine that

1 the import will not be for commercial purposes
2 the use of the import will not be detrimental to the species survival and
3 living specimens will be properly housed and cared for

Before the exporting country can issue an export permit it must determine that

1 the export will not be detrimental to the survival of the species
2 the export was not obtained in contravention of State law
3 the export will be shipped in such a way as to minimize the risk of injury to living specimens and
4 an import permit has been granted

Appendix II species require only an export permit The exporting country must make the same findings as for Appendix I species with the exception that they need not determine that an import permit has been granted Art IV Appendix III species require only an export permit certifying that the specimen was not obtained in violation of law Art 5

The key difference between species listed in Appendix I and those listed in Appendices II and III is that commercial trade in Appendix I species is prohibited As the parties have interpreted that term, any transaction that is not wholly non commercial should be treated as commercial Res Conf 5 11

A party must establish a Management Authority and a Scientific Authority which have the duty to make the permitting decisions described above A party also must pass legislation to prohibit trade in violation of CITES, including measures authorizing penalties for trade in or possession of, specimens taken in violation of CITES and confiscation of such specimens Art VIII

Each party must submit an annual report detailing the number of violations of CITES requirements the number of permits granted and the number of specimens exported and imported Art VIII

General Status

The list of parties to CITES continues to grow, the number now stands at 117 However, there is a great deal of concern that countries are not fully implementing the treaty In particular, many parties do not appear to comply with the treaty's requirements in the permitting of Appendix II species At the 1992 Conference of the Parties, 135 alleged infractions were reported as a sample of the range of infractions occurring throughout the world The parties banned *all* trade in species listed under CITES with Thailand because of Thailand's extremely poor implementation of CITES

The CITES Secretariat reported that many parties do not have implementing legislation or have legislation that does not fully or effectively implement the Convention The result is weak enforcement The Secretariat also noted that some countries issue certificates for exemptions to the Convention's trade restrictions in a manner inconsistent with the treaty's obligations This has resulted in continuing commercial trade in species that are not supposed to be traded [26]

Implementation in Bulgaria

The National Assembly ratified CITES on December 12, 1990, effective April 16 1991 published D V No 6, 1992 [27] Bulgaria did not make any reservations with regard to the species listings [28] The MOE plans to develop implementing legislation and submit it to the National Assembly [29] Because international instruments are "self executing" under the Bulgarian

Constitution species listed on CITES' appendices automatically receive legal protection in Bulgaria (at least assuming that appendices are published in the State Gazette) but implementing legislation will be needed to provide for penalties for violations and other necessary measures

Bulgaria has designated the Ministry of Environment as the Management Authority three officials in the MOE's Department of Biodiversity, Protected Areas and Forests (DBPAF) have the authority to issue permits [30] The government has also designated several Scientific Authorities (the Institute of Zoology for vertebrates and invertebrates the Institute of Botany and Botanical Gardens for plant species, and the Institute of Ecology for vertebrate species) to provide assistance with regard to species listed in the *Red Data Book* of Bulgaria

As required by CITES, the Management and Scientific Authorities have the power to make the findings necessary for issuing an import or export permits To make the findings, the authorities rely on information and advice of the CITES Secretariat and communication among the authorities In particular, the MOE does not have experience in determining whether a specimen is shipped in a manner that will not damage the specimen's health and relies on the advice of the CITES Secretariat The Scientific Authority makes its "no detriment" findings based on Bulgaria s *Red Data Book* of endangered species and bases its findings on two criteria (1) biological possibility for breeding and (2) present population numbers A separate permit is required for each shipment

Customs is responsible for ensuring that illegal specimens are not imported into or exported out of Bulgaria The Regulations on Customs Control grants customs officials the power to confiscate illegal shipments As of 27 April 1993, Customs has confiscated five pythons and one jaguar Because there is no implementing legislation yet civil penalties are administered under the general civil and penal provisions of domestic legislation In addition to confiscation civil penalties include fines up to 150,000 Leva for first time offenders and 300 000 Leva for repeat offenders Under the provisions of Article 29, the offender may also be required to remedy the harmed caused by their action which could include replacement costs Criminal penalties are also available [31]

Recommendations

While Bulgaria has implemented some of the provisions of CITES implementing legislation and regulations are needed to cover the following points

1 Explicitly delegate authority (including division of responsibility among ministries and among national regional and local/municipal authorities) to issue regulations implementing CITES to make management decisions under the legislation and regulations and to enforce CITES trade limitations

2 Designate a single scientific authority rather than several different scientific authorities (experience in other countries suggests that more than one scientific authority can cause confusion in issuing export and import permits)

3 Designate an adequate budget and sources of revenues, possibly including fines and penalties collected for violations

4 Establish sufficiently severe penalties for violating prohibitions or limitations on trade, including fines civil penalties confiscation and imprisonment because the present fines do not always provide sufficient economic deterrent

5 Provide for citizen participation in enforcement by giving citizens the power to bring legal actions (in courts or agency proceedings) against violators

6 Establish the Management Authority's procedures for

- (when a specimen is being *exported* from Bulgaria)
  - determining that a valid import permit has been granted
  - determining whether a specimen was obtained in contravention of the laws of Bulgaria
  - determining that the specimen will be shipped in a manner that will not damage its health
- (when an Appendix 1 specimen is being *imported* into Bulgaria) determining that the import will not be for primarily commercial purposes

7 Establish the Scientific Authority's procedures and criteria, including collection and evaluation of information for determining that the export or import of a specimen will not be "detrimental to the survival of the species " Reliance on the *Red Data Books* published in 1984 (for plants) and 1985 (for animals) may not provide up to date information upon which to make informed decisions regarding the ability of a species particularly a foreign species to sustain trade

8 Designate ports of entry and ports of exit where specimens must be presented to customs officials with valid permits

9 Continued submission of reports to the CITES Secretariat as required under the Convention

B Convention on Wetlands of International Importance, Especially Waterfowl Habitat ("Ramsar")

Major Obligations

Ramsar requires parties to include one wetland site on the List of Wetlands of International Importance Ramsar "encourages" parties to take certain other actions At the Fourth Conference of the Parties, however, the parties passed a resolution to clearly define the obligations of parties as well as committees established under Ramsar The Resolution is to form the basis for determining Ramsar activities, and summarizes the commitments of the parties under the provisions of Ramsar [32] These include (1) designating wetlands for the List (Art 2 1) (2) developing and implementing plans to promote conservation of listed sites (Art 3 1), (3) notifying the Ramsar Bureau of any change in the ecological character of listed wetlands resulting from human interference (Art 3 2) (4) compensating for any loss of a listed wetland by creating or expanding other protected wetlands (Art 4 2), (5) developing criteria to identify wetlands of international importance and (6) establishing national inventories of potential Ramsar sites and all other wetlands

In addition, parties are committed to (1) developing and implementing plans to promote the wise use of wetlands (Art 3 1), (2) preparing environmental impact assessments before changing the character of wetlands (Recommendations Cagliari 1 6 Groningen 2 3 Regina 3 1 Montreux REC C 4 10) and (3) establishing nature reserves on wetlands and providing for their protection (Art 4 1)

General Status

The Ramsar Convention now covers 538 wetlands totalling 32 3 million hectares [33] Most parties take the provisions of Ramsar seriously For example, some parties have used Ramsar to prohibit lead shot or hunting in listed sites Many countries feel that implementing legislation is not required because existing nature protection legislation can be used to designate sites that are named under Ramsar In a typical example the United States did not pass special laws governing Ramsar sites, believing that the Clean Water Act and the other laws established regulations that adequately protected Ramsar sites

Many countries have established national Ramsar committees to help them meet their obligations under Ramsar The composition of the committees varies Many include non governmental representatives Such committees help overcome budget constraints and also help fulfill Ramsar's commitment to public participation

Implementation in Bulgaria

Limited information was available on Bulgaria s implementation of Ramsar Bulgaria signed Ramsar on September 24 1975 the treaty entered into force on January 24 1976 [34] The treaty s text was published in the State Gazette D V No 56 1992 [35] Bulgaria has placed four wetlands on the Ramsar List including the Srebarna Reserve (600 ha, Sept 24, 1975), the Lake Atanasovsko Ezero Reserve (1050 ha), the Lake Arkutino Reserve (97 ha, Sept 24, 1975), and the Durankulak Natural Monument (9350 ha, Nov 28, 1984) [36]

The MOE has named these Ramsar sites using its general power to declare protected areas under the Nature Protection Act Art 22 The MOE published an order declaring the protected area and establishing limitations on activities within it in the State Gazette relying on its regulatory powers under the Act *Id* The declaration that an area is protected does not deprive private landholders of possession although they are governed by the MOE's rules limiting activities *Id* at 25 The large majority of wetlands protected by Ramsar are state owned and will remain so leaving them unaffected by land restitution programs [37]

The MOE's DBPAF is leading a task force that is developing a national plan (using funding provided by the French government and with technical assistance from the Ramsar Bureau) for protecting wetlands on the Danube and the Black Sea that will include proposals to name new Ramsar sites [38] The plan is to be presented at the next Ramsar meeting in Japan [39]

Recommendations

Based on available information, the following is recommended

1 See recommendations regarding protected areas in Part III C above

2 The DPAA should specify that all wetlands of international importance (as defined under Ramsar Art 2 these could for instance, include wetlands having unusually high biodiversity or significant for migratory birds) should be designated as protected

3 The law should require an EIA of any project with potential for significant environmental impact on a wetland listed under Ramsar This implements Art 3(2), and could be effected through amendment of the DPAA or through regulations implementing the EPA's EIA provisions

C Convention for the Protection of the World Cultural and Natural Heritage ("World Heritage Convention")

Major Obligations

The Convention for the Protection of the World Cultural and Natural Heritage adopted Nov 16 1972 entered into force Dec 17 1975 now has 127 parties, the World Heritage List consists of 358 sites in 82 countries of which 95 sites are natural and 8 mixed natural/ cultural [40]

The Convention is administered by the United Nations Educational Scientific and Cultural Organization (UNESCO) through a World Heritage Committee of representatives from twenty one of the parties The Committee creates and administers the World Heritage List of sites and areas that are of "universal outstanding heritage" and part of "the world [natural and cultural] heritage of mankind as a whole " Each party must submit a list of sites within its jurisdiction for possible inclusion that it recognizes as having global importance and which it obliges itself to protect Articles 3 5, 11 The Committee reviews nominations and selects those of outstanding universal value The Convention also establishes a List of World Heritage in Danger which can include sites even if they are not nominated by the government with jurisdiction [41]

"Natural heritage" includes (1) "natural features consisting of physical and biological formations which are of outstanding universal value from the aesthetic or scientific point of view" (2) "precisely delineated areas which constitute the habitat of threatened species of animals and plants of outstanding universal value from the point of view of science or conservation ' and (3) 'natural sites or precisely delineated areas of outstanding universal value from the point of view of science conservation or natural beauty " Art 2

The Committee's operational guidelines define narrowly the kind of biodiversity site that can be included giving as examples "*superlative natural formations* ' such as "the most important ecosystems" or '*the most important and significant natural habitats where threatened species of animals or plants of outstanding universal value* from the point of view of science or conservation still survive (emphasis in original)

The Convention requires parties to take measures to protect their heritage At least one court has decided that parties are legally obligated to take special measures to protect World Heritage Sites within their jurisdiction [4] Parties must also cooperate to (1) protect all heritage not just all World Heritage cultural and natural sites (2) help other parties protect and conserve sites and (3) avoid deliberately damaging sites in others' jurisdictions They must also submit reports every two years to the UNESCO General Conference with information on implementation including legal measures adopted and results obtained

The Convention pioneered the concept of a multilateral fund to support implementation, establishing a World Heritage Fund (administered by the Committee) to assist countries that need help to protect and maintain sites Parties pay into the fund in an amount equal to 1% of UNESCO dues The fund currently totals approximately US $2 million [43]

General Status

The Convention is valuable in that naming a site to the World Heritage list gives it special international legal status that can enhance protection and also makes it eligible for small amounts of multilateral funding for protective measures It is progressive in that it affirms the interest of all of humanity in places of universal heritage even though they are within the sovereign jurisdiction of a single state Interest in the Convention has tended to come mostly from the cultural side, and the rigorous criteria for selecting sites ensures that the List will never comprehensively protect biodiversity Nevertheless unusual richness in biodiversity can qualify a site for inclusion on the List, and a site's presence on the List helps protect the biodiversity within the site

Implementation in Bulgaria

Limited information was available on Bulgaria's implementation of the World Heritage Convention Bulgaria ratified the Convention March 7, 1974, with a reservation to the provision concerning voluntary financial contributions [44] The text of the Convention has not been published in the State Gazette and consequently it does not yet have direct force as domestic law [45] While the government authorities in charge of cultural affairs are responsible for administering implementation of the Convention, the MOE actually manages the natural heritage sites

Two natural heritage sites in Bulgaria have been placed on the World Heritage List [46] Pirin, covering 27,500 hectares in the Pirin Mountains has protected legal status as a national park [47] The Srebarna Reserve consisting of 600 hectares of wetlands near the Danube River west of Silistra, provides critical habitat for rare birds and has the protected legal status of a nature reserve [48] It has been placed on the List of World Heritage Sites in Danger [49] These sites are protected pursuant to the Nature Protection Act according to their protected status as a park and as a reserve respectively There is a question as to whether or not these areas are protected in practice however

Because of the reservation taken to Article 16(1) Bulgaria does not make voluntary financial contributions to the trust fund established to protect World Heritage sites [50] In addition Bulgaria is no longer a member of UNESCO's World Heritage Committee

and does not report on its activities undertaken pursu ant to the Convention [51]

Recommendations

Based on available information, the following steps are recommended

1 Publish the text of the Convention in the State Gazette to give it official status as Bulgarian law

2 Ensure that Bulgaria's *inventory* of potential sites, required by Art 11(1), is complete and up to date, especially with respect to sites rich in biodi versity in light of current science, and

3 Ensure that legal measures to protect World Heritage sites are fully enforced in practice

D Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of All Types of Forests (1992) ("Rio Forest Princi ples")

Major Obligations

While the Rio Forest Principles are non binding, they include several useful principles that can guide forest policies so as to increase protection of biodiver sity, including

- preparation of a national plan for the manage ment of forests that considers the relationships among management conservation and sustain able development,
- reforestation of forests cut for timber
- management of forests on a sustained yield basis
- protection of valuable and unique forest areas
- distribution to the public of information concern ing forests and timber cutting and provision for public participation in forest policy decisions,
- incorporation of costs and benefits of timber har vesting into prices of forest products,
- consideration in forest management decisions of both economic and non economic values of 'forest goods and services,' including environmental costs and benefits

General Status

The destruction and degradation of forests is a se vere, world wide problem and few if any countries adequately implement all of the principles listed above Many countries are however improving their policies to some extent

Implementation in Bulgaria

Forests cover 34 8% of the territory of Bulgaria 97 5% of the forests are state owned, and only 13 8% of forests have trees with an average age greater than 80 years [52] Forests in protected areas are as much as two to five hundred years old, but most forests have been logged during the last fifty years [53]

A comprehensive review of Bulgarian forest pol icy and management is beyond the scope of this re port The comments under "Recommendations," be low however apply both to the existing Forestry Law as well as to a draft Forestry Law that has been circu lated

Recommendations

1 Any national plan or new legislation must provide for consideration in policy and decision making of the benefits and value of biodiversity found in the forests (Such values and benefits include aesthetic economic environmental, and cultural benefits both long and short term whether or not they are traded on markets or paid for with money)

2 The government authority with jurisdiction over a forest must consider environmental costs, benefits, and values – including the biodiversity of the for est – in any decision and in doing so must use the best and latest available scientific evidence

3 Forestry policy and management decisions and the bases for those decisions – including evalua tion of costs and benefits and assessment of biodi versity – must be made public and the public must have a chance to comment

4 The environmental impact – including the impact on biodiversity – of forestry management deci sions must be assessed, and the public must be in cluded in the assessment process (see also Rec ommendations in Part III A above)

E Framework Convention on Climate Change ("Climate Change Convention")

Major Obligations

The Climate Change Convention adopted May 9 1992, requires that parties take climate change into account to the extent feasible" in 'relevant" social, economic and environmental policies Art 4(1) Because research indicates that climate change will have a serious impact on biodiversity – although effects will vary widely from region to region – biodiversity conservation policy is clearly one of the relevant policies that must incorporate consideration of climate change [54]

The Convention also requires parties to prepare publish and update inventories of greenhouse gas emissions and sink removals and requires developed countries and countries in transition to take measures to mitigate climate change by limiting emissions and enhancing sinks [55] This requirement is relevant because forests – which are often relatively rich in biodiversity compared to habitats resulting from the conversion of forested land – are also major natural 'sinks" of carbon that is, they accumulate and store large amounts of carbon Growing trees absorb carbon dioxide from the atmosphere While mature forests absorb relatively little carbon they store large amounts in the soil as well as in vegetation if they are cut for timber significant amounts of carbon can be released into the atmosphere especially in clear cutting [56] Thus, protecting forests can simultaneously avoid greenhouse gas emissions and conserve biodiversity

General Status

Most countries have yet to take comprehensive steps to implement the Climate Change Convention and are still in preliminary planning stages While scientists have offered general proposals for the protection of bio diversity against climate change – including enlargement of reserves increased conservation outside of protected areas, and restoration ecology through translocation and *ex situ* conservation – authorities have so far taken very little action

Implementation in Bulgaria

The Climate Change Convention was signed by Bulgaria June 5 1992 As of March 1993 ratification was pending In Bulgaria, an increase in temperature and decrease in precipitation over the past ten years – with consequent damage to forests – has been reported but it is not known whether the change is related to global warming [57] The MOE s outline for implementing the Convention covers the inventorying of emissions development of a national plan for reduction of emissions (including selection of a pre 1990 base year), and protection of carbon sinks (specifically including forests)

Recommendations

1 In laws for biodiversity protection, include provisions for the mitigation of climate change's effects on biodiversity, such as enlargement of protected areas based on available scientific knowledge

F The Convention Concerning Fishing in the Black Sea of 1959 and the Convention Concerning Fishing in the Waters of the Danube of 1958

Major Obligations

The Black Sea Fishing Convention regulates fishing on the Black Sea and commits parties to 'rational" fishing, improving fishing techniques and research Art 1 The Convention allows fishing vessels to seek refuge and repairs in designated ports of other parties Arts 2 & 3 It also establishes minimum size limits for certain species of fish, each party must appoint one representative to a Mixed Commission for development of other fishing regulations Arts 5 & 8

The Danube Fishing Convention regulates fishing in the "waters" of the Danube, a term which is broadly defined to include the Danube's mouth tributaries up to the maximum extent of flood waters, lakes, and temporary pools Art 3 The obligations under this Convention are similar to the Black Sea Convention It establishes closed seasons and minimum size limits for certain species of fish and creates a Mixed Commission to further regulate fishing on the Danube Art 11 13, Annex It also requires parties to ensure the migration of fish around dams and other obstructions and to ensure the normal breeding of economically valuable fish above and below such works Art 5 Parties must also create hatcheries for economically valuable fish Art 6 Parties must prepare and apply plans to prevent the contamination of the Danube from waste that is harmful to fish and other aquatic organisms Art 7

Implementation in Bulgaria

Limited information was available on Bulgarian implementation of these agreements The National Assembly of Bulgaria ratified the Black Sea Fishing Convention on December 12 1959, it was published in the State Gazette, D V No 33, 1960, and it came into force March 21 1960 Bulgaria ratified the Danube Fishing Convention on August 8 1958 it was published in the State Gazette D V No 17 1959 and it came into force December 20 1958

The Fish Industry Act of 1982 implements the provisions of these two conventions that relate to fishing, but not refuge and repairs [58] Fish passages are required for any dam project and dams that completely block the migration of fish are prohibited Discharge of waste water that adversely affects fish is

prohibited Although in theory the law implements the two conventions Bulgaria's toxic contribution to the Danube indicates that enforcement of the Fish Indus try Act is less than ideal in practice

Unlike other environmental protection laws, im plementation of the Fish Industry Act is dependent on sport and commercial fishermen who comprise the Union of Hunters and Fishermen They are largely re sponsible for stocking fish and for production at hatcheries The Ministry of Forests and Wood Indus try and the Committee for Environmental Protection were the governmental bodies originally charged with implementing the conventions

Recommendations

1 Ensure that the fish in the Danube River and Black Sea are not over harvested by adapting regulations of the commissions to meet the needs of the fish and ecosystem

2 Enforce the prohibition on the discharge of wastes that are harmful to fish stocks

G UNESCO Man and the Biosphere Program ("MAB")

Major Obligations and General Status

The MAB was established in 1970 by UNESCO over 110 countries now participate Worldwide, bio sphere reserves now number some 300 sites, totalling nearly 162 million hectares The MAB is governed by an International Coordinating Council, the Secretariat is in Paris at UNESCO Each participating nation ap points a national committee

The Biosphere Reserves system is the main pro gram of MAB Biosphere reserves are intended to conserve characteristic ecosystems while permitting sustainable development of resources to meet human needs The objective is to link the natural and social sciences in efforts to rationally use and conserve the biosphere by improving the relationship between hu manity and the environment Other objectives are to conserve natural or minimally disturbed ecosystems to provide a legal or administrative basis for resource protection and to conserve specific genetic re sources [59]

Implementation in Bulgaria

Bulgaria participates in MAB maintaining sev enteen biosphere reserves totalling almost 40,000 hec tares [60] Bulgaria has appointed a National Committee on MAB, but not a secretariat [61] As a practical matter, the MOE's DBPAF is responsible for managing bio sphere reserves Biosphere reserves have protected le gal status in domestic law as nature reserves the strict est level of protection under the NPA In some cases biosphere reserves are situated within the boundaries of a national park so that the national park – where more human activity is allowed – functions as a "buffer zone" for the biosphere reserve [6-] In the past, Bulgaria participated in MAB organized research and confer ence activities, but has not done so since 1985 because of a lack of funds [63] As with other protected areas there is concern that MAB sites are protected by law but not in practice

Recommendations

1 Where necessary, redefine the boundaries of bio sphere reserves to reflect MAB's mission to inte grate conservation and human activity (e g ex pand borders to include "buffer zones" as well as core areas)

2 Ensure that MAB sites are not only protected by law but also that the laws are adequately en forced

NOTES

1 Article 5(4) of the Constitution states that [a]ny international instruments which have been ratified by the constitutionally established procedure promulgated and come into force with respect to the Republic of Bulgaria shall be considered part of the domestic legislation of the country They shall supersede any domestic legislation stipulating otherwise Constitution of the Republic of Bulgaria established by the Grand National Assembly on 12 July 1991 promulgated in Durzhaven Vestnik [State Gazette] [abbreviated D V] No 56 Jul 13 1991 (English translation published by Sofia Press Agency)

2 Decision published in D V No 56 Jul 10 1992 The Constitutional Court is empowered to determine whether domestic laws are compatible with international instruments to which Bulgaria is a party Constitution Art 149(4) CITES Ramsar the World Heritage Convention and the two fishing treaties were ratified before the 1991 Constitution came into effect

3 ENVIRONMENT AND DEVELOPMENT OF REPUBLIC [OF] BULGARIA NATIONAL REPORT FOR THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT (1991) at § 2 7 [abbreviated BULGARIA UNCED REPORT] Another

problem is that even when substantial fines were imposed the economic structure was such that fines did not create disincentives for the authorities managing state owned enterprises *Id*

4 Some laws do provide for public participation The new Environmental Protection Act of 1991 provides in general terms for the right to obtain information and the right of the public to participate in environmental impact assessment procedures The Nature Protection Act of 1967 Art 23 gives the public the right to petition the government to declare an area protected The draft Protected Areas Act Arts 8 & 9 establishes a procedure for involving the public in protected status decisions These laws are discussed in more detail in Part III C below

5 Developing countries - but not developed countries including countries in transition - might also argue that the phrase refers to their need for additional international aid to meet the Convention s requirements or their need to balance conservation with economic development and the eradication of poverty needs which are specifically mentioned in Article 20(4) as affecting implementation

6 Bulgaria signed the Convention on Jun 12 1992 Bulgaria s Ministry of the Environment (MOE) plans to submit the treaty to Parliament for ratification The Convention enters into force 90 days after the 30th country has submitted evidence of ratification art 36 As of June 1993 21 countries had ratified it and it will likely enter into force by early 1994 [Note the Convention on Biological Diversity officially entered into force in January 1994 ed]

7 Ch 4 Environmental Protection Act D V No 86 Oct 18 1991 amended D V 100 Dec 10 1992 [abbreviated EPA]

8 Interview with George Penchev Feb 25 1993

9 Article 8(g) Biosafety regulation is regulation designed to ensure that bioengineered organisms are released safely

10 BULGARIA UNCED REPORT at § 1 1 Summary

11 DRAFT REPORT PLANT GENETIC RESOURCES AND THEIR MANAGEMENT IN BULGARIA (prepared for NBDCS Workshop by Dimitar Stoyanov)

12 Nature Protection Act of 1967 Art 22 D V No 47 Jun 16 1967 amended D V Nos 3 1977 39 1978 28 1982 26 1988 and 86 1991 [abbreviated as NPA]

13 BULGARIA UNCED REPORT at § 4 4

14 *Legislative Protection of the Biological Resources in the Republic of Bulgaria* DRAFT DOMESTIC LAW REPORT (citing Rules for the Application of the NPA art 17)

15 J SPIRIDONOV AND A JURAS NATURE CONSERVATION IN BULGARIA at 69

16 BULGARIA UNCED REPORT at § 4 4

17 SPIRIDONOV AND JURAS at 67 Interview with Jeko Spiridonov Feb 25 1993

18 Interview with Jeko Spiridonov Feb 25 1993

19 For instance the criteria developed by the Ecology Institute in its Prognosis and Program for the Development of the System of Protected Areas to the years 1995 and 2010 could be used Among these criteria are for instance the presence of a high degree of biological diversity and a high degree of floristic endemism See JEKO SPIRIDONOV CONTEMPORARY TENDENCIES IN PROTECTED AREAS SYSTEM DEVELOPMENT IN BULGARIA 3

20 It is worth noting that Western governments routinely regulate activity on private lands to protect the environment including biodiversity Most countries including the U S impose significant limitations on private use of land without paying the compensation that is required for a taking of private property on the principle that the rights of private ownership by

definition include limits on the owner s power to affect other citizens or the environment

21 KEYSTONE CENTER KEYSTONE INTERNATIONAL DIALOGUE SERIES ON PLANT GENETIC RESOURCES OSLO PLENARY SESSION FINAL CONSENSUS REPORT GLOBAL INITIATIVE FOR THE SECURITY AND SUSTAINABLE USE OF PLANT GENETIC RESOURCES 7 (1991)

22 *Id* at 7 8 19

23 Note that the Convention requires parties to regulate releases of GMOs that may significantly injure biodiversity Art 8(g) In addition the Convention provides that the parties shall discuss at future meetings whether to draft a protocol - a related but new treaty - that would establish uniform international standards for safety regulation of GMOs Art 19(3)

24 Some of these provisions will be discussed for instance at the meeting of the Inter Governmental Committee on the Convention on Biological Diversity organized by UNEP and scheduled for October 11 15 1993

25 BULGARIA UNCED REPORT at § 12 2

26 Doc 8 19 *Review of Alleged Infractions and Other Problems of Enforcement of the Convention*

27 State Gazette No 103/1990 (ratification of CITES) State Gazette No 6/1991 (publication of text and coming into force) MOE International Environmental Agreement Implementation Outline

28 Interview with George Penchev Mar 12 1993 When a country takes a reservation regarding a treaty s requirements it indicates its intent not to be bound by that provision of the treaty CITES permits reservations

29 Interview with Lubomir Profirov Department of Biodiversity Protected Areas and Forests (DBPAF) Feb 22 1993

30 Interview with Lubomir Profirov Feb 22 1993

31 Letter to David Downes CIEL Attorney from George Penchev April 27 1993

32 FRAMEWORK FOR THE IMPLEMENTATION OF THE CONVENTION AND PRIORITIES FOR ATTENTION 1991 1993 (Doc C 4 12) (Rev)

33 GLOBAL BIODIVERSITY at 475

34 DRAFT DOMESTIC LAW REPORT Parts 12 & 14 The Paris Amendments have been in force for Bulgaria since Jan 24 1976 Ratification by the national assembly was apparently thought unnecessary as the Convention was made effective by a resolution of the Council of Ministers Resol No 389 Nov 18 1974 *Id* at Part 12 Bulgaria has taken no reservations to Ramsar Interview with MOE DBPAF officials Feb 22 1993

35 DRAFT DOMESTIC LAW REPORT Part 14

36 Fax letter from Venelin Iliev to David Downes May 25 1993

37 Interview with Mira Mileva MOE DBPAF and Tanio Michev Institute of Ecology Bulgaria Academy of Sciences Mar 19 1993

38 MOE International Environmental Agreement Implementation Outline

39 *Id* Interview with Mira Mileva MOE DBPAF Feb 22 1993

40 U S DEPT OF STATE TREATIES IN FORCE ON JAN 1 1992 at 406 (1992) Michel Batisse *The Struggle to Save Our World Heritage* 34 ENVT no 10 at 12 (1992) GLOBAL BIODIVERSITY at 475

41 For instance the Committee recently placed Dubrovnik on the danger list although the government had not requested it

42 SIMON LYSTER INTERNATIONAL WILDLIFE LAW 223 (1985) citing No C6 of 1983 *The Commonwealth of Australia v The State of Tasmania* 46 A L R 625 68 I L R 266

43 GLOBAL BIODIVERSITY at 492

44 DRAFT DOMESTIC LAW REPORT Part 14 WORLD CONSERVATION MONITORING CENTRE GLOBAL BIODIVERSITY at 475 TREATIES IN FORCE at 406 407 Letter from George Penchev to David Downes April 27 1993

45 DRAFT DOMESTIC LAW REPORT at Part 14

46 GLOBAL BIODIVERSITY at 475

47 SPIRIDONOV AND JURAS at 69 71

48 *Id*

49 Interview with MOE DBPAF officials Feb 22 1993

50 Letter from George Penchev Apr 27 1993

51 *Id*

52 BULGARIA UNCED REPORT at § 2 4

53 Interview with Jeko Spiridonov Director MOE DBPAF Feb 25 1993

54 GLOBAL WARMING AND BIODIVERSITY (ROBERT L PETERS AND THOMAS LOVEJOY EDS 1992)

55 Parties must notify the Convention secretariat of these mitigation policies and measures (with the aim of reducing emissions to 1990 levels) and their projected results

56 MICHAEL OPPENHEIMER AND ROBERT H BOYLE DEAD HEAT THE RACE AGAINST THE GREENHOUSE EFFECT 146 (1990)

57 BULGARIA UNCED REPORT at § 5 4

58 DRAFT DOMESTIC LAW REPORT Part 14

59 William P Gregg Jr *MAB Biosphere Reserves and Conservation of Traditional Land Use Systems* 278 *in* BIODIVERSITY CULTURE CONSERVATION AND ECODEVELOPMENT (MARGERY L OLDFIELD AND JANIS B ALCORN EDS 1991)

60 SPIRIDONOV AND JURAS at 69 GLOBAL BIODIVERSITY at 475

61 Letter from George Penchev to David Downes April 27 1993 The Committee is an independent body usually chaired by the director of the Institute of Ecology Bulgarian Academy of Sciences *Id*

62 Interview with Jeko Spiridonov Feb 25 1993

63 Letter from George Penchev to David Downes April 27 1993

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Economics and Biodiversity Conservation in Bulgaria

Carollyne Hutter

INTRODUCTION

Bulgaria is in the process of moving from a centrally planned economy to a market economy At present elements of both systems can be found Most prices have been liberalized, trade policy has been reformed and private businesses have come into existence However very little privatization has occurred the means of production are still owned and operated primarily by the state The country has also inherited a huge foreign debt from the previous regime

It is a difficult time for Bulgaria A viable financial infrastructure is still being developed The potential for political instability exists And inflation continuously erodes purchasing power and the value of salaries The danger during this period is that many people have placed their faith in a "business first' approach – that is emphasize economic development first and give thought to environmental considerations later "Such reasoning only increases the cost of later restoration of the environment and often has the effect of defeating the very economic benefit sought "[1] This part in the Bulgarian Natural Biological Diversity Conservation Strategy will provide an overview of biodiversity conservation in Bulgaria and its economic implications

The report comprises five sections Section one discusses the value of biodiversity and explains how economists place values on goods and services that do not pass through the market Section two examines Bulgaria's forestry sector (and, briefly those of some other countries) Section three explores the role of incentives and disincentives in government policy Section four addresses the issues of private property and land use The final section looks at additional economic considerations Bulgaria's foreign debt situation, the use of appropriate discount rates, and modifications of national income accounting to reflect environmental degradation and natural resource depletion

This report raises a number of questions about economics and biodiversity conservation These are profound questions however and this report can provide only a beginning step It will lead I hope to further investigations

VALUE OF BIODIVERSITY

Economists have sought to define the value of biodiversity as reflected both in traditional markets and in nonmarket goods and services

Market Goods and Services

Bulgaria's biodiversity directly provides a number of products, including timber, medicinal plants mushrooms fish, wild game and fauna and livestock genetic resources These various products are discussed in detail in several of the other background reports for the conservation strategy So as not to duplicate their efforts, the information they provide will not be repeated here The reader should refer to them for specific information on these products in Bulgaria

It is fairly easy for economists to assign monetary figures to such products since they are bought and sold at a market These products are what economists call "market goods " If products are harvested and consumed directly by a family or in the local community without going through a market, economists place a value on them by figuring out their prices as if they were sold in a market Economists estimate the market value of these products by using surrogate market techniques

Biodiversity may also generate income by attracting tourists, providing genetic resources, and serving as education material

Recreation and nature tourism can both preserve areas of biodiversity and generate income Every year in the United States millions of people leave their homes in cities and towns to enjoy the natural beauty of wilderness areas, national parks, and national forests In just one year, between 700 and 800 million people visit state and national parks, while some 200 million visit national forests A national survey by the U S Fish and Wildlife Service determined that 77% of the American population 16 years or older participate in some type of wildlife related recreation including fishing hunting photography and wildlife viewing and feeding Americans spent almost $56 billion on wildlife associated recreation in 1985 The money went to equipment purchases (56%) trip related expenses

(38%), and other expenditures, such as magazine sub scriptions membership dues licenses tags, and per mits (6%)

Nature tourism and recreation is not the perfect solution to preserving biodiversity and generating in come The advantages and disadvantages of ecotourism depend on the type of activity and the dis tribution of the income these activities generate - In terms of disturbance to natural ecosystems and wild life there are great differences between, for example bird watching and skiing Bird watching, a quiet, nonintrusive and nonconsumptive outdoor activity can actually generate considerable income to the local economies that bird watchers frequent A study of the Cape May Peninsula in New Jersey, U S A by Paul Kerlinger and David Wiedner discovered that bird watchers directly contributed $6 million (based on ab solute values, i e , without using economic multipliers) to the local economy More than 90 000 bird watchers visit Cape May each year The researchers found other benefits to bird watching for Cape May bird watchers come in non peak seasons they do not re quire supervision (game wardens or law enforcement officers), and they require low overhead [3]

Investment and promotional activities are needed to encourage ecotourism it is not enough simply to set aside areas of undisturbed natural beauty (For spe cific recommendations regarding ecotourism opportu nities in Bulgaria see Nicholas Spall's report on eco and sustainable tourism in this volume)

Plant genetic material is essential for agricultural One way to develop disease resistant crops is to crossbreed cultivated species with the wild ancestors or relatives of cultivated plants Genetic diversity of crop plants is also vital for developing new crops suited to varying climate patterns and other environmental con ditions Unfortunately, modern agricultural practices have led to a narrowing of the base of genetic diver sity This has happened as monocultural farming sys tems using a small number of modern hybrids have re placed traditional systems in which farmers selected and maintained thousands of different plant varieties

How economically valuable are wild species to ag riculture and the food product sector? Wild species can be very valuable For example, the tomato indus try in the United States relies on wild tomato species from South America When two American scientists, Hugh Iltis and Don Ugent accidentally discovered a new species of tomato in Peru in 1962, it turned out to be worth $8 million a year to the U S tomato industry "The importance of plant genetic resources for the de velopment of Bulgarian agriculture became clear in the beginning of the century " Dimitar Stoyanov states in his background report (For a thorough examina tion of plant genetic resources in Bulgaria and their role in assisting agriculture see Dr Stoyanov's back ground report in this volume)

The pharmaceutical field has recently recognized the value of maintaining plant genetic material since over 25% of modern prescription drugs contain at least one substance derived from a plant These drugs vary from simple mouthwashes (which use winter green) to cancer treatments (such as taxol from the Pacific yew tree in North America) A unique agree ment has been reached between the pharmaceutical company Merck & Co and the Instituto Nacional de Biodiversidad (or InBio) of Costa Rica Under this agreement Merck will pay InBio one million dollars for the opportunity to screen collected organisms for compounds of potential medicinal use The money will be used to further Costa Rica s conservation pro grams

Natural ecosystems, such as forests and wetlands, can also be living classrooms for scientists and stu dents For example, every year many American and European ecologists travel to the tropical forests to pursue scientific studies, generating income for the lo cal economy in the process

Beside the value of consumptive and productive uses of biodiversity economists identify other values of biodiversity

Existence value, as identified by David Pearce and Anil Markandya refers to the feeling of stewardship that biodiversity engenders It is the value of knowing that something exists, even if one may never see it The Himalayas the pandas in the wilds of China and rare species of cranes all have value to people who will never actually visit these areas or see these things themselves People feel concern, responsibility and a sense of well being just knowing that these organisms or ecosystems survive This value is very difficult to measure but an indication of its extent is the amount of money people contribute every year to environ mental organizations such as the World Wildlife Fund or to movements to save specific plant and animal spe cies or ecosystems, such as tropical rain forests

Option value To quantify society's strategies of risk aversion, economists use the idea of option value – a type of insurance People consider it essential either for the immediate future or for future generations to preserve ecosystems or species They may want to preserve a natural ecosystem so that their children or others can visit it and enjoy its beauty Or they may believe that a plant or animal species will have value in the future as a possible medicinal treatment or food source As with existence value it is very problematic attributing a monetary figure to option value How ever the agreement between Merck & Co and InBio shows that option value can be considerable

Nonmarket Goods and Services

Economists have developed a range of methods to determine the value of the nonmarket goods and services provided by biodiversity such as soil conser vation and flood control These methods are catego rized into three groups (1) valuation methods based

on observed economic behavior, (2) valuation based on surrogate values and (3) valuation established from elicited responses

Valuation based on observed economic behavior assigns values to environmental services by calculating how changes in environmental services are connected to the supply or productivity of goods and services that are traded in the market Commonly used methods include the changes in productivity approach, the loss of earning expenditure approach, the cost effectiveness approach the replacement cost approach, the compensation approach, and the wage differential approach

Valuation based on surrogate values looks at prices for other market goods to estimate implicit values The shadow pricing approach, the best known of these approaches, examines the price of substitutes for the environmental service in the marketplace Other approaches in this group are the travel cost approach and the property value approach

Valuation based on elicited response uses surveying methods In this approach individual are asked how much are they willing to pay for high quality water endangered species conservation and other environmental features

Valuation of Ecosystems

Economists when they place values on ecosystems necessarily undertake their work with incomplete information about ecosystem functions and processes It is relatively simply to ascertain the monetary value of an ecosystem function and process that supports a well defined product (for example, shrimp from the sea) Difficulties come when we attempt to determine the value of non market goods such as flood protection or climate regulation

However even in the case of commodity goods, the market price may not represent the entire value of a good In addition to their being a valued commodity, shrimp are also valuable as food for other fish and as unique species in and of themselves Ecosystems such as wetlands and forests, are very complex systems The lack of both ecological and economic knowledge creates difficulty in the effort to value ecosystems Problems arise in measuring the functions and process of ecosystems or assessing how various disturbances will alter these intricate systems It is unlikely that complete information about complex ecosystems will ever be available Moreover no techniques exist to quantify the functions and processes for the many different types of ecosystems The Ecosystem Valuation Forum sponsored by the U S Environmental Protection Agency concluded in a recent study[4] that generally many experts feel that existing ecological models do not provide information in a form readily useful as information inputs either into valuation processes or as information inputs directly into the policy process "

Ecologists have reproached economists for not adequately including in their calculations the cost of irreversibility, since the destruction of an ecosystem is irreversible

A Case Study the Coastal Wetlands in Louisiana, U S A

Despite the many difficulties involved in valuing ecosystems economists have made a few attempts to do so One example involves the coastal wetlands in the state of Louisiana in the U S A A fundamental part of Louisiana's cultural identity, the coastal and inland wetlands are also an integral part of the state's economic base The wetlands are vital sources of many market goods Commercial and sport fisheries which depend on wetlands, contribute over one billion dollars annually to the state's economy Other market goods that depend on the wetlands include furs and hides (an annual value exceeding $17 million) and waterfowl (about $58 million annually)

The ecological services of the wetlands also have economic importance To gain an understanding of the value of Louisiana's coastal wetlands that is more complete than that provided by market product figures alone, economists Robert Costanza and Steve Farber measured various wetland benefits using different techniques One used willingness-to pay surveys to calculate the benefits of commercial fishing trapping recreation, and storm protection This calculation was obtained through two approaches First they simply interviewed recreational users about their willingness to pay for coastal wetlands The problem with this approach according to Costanza and Farber is that interviewees will suggest a value too high or too low depending on the purpose to which they believe the information will be put And so Farber and Costanza relied primarily on the travel cost approach to measure user willingness to pay, examining the amount of money spent on plane fares gasoline, boat rental and so forth Energy analysis was the other valuation technique used to measure coastal wetland values The energy analysis technique calculates the value of an ecosystem by measuring the amount of solar energy captured and stored in plants To obtain a monetary value this figure was converted by estimating the cost of producing the same energy from fossil fuels

Using these two techniques Farber and Costanza produced an estimate for the value of Louisiana's coastal wetlands of between $2 500 and $17 000 for every acre of marsh By comparison, the market price (not including mineral rights) is about $500 an acre

Benefit Cost Analysis

As noted valuations of ecosystems by economists are at best partial efforts, but the findings are still important since they present some evidence of the value of ecosystems If some value is not placed on an ecosystem or environmental service they will often be treated as 'free" public goods and both the benefits they provide to society and the costs of their destruction are likely to be dismissed in making development or policy decisions Moreover the figures derived from valuations of ecosystems or environmental services can be used in performing modified Benefit Cost Analyses (BCA)

John Dixon and Paul Sherman provide a precise definition of BCA[5]

> A project analysis technique based on welfare economics theory that examines the present value of the stream of economic benefits and costs of an activity or project over some defined period of time (time horizon) using some predetermined discount rate A boundary of analysis is also defined in order to indicate what effects are included in the analysis The results of a BCA are usually present in terms of a net present value (NPV), a benefit/cost ratio (B/C ratio) or an internal rate of return (IRR) A benefit/cost analysis uses economic scarcity values (shadow prices) as opposed to the market prices used in a financial analysis

Modified Benefit Cost Analyses can be an important tool in deciding whether to carry out a proposed development project This type of analysis examines all the benefits and costs of a project or policy to determine whether the benefits outweigh the costs Included in the measurements are noncommercial components such as environmental services, which place additional weight on the preservation side of the decision than would be the case in strict financial analyses that use only market prices

FORESTRY

"Sustainable management of tropical forests is dependent on accounting correctly for all the economic uses of the forests "[6] Correct valuation of forests, which Edward Barbier, Joanne Burgess and Anil Markandya advocate in terms of tropical forests is also important for temperate forests Economically, forests are usually seen merely as potential sources of timber But in addition, forests provide a variety of products and services that are valuable to society

- *Nontimber products* Tropical forests are known to be rich in nontimber products such as nuts, fruits and latex However even temperate forests provide a wealth of nontimber products The forests of Canada and the United States, for example yield a number of other forests products The best known example is maple syrup Others include aromatics animal bedding, basket making materials berries, charcoal, cooking greens cones and greenery dye stock and tanning materials, herbs and spices honey mushrooms naval stores nuts ornamental plants, trees and shrubs pitch wood stumpwood or fatwood seeds seedlings and cutting, smokewood and flavor wood "Bulgaria is managing its forest resources very effectively for preservation of standing timber reserves," the report stated This analysis however did not differentiate between primary forests, secondary forests, and tree plantations Moreover, it is implied that the only value, particularly the only economic value, of a forest is as a source of timber

The forests in Bulgaria are considered fairly young About 60% are new plantings (1 20 years old) 30% are of an intermediate age, 10% are older (over 80 years old) Although the natural mixture is one third coniferous and two thirds deciduous the proportion of coniferous forests has increased since the majority of new plantings are conifers The change in natural composition and the loss of hardwoods worries some Bulgarian foresters Moreover the shift from hardwoods to conifers may make the forests more sensitive to damage from air pollution acid rain drought and global warming Theoretically 40 45 percent of annual growth is harvested – 3 3 million m^3 of timber, of which 60 percent is firewood and 40 percent is lumber Re planting from 1986 1990 occurred at a rate of 30,000 ha/year while previously (1980 1985) the replanting rate exceeded 40 000 ha/year

State management of forests is performed by the Committee of Forests Forests are classified as economic forests or 'special purpose" forests each with its own regulations Economic forests are used for timber production and comprise about 70 percent of the forests managed by the Committee of Forests Special purpose forests include national parks reserves and protected catchment areas Logging also occurs in special purpose forests although less intensively and frequently than in economic forests

The Committee of Forest is hierarchically structured with three levels the central body district departments, and local (so called state) forestry enterprises The Committee decides how much timber is to be cut and prepares management plans for each local forestry enterprise to follow The plans are prepared every ten years by teams of forestry experts who gather information on the forests When the Committee approves a plan a special commission – the majority of which consists of forestry personnel – must be called together The Ministry of Environment is involved when the commission deals with protected areas, however it has only one vote

The local forestry enterprises of the Committee (with the assistance of temporary workers) perform the actual logging, and forward 55 percent of the reve nue from the logging operations to the central body About two thirds of the employees of the Committee work in local forestry enterprises Their salaries are derived from forest resources, primarily logging reve nues

The Committee through the local forestry enter prises, is also responsible for selling the timber Be cause timber is a natural resource, there are restric tions on the exporting of logs, particularly logs over 18 cm^3 The logs are primarily bought locally The price of the log includes the expenses of transportation planting administration labor, and road construction and maintenance

According to a draft version of the new forestry law [Article 7 (1)], "(T)he forest fund, regardless of who is their owner is managed and used on the basis of the forest plans which shall be approved by the Committee on Forests in cooperation with the de partments concerned " This means that the Commit tee approves the management of all forest land whether privately or publicly owned

A number of issues regarding the forestry situa tion require further analysis What follows is a brief over view of these issues It is recommended that these issues be studied in greater depth

According to Christo Bojinov s background report on forest resources in this volume "The expenditures in the Forestry branch which are not compensated by cash inflow from direct commercial exchange are compensated through governmental subsidies " This statement leads to the question what exactly does the government subsidize and how do these subsidies in fluence logging activities, the price of timber and ef forts to conserve biodiversity?

Another issue is whether the forestry sector is promoting economic development in Bulgaria This question requires a complete market analysis of the Bulgaria forestry sector There is however evidence even from a superficial analysis that the forestry sector is only providing limited contributions to the economy The current system is almost a closed loop the Committee logs the forest and the income from this activity returns to the Committee Economic contri butions are possibly coming from secondary industries, such as wood processing industries However the country uses 60 percent of the wood for fuelwood which limits the potential for secondary industries

The issue of the forestry sector and its actual con tribution to economic development has been studied in a number of countries Throughout the world state forestry departments have not successfully utilized their forests in promoting development In general governments have lost primary forests (and the serv ices and goods they provide) without even obtaining the full revenue potential of the timber

In the United States, the federal Forest Service has been criticized severely for it management of na tional forests It has been reproached for having tax payers subsidize the harvesting of the national forests and the selling of timber at below cost In addition the 'benefits of the forests to wildlife and recreation are inadequately protected "[7]

In Southeast Asia governments have failed to capture the revenue potential of their tropical forests In these countries the actually logging is done by pri vate companies who have signed timber concession agreements with the government Usually the conces sion fees in the agreements have been set too low ar tificially reducing the harvesting costs for concession aires and encouraging more logging than would be the case with higher concession fees This situation has allowed a few individuals and corporations to become wealthy at the expense of local people, the govern ment and social programs Another problem with these concession agreements is that, due to their lim ited time frames there is no incentive for concession aires to manage the forests properly, since the benefits of such management will not will not accrue to them According to Robert Repetto of the World Resources Institute "Governments have typically sold off timber too cheaply, sacrificing public revenues and non timber benefits of the standing forest while encourag ing 'timber booms ' profiteering and rapid logging ex ploitation "[8]

Another issue involves the question of whether the amount of forest logged is influenced by the fact that the salaries of the local forestry enterprises of the Committee are dependent on timber sales

And there is also the issue of the age of the Bul garian forests According to Bojinov the average age of the forests is 42 years old (which is fairly young) What effect does this have on biodiversity? Orn thologist John Terborgh has found from his various studies that a younger forest can not support as great a bird population as a mature forest

There are also broader questions involving the consideration of biodiversity conservation in forest management – not just within protected areas but also in economic forests With regard to the forest man agement plans, are the values of recreation environ mental services, and non timber goods recognized as the plans are created? Should the price of a log in clude a conservation fee?

The final issue pertains to local participation The Committee of Forests follows a centralized and top down approach toward the management of forests which means that instructions and polices are pre scribed at the top of the hierarchical structure and im plemented at the lower level But what about local participation and involvement? According to the draft version of the new forestry law [article 31] "The population permanently living in the region of the state forestry board may obtain wood per root for per sonal needs from the state forest fund at tariff tax without the right to sell it " What about having the lo

cal population actually contribute to the decision making process? Robert Repetto has described his experiences with local participation in forest management

> (W)hile national governments have overestimated their own capabilities for forest management they have underestimated the value of traditional management practices and local governance over forest resources Local communities dependent on forests for many commodities and services, not just timber have been more sensitive to their protective functions and the wide variety of goods available from them in a sustainable harvest [9]

ECONOMICS AND POLICY

Moving to a market economy can help raise environmental, social,and economic well being through competition Monopolies do not promote efficiency or innovation However conversion to a market system is not sufficient to ensure the conservation of biodiversity Markets need to be coordinated with other institutions to address various societal needs No country has an economic system that operates free of the influence of governmental policy Every country makes decisions – conscious or not – that contribute to or detract from efforts to achieve long term sustainable economic development and the conservation of natural wealth

In an unfettered market system it is usually only a small group of individuals that earns high returns from exploiting natural resources and society – not the group of individuals – pays the costs of depleting these resources This situation has been witnessed again and again in Southeast Asia where large areas of tropical forest have been destroyed benefitting only a small group of people while depriving the world of a cornucopia of biological wealth As a report from the Humphrey Institute in the United States notes

> Markets tend to fail in the provisions of public goods in accounting for environmental pollution and in protecting fragile natural resources Experience with unfettered markets has resulted in significant inequalities in the distribution of social welfare [10]

This section will address how government policy can be used to internalize externalities and alter individual self interest to incorporate societal needs The way to accomplish this is by using a system of incentives and disincentives Incentives are mechanisms or methods which promote conservation while disincentives discourage activities which deplete natural resources

One major obstacle to the conservation of biological resources in many countries has been that government policies encourage the depletion of natural resources Economic incentives have been far more pervasive in over exploiting biological resources than conserving them,"[11] Jeffrey McNeeley from International Union for Conservation of Nature and Natural Resources notes Incentives that encourage people to deplete natural resources are termed 'perverse incentives " Examples of perverse incentives are easy to find The Brazilian government's subsidies of cattle ranching led to the clearing of tropical forests for ranches and farms The Indonesian government's transmigration policies moved millions of people from Java to outer islands, where primary forests where destroyed for their settlement In such cases the first requirement is to remove the perverse incentive and then afterwards to adopt new incentives to counterbalance their harmful effects [12]

Some perverse incentives are easy to detect since their effects directly cause damage to or depletion of a natural resource In Costa Rica, for example the availability of agricultural credits from banks is linked to the use of certain minimal amounts of pesticides Some perverse incentives are much more subtle their intent often having nothing to do with natural resources or the ecosystems they affect In the United States for example subsidies for agriculture have lead to environmental degradation "Agriculture was responsible for 82% of wetland conversion between 1950 and 1980 and direct government subsidies were the main reason the conversion were undertaken [13]

Bulgaria has removed some perverse incentives by liberalizing most prices Under socialism the prices for natural resources were artificially kept very low to promote industrialization Natural resources were considered "free goods " leading to high depletion rates and inefficient use of resources The socialist scheme emphasized energy intensive heavy industry, which created high levels of pollution By liberalizing prices and restructuring the economy a shift has begun – away from heavy industries and toward lighter industries and lower per unit amounts of raw material inputs and energy consumption For example, the prices for fertilizers and pesticides (major sources of groundwater pollution) have risen since prices were liberalized causing a decrease in the use of fertilizers and pesticides by farmers

It would be beneficial to perform an investigative study in Bulgaria to discover which perverse incentives still exist in Bulgaria and how they encourage the destruction of natural resources or high rates of depletion

A system of effective incentives and disincentives is essential to conservation because law and enforcement are not enough to protect natural resources This has been shown throughout the world One cannot save a piece of wilderness simply by locking it up and putting guards on duty to save it There need to be ways to persuade people to conserve natural resources and values Various incentives and disincentives can be used Not all of these are economic social incentives and disincentives such as peer pressure, can also be important Even economic incentives do not have to be strictly economic or financial Incentives can also include in kind benefits, which provide material

goods such as food and equipment or access to natural resources in restricted areas

In the conservation strategy workshop, Wilbur LaPage[14] explained that he found the idea of "partner ship' useful for the New Hampshire state park system – the sharing of maintenance, costs, and benefits of the park system with others LaPage manages one of the only state park systems in the United States that is to tally self supporting and does not use funds from the state budget LaPage places park partnerships in six general categories partnership with the public, private persons and benefactors, professional organizations and agencies corporation and businesses environ mental and historical organizations, and park friends groups

Examples LaPage provided examples of partner ships and their benefits

- *Public Partnerships* The park system has a litter program in which visitors are given plastic bags and asked that all the materials they bring to the park they also take out of the park The park system has re moved all trash cans and found that this system has generated cleaner parks Another example is a dis count fee programs for frequent visitors, which has created goodwill increased visitation, higher volume of purchases in park stores, and free advertising

- *Private Partnerships* Individuals gave over 100 000 hours of their time to work last year on the maintenance of a particular mountain park while oth ers volunteered as hosts and guides (called "interpreters")

- *Organizational Partnerships* An historic associa tion operates and maintains an historic site while vari ous service organizations take care of wayside parks

Corporate Partnerships A corporate partnership with Pepsi Cola has contributed to promotional pro grams for the park system

It has been LaPage's experience that pride (whether local national, or regional) in park land 'has value which can be converted to an array of park as sets, from volunteerism to fund raising and steward ship " The park's image can be a corporate asset for various business partnerships with local or national businesses "The educational opportunities afforded by parklands have both short term and long term eco nomic spin offs through increased demand and the creation of more appreciative users

Parks can and should receive some of the eco nomic benefits that the tourism industry and recreation equipment industry reap from the parks LaPage stressed This in line with what the World Bank rec ommended in their 1992 environment strategy study for Bulgaria – a special "nature tax' for Balkantourist and other operators of facilities in or near parks The revenue from this tax would be directed toward nature protection and public education activities

LaPage also emphasized the importance of local involvement in the park system "The best long term guarantee of park protection is an appreciative public Without awareness and understanding there can be no appreciation " It is essential to involve the public in park policies, plans, and practice, LaPage noted, and this involvement can lead to other partnerships The importance of local involvement has been seen in various parks system all around the world In park systems where the practices of local people have led to environmental destruction, such as the killing of wild life, it is particularly important to involve the local people in a dialogue about stewardship of the park Economic incentives are also often needed to preserve the park (e g having local people work as guides or in one of the service industries in the park)

Beyond the various parks what other types of in centives and disincentives can promote the conserva tion of biodiversity? Here are some general ideas

- *Incentives* – financial incentives, such as tax cred its or subsidies for private owners conserving biodiver sity or preserving endangered species access to credit or easy credit terms for industries using pollution con trol devices or farmers using alternative practices, such as integrated pest management, and debt for nature swaps (a form of international incentive) It should be noted that incentives do not always have to be gov ernmentinitiated In the United States a private duck hunting organization pays landowners to keep their wetlands in exchange for allowing their members to hunt on the private property

- *Disincentives* – penalties, such as fines, for de stroying harming importing and exporting endan gered and rare species These penalties already exist in Bulgaria but it is generally recommended that the fines be raised to inhibit this type of behavior An other very useful disincentive is peer pressure Educa tion and the development of local pride may be needed to develop peer pressure The World Bank 1992 environmental strategy report recommended es tablishing user fees for water, forest minerals land and other resources, and where such fees already exist ensuring that they are high enough to encourage com panies and individuals to use these resources effi ciently

It should be noted that the Nature Conservation Fund proposed by the Ministry of Environment would derive some of its funding from a system of incentives and disincentives and incorporates some of the incen tives and disincentives discussed in this section

PROPERTY AND LAND USE

The shift from a centrally controlled economy to a market economy in Bulgaria also entails the reintro duction of private property Bulgaria now has a series of options in terms of managing natural resources and property rights The question is not only who owns the

rights to resources (such as a forest) but who manages it who benefits financially, and how all of this influences long term sustainability Many tropical forests for example are state owned but timber is extracted by private domestic or foreign companies Agricultural land can be owned by one party but leased to others under various land tenure arrangements Historian Patricia Poses notes

> Regarding property in India there are people who own the property and there are people who have rights to use this property The rights to use the property may be handed down from generation to generation and these rights can not be denied During the Raj period the British were confronted with the fact that their property concepts did not translate well into Indian society [15]

Economists often simplify property regimes by placing them in two categories – public and private – thereby dismissing the variation that may be found in land tenure schemes Common property they regard as an 'open access system " and discussion often revolves around the tragedy of the commons Economist Daniel Bromley identifies four primary property regimes public private common and open access [16] He argues that what others label as common property regimes are in reality open access property regimes According to his definition the four property regimes are

- *State property regimes* The state controls and owns the property, although individuals and companies may use the natural resources if the state agrees State agencies may manage the resource for the state or the state may lease the natural resources to individuals or companies for a specific time period 'State property regimes Bromley explains "remove most managerial discretion from the user and generally convey no long term expectations in terms of tenure security "[17]

- *Private property regimes* Private property is owned either by an individual or a corporation When a corporation owns private property, it is actually being administered by a group Despite the label of "private " most owners of private property face some restrictions regarding its use especially regarding natural resources

- *Common property regimes* In common property regimes a group of specific co owners own, use and participate in the decisions regarding the property Examples Bromley provides are tribal groups, subvillages neighborhoods kin systems, and extended families which may own in common natural resources such as farm land grazing land, and water sources Agricultural cooperatives which were prevalent in the former socialist economies of Central and Eastern Europe and the Soviet Union are not common property regimes since the land was owned by the state and not by the members of the cooperative

- *Open access property regimes* In an open access property system there are no property rights since no one owns it and its resources belong to the first person to seize or control them

There is no way to determine which regime is appropriate for conserving natural resources and promoting sustainable utilization of these resources Each regime is fraught with examples where resources been severely degraded and short term financial benefits reaped The problems of an open access system are obvious but the other three regimes are also problematic

Forest resources are commonly managed under state property regimes In tropical countries particularly in Asia, there has been a movement over the last fifty years away from local community control and toward the nationalization of forest lands Critics of this policy maintain that this movement has created both environmental destruction and economic inefficiency and has opened up large areas of forest land to exploitation by forest departments concessionaires and local people "Timber concessionaires seldom have a long term interest in conserving forests and local people who no longer have legal rights to harvest timber or forest products have few incentives to protect trees and strong incentives to clear land for agriculture "[18] As previously discussed, throughout the world government forest departments, such as the U S Forest Service have failed to collect the full revenue potential of timber sales "According to (U S) Forest Service budgets seven national forests [with below cost sales] had losses in fiscal year 1988 totalling $7 15 million "[19]

One problem with state property regimes is the centralization of management and exclusion of local participation that they usually entail In Bulgaria the decision making and policy making process under socialism was centralized Part of the transition to a democracy involves decentralization and citizen participation However as the Humphrey Institute report points out even today there is a tendency to have decisions made by the central authorities "(R)egional and local bodies non governmental organizations (NGOs), entrepreneurs, churches and others frequently have the best understanding of their needs," the report argues "This is true as well in terms of sustainable development environmental protection land use, and economic development "[20]

Common property regimes are "neither private or public neither commercial farm not communist collective neither business firm nor state utility, neither jealously guarded private plot not national or city park Nor is it usually open to all The relevant local community typically decides who uses it and how "[21] These regimes have been applauded for creating a system of checks and balance and for their successes in safeguarding their environments The official National Report to UNCED for Pakistan found traditionally

managed communal forests better at environmental protection than state owned and managed forests -- Bromley discusses a potential problem with common property regimes

> a breakdown in compliance by co owners may be difficult to prevent because this will entail loss of opportunity arising from changes elsewhere in the economy If spreading privatization pre cludes seasonal adaptation to fluctuating resource conditions then overuse of a local resource may be necessary by members of the group [23]

The advantage of private property is that the owner of property can make management decisions and invest ments knowing that he or she will receive the benefits of good care and stewardship The difficulty with pri vate properties is that the behavior of the individual or group regarding the property may not be of benefit to society "If soil erosion polluting smoke clangorous sounds or insufferable odors emanate from a private property regime then, once again the sanctity of that particular institutional setup will be under close scru tiny "[24]

As land restitution continues the issue of what type of strictures and obligations private land owners will face becomes more important Moreover with restitution land in some of the protected areas will be returned to previous owners or to their heirs This will create a patchwork system of private and public land in these areas Difficulties may arise with regard to management of protected areas that have two very different property regimes According to a draft of the new forestry law if the land is forest then manage ment plans must be approved by the Committee of Forestry This situation could negate some advantages of private ownership

Another question involving restitution is how pri vate property ownership will influence the gathering of wild species of medicinal plants and mushrooms Will private property ownership help to mitigate the prob lem of inappropriate gathering activities which have led to the exhaustion of certain plant species? Or will it further exacerbate the problem?

And what about the development of the Black Sea coast? The Bulgarian coastline has been praised for not being as overly developed as other European coastal areas, and for containing a mixture of tourist complexes agricultural and forest lands and protected areas This situation was due to the central govern ment's control and management of the coastal area Land reform and the establishment of private property will place pressures on the land and its resources as further development occurs along the coast The World Bank s recommendation is for the government to set up a formal system of coastal zone management a multi sectoral management approach to ensure that the public's interest is incorporated into land and water use in the region

NATIONAL INCOME ACCOUNTING

As Bulgaria shifts toward a market style economic system it will be important to measure the economic status of the country Figures from national income accounting methods – for example gross national product (GNP) and net national product (NNP) – are important since they as employed in policy prescrip tions and economic analyses However these meth ods have been severely criticized for not presenting an accurate image of a country's income or wealth, par ticularly in developing countries, where a significant amount of economic activity occurs within households or community markets without market exchange

> GNP increases when subsistence farmers join the labor force and stop producing their own food when women join the labor force and hire do mestic help and childcare when the stock of housing and factories is destroyed by war and then replaced and when the environment deterio rates and the government initiates corrective ac tions [25]

National income accounting (NIA) has been criti cized for its treatment of natural resource depletion and environmental costs The United Nations System of National Accounts (SNA) could report that a coun try is economically growing even though the country is depleting its natural resources and damaging its envir onment Missing from the SNA is the question of whether economic growth is sustainable In SNA de preciation of man made capital is measured but not the depreciation of natural capital renewable or non renewable "If a country is exhausting its renewable or nonrenewable resources, its current income will thus be inflated by the sale of natural assets that will even tually disappear "[26]

Another problem with SNA, according to some economists is the inclusion of defensive expenditures Defensive expenditures are primarily spent on restor ing or protecting the environment For example the money used to clean up an oil spill is a defensive ex penditure and is considered to be an income generating activity by SNA even though there is no negative accounting for the environmental loss due to the spill

The problem is that natural resources are assumed to be "free gifts of nature " A country can temporarily improve its income level by selling off its natural re sources and then increasing its consumption The prosperity" the country experiences cannot be main tained particularly when the additional income is not devoted to new productive investments Policy mak ers relying on income accounting figures in this situa tion could base their analysis on a false image of the country and thereby make inappropriate decisions

If a natural resource stock is privately owned it may be recorded since a number of private companies

"make provisions for the decrease in the capital stock or natural resources and in certain countries tax leg islation permits such provisions to be excluded from taxable income "[27] These types of provisions do not exist when resources are owned or used by the gov ernment

To address the problems of NIA involving natural resource depletion and environmental degradations, scholars have begun to develop alternative systems for measuring the wealth of a country This is a new field with varying opinions on the best methods and ap proaches to use in amending the SNA and presenting a more realistic picture of economic development and sustainable income

The depreciation approach and "user cost" ap proach are two basic conceptual approaches used to take natural resource depletion into account The de preciation approach basically adopts the same ap proach currently used to measure depreciation of man made capital, with the depreciation of renewable and nonrenewable resources expressed in monetary rather than physical units This translation from physical to monetary units can be done with various valuation methods based on the principle of replacement or willingness to pay

Salah El Serafy originally suggested the user cost approach for mineral resources depletion He advo cates this approach since the depreciation method does not recognize the income advantage imputed to the natural resource owner [28] Possession of a natural resource conveys on its owner an income advantage that is denied to those without a natural resource, and it not satisfactory to arrive at a measurement of zero net income, as proposed by the depreciation method

Economists and national accountants disagree over not only the appropriate approach to take in re solving these problems, but also over what to measure when constructing environmental and natural resource accounts The World Resources Institute (WRI) has been a leader in creating these accounting procedures William Cruz explained their approach

> The usual distinction that people try to make is whether you examine productive natural resources (productive sectors), i e forestry coastal fishing and watershed resources or whether you look at amenities environmental concerns such as water quality air quality noise or pollution WRI fo cuses on the production sectors while others focus on the second [29]

Henry Peskin suggests a broader approach than WRI by including environmental and other nonmarket factors

Should expanded accounts be confined to envi ronmental assets or should they attempt to cover the full spectrum of nonmarket assets? In principle the latter approach is preferable because a fully expanded accounting system will be able to show important rela tions between the use of environmental assets and other nonmarket activities

Herman Daly of the World Bank advocates, in stead of NNP or GNP, a new income concept of "sustainable social net national product" (SSNNP) SSNNP is defined as net national product minus both defensive expenditure and depreciation of natural capital Anne Harrison suggests dealing with defen sive expenditures in a conceptually different way by having water air soil, and other resources viewed as natural capital Degrading such natural capital ac cording to Harrison's proposal, would be considered as consumption in the measurement of national income, independent of whether the situation had been im proved by defensive expenditures or not At the level of net domestic product, the depreciation of environ mental capital would be noted

Since economists and national accountants have not reached a consensus on how to best to improve SNA to represent sustainable income, a number of theorists in the field (including Ernst Lutz Salah El Serafy and Peter Bartelmus) believe that a satellite system of environmental accounts should be published next to the existing SNA, but not incorporated into the SNA

By having satellite accounts, the user could com pute sustainable GDP and NDP (SGDP and SNDP) This half way solution would not represent a threat to the historical continuity of GDP and has a fair chance of being adopted Along these lines, the United Na tions will be setting up environmental satellite ac counts, and revising its "blue book" (the volume de scribing the core accounts of SNA) to include a section summarizing environmental satellite accounts

At present, a number of industrial countries – France, Germany, Canada Norway, Japan, France the Netherlands, and the United States – are produc ing resource accounting systems

NOTES

1 Hubert H Humphrey Institute of Public Affairs *Environment and Development in Bulgaria A Blueprint for Transition* (Prepared for the International Workshop on Institutional Design for Environmental Protection in Bulgaria Shtarkelovo Gnezdo Bulgaria September 5 7 1992 Minneapolis Minnesota Hubert H Humphrey Institute of Public Affairs University of Minnesota 1992) 13

2 For an extensive study on this topic see Elizabeth Boo *Ecotourism The Potentials and Pitfalls* (Washington DC World Wildlife Fund 1990)

3 Paul Kerlinger and David Wiedner Birding Economics or Birders Mean Big Bucks *Living Bird* Volume 11 Number 1 p 9

4 Gail Bingham and Paul DeLong *Valuing Ecosystem Functions and Processes Issues Concerning How to Provide Information Useful in the Policy Context* (Background Paper 1 Washington D C) p 4

5 John Dixon and Paul Sherman *Economics of Protected Areas A New Look at Benefits and Costs* (Washington D C Island Press 1990) p 201

6 Edward Barbier Joanne Burgess and Anil Markandya The Economics of Tropical Deforestation *Ambio* April 1991

7 Tom Tietenberg *Environmental and Natural Resource Economics* (New York Harper Collins Publisher 1992) p 295

8 Robert Repetto *The Forest for the Trees* (Washington D C World Resources Institute 1988) p 2

9 Robert Repetto *Forest for the Trees* pp 16 17

10 Hubert H Humphrey Institute of Public Affairs *Environment and Development in Bulgaria A Blueprint for Transition* p 5

11 Jeffrey McNeeley *Economics and Biological Diversity Developing and Using Economic Incentives to Conserve Biological Resources* (Gland Switzerland IUCN) x

12 *Ibid* xi

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Institution Building to Protect Biological Resources
A Perspective from the United States Park Service

William J Briggle

The United States National Park Service is honored to participate in the Bulgarian National Biological Diversity Conservation Strategy workshop It is also my privilege to represent the director of the National Park Service as this group faces this most challenging opportunity The National Park Service has a long history of involvement in the international community, assisting in the identification of resource protection issues developing strategies to mitigate resource damage and recommending options for management action The Republic of Bulgaria deserves special commendation for its early attention to countryside protection and for its enactment of laws to establish protected areas This effort to devise a national conservation strategy, including the establishment and expansion of protected areas is a further expression of Bulgaria s commitment

The National Park Service recently celebrated its 75th anniversary which culminated in a symposium that attracted many international participants Out of this symposium came a report with recommendations to guide the Service into the 21st century I commend it to you

The first national park in the United States, Yellowstone was established in 1872 Prior to this our nation's countryside contained large expanses of superlative scenery and rich biological resources that were under siege by western frontier inhabitants seeking private gain Fortunately, the erosion of resources was slowed by the presence of the United States Army which took up positions in Yellowstone until such time as the park could be turned over to civilian control In 1916 an act of the U S Congress created the National Park Service which immediately assumed responsibility for the parks that Congress had created and that the Army had administered Thus the United States sent a signal worldwide that it was embarking on a national strategy to protect and conserve its unique natural and cultural resources while allowing for their use and enjoyment

The purpose of the newly established National Park Service was to administer for the American people an extensive system of national parks monuments historic sites and recreation areas Its objectives are to manage the areas under its jurisdiction for the enjoyment and education of our citizens and to protect and conserve them for the enjoyment of present and future generations

The National Park Service is but one of several models that have been adopted in the United States The mission of the U S Forest Service is to provide a continuous flow of natural resource goods and services to help meet the needs of the nation, while the programs of the Bureau of Land Management provide for the protection, orderly development, and use of the nation's public lands and resources They operate under the principles of multiple use and sustained yield The U S Fish and Wildlife Service has responsibility for wildlife refuges and related habitats Memoranda of Understanding (MOUs) and cooperative agreements define areas of mutual assistance among these agencies and allow them to take advantage of available expertise

The National Park Service is a large, multilayered decentralized organization comprised of career employees It has full authority to manage all properties within its sphere of influence The sheer size and complexity of the Service bureaucracy affects the range of perceptions problems, and solutions among its employees and the public For example, some believe that the Service should not be involved in managing recreation areas or urban parks, or should not allow historic uses to continue on inholdings within certain park areas Scientists and resource managers believe that resource inventory, monitoring and the expansion of research capabilities are paramount and take precedence over visitor use and enjoyment These debates have not been ignored by the Service's top management, who recognize the importance of open dialogue with employees and detractors We have come to understand that we cannot be all things to all people

Administratively the National Park Service is an executive branch office under the direct supervision of the U S Department of the Interior As a result the Service is subject to the strategies and political agendas established by the Secretary of the Interior and approved by the President Consequently the priorities established for the National Park system may fluctuate with changes in political considerations and concerns

The United States Congress provides oversight and budgetary approval to the Service and serves essentially as a watchdog over the actions and programs of the Service It has the ability to increase or decrease budgets to legislate new responsibilities and to remove programs The Service is under constant pressure to add new lands to the park system and more often then not these areas (whose protection is sometimes politically motivated) do not meet national criteria for inclusion

Today the Service is an institution shaped by its mandates to protect and conserve the resources under its control while allowing for their use and enjoyment Mindful of its past aware of its present position in the conservation and public use of the resources entrusted to its care, it is now engaged in the task of moving into the 21st century As we do so we can identify a number of components that have been and remain important for institution building to protect biological and cultural resources These are

- directives and guidance provided through an organic act (1916) that allows for diverse, nationally significant areas to be included in the National Park system,
- enabling legislation that sets the agenda for devising park management strategies, establishing service polices, and preparing vision statements,
- a commitment to goals at all levels
- a commitment to resources – biological cultural and human,
- adequate funding to support programs
- the recognition of and ability to respond to external threats
- the adoption of overarching objectives, including strategic planning,
- the capacity to identify and acquire areas of national significance that need protection
- the gaining and holding of public support (both national and local)
- involvement of the public in the decision making process affecting resources and the expansion of protected areas,
- a proactive public relations program that clearly articulates agency goals and objectives
- well conceived and documented management plans that define types of use and areas for development, and that establish land use carrying capacities and
- maintenance of linkages with other federal, state, and local entities that have similar responsibilities and interests

While it is not critical that all of these components be in place and fully functional at the outset it is essential that the protection of biological resources be held as a fore-most goal

In the National Park Service the mandate to protect while recognizing the need for public enjoyment is followed by appropriate authorities who manage and regulate use Authority and decision making powers are vested in park and regional managers Matters involving jurisdiction over resources are clear The importance of developing organizational capabilities that embody protection and interpretation of the resources while providing the scientific data essential for decisionmaking and management is understood Working relationships with NGOs are important and every opportunity to strengthen these partnerships is explored Outside funding sources are pursued to help manage and protect resources Providing outreach services to school children and teaching the importance of national parks and reserves are of immense importance in developing public understanding and support

Organizational effectiveness is enhanced by developing and maintaining a professional cadre of scientists, resource managers law enforcement rangers interpreters, and administrators This entails training and the identification of requisite skills, constructive supervision and leadership, the provision of opportunities for career advancement in the protection and management of biological resources, and the education of various publics in the use and enjoyment of parks To ensure that the quality of leadership and resource management does not slip a process for evaluating staff performance and organizational effectiveness is essential

Building a strong institutional commitment to the retention of biodiversity and the protection of resources does not necessarily ensure that these objectives will always be realized What is important is that the "checks and balances' necessary to sustain the resource base be in place that the capacity and commitment to learn from error or oversight are present and that awareness and ability increase as a result

To help us focus on our task I would like to offer some examples of strategic objectives for your consideration

- *Education and interpretation* Interpret and convey, for each park unit and the overall system of protected areas, its contributions to the country's values, character and experience
- *Science and research* Engage in a sustained and integrated program of natural, cultural, and social science research aimed at acquiring the information needed to manage and protect park resources
- *Professionalism* Create and maintain a highly professional organization and work force
- *Access and enjoyment* Each park system unit has

unique attributes that are its contribution to the protected areas system Manage each unit to pro vide a diverse public with access to and recrea tional and educational enjoyment of, these attrib utes while maintaining them in an unimpaired state

- *Resource stewardship and protection* The pro tection of park resources should be a primary re sponsibility

In summary, organizations cannot remain static if they are to remain viable in today's changing world Strategic objectives and goals must be defined and im plemented and an informed public must be in place to support the concept and management of protected ar eas Institutional success requires employees who are skilled at their work and well motivated, and who re ceive strong leadership and direction National priori ties must be responded to in a professional manner, and the organization must be politically astute to sur vive However, the organization must guard against becoming internally politicized if its to retain its credibility and its sense of professional responsibility This task can be made easier if public understanding and support is evident and nurtured

The strategy that I have outlined for building a strong institution should be taken in context That is, this is the view of an outsider looking in, and must therefore be weighed against current in country condi tions and attitudes Some characteristics, however, can help define success under widely varying circum stances flexibility and resiliency, holding true to the institution's vision and overarching objectives if we err, to err on the side of the resources, and, finally the capacity to develop future leaders to manage the in stitution and ensure its ability to "take it to the next level of excellence "

Remember – the U S Park Service has been at this for 76 years, and we are still seeking solutions in the wise management and use of our resources There will always be differences of opinion on how we carry out our responsibilities as resource stewards Weigh the costs and benefits involved and make allowances where you can

Regional Planning and the Conservation of Biological Resources in Bulgaria

Plamena Borisova

To clarify the impact of regional planning on the conservation of biodiversity in Bulgaria I shall focus my attention on the basic objectives, instruments, and norms foreseen by the national legislation in force at present

The basic normative act that regulates regional planning is the Law for Territorial and Urban Plan ning (LTUP) According to this law, the objective of regional planning is to create the most favorable con ditions for living, labor, and rest for the population of the country in accordance with the needs of society as a whole and in compliance with the requirements for environmental conservation

The instruments for regional and land use plan ning are the National Land Use Plan, regional land use plans for municipalities or groups of municipalities and urban development plans for human settlements The land use plans lay out the geographic basis for the socioeconomic development of towns, villages, and their zones of influence the territories beyond the set tlements (including the protected natural areas), in dustrial zones forests and agricultural lands and areas that are defined on the basis of specific geographic ecological, demographic or economic characteristics (for example, the Black Sea coastal zone and the area of the Danube River)

The urban development plans provide for the most advantageous building and development of urban areas according to their economic natural, demo graphic, and social conditions All plans under the LTUP are elaborated approved and affirmed using specific procedures and then come into force as nor mative acts

The plans define directions for the protection of the environment including biological resources and (depending on the degree of detail to which the plans are elaborated) the specific measures to be taken In coordinating plans the general requirement is that the recommendations of every higher level of planning should be considered at the lower levels

The regional planning process also defines re gimes for land use and development in every part of the nation s territory Each of these regimes consti tutes a system of prohibitions restrictions and permis sions to carry out certain activities The objective is to promote sustainable development conservation and restoration of the environment Planning is under taken in compliance with the requirements of three macro regimes embracing seven regimes and fourteen sub regimes The macro regimes are the Natural and Forest Environment the Agricultural Environ ment, and the Urbanized Environment

The Natural and Forest Environment is the re gime under which the most favorable conditions for the development of biological resources and for the conservation of biological diversity are ensured through strict prohibitions and restrictions on human activities This regime covers all the protected natural territories – natural reserves national parks, protected areas, natural areas of particular significance and historical sites

The Urban Environment macro regime embraces 4% of the territory of Bulgaria and includes practically all highly urbanized territories, including towns indus trial zones and technical infrastructure The damage to biological resources in these areas is the most sig nificant

Town parks and gardens are artificial tracts of green space within the environment and for some bioresources serve as the sole source of the conditions necessary for their existence and reproduction For this reason, Bulgarian legislation requires that 15 to 30 m^2 of green area per inhabitant be provided within every settlement For the same reason parks must be established around the settlements according to the standard of 500 700 m^2 per inhabitant for 5 15% of its population

At this point it should be noted that the process of restitution of private property is making the obser vance of these standards very difficult and even, in some cases, impossible The development of a park restricts property rights and requires that the initiator (usually the municipality) buy land from the private owner at a price acceptable to the individual At pres ent the municipalities in Bulgaria do not have suffi cient finances for this purpose

Another type of standard used in regional land use planning that affects biodiversity conservation in volves the permissible capacity for areas with signifi cant recreational potential For example, the sea beaches support a maximum load of one visitor for every 8 12 m^2 Skiing areas carry a maximum of 10 skiers for each hectare

According to the requirements of our legislation the use of agricultural land for the expansion of set tlements is allowed only after the need has been proven Urban planning standards are used to define the additional area needed (depending on optimal set tlement conditions) and to minimize the plundering of the land – and in this way to limit the damage to bioresources In compliance with the Environmental

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Protection Law, every regional development plan must be accompanied by an assessment of environmental impact including the impact on biodiversity Additional standards are implemented to regulate investment activities that have a direct or indirect impact on biodiversity

I do not assert that the existing legislation and regional land use plans are perfect I will not comment further on this, but it should be noted that in their concrete implementation we have had certain negative results These problems can be attributed to

- Centralized planning and distribution of resources (including financial, material, labor, and other resources), which isolated local governments from the process of decision making and decision implementation

- The lack of a legislative basis for public participation in the regional land use planning process Public participation under the current conditions could have negative effects, especially in cases when measures for the conservation of biodiversity affect private interests

- Inadequate institutions for the execution of land use controls, as well as inadequate penalties

This brief analysis leads to the formulation of several important remarks concerning the Bulgarian National Biological Diversity Conservation Strategy

- The development of the strategy should proceed through the elaboration of local strategies in which the general directions tasks, and activities are worked out in detail

- The social changes that occurring in Bulgaria demand changes in legislation including changes that concern biodiversity These needed changes should include
  - extension of the regulations used in regional land use planning
  - updating of construction standards for the settlements,
  - strict standards for construction in agricultural lands
  - prohibitions on construction on fertile lands and lands with high natural value,
  - regulations for the use of areas with important recreational qualities

Legislation should involve two types of conservation provisions measures that protect the conditions necessary for the development of biological resources and measures that provide for their conservation and sustainable use

- The State should intervene with proper incentives for the conservation of bioresources, including
  - financial grants, credits, tax preferences, and so forth
  - other types of incentives, and
  - establishment of a National Conservation Fund

- The effective management of bioresources, and especially protected natural areas, should be undertaken through a purposeful state policy based on coordinated activities and involving institutions capable of carrying out the responsibilities granted to them

- Trans boundary interactions among the elements of the environment including the biological elements require the establishment and implementation of trans border projects to conserve the biodiversity of Bulgaria and its neighboring countries,

- The conservation of biodiversity should be the task first of all, of the local population This requires the stimulation of ecological consciousness and behavior – a task for the local government and nongovernmental organizations New legislation is needed to promote democratic procedures to involve public nongovernmental organizations and other citizens in the decision making and implementation process, and to grant citizens a share of responsibility for the results

Taking into consideration the existing consciousness and way of life of the Bulgarian citizens their desire for rapid change, and the real pace of change in people legislation, and government bodies I think it will be more reasonable to seek a balance among the interests of the citizens the municipalities, and the nation by observing two principles

1) Do not seek a sharp transition from centralized government and the absolute priority of state interests to local self government (which can degenerate into uncontrolled activity) and the absolute priority of the rights of private property

2) Grant municipalities the possibility of expressing themselves as autonomous self governing communities in all their fields of activity and responsibility, including the conservation of biological resources

An Eco and Sustainable Tourism Development Strategy for Bulgaria

Nicholas Spall

INTRODUCTION

Thus far delegates to this workshop have been hearing about Bulgaria's biological resources and dis cussing the need for their effective long term con servation One obvious and important question arises out of these discussions how can the nation preserve and enhance these unique resources in the future? Eco and sustainable tourism provides a useful solution

How can we develop a workable eco and sustain able tourism strategy for Bulgaria? This paper ex plores the background for a practical set of proposals I will consider the country's tourist resources, their value in terms of expanding the tourist economy ex isting tourism "image" problems the need to link con servation and economic growth immediate measures that can be proposed, and longer term steps that can be taken to provide a growing and at the same time sustainable tourist economy for the country

THE NEED FOR A SUSTAINABLE TOURISM APPROACH

It is worth pausing to note relevant work that has already been undertaken Several tourism studies re lating to Bulgaria are now available The Horwath Consulting report Tourism Development Strategy for Bulgaria" (1992) (for which my planning practice Sheppard Robson provided assistance) is a starting point for a future sustainable and eco tourism strategy This report focused on the development of commer cial and marketing policies for tourism, but several of its recommendations are relevant to this workshop I will explore these points later in this paper

An important project now being prepared is the "Pirin and Rila Eco and Sustainable Tourism" Strategy (PREST) This United Kingdom "Know How" Fund project is intended to provide a regional strategy for the Pirin/Rila National Park area It was initiated at a work shop in Bansko in 1992 and will eventually result in the creation of an association of municipalities to implement a strategy of policies and guidelines for im proving the tourist potential of the region and pro tecting the national parks and surrounding areas If PREST works and the municipalities work together effectively similar projects could be undertaken in other regions (for example such an approach could be adopted in the Strandzha region)

The need for sustainability in any tourism strategy should be emphasized at the outset It is often easier simply to consider tourism development and economic growth for its own sake – to the ultimate detriment of the tourism market The damage done to the Spanish Costa del Sol coastline in the 1960s and 1970s testifies to this many tourists eventually turn away from such areas

It is important to note that a strategy of this type must take into account not only eco tourism, but also slightly less rigid (i e sustainable) forms of tourism de velopment The following definitions (after Professor A S Travis) can be applied to such a strategy

"*Eco Tourism* is environmentally responsible travel and visitation to relatively preserved or natural areas that fosters conservation of nature and any cultural elements present there has a low impact on the envi ronment, and actively involves the local population so that they may share in the resultant economic 'bene fits ' "

"*Sustainable Tourism* is all forms of tourism develop ment management and activity that enable a long life for that cultural activity we call tourism, involving a sequence of economic tourism products compatible with keeping in perpetuity the protected heritage re source base – be it natural, cultural, or built – which gives rise to tourism "

I believe that these definitions emphasize the ac tual improvement and enhancement of current re sources and should be maintained as a strategy is de veloped A basic theme of this paper is that improve ments in existing tourist facilities can be achieved through careful regional planning and practical atten tion to detail and that future developments can be pursued in accordance with these plans and strategies

Despite the freedoms related to land restitution and privatization that have been gained since 1989 and despite the continuing world-wide recession in vestment and interest in tourism related development in Bulgaria has not yet reached the peak of its ex pected growth Interest is expected to expand in the next few years as international investors show in creasing awareness of Bulgaria's unique environmental character its national parks and nature reserves and the quality of its countryside, coastline, and culture Already interest is growing in major tourist develop ments and these will have implications in terms of the

environment and sustainability Current examples in clude

- Proposals for the expansion of the Bansko ski vil lage facility, and the growth of interest in the Sa pareva Banya area of Rila
- The St Constantine project at the Grand Hotel, Varna which involves construction of a marina and other coastal development
- Proposals to expand tourism facilities at the Kam chia Nature Reserve south of Varna on the Black Sea
- Interest in the region of Strandzha Mountain and the southern Black Sea coastline south of Bour gas This includes the possibility of tourist villages similar to those in the controversial Duni com plex

In view of these trends work must be done before the next economic upturn An effective and clear Eco and Sustainable Tourism Strategy is an important require ment for Bulgaria for three important reasons

- Tourism depends upon a high quality environ ment and therefore can and should act as a posi tive force for the protection and enhancement of that environment
- Eco Tourism and Sustainable Tourism have en during benefits in areas that are important in terms of the conservation of biodiversity
- Appropriate scales of tourism investment and commitment have important implications for the national economy and for the economic prosperity of urban and rural areas

THE ECONOMIC IMPORTANCE OF TOURISM

In order to illustrate the economic gains to be obtained through tourism development in Bulgaria it is worth looking at a few figures World wide tourism has vastly affected national economies To illustrate this it should be noted that in 1991 there were 450 million international tourist arrivals (a provisional Work Tourism Organization figure), with a growth rate of approximately 8% per annum between 1960 and 1980 In terms of expenditures tourism receipts were estimated at US$278 billion in 1991, having also grown by approximately 8% per annum during the 1980s This growth can be expected to continue into the next century Tourism is the second most impor tant international trade receipt activity (oil is the first) and represents 12% of the world's gross national prod uct

Changes in the world share of tourism receipts in dicate that significant potential exists in the Balkan re gion In comparison with other parts of the world the Balkan region has had one of the lowest rates of growth since 1980 (Africa and Asia have had the high est growth rates) Eastern and Central Europe at tracted approximately 11% of the tourist arrivals (by comparison North America attracted 12 5%) but has the lowest share of tourist investment (under 1%)

Tourism in Eastern Europe has benefited from the political and social changes of the last few years The region's scenic beauty cultural heritage, history and art were largely undiscovered by the west until this time Low costs and good values have allowed visits to Eastern Europe (particularly Hungary and Czechoslo vakia) to continue to increase gradually However tourism to Bulgaria has been directly affected since 1990 by the decrease in tourists from the former East ern Bloc countries as well as visitors from Turkey

In 1990 the total of 10 3 million visitors to Bul garia consisted of 51% "transit" visitors, only 22% vis ited for holiday and recreational purposes In 1991 the total number of visitors decreased to 6 8 million (a de cline of approximately 45% in one year) This was due to a decrease of 2 8 million visitors from the for mer Eastern Bloc countries and a decrease of 1 1 mil lion visitors from Turkey However there was a growth in visitors from the UK and other Western European countries The decline in tourism in 1991 led to the underutilization of many tourist accommo dations even at major resorts during the peak season This underutilization can be expected to continue due to the current economic climate in Western European

This excursion into statistics is important for it shows two things

(1) that Bulgaria will have to compete for the future tourist market and improve its market image and

(2) that, despite steady growth in tourism world wide variable tourist choice and short term economic factors indicate the need for a clear development strategy for the future I believe that this strategy should focus on eco and sustainable tourism for market as well as environmental reasons

BULGARIA'S TOURISM POTENTIAL

For many years tourism in Bulgaria was seen as a matter of satisfying domestic demand and demand from other Eastern bloc countries The 1970s and 1980s saw much governmental activity in tourism pro motion Two key destinations in Bulgaria for outside tourists – the Black Sea coastline and mountain ski re sorts – were identified for investment and develop ment Often development was of poor quality by Western European standards and in many cases visual and environmental damage was done to the landscape and to countryside resources The Black Sea coastline is an obvious example

Bulgaria will inevitably continue to offer good value for money as a tourist destination Skiing holi days in Bulgaria can be up to 40% cheaper than in other European sites But there are three categories of tourism resources that Bulgaria will need to concen

trate on in improving its image

- *Coastal tourism* – preserving the best of the northern Black Sea that remains and very carefully controlling development in the South

- *Mountain tourism* – considering the potential of these areas and enhancing existing facilities (e g , at Rila and around Bansko) in a sustainable manner especially by avoiding damage to their appearance and biodiversity

- *Special interest tourism* – (e g , health, religion, etc) answering questions of how to introduce good accommodations and facilities without spoiling the features that make these areas attractive to visitors

If a two level approach is adopted – Eco and Sustainable Tourism – certain tourism activities can be highlighted and related to identified areas and regions according to their appropriateness These "soft" tourism activities may include

- nature and wildlife trails
- hiking and climbing opportunities
- wine trails
- history tours
- cultural visits
- monasteries/religious tours
- "Agro tourism"
- paraders

EXISTING TOURISM IMAGE FACTORS

In the course of the Horwath Consulting strategy work on a tourism development strategy for Bulgaria early in 1992, a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis was performed This analysis identified the characteristics of the Bulgarian tourism product and compared it with others that had the benefit of careful planning and investment The SWOT findings are described below (Tables 1 and 2)

It should be pointed out that the development strategy proposed in the Horwath study was market led and advanced proposals to capitalize on the country's strengths and weaknesses (and to avoid the threats) Happily conservation of the environment came out strongly as an effective means of both improving image and achieving market growth

Table 1 SWOT Analysis of Bulgaria as a tourism destination

Strengths	Weaknesses
Bulgaria has a diverse and scenic terrain comprising spectacular costal pastoral and mountain landscapes	Poor quality of the built product in terms of finish landscaping maintenance design
Rich biodiversity	
A diversity of tourist products by region and location	The non customer/service orientation of personnel
A rich heritage in terms of folklore tradition religion architecture, and culture	Poor management and operational skills within the tourist industry in all sectors and at all levels
A generally high level of education of the population	Poor quality of infrastructure in term of airports roads signs toilets telecommunications entry/exit procedures
A good location within Europe in terms of access from the heart of Europe as well as Asia and the new Asian republics	
The orientation of the Black Sea coast for families and the ski resorts for adults	
The low price of holidays and tourist related services generating a strong perception of value	Poor safety and hygiene standards in tourist facilities and areas
A strong competitive position vis a vis other Eastern European countries in certain markets	Poor organization of tourism at a national level

Table 2 SWOT Analysis of Bulgaria as a tourism destination

Opportunities	Threats
Virgin areas for development	Financial constraints in statutory and non statutory bodies for monitoring guiding promoting and manag ing tourism options and developments
Developing international markets for special interest tourism such as historical cultural and religious hunting spa and health wine and food	Economic, political and social climate (currently per ceived to be unstable)
	Competition from other tourist destinations
Desire to attract international tourists	Pollution
Easing of travel restrictions to and in Central and East ern Europe	Uncertainty regrading the future implementation of a visa requirement for all tourists
The potential for developing a thriving tourist industry from existing base	Lack of governmental control and planning and uncer tainty of future tourism strategies
	Competing demands on land for forestry agriculture etc

ECONOMIC BENEFITS AND ACTION ITEMS

There can be no doubt that the economic benefits resulting from tourist development have environmental consequences In principle the benefits are to be found in employment national income (mainly in the form of taxation duties and other fiscal activities), foreign currency infrastructure improvements and domestic recreation facilities

Investment in tourism is a good value In Eng land for example the cost of creating a job in tourism in 1980 was about US$10 000 (5 000) This cost was substantially less than the cost of job creation in manufacturing industry and agriculture and once tourist jobs are created they are relatively long lasting By comparison the actual average cost of maintaining benefits for unemployed persons in Britain was $8 9 000 per annum The tourism "multiplier" will there fore always help the national economy

It is worth pointing out how the positive environ mental effects of eco tourism and special interest tour ism will occur Hector Ceballos Lascurain has de scribed the consequences of eco tourism where mar ginal agricultural areas are conserved with natural vegetation cover as a consequence of an expanding eco tourism economy Ceballos Lascurain also points out that the Kenyan tourist experience shows how careful conservation of lions and elephants within na tional parks generates 162 times more income than crop agriculture (or indeed hunting trophy) One could extrapolate this argument to the Bulgarian situation with its birds, mammals, and excellent flora and fauna The Strandzha region, for example, con tains wild cats wolves otters, and marbled polecats, and is the only place in Europe where the wild medlar tree occurs (In 1992, the rare Eleanora's falcon was also sighted there)

What are the action items for tourism develop ment? As part of work already undertaken in the Horwath study a number of general but key medium term tourist development measures were recom mended These were

Transportation and communications infrastructure

- refurbishment/reorganization of the Sofia airport
- new airport facilities at Sofia (a longer term need)
- upgrading of major national and international roads
- network of service stations and petrol facilities
- development of accommodation and refreshment facilities
- improvement of road surfacing in key tourist areas
- sign posting and map information program

Pollution

- establishment of an Environmental Protection Agency
- full implementation and completion of the sewage treatment investment program on the Black Sea
- continued pressure on Danube and Black Sea neighboring countries to control pollution of riv ers and the Black Sea
- effective repair and maintenance program for the Kosloduy nuclear power plant
- proper agreements with neighboring countries re

garding pollutant emissions (e g , Rousse is af fected by the plant at Giurgiu, Romania)

Environment and planning control

- clarification of responsibility for planning at the national regional and municipal government lev els
- formation of a Regional Planning Board for the Black Sea coast
- set up National Park Planning Boards to control development in and around national parks
- promote design excellence, including Balkan and Bulgarian building styles

Physical/Built Environment

- policy guidelines and codes of practice for mini mum hotel standards, including sustainable energy aspects such as insulation service efficiency, and alternative energy sources (e g , solar panels)
- hotel appearance and design improvements (e g , promotion of Bulgarian vernacular styles, im provements in landscaping)

The Horwath study also recommended detailed action on marketing and management/staff training measures

CHANGES IN THE PLANNING STRUCTURE

To implement an effective sustainable tourism strategy, certain key changes in the approach to the Bulgarian town planning system are necessary and clear guidance will be required from the central Gov ernment (in a form similar perhaps to that of the Brit ish Government Circular and "Guidance Note" ad vice) For example the British Department of the En vironment recently issued a Tourism Policy Guidance Note (PPG 21) that described "sustainable" intentions and requirements as a national policy These sustain able policies are to be implemented by the municipali ties and Regional Tourist Boards

It is worth noting the changes that have recently occurred in the town planning system in Bulgaria Until just a few months ago Bulgaria followed a rela tively centralized town planning approach A National Plan existed that directed investment to specified areas and controlled major planning decisions in the mu nicipalities The National Plan was integrated with Regional Plans (covering 'problem" areas such as the Black Sea coast and the Danube region) The Re gional Plans in turn influenced the Land Use Plans for areas of up to 20 settlements and the large municipali ties The more detailed inner city master plans cov ered specific inner urban areas Today the munici palities have much more control over their futures and we must ask how this will affect a sustainable strategy approach

In terms of control over development and envir onmental protection within specified areas, the current privatization and restitution process is radically alter ing the context of land use control and development in Bulgaria, and creating concern over the responsibility for effective management of the national parks and protected areas The relaxation of centralized gov ernment control and the increasing powers of munici palities may make integrated policies in the larger parks difficult unless a unified approach is adopted within the planning system

Regional tourism and economic plans will need to be promoted, possibly via associations of municipali ties and Regional Tourist Boards based on national support and encouragement The National Tourism Strategy (and the regional "PREST" type bodies) should be examples of this

Clear land use plans for sensitive areas are needed The sensitive "buffer zones" around the na tional parks need careful and firm policies Environ mental impact assessment will also be a vital compo nent in planning work in the municipalities European Community legislation and experience is also relevant for the future

Another element vital to the future of a sustain able tourist development strategy for Bulgaria is the close link that it must develop with effective pollution control efforts The central government must continue to emphasize this in investment and legislation The Ministry of Environment has already implemented a sewage discharge program for the Black Sea and stan dards of pollution for the country's internal rivers will be addressed following introduction of the 1991 Envi ronmental Protection Act Again the "image" factor is of vital importance in this regard For example the damage from a major problem at the Kosloduy nuclear installation on the Danube would have far reaching consequences for the country's tourist economy (not to mention its environmental quality)

TASKS FOR A NATIONAL SUSTAINABLE TOURISM STRATEGY

I believe that the following key areas of study would be required in developing a National Eco and Sustainable Tourism Strategy

- Assessment of existing environmental resources (as a follow up to the National Biological Diver sity Conservation Strategy work) This would be a broad review and appreciation of the situation
- Identification of key sensitive areas, defined na tional parks national park "buffer zones" nature reserves other protected sites and other areas of high landscape value
- Consideration of the impact of varying degrees of tourism activity Eco and Sustainable tourism op tions would be reviewed and compared with ex isting environmental resources
- Analysis of the effectiveness of, and current situa

tion regarding, methods of protection and countryside conservation (e g town planning policy approaches) and the structure of the planning system (i e municipalities and central government) taking into account the recent changes in Bulgaria (especially privatization land restitution, and the shift of planning powers to the municipalities)

- Examination of European and international examples of Eco and Sustainable tourism, and consideration of their relevance for Bulgaria De velop conclusions on their appropriateness and possibilities for implementation

- Consultation with private organizations and tour operators together with other key parties in the process (such as conservation groups), on existing and future development proposals

- Identification of "pressure areas" in terms of tourism development and interest (e g , Strandzha Mountain, the Black Sea coast and the Rila/Pirin skiing areas)

- Consideration of the consequences of environmental pollution for existing and future tourism development

- Consultation with appropriate ministries and government organizations in establishing action plans

- Establishment of action plans identifying priority policy measures and specific action items together with the allocation of responsibility and a time frame for implementation

PRACTICAL STRATEGY ASPECTS

As part of the effort to improve the national image it is considered vital that the strategy apply detailed environmental and development codes of practice and design guidelines Without clear policies regarding new design layout and landscaping development schemes cannot be properly tested as they are put forward The United Kingdom s experience in establishing Conservation Areas, Area of Outstanding Natural Beauty and National Parks clearly shows that both developers and the public always benefit from positive environmental design policy advice from public bodies

The following practical features should also be part of the strategy

- tourism related literature for protected areas

- development of visitor centers

- building and conservation design guidelines

- effective management plans for protected areas and 'buffer zones

- municipal environmental eye sore' plans (a rolling program of small improvement projects

- establishment of a grant system for conservation projects

- establishment of regional tourism bodies

- business advice (particularly for craft industries)

- education programs devoted to ecological and tourism related topics

Emphasizing small business activities particularly those involving local craft industries, is very important The use of well designed and managed visitor centers in protected areas will also help to attract "soft" tourism interest

CONCLUSIONS

In view of the economic benefits to be gained from the careful and sustainable growth of the national tourist economy one message seems clear trends in international tourism show that without doubt the expanding interest in Eco Tourism holidays could be of great benefit to Bulgaria If a strategy is solidly prepared and implemented in the near future, this can be achieved in a manner that is sustainable and that will have long term benefits for the national image

There are many economic success stories involving tourism Cyprus for example has a resident population of only about 1 million but 1 million tourists visit annually As a consequence it has little or no unemployment even while maintaining a successful agricultural industry Switzerland and Austria have strict planning and conservation controls and excellent sustainable tourism facilities resulting in a high quality national image

The successful implementation of a national strategy will require the involvement of several ministries and committees The Ministries of Environment Regional Development, Transportation and Agriculture as well as the Committees of Forestry and Tourism, will need to work closely together to carry out a strategy Of vital importance will be the practical application of the strategy by regional associations of municipalities and by the individual municipalities themselves

Bulgaria has everything to gain by preparing such a tourism strategy I believe that it is a necessary extension – for both conservation and economic reasons – of the biodiversity conservation efforts that are the focus of this workshop

Section Four
Reports of Bulgarian Non-Governmental Organizations

Summary Report of the Bulgarian Conservation Nongovernmental Organizations

Boriana Mihova

OVERVIEW

The report of the team of Bulgarian nongovern mental organizations (NGOs) is presented in seven sections

1 Introduction

This section provides background information on the team of NGOs contributing to the National Bio logical Diversity Conservation Strategy, including a review of the selection process and summaries of each of the appointed NGOs' objectives and activities The approach to the compiling of this report and the sources of information are also described here

2 Expert Assessment of the Value of Biological Re sources and Protected Areas in Bulgaria

This section summarizes the expert data compiled by the NGOs in the process of their present work This information pertains to the diversity of the flora and fauna on a national and regional scale It includes analysis of the status and dynamics of species popula tions and their habitats as well as an assessment of the protected areas system The existing legislation and institutional structure are also analyzed in the light of nature conservation objectives The information here is presented in summary form so as to avoid overlapping the information presented by the team of biodiversity experts

3 Evaluation of the Threats to Biodiversity in Bulgaria

This section expresses the perceptions of the NGOs and the general public – including local officials with the municipal and county governments, the State Forestry Departments and the Regional Departments of the Ministry of Environment – on critical problems of biological resource use This encompasses issues likely to arise from the on going process of privatiza tion expected changes in agricultural land manage ment and problems involving pollution and its sources as well as the more typical problems associ ated with the conservation of biological resources Emphasis is placed on five regions of Bulgaria that are considered to have high priority in terms of the species richness of plants and animals and habitats the Da nube River the Balkan (Stara Planina) Mountains the Rila and Pirin Mountains the Rhodope Mountains and the Black Sea coast and Strandzha Mountain

4 Perceptions and Attitudes of Local People

This section summarizes the results of a survey of environmental attitudes among local residents, indi viduals with environmental interests and administra tors

5 Opportunities for the Integration of Conservation and Development

This section discusses projects that have been proposed as means of integrating conservation and de velopment

6 Summary

7 Recommendations

This final section of the report includes the NGOs' recommendations for effective conservation of biological resources This can be considered the most essential part of the report and represents the direct input of the NGO team to the elaboration of the Bul garian National Biological Diversity Conservation Strategy

INTRODUCTION

This report provides an overview of the percep tions of five Bulgarian nature conservation NGOs It is based mainly on the detailed reports of the NGOs prepared for the NBDCS workshop, and published in this volume The information has been compiled and summarized by Boriana Mihova, the project facilitator of East European Program of the International Union for the Conservation of Nature (IUCN EEP)

The team of Bulgarian NGOs was appointed and began working in January 1993 The selection process was based on several strict criteria The NGOs were required

- to have been legally registered
- to have elected officials

- to have stated in their charters strong concern for the problems of the conservation and long term survival of nature in Bulgaria, and
- to have been actively working on nature conservation issues on a regional or national basis over the last two years

Five NGOs were appointed

1 ***The Bulgarian Bird Protection Society (BBPS)***

The BBPS established in 1988 was one of the first nongovernmental, non political organizations formed in the country The national structure of the BBPS is well developed They have some 602 members Their main objective is to protect birds and their habitats throughout Bulgaria They are involved in 11 projects specifically aimed at preserving threatened birds The most important of these are Conservation of Raptorial Birds in Bulgaria, Support for the Waterfowl in Atanasovsko Lake and projects concerning the conservation of the Black Vulture, the Dalmatian Pelican the Montegue's Harrier and other threatened species

The Society is cooperating fruitfully with other national and international NGOs, governmental institutions, and local communities on behalf of nature protection in Bulgaria They are successfully involved in activities related to significant increases in the populations of some rare and endangered species decreases in the degree of threat to some important bird habitats, and especially in building awareness in the local communities and acquainting young people with the ideals and philosophy of nature protection

As a result of their activities the Society has compiled significant scientific data in this field It maintains a national ornithological database

The Society is a member of and the Bulgarian representative for, BirdLife International (formerly the International Council for Bird Preservation)

2 ***Green Balkans Movement (GBM)***

The Movement is built on a regional basis and covers the entire southern part of Bulgaria The first section of the Movement was established in 1988

It is one of the most active NGOs in Bulgaria Members are working on several on going inventories of the flora and fauna in the Strandzha and Rhodope Mountain regions, as well as in the Maritsa Strouma and Mesta River valleys They have been actively campaigning to prevent decisions that contribute to the extermination of species For example, they have taken action against the use of rodenticides in agriculture and the battle against wolves promoted by the High Hunting Council The Movement has also been working to build public awareness and to monitor the impact of various anthropogenic factors on biodiversity

3 ***Wilderness Fund (WF)***

The Wilderness Fund was established in 1989 It is a society of experts from different fields of the natural sciences with special interests in biodiversity conservation and the establishment and management of protected areas The Fund has compiled a impressive amount of reliable data on Bulgarian biodiversity and the status and dynamics of the country's protected areas Portions of this information have been submitted to the World Conservation Monitoring Centre (WCMC) in Cambridge an organization associated with the IUCN that assists various directorates and prepares environmental publications

Since January 1991, the Wilderness Fund has been working with the Bulgarian Union for the Preservation of the Rhodope Mountains on a WWF International funded project for the conservation of the Rhodope Mountains It has also been appointed to serve as secretariat for the newly established Association of the Mountains of the Balkans (founded in Tichino Italy in 1992) It is a member of the IUCN

4 ***Independent Society Ecoglasnost Varna (ISEV)***

Ecoglasnost Varna is a regional organization It was officially registered on March 7 1990, and thus became the first of the different Ecoglasnost sections to be legally registered This NGO concentrates on the preservation of the specific values of the Bulgarian Black Sea coastline the aquatic areas and the typical continental landscape It has been a member of the Council of Europe's Environmental Commission since December 1991 and is now working on a coastline monitoring project

5 ***Bulgarian Union for the Preservation of the Rhodope Mountains (BUCRM)***

The BUCRM was established in 1990 as a non governmental non political organization Its main objectives are the promotion of sustainable development in the whole Rhodope Mountain region the establishment of a stable balance of uses of the Rhodope Mountain resources for the purposes of tourism, recreation and traditional land uses and conservation of the natural cultural, and historical heritage of the area There are 10 local sections of the Union in different parts of the Rhodope Mountains At present they have some 4 000 members

In addition to local and regional activities, the Union is trying to promote the policy of sustainable use of the Rhodope resources at the governmental level

They have been working for two years on a WWF International funded project on the preservation of the Rhodope Mountains They are involved in joint projects with the International Mountain Centre in France and the International Commission for the

Preservation of the Alps The Union is the in country coordinator of the Ecological Bricks for Our Common European House initiative

As a result of the Union's work the Rhodope Mountains are now included in the list of Bulgaria's significant natural and cultural heritage sites It has begun to elaborate a Regional Strategy for Sustainable Development and also conducts on going public awareness programs

Sources of Information

The data on biological diversity included in this report has been compiled through investigations by the authors of the different reports or by the NGOs in the process of their work Some of the information is based on published documents (other reports, etc) produced by the organizations Some unpublished data has also been included

The information on human impacts on biological diversity is based on the experience of the different NGOs and thus presents their expert assessment of these issues This information has also been compiled in part through a specially commissioned sociological survey The survey was conducted through a questionnaire and interviews with 500 persons in five regions of Bulgaria It presents the opinions of local people on issues involving the conservation of biological diversity The survey attempts to examine public understanding of the value of biological resources on several levels The first is the local and regional level and involves the link between the individual's interests and the institutional regulations for biological resource use The second is the individual level, and involves the connection between cognitive values and emotional responses The third level involves resource management trends, and includes technological, economic, political, and cultural aspects of conservation and evaluation of potential environmental risks (The survey is discussed in the paper "500 Opinions of Man and Biodiversity Analysis of an Opinion Poll ' which follows this summary report)

EXPERT ASSESSMENT OF THE VALUE OF BIOLOGICAL RESOURCES AND PROTECTED AREAS IN BULGARIA

General Biogeographical Characteristics of Bulgaria

Richly endowed with a variety of landscapes Bulgaria is extremely interesting in terms of nature conservation The Stara Planina Mountain range (better known as the Balkan Mountains) with a length of 550 km and its highest peak (Botev) reaching 2 376 m above sea level divides the hilly Danubian Plain from the Thracian Plain In the south and southwestern regions of the country the Rhodope Pirin and Rila Mountain massifs contain many high peaks, including Mussala – at 2,925 m the highest peak on the Balkan peninsula To the east the 380 km long coastline marks the border between the country and the semi saline Black Sea

Agricultural lands represent 61 5% of the country's territory Two thirds of this (42% of the total area) is arable land Forests cover some 35% of the nation's territory, while settled areas represent 3 6% of the total area

Bulgaria is situated at the crossroads between Europe and Asia, which is one of the major reasons behind its high level of floral and faunal diversity The country occupies a territory where three phytoclimatic regions – the European Deciduous, the Steppe, and the Mediterranean – meet and overlap A third factor influencing the character of Bulgaria's biodiversity is the specific historical circumstance of species formation and migration processes The result of these processes is the present coexistence of species belonging to different biogeographical regions – Central European Eurasian Kazakh Steppe Asia Minor and Mediterranean Bulgaria itself is an active species formation center, and home to many Bulgarian and Balkan endemic species At the same time, these diverse influences account for the difficulty in the classifying Bulgaria biogeographically

It is worth noting here that the scientific community in Bulgaria has not yet reached consensus on the phyto geographical zonation of the country According to one of the widely quoted classifications, Bulgaria falls into three botanic regions

1 The European Broadleaf Forest region The larger part of the country's territory falls within the boundaries of this region The characteristic feature of this region are the broadleaf deciduous forests It is divided to three provinces a) Macedonian Thracian b) Ilirian (Balkan) and c) Euxinian

2 The Euro Asian Steppe and Forest steppe region This region is characterized by secondary vegetation most commonly grass and shrub communities as well as xerothermic forests Only one Bulgarian province is identified within the boundaries of this region – the lower Danubian Plain

3 The Mediterranean Sclerophilic region Only a small part of the country's area falls within this region's boundaries – the Strouma River valley The region is characterized by transitional Mediterranean xerothermic deciduous forests

The zoogeographical division of the country is somewhat better defined The country belongs to the Palearctic region The border dividing the European and Mediterranean sub regions crosses the country Many animal species have either their northernmost or southernmost limits of distribution in Bulgaria At the same time, there is great differentiation between the

species of the mountain regions and those of the plains Most typical for the mountains are the Central European Euro Siberian and Boreal species, while the Danubian plain is rich in habitats of a variety of steppe species and the area south of the Balkan Mountains is dominated by Mediterranean species

The contemporary Bulgarian flora and fauna have been strongly influenced by the glaciations of the Quaternary Period During the Quaternary the terri tory that is now Bulgaria was at the southern border of the glaciers This gave some of the native species a chance for survival These are the so called Tertiary relicts Of special interest are those that occur only on the Balkan peninsula or within Bulgaria – the so-called Tertiary paleoendemic species At the same time, as the glaciers withdrew toward the north some typical boreal species remained in the higher parts of the mountains

General Characteristics of the Bulgarian Flora

The Balkan peninsula in general is characterized by its immense floral diversity The number of vascu lar plants in the region is approximately 7,000 A quarter of these are Balkan endemics The flora di versity of the region is much considered much richer than that of the Apennine or Iberian peninsulas

At present the number of known species repre sented in the native Bulgarian flora is 12,360 The number of the vascular plants stands at about 3 550, which is twice the number of vascular plants in the flora of the British Isles and much higher than that of the German flora The numbers of species per class are distributed as follows

Algae	approximately	4 000
Lichens	approximately	640
Mosses	approximately	669
Fungi	approximately	3 550
Ferns	approximately	50
Seed plants	approximately	3,550

It is worth noting that new species within the different groups are being discovered each year The report of the Green Balkans Movement describes in detail the state of the flora in southern Bulgaria, where four vas cular plants new to the Bulgarian fauna have been identified *Sorbus bobrasii Sorbus mougeottii Parvo-tricetum myrianthum* and *Aegilops cosmosa*

The contemporary flora of Bulgaria is character ized by a high degree of endemism At present, some 270 Bulgarian endemic species and sub species have been recognized Most of these are described in the *Atlas of the Endemic Plants in Bulgaria* The Green Balkans are suggesting that 10 15 additional taxa be included when the *Atlas* is updated

The number of endemic species demonstrates the potential of the species formation centers Among the most significant of these is the central part of the Bal kan Mountains This is pointed in the report of the Wilderness Fund According to them, this is due pri marily to the fact that this is the region where different populations of the same species, as well as the popula tions of different species, meet Proof of this statement can be found in the fact that there are 12 plant species and 1 sub species considered to be local endemics *Silene balcanica* (Urum) Hayek *Rosa balcanica* Dim *Alchemilla achtarovii* Pawl *A jumrukczalica* Pawl *A asteroantha* Rothm *Trifolium pannonicum* ssp *jurkovski* Koz *Viola balcanica* Delip *Seseli bul garicum* P W Ball *Primula frondosa* Janka *Mi cromeria frivaldszkyana* (Deg) Vel *Betonica bulgarica* Deg et Neic *Centaurea karlovensis* Friv , and *Satureja pilosa* Vel The region contains 11 plant species and 2 sub species that have been identified as Bulgarian en demics To complete the characterization, the Wil derness Fund points out that 22 Balkan endemics are found in the region

In addition to the central part of the Balkan Mountains where a total of 90 endemic species are to be found other important centers of species formation are the Rhodope Mountains (with 80 endemics) the Pirin Mountains (70) and Rila (50) According to Ecoglasnost Varna, 49 endemic plants inhabit the Black Sea coastline

In terms of floral diversity it should also be noted that the total number of plant communities occurring in Bulgaria is approximately 1,000 They vary in terms of composition, structure, ecology productivity, and potential Some 50% of these are forest communities covering about 1/3 of the total area

Bulgarian vegetation falls into five ecological geo graphic groups the Nemoral the Steppe the Moun tain boreal the Arctic Alpine, and the Mediterranean

The main representatives of Nemoral vegetation are forest formations dominated by broadleaf decidu ous tree and shrub species These include, for exam ple, formations of northern red oak (*Querceta roboris*) cerris oak (*Querceta cerris*), beech (*Fageta sylvaticae*), hornbeam (*Carpineta betuli*) and bushes such as sy ringa (*Syringeta vulgaris*) and smoke tree (*Cotineta coggygriae*) Also included in this group are a number of marshes bogs and grass formations This is the ba sic vegetation cover type of the country Its altitudinal range of distribution is up to 1,700 1,800 m

Steppe vegetation is distributed primarily in the northeastern part of the country and along the Da nube It is represented by formations of xerophilic species of the Poa family and by some bush forma tions These communities have now spread through out the country but this is a secondary type of distri bution resulting
from human activities The altitudinal range of distri bution is up to 600 700 m In the mountains it occurs up to 2,000 m

The Mountain boreal vegetation type occurs in the high mountains which were at the border of the Quaternary glaciations Its most typical representa tives are coniferous formations dominated by the Norway spruce (*Picea abies*), Scotch pine (*Pinus sylvestris*) and silver fir (*Abies alba*) It is found from 1 400 to 2 000 m in the high Bulgarian mountains

The Arctic Alpine vegetation type also occurs in the high mountains It is characteristic of areas above 2 000 m More specific to this type are the formations of Siberian juniper (*Juniperus sibirica*), mugo pine (*Pinus mugo*), nard (*Nardus stricta*) blackberries (*Vaccinium myrtillus*), etc

The Mediterranean vegetation type occurs in the southernmost parts of the country and along the coastline Typical of this vegetation are the formations of the so called pseudo maquises These are forma tions of broadleaf deciduous and evergreen trees and bushes, including scarlet oak (*Quercus coccifera*), hairy oak (*Quercus pubiscens*), syringa (*Siringa vulgaris*), and western juniper (*Juniperus occidentalis*) They differ from the typical maquises in that they are poorer in over all species richness and deciduous species are present within them Within this group, the only dominant species whose formations occur above 700 m is the White Fir (or Macedonian) Pine (*Pinus peuce*)

According to current Bulgarian legislation threat ened plant species are protected under the Nature Protection Act (1967) Their protected status has been determined by placing them on the official List of the Protected Plants The list now contains 330 species The threatened plant species are described in the *Red Data Book of Bulgaria* The Green Balkans are pro posing that the status of 15 species be changed from "rare to "threatened with extinction " Their argument is that NGO surveys are showing reduction in the habitats of those plants which will inevitably lead to their disappearance These species are *Amygdalus webbii Astragalus aitosensis Astragalus thracicus Cal luna vulgaris Chamaecytisus frivaldzkyanus Daphne pontica, Daphne laureola, Erica arborea, Ilex aquifo lium Juniperus sabina Rhododendron myrtifolium, Salix hastata* and *Saponaria stranjensis*

A considerable portion of the plant genetic pool has been preserved in the more than 95 strict nature reserves It is notable however that only 10% of their total area has been studied in any systematic manner

Thirty one vascular plant species are considered to have disappeared from the Bulgarian flora over the last 70 80 years According to the *Red Data Book of Bulgaria* 158 species are considered endangered and 574 species are considered rare In the IUCN *Red Data Book of Threatened Plants* (IUCN 1978) 78 Bulgarian species are listed

This is only a brief description of the characteris tics of the Bulgarian flora and vegetation It is in tended to serve as background information for analy ses of the main threats to the floral diversity of the country

General Characteristics of the Bulgarian Fauna

It is believed that the Bulgarian fauna presently contains about 35,000 species Reliable data has been compiled for about 15,000 of them The vertebrate fauna is comparatively well studied It contains 4 5% of the total number of fauna species and includes na tive and re introduced species The numbers of verte brate species that occur in Bulgaria are as follows

Fishes	200
Amphibians	17
Reptiles	37
Birds	383
Mammals	90

According to the Green Balkans Movement, the state of knowledge of the bat and reptile fauna in Bulgaria is far from satisfactory Except for the insects the in vertebrate fauna has not yet been inventoried in a systematic fashion The report of Ecoglasnost Varna points out that the first complete study of the zooplankton in the Black Sea was completed in 1991

The Bulgarian fauna is characterized by the pres ence of Quaternary and Tertiary relicts and of broadly spread European species The majority of the Tertiary relicts are invertebrates – for example, some of the wood lice (*Cyphoniscellus bulgaricus Balcanoniscus corniculatus*), millipedes (*Trachysphaera orghidani Bulgarosomata orucis*), and crustaceans (*Troglophantes drenskii Buressiola bureshii*) Of the fishes, the most characteristic tertiary relicts are the pumped goby (*Benthophilus brauneri*), which is distributed in the brackish waters of the Black Sea, and *Nemachilus bu reshi* an inhabitant of the Strouma River The glacial relicts are of boreal origin They are common in the Bulgarian fauna and are especially typical of the Rila and Slavyanka Mountain regions It is also worth mentioning in this context the three toed woodpecker (*Picoides tridactylus*) and the Ural owl (*Strix uralensis*) which are also likely glacial relicts according to the Wilderness Fund

Endemism in the Bulgarian fauna is relatively high In terms of the invertebrate cave fauna, this is self explanatory, given the isolation of their habitats What is notable is that, despite Bulgaria's small total area and geographical position it still contains some vertebrate endemics Such are the Newton hamster (*Mesocricetus newtoni*), whose habitats tend to be found only in the steppe regions in Dobrudzha and the mouse like dor-mouse (*Myomimus roachi bulgari cus*) whose remaining European habitats are located in the southeastern part of the Balkan peninsula

Of great conservation interest are the large mam mals that have been successfully preserved either by conserving their habitats or by direct conservation measures The Bulgarian populations of bear (*Ursus arctos*), wolf (*Canis lupus*), jackal (*Canis aureus*) wild cat (*Felis silvestris*) otter (*Lutra lutra*) Balkan chamois

(*Rupicapra rupicapra balcanica*) and marbled polecat (*Vormela peregusna peregusna*, whose last European habitats are in Dobrudzha are considered healthy There are reasons to believe that further opportunities exist to ensure the long term survival of some of the larger mammals as stated in the report of Wilderness Fund For example this has already been promoted to a certain extent by the establishment of the Central Balkans National Park (an IUCN category II pro tected area)

Bulgaria is home to a number of species rare in Europe and even at the global scale According to the BBPS, the number of bird species that occur in Bul garia today is 383 The BUCRM states that the east ern part of the Rhodopes, including the Greek por tions of the mountains, constitute the second most im portant nesting area in Europe for birds of prey (after Spain) Considering that one of the two major migra tory flyways – the Via Pontica – crosses the territory of the country it is not difficult to conclude that Bulgaria is a high priority country for bird conservation Still according to the report of the BBPS urgent conserva tion measures are necessary BBPS is monitoring the state of bird populations in Bulgaria and the trends in bird populations are negative despite the occurrence of 30 newly discovered species

The report of the GBM regarding the reptile and amphibian fauna identifies 8 species that are unique for Europe Having been exterminated throughout the continent these species have their last remaining habitats in the Balkans

The ISEV report after presenting summary infor mation of the fish in the Black Sea states that a large number of them are rare

Several legal measures directly related to preser vation of the fauna have been enacted including the Nature Protection Law (1967), the Forestry Law (1958), the Hunting Act (1982), and the Fishing Act (1982) Up to 1991, the lists of protected animals in cluded 44 mammal species 327 birds and 31 amphibi ans and reptiles

The second volume of the *Red Data Book of Bulgaria* includes descriptions of 156 vertebrate fauna species Among these are 19 mammal species 100 birds and 13 reptiles and amphibians Fifteen verte brate species are considered to be exterminated from Bulgaria 89 species are threatened with extinction and 52 are rare The 1990 IUCN Red Data List of Threatened Animals lists 27 Bulgarian vertebrate spe cies under different categories These should be con sidered globally threatened species requiring urgent conservation measures

The main reason for the disappearance of animal species is the loss of habitat The major threats to their habitats are the same as those of the plant spe cies and so the factors with the strongest negative ef fects will be jointly reviewed below

The State of the Protected Areas System

The existing protected areas provide a consider able foundation for future elaboration About 3 5% of the Bulgaria's total territory has been placed under different levels of protected status A very high per centage of the total area of the strict reserves – 82% – and of the National Parks (II category IUCN) – 89% – falls within the mountainous regions (To make this part understandable for the foreign reader the IUCN categories are used in the description of the protected areas)

There are 28 strict nature reserves (IUCN cate gory I) larger than 1,000 ha At present, 11 National Parks have been established Only three of the parks – Pirin (established in 1963), Central Balkan (1990), and Rila (1991) – fall within IUCN category I Their combined area is 221,000 ha All the other parks are considered to be IUCN Category III IV and V pro tected areas There are currently about 470 natural monuments (IUCN category III) in the country with a total area of 22,850 ha (not including the thousand year old trees), 99 protected sites (IUCN category IV and V), with a total area of 21 850 ha, and 972 histori cal sites, with a total area of 12,000 ha

Over the last three years the total area under protection has increased about 1 5% due to the estab lishment of the two new national parks – Rila (107 923 ha) and the Central Balkans (73 923 ha) The report of the Wilderness Fund analyzes the approach taken in conserving the natural values of the central part of the Balkan Mountain range, based on the principles and the processes followed in establishing the Central Bal kans National Park It discusses existing gaps and weaknesses in the management of the area This methodology might serve as a useful model in devel oping and strengthening the larger protected areas

Unfortunately it seems obvious that the regime of protection envisaged in declaring almost any protected area is far from being respected and enforced Ac cording to the NGO team, most of the protected areas in Bulgaria are in a critical state As the BBPS stresses the "Srebarna Case" is only one well known example The general conclusion of the NGOs is that Bulgaria is sorely lacking in legislative regulations that clearly define the functions of the protected areas and address the issues of protected area ownership main tenance management, and safeguarding

The lack of adequate regulations is due to a com plex set of factors One of these is the irrelevance of current legislation in terms of modern trends in nature protection, and in particular in terms of the preserva tion of biological diversity

A package of new legislative measures will soon be formulated This package will include Acts re garding protected areas protection of biological diver sity forests and hunting and fishing It is likely that those Acts will be able to regulate the use and conser vation of biological diversity The NGOs consider the submission and passing of these laws in Parliament to

be a high priority and critical to the effective preser vation of the rich natural variety and variability that has survived in Bulgaria The general concern of the team is that the legislative texts should provide for the protection of natural areas with high national or inter national value, despite the possibility of objections by the local governments or other institutions or sectors of the population Legislation should address the need for reimbursement by the State when conflicts occur

As noted previously lack of enforcement of ex isting regulations is a serious problem To a certain extent this is related to the problem of the right to manage and use the protected areas To date these rights have been distributed among the State Forestry Departments and the respective municipal councils This is at the root of the problems regarding institu tional conflicts and divided executive power that we face today Arguing that about 70% of the protected areas fall within forest regions, the Committee of For ests claims the right to manage and safeguard them Control over protected areas is a responsibility of the Ministry of Environment as the highest nature protec tion institution in the country On the other hand the forestry committee retains its functions regarding for est resource use (timber harvesting, hunting, interna tional hunting tourism, etc) The chairman of the Committee has the power to enforce executive deci sions concerning the use of natural resources even in cases where they contradict the position of the Minis try of Environment on the same topic A recent con crete example of this is Order No 31/1 20 1993 which extended the waterfowl hunting season in Bulgaria until the end of February It was enforced despite strong objections from experts in the Ministry of Envi ronment, the Bulgarian Academy of Sciences and the NGOs Such behavior is not in any case, beneficial to the natural objects that have been preserved until now It is widely agreed that the poor state of the protected areas is due mainly to this dualism in the executive power This opinion is expressed directly or indirectly in all of the NGO reports

The lack of general management plans to imple ment the nature preservation functions of the pro tected areas presents an additional obstacle to effec tive preservation of the biodiversity within their boundaries The only documents stating management objectives are the forestry management projects The development of long term plans for management of protected areas is a standard practice throughout the world With the expertise Bulgaria already possesses and with some technical support and advice from countries or international organizations with proven skills in this area it should not be difficult to elaborate such general management plans

Another major flaw in the current system of pro tected areas is the lack of a specialized administrative structure responsible for their management and main tenance According to the NGO team, only a few of the protected areas are organized to provide true safe guarding In a formal sense, the responsibility for safeguarding most of the protected areas falls upon the Committee of Forests The members of the NGOs re port that in the course of the many visits they have made to protected areas throughout the country, they have never been inspected by anybody This leads to the conclusion that most of the protected areas exist only on paper The fact that they have preserved rep resentative samples of biological diversity is due mainly to the difficultly of access It is the opinion of the NGOs that the people working for the protected areas system should be professionals committed to the protected areas and strongly motivated by conserva tion goals

Some of the team members believe that the NGOs can and should actively participate in the man agement maintenance and safeguarding of the pro tected areas This would make the task of the gov ernmental conservation agencies much easier and would enable them to concentrate on the broader is sues in this field

The general proposals of the NGO team regard ing the effective management of protected areas, as well as other gaps in biodiversity conservation in Bul garia are listed later in this report

EVALUATION OF THE THREATS TO BIODIVERSITY IN BULGARIA

The main factors threatening biodiversity in Bul garia generally involve unsustainable and unreason able methods of resource use and development Only the main threats and their expected impact on natural resources will be discussed here

1 Resource Use Practices

1 1 Use of Biological Resources

Direct uses of biological resources include hunt ing, fishing, and harvesting of forests (for both timber and non timber products)

Hunting is a danger to the species subjected to such use It is paradoxical that some of the species hunted in Bulgaria are listed in the IUCN's *Threatened Animals in the World* Such is the case with the grey wolf (*Canis lupus*) as well as some bird species that although not directly subject to hunting, are indirectly endangered because of insufficient knowledge and the general low level of conservation awareness Among these bird species are the globally threatened pygmy cormorant (*Phalacrocorax pygmeus*) lesser white throated goose (*Anser erythropus*) red breasted goose (*Branta ruficollis*) marbled teal goose (*Marmaronetta angustirostris*) white headed duck (*Oxyura leucocephala*), corn crake (*Crex crex*) and slender billed curlew (*Numenius tenuirostris*)

Hunting represents a serious threat to the genetic diversity within and among the populations of different species The Wilderness Fund presents as an example the introduction in Bulgaria of Carpathian bears for hunting purposes They differ from the local population and their release in the natural areas of Bulgaria threatens the genetic pool of the native bear population The local Bulgarian subspecies of the ring necked pheasant has practically lost its identity as a result of cross breeding with a foreign subspecies introduced into the country by the Union of Hunters and Fisherman in Bulgaria

Poaching is becoming an extremely serious problem The lack of effective actions by those governmental institutions officially authorized to safeguard game animals, discussed previously, creates conditions under which poaching flourishes According to the BUCRM, the abolition of the State Hunting Husbandries in the Rhodope Mountains and their current status as a part of the State Forestry Departments has actually facilitated poaching This results in the disturbance or disappearance of the game populations that are selected for exploitation each year which in turn relates to the degradation of the self regulating natural systems in these areas The report of the Union states that abolition of the former official residencies has resulted in serious degradation of the natural ecosystems in their territories The Green Balkan Movement shares this opinion

Fishing is an economically important activity in Bulgaria We cannot say that fishing has been performed in a sustainable fashion The report of Ecoglasnost Varna discusses this activity within the Black Sea basin The diminishing of fish resources there is due mainly to over fishing by Turkey and by the countries of the former Soviet Union An attempt has been made to reach an international agreement on fishing in the Black Sea, but unfortunately some of the countries did not participate

The different forms of trawling present an extremely serious threat to biodiversity Despite various restrictions this method of fishing is progressively increasing According to the statements of local fishermen and divers the bottom of the Black Sea is literally plowed by trawling ships This either reduces fish resources directly or decreases their opportunities for reproduction This also contributes to the increase in the hydrogen sulphide content of the Black Sea waters This, together with eutrophication due to sewage pollution, results in decreased oxygen content in the water Fishing in inland and near shore ponds and lakes presents a threat mainly to the bird fauna According to the BBPS this is a serious problem, and in some cases hinders the effective functioning of protected areas (as in the case of Bourgas Lake)

The economic use of forests is a factor directly affecting biodiversity preservation It is the common opinion of the NGO team that in the past non rational economic use of the forests has resulted in the disappearance of the habitats of a number of species In the literature there is data showing an increase in the forested areas with about 1 5% due to reforestation of waste lands Unfortunately in most of these cases broad leaf forest trees have been replaced with coniferous species This is actually a case of ultimate alteration of natural habitats Such is the case with the reduction of alluvial and very wet forest habitats (according to the CORINE biotope) which directly affects the status of the avifauna

Timber harvesting directly damages the populations of some species, including bear, some kinds of bats, some rare species of woodpeckers, owls, some predatory birds, etc A typical example of this is the extermination of the nesting populations of the Cinereous vulture (*Aegypius monachus*) – a species of conservation concern at the European scale Since the old primary forests along the southern boarder were cut the species has no longer bred in Bulgaria

Beyond such direct effects, timber harvesting involves other negative factors One of these is the quite old equipment that is used in the extraction process In general, these are heavy machines that require special forest roads The building (and later abandonment) of such roads contributes to deep and extensive soil erosion

Last but not least, the uncontrolled introduction of non native seeding material may result in the genetic erosion of typical native forest formations

The harvesting of non timber products (mushrooms, herbs snails, and frogs) from the forests as well as the extremely popular capturing and breeding of snakes, should also be considered in this context The incidence of almost industrial level harvesting of these products is well known throughout the country Unfortunately, they are usually exported as raw materials due to a lack of adequate processing methods In this case it is clear that neither the individual local businessman nor the country as a whole – not to mention the harvesters – benefit Given the severe economic crisis the country is now experiencing this situation is to a certain extent understandable In the case of the captive breeding of snakes, however, a certain group of people has provoked a mania for this activity through the media It has certainly not resulted in the promised quick profits If the advice of specialists had been sought prior to the campaign, this could have been avoided Finally the increasingly frequent capture of songbirds, predatory birds, reptiles, and insects for commercial purposes deserves serious consideration

For all these real and potential threats, effective preventive measures should be addressed in the legislation involving biodiversity and its conservation In the case of degraded habitats – when it is not too late – restoration strategies should be developed

1 2 Use of Non Biological Resources

Under this category we may include the extraction of different mineral and non mineral resources The current practice of extracting ore marble stone, and other minerals using explosives is a serious factor dis turbing wildlife populations The NGO reports de scribe the negative impacts of this practice on a num ber of species including nesting populations of endan gered species such as the white headed vulture, the Dalmatian falcon and the black stork as well as bat fauna

The development of underground deposits of dif ferent minerals and ores disturbs hydrological func tions, which in turn results in the alteration of habitats According to the BUCRM this often happens in the Rhodopes Recent increases in the extraction of dif ferent mineral resources and the related changes in natural habitats, can be considered problems even more dangerous than the extermination of forest habitats in so far as minerals, unlike forests, are non renewable

The extraction of natural gas and oil is a potential threat that should be kept in mind Foreign corpora tions have begun to explore for such resources in northeastern Bulgaria Very precise environmental impact assessments should be requested Petroleum processing and frequent oil leaks and spills in the area of the Varna and Bourgas harbors represent a real danger According to the ISEV only this winter there were three serious incidents of oil pollution in Varna bay As a result a huge number of various wintering birds in the area were harmed

For each of these activities it is necessary to think in advance and to insist on complete environmental impact assessments Emphasis should be placed on the potential threats to biodiversity and not only to human health

2 Land Privatization

In so far as the restitution and privatization of land has not yet taken place on a scale that allows us to judge its actual impact on biodiversity, only a pre liminary evaluation of the process can be presented

The privatization and subsequent redistribution of land may result in the disappearance of extensive blocks of agricultural land and the appearance of new belts of bushes and trees in the landscape This will provide new habitats for some species and place in danger the existence of others In any case, it will pose a threat to species that require large open spaces or that cannot tolerate frequent or close human presence

Considering the fact that the NGOs on the team have been working in different regions the plurality of opinions in this area is understandable Most state that the privatization of land is likely to have a net negative impact on biological diversity Bearing in mind that previously landless people may receive properties in so called wastelands the NGOs are stat ing that this will lead to the extinction of habitats in these areas These consequences are expected to be more serious in the northeastern parts of Bulgaria, where the last remaining native steppe communities in Bulgaria are to be found The drastic transformation of the steppe regions will probably place under serious threat populations of some extremely valuable species including the marbled polecat (*Vormela peregusna peregusna*), the steppe polecat (*Mustela eversmanii*), the Newton hamster (*Mesocicetus newtoni*) the thick billed lark (*Melanocorypha calandra*), the short toed lark (*Calandrela brachydactila*), and the pink starling (*Pastor roseus*)

There is some expectation that land privatization in forest areas will pose a serious threat to species di versity Since most of the areas important from a con servation standpoint fall within forested territories the approach to the restitution of forestlands should be very strictly and carefully considered About 16% of Bulgaria's forests were held by individuals prior to na tionalization (this increased to about 20% as a result of afforestation in the "wastelands") Of these, only 1 5% were areas over 50 hectares Municipal forests constituted 56% of the total With the severe eco nomic crisis that Bulgaria is now experiencing, the potential threat is that the municipalities could use the restoration of their property as an easy way to make quick profits

The BUCRM states that this problem does not exist in the Rhodope region and that, on the contrary restitution will have a positive influence on the preser vation of biological diversity in the area Their con clusion is based on a review of sustainable land use practices that are traditional in the Rhodopes

The common opinion of the NGO team is that the process of privatization will not affect the already protected areas This is due to the provisions and en forcement of some of the newly elaborated legislative acts

Inevitably as privatization takes place and the actual development of private land begins, the con flicts between wildlife and the economic interests of the owners will deepen The problems related to damage caused by wild animals on private farms and herds will become heavier, and the attitudes will be far from tolerant One of the crucial questions will in volve the ownership of wildlife inhabiting private lands If incorrect or vague legislative regulations are authorized within the new Acts many species will be placed in danger This is a problem faced in privatiz ing all the kinds of property – agricultural lands, for ests, and other types of real estate

3 Agriculture

3 1 Agricultural Land Use Practices

The main problems facing biodiversity today re sult from the drive to increase the arable land base by draining wetlands and plowing meadows At the same time, the unreasonable use of agricultural chemicals – defoliants insecticides rodenticides, etc – has directly

damaged many plant and animal species This has led to the disappearance and decline in quality of many species' habitats Most affected have been the low lands in Bulgaria

In addition to the extinction of plant species, communities and whole ecosystem types through the draining of marshes agricultural development has caused serious declines in the populations of steppe species This has altered the few remaining European habitats of the rare marbled polecat (*Vormela peregusna peregusna*) and the Balkan endemic Newton hamster (*Mesocricetus newtoni*), the main habitats of both are localized in the southern parts of Dobrudzha

The threat that mowing and reaping presents to ground nesting birds is self explanatory The data of the BBPS show that these activities have a critical in fluence on the survival rates of meadow harriers (*Circus pygargus*), corn crakes (*Crex crex*), and other species

The disappearance of several bird species from Bulgaria is due mostly to the intensive use of different chemicals This process was most notable during the 1970s The mass campaign to exterminate rodents that was undertaken in 1988 and 1989 has been a true dis aster, and has resulted in the killing of thousands of birds and mammals According to the BUCRM, the aerial fertilizing and spreading of pesticides in potato fields in the Rhodopes has caused serious damage to large vertebrates and to the fish fauna in the region

3 2 Domestic Animal Breeding

This is a traditional aspect of agriculture in Bul garia There is again a notable polarization of opin ions on this topic among the NGOs due mostly due to differences in the regions in which they work The Wilderness Fund the Bulgarian Society for the Protec tion of Birds Ecoglasnost Varna and the Green Bal kans share the view that animal breeding is one of the activities that most clearly reflects the antagonistic re lationship between human beings and nature and has direct and strong negative effects The example cited most often is the setting of traps and the use of differ ent poisonous substances or tranquilizers in attempts to reduce wolf populations This presents an ex tremely serious threat to populations of vultures, some of the larger eagles, and other birds of prey In some regions of the country, the free grazing of sheep and goats and free raising of pigs are traditional practices This has a pernicious influence on natural vegetation and on populations of different animals To a great degree domestic animals compete with the hoofed animals for food They disturb and damage the popu lations of ground nesting birds, such as the avocet (*Recurvirostra avosetta*), stilt (*Himantopus himanto pus*) pratincole (*Glareola pratincola*) and various spe cies of sea gull Unfortunately, this occurs even within the nature reserves

Animal breeding farms especially pig farms pose another serious problem They seem to be one of the greatest sources of pollution of rivers and wetlands in that the wastes are often thrown directly into them It is quite sufficient to mention that the serious problems of Srebarna Lake are partially related to the pig farms that flourish on its banks Such farms might also be affecting two of the cleanest rivers in Bulgaria – the Veleka and the Rezovska, both considered to be in near natural condition This will alter the ecological balance in the rivers and damage the habitats of the stable otter populations (*Lutra lutra*) that occur there

The Bulgarian Society for Conservation of the Rhodope Mountains holds a completely different opinion They state that animal breeding (especially sheep breeding), as the most traditional occupation of the local population, has not only caused no danger to biological resources, but has promoted their preserva tion According to this view, the successional dynam ics of the Rhodopes are such that only grazing could have allowed subalpine meadow vegetation to estab lish itself within the watersheds If grazing is prohib ited or prevented, there is a serious danger that forests will invade and ultimately replace the highland mead ows This in turn will result in the disappearance of plant species, such as the orchids For this reason, the BUCRM favors the introduction of some incentives to promote sheep breeding in the region

4 Public Construction Projects

According to the NGO team public construction projects pose an important threat and one that should be more strongly stressed Most building and devel opment projects in general have never been accorded preliminary environmental impact assessments that de scribe the risks to wild nature Such is the case with the construction of artificial lakes and dams on habi tats of rare species According to the BBPS the main factor behind the disappearance of the pink pelican (*Pelicanus onocrotalus*) is the construction of the dam at Mandra Lake, leading to drastic alterations in habitat conditions Under discussion at the moment is another construction project – the Gorna Arda reser voir system Two of the NGOs – the Green Balkans Movement and the BUCRM – point to this problem in their reports They state their strong disagreement with the decision to initiate the project prior to the preparation of a total environmental impact assess ment The whole system as proposed would be 70 km long It will result in the disappearance of many spe cies and habitats of rare and endemic plants and ani mals According to the BBPS the project in its initial design will cause immense disturbance to the ecosys tem on both sides of the river

The artificial lakes and dams also have indirect impacts on the habitats of different species Access to well preserved natural areas is made easier and urban

ization increases These areas become more attractive for recreation on a local, regional and national level Very often these territories are inhabited by exotic species Increased human pressure is expected to af fect even the best preserved and most natural sites, and this threat should be kept in mind in regional de velopment plans

The construction of railways and highways is not undertaken in accordance with requirements to cause as little harm to biological diversity as possible The report of the Green Balkans Movement discusses this problem in connection with the Blagoevgrad Kulata railway which is soon to be doubled It will pass through protected areas and destroy a number of unique habitats No careful environmental impact as sessment has been done, nor have any plans for the restoration of damaged sites been drawn up

Recreational and the tourism related construction has also seriously affected various natural habitats and even threatened protected areas The Baltata Nature Reserve has practically been destroyed by the nearby construction of a huge recreational complex and a road across its territory Many examples can be cited, but the most obvious is the disturbance of natural sites along the Black Sea coastline The Zlatni Piasatcy National Park (IUCN category V) is urbanized to such an extent that it is not possible to speak of this park as performing any nature conservation function Similar threats now face the Alepu Ropotamo and Poda Na ture Reserves The pressure on Alepu marsh is ex pected to be especially serious A huge complex is to be built there shortly The marsh will be confined to a tiny undisturbed area between the new complex and the tourist village of Duni The same complex also threatens the Ropotamo Nature Reserve (IUCN cate gory I) Another negative aspect of the tourism in dustry in Bulgaria is its role in encouraging the intro duction of many exotic species most often plant spe cies that are intended to increase the scenic beauty of different places Such is the case with the planting of the exotic amorpha (*Amorpha fruticosa*) on large areas along the Black Sea coast This has severely disturbed and even destroyed unique dune complexes

The increased pressure from tourism that is ex pected will make the survival of many protected areas and important habitats a critical issue This should be considered in the process of elaborating new protec tive legislation

5 Private Development

It is difficult for two main reasons to assess the threats posed by private development First private enterprise in Bulgaria is mainly in the nonproductive branches of the economy Second private enterprise is still in its earliest stages It is however possible to state hypothetically some of the threats that are ex pected to arise One major threat will be the addi tional development of private tourism and associated services Measures to prevent possible damages could and should be undertaken, based on new legislation and its proper enforcement

6 Industrial Pollution

The unsustainable and unreasonable development of industry in Bulgaria in the past has now become a serious problem It has resulted in substantial pollu tion of the air and waters, contamination of soils, and disturbance of the ecological balance in the country The pollution of the Danube River and the Black Sea is an absolutely critical issue The decrease of the oxy gen content in the sea waters has resulted in dimin ished numbers of aquatic species and a decrease in fish resources This problem is not simply national in scope but involves transboundary sources and effects Some solution must be sought on the international level On the other hand, it should be pointed out that industrial pollution has not yet reached an irreversible stage In this sense, the restoration of natural habitats is possible, and if achieved could allow for the reintro duction of native species

It has already been stated that a significant part of Bulgaria's natural heritage has been preserved in an almost intact state in the remote areas, where access is difficult Some measures to prevent industrial devel opment in these areas should be undertaken

7 Other Threats

According to the NGO team, the most serious threat to the biological diversity of Bulgaria is actually the low level of understanding and awareness of the problems among the general public Most people have little or no knowledge about or exposure to nature conservation This accounts for the damage to natural habitats by the local people, and the direct extermina tion of different plants and animals For example many harmless species of snakes, lizards, and bats are killed simply because of traditional prejudices, because the local population does not differentiate among them (i e cannot distinguish between poisonous and harm less snakes), or because their conservation value is not understood (as with the tortoises and bats)

There is no tradition of environmental education and awareness building in Bulgaria It is more than clear that no effective conservation and protection of biological resources is possible without the support of the general public Because there are no printed ma terials promoting the unique value and importance of the Bulgarian flora and fauna, the population of the country remains indifferent to the major issues of con servation This problem could probably be overcome especially as the NGOS and governmental institutions gain experience in communicating information and building awareness The elaboration of a strategy to involve the general public in nature conservation is of paramount importance Activities in this areas should

be undertaken as joint efforts involving everybody working for the preservation of nature at different lev els Otherwise it is absolutely impossible to imagine how attempts to prevent different activities from dam aging biological resources will be understood ac cepted and supported by the people (As one exam ple, the effort to address problems connected with the use of dancing bears failed due to the lack of public support)

PERCEPTIONS AND ATTITUDES OF LOCAL PEOPLE

Attitudes about biodiversity and the problems as sociated with its protection and long term preservation were the subjects of the opinion poll undertaken in connection with the NGO reports The task of the sur vey was to assess attitudes toward the environment at both the personal and social levels through questions about different public activities and their impacts on biodiversity and on the environment in general One hundred people were interviewed at each research point They were selected from among the inhabitants of large and small towns (41 1% and 42 7% respec tively) and small villages (16 2%)

Every hundred people interviewed included not only those that were randomly selected (54 1% of all those interviewed), but a smaller group selected from local units of the Bulgarian Hunters and Fishers Un ion clubs, medicinal plant harvesters, mushroom har vesters environmental protection activists, etc These people who have specific interests in environmental problems we will provisionally call "committed " They represent 27 1% of the interviewees A third group consisted of people working in the local municipalities – officers mayors, employees in the Regional Inspec torates of the Ministry of Environment police etc This group represents 18 8% of all those interviewed and will be provisionally called the "administrators The diversity of respondents was no doubt important for collecting a broad range of information It also provided some protection against distortion, since the survey was not representative

On the basis of the survey results the following conclusions can be drawn

1 Environment values, among all the main values are basic and important in determining the quality of life

2 In most cases attitudes toward the environment and biodiversity are influenced by the individual's life needs The first reactions are based on evaluations of the quality of the air soils and waters Only then is attention paid to the prob lems of biodiversity preservation and the more reasonable use of biological resources

3 The survey shows an aesthetic perception and ap preciation of wild nature among the interviewed and suggests that it may be possible to develop this into a cognitive attitude toward nature The development of such a cognitive attitude towards nature is the first prerequisite for forming a gen eral understanding in favor of nature conserva tion

4 The survey reveals a general lack of environ mental knowledge The majority of people do not know what a protected area is what its aims are or what the rights of people in the areas are Many of them do not differentiate between a hunting reserve and a nature reserve, and do not know that the national parks are protected areas But a majority wishes a number of animals, plants, natural areas, and natural monuments to be pro tected

5 Attitudes toward the development of private agri culture and other private activities is contro versial There is a clear division of attitudes The percentage of people who see these activities as a real threat to biodiversity is about equal to those who consider private farming as a way to rea sonably use biological resources are equal

6 The basic concerns about land restitution involve forests A legislative solution is expected for this

7 Among those interviewed the highest percentage cites building activities close to or within pro tected areas as the greatest danger (among those enumerated) for biodiversity

8 There is also a clear opinion that imperfect or totally non existent legislation and rulings in re gard to ecological problems have had and will have the worst impact on the protection of the environment

9 Similarly, those interviewed were of the opinion that the lack of changes in legislation or the lack of application of existing provisions, hinders envi ronmental protection They see no changes in lo cal administrative personnel including the staff in charge of the environmental programs In some cases the staff of the environmental departments of the municipalities is literally unknown or is viewed negatively

OPPORTUNITIES FOR THE INTEGRATION OF CONSERVATION AND DEVELOPMENT

The Green Balkans Movement has offered a con crete proposal for the integration of development and biodiversity conservation They envision a plan to provide natural habitats for plant and animal species in the country's plains through linear corridors and

"spots" (small areas inhabited by valuable species) According to the GBM the existing facilities in these regions – channels, artificial ponds, fish farms – could be transformed into habitat more typical for the birds of the plains by planting appropriate broad leaf trees and bushes along their banks An especially interest ing feature of this approach involves the fish farms with their extensive and semi intensive methods of fish production They could be used to preserve the gene pool of the rare migratory birds that nest in Bulgaria during the winter and spring months During those months the fish farms are not used for fishing

According to the NGO team and the local people interviewed in the survey environmentally sound tourism is one of the main potential methods of achieving development without destroying nature Many types of tourism – bird watching, photography, agricultural tourism etc – are cited as sustainable ways to derive benefits from the natural, cultural, and historical features of Bulgaria The necessity of link ing these three parameters is pointed out Of course there are some shared anxieties that uncontrolled or unregulated tourism in the protected areas might seri ously disturb populations of rare animals and plants The development of these forms of tourism requires investments in improvements, advertising, and other areas but these will be investments for the future of nature in Bulgaria

SUMMARY

This report is a result of efforts by five of the most active conservation nongovernmental organizations in Bulgaria to assess the actual state of the country's bio logical diversity and its system of protected areas Their assessments provide the background for com ments on the major threats to the long term preserva tion of Bulgaria's natural heritage The report is based on the comprehensive data most of which is unpub lished compiled by the NGOs in the course of their work

It is worth stating here that due to the differences in their character, each of the five NGOs have also prepared separate reports In each of the NGO re ports the natural resources in the country are re viewed at a very high professional level In this sum mary report we have tried to avoid overlapping the reports submitted by the team of scientific experts However the most important scientific data are men tioned

The emphasis in this report is on the status of the existing protected areas and problems associated with their management However since the Bulgarian con stitution provides a good basis for effective preserva tion of biological diversity within the protected areas more serious attention needs to be paid to the major threats to biological resources outside the protected areas and in areas with a lower degree of protection

In reviewing the state of the existing protected ar eas all five NGOs share the opinion that the present problems are due mostly to the system s institutional dualism the absence of a single governmental struc ture to manage the protected areas and to preserve the immense biological diversity they contain and the lack of trained professional staff to manage and safeguard the areas The NGOs state that they have the ability and are ready to take on the task of managing and safe guarding some of the smaller territories thus pro viding support for the governmental institutions

This report pays special attention to the existing and expected threats to biological diversity in Bulgaria Activities identified as main factors impacting or di rectly damaging ecosystems and wildlife populations in the country are unreasonable use of biological and non biological resources, the process of privatization expected changes in agricultural practices, industrial pollution the potential development of natural areas as a result of the emerging private sector and public construction projects

Among current biological resource use practices hunting and fishing are identified as the most serious threats Hunting is responsible not only for the direct extinction of species, but for the introduction of non native species This is harmful to the gene pool of the populations of a number of species Fishing practices especially the two forms of trawling, are among the main reasons for declines in fish resources and species diversity The harvesting of timber and non timber re sources, if it continues in its present fashion, will cause severe damage within and outside many protected ar eas

The present period of change in land and property ownership should be used to introduce modern sus tainable agricultural practices This conclusion is drawn after a careful consideration of the conse quences of the former unreasonable and unsustainable methods of extensive and intensive agriculture To develop more sustainable strategies, the natural and historical roots of the country's regions should be kept in mind For example in the Rhodope Mountain re gion land use practices that have been in place for a thousand years or longer have supported the survival and preservation of representative biological commu nities that are extremely rich in biological diversity

The on going process of land privatization will in evitably lead to the disappearance of some habitats at the same time the resulting redistribution of land will result in the appearance of new habitats This should be considered as new legislation concerning biological diversity is elaborated Potential threats should be an ticipated and prevented It is reasonable to state that privatization of forest lands should be performed very carefully Because some 56% of the Bulgarian forests were municipal property prior to nationalization there is a danger that the municipalities might use their re stored property as a easy way to make quick profits In this context private development should also be mentioned as a potential threat to biological diversity If strong regulatory mechanisms are not included in future conservation legislation, the expected increase in demand for different services might result in further

degradation of habitats and ecosystems

Intensive industrial development in the past is considered to have a strong negative effect on biodiversity The results are now becoming more and more obvious Air and water pollution and soil contamination alter the state of natural habitats and ecosystems Within the main branches of the non manufacturing sectors of the economy the major factor affecting natural sites is tourism and related recreational construction Many examples are given to illustrate the direct and indirect impacts of tourism The potential for transforming tourism into a more environmentally sound form is discussed The report points out that Bulgaria has very good opportunities to develop different forms of ecotourism

A sociological survey was carried out in five regions in Bulgaria to determine the opinions of local people on the uses and values of biological resources Although the local people are fully aware of the beauty and importance of the natural elements in the vicinity of their settlements they have little knowledge of conservation or nature protection principles Often they are totally unaware of the existence of protected areas, and lack knowledge of the species and habitats they contain However, in some cases the local population shows an intuitive sense of the factors that negatively or positively affect conservation and of ways to develop sustainably Their general feeling is that incentives for environmentally friendly enterprises should be assured

According to the NGO team the most serious threat to biological diversity in Bulgaria is actually the low level of understanding and awareness of the problems among the general public Most people have little or no knowledge about or exposure to, nature conservation It is clear that the conservation and protection of biological resources will not succeed without the support of the general public For this reason the elaboration of a strategy for educating and involving the general public in conservation is of paramount importance Such a strategy should involve all those who are working for the preservation of nature including educators, NGOs, and governmental agencies

RECOMMENDATIONS

Legislative Recommendations

1 Priority should be given to elaborating and submitting to the Parliament a package of legislative acts concerning the protection of biological diversity In developing legislation the following measures should be considered

- placing under protection all species listed in the red data books as well as all habitats that are of national European, or global conservation importance,
- making species and their habitats state property
- regulating economic activities that affect biological diversity to minimize their impacts and requiring environmental impact assessments by authorized institutions prior to development activities, even small private developments,
- using legislation to control the commercial use of biological resources

2 The responsibility for making decisions concerning biological diversity should be given to the Ministry of Environment, with requirements established for consultation on these decisions with scientific institutions and NGOs

Institutional Recommendations

1 The Committee of Forests should be deprived of the functions of managing and protecting biological diversity in areas of national and international importance Its functions of managing forest resources for economic uses hunting and fishing and for protecting smaller natural areas or sites of lower conservation status should be preserved

2 A single national institution should be established to manage protected areas for the conservation maintenance, and safeguarding of their biological diversity and biological resources

3 This institution should be responsible for the design, development, and implementation of general management plans and action plans for each protected area

Scientific Recommendations

1 The population status and dynamics of rare and threatened species should be examined and special programs elaborated to monitor their status and their conservation

2 The existing red data books need to be updated (and where necessary, new red books prepared) for the different groups of flora and fauna Red list categories should be brought into accordance with international categories

3 The restoration of disturbed and vulnerable habitats is a paramount necessity Elaboration of programs for restoring the most endangered habitats – sand dunes, wetlands, and steppe communities – should be initiated immediately

4 The continuity of scientific research should be as sured

Recommendation for Integrating Biodiversity Con servation and Development

1 Develop and begin to implement sustainable de velopment programs especially in areas with high natural values where the standard approach to biodiversity conservation is impossible

Additional Specific Recommendations

1 In light of their limited and vulnerable habitats, six plant species should be included in the list of those requiring protection plans *Schoenoplectus litoralis Schoenoplectus triqueter Bromus lanceo latus Artemisia pedemontana Urospermum pit croides* and *Reichardia picroides*

2 For the following species, the category of the de gree of threat should be altered from rare to en dangered *Juniperus sabina Salix hastata Rho dendron myrtifolium Calluna vulgaris, Saponaria stranjensis Erica arborea Amygdalus webbii Ilex aquifolium Daphne pontica Daphne laureola Chamaecytisus frivaldzkyanus Astragalus aitosen sis* and *Astragalus thracicus*

3 Urgent measures should be undertaken for the conservation of habitats or enlargement of pro tected areas where the habitats of rare species are found (a detailed list of 17 areas is included in the report of the Green Balkans Movement)

4 Urgent conservation measures should be under taken to protect 54 larger areas containing rare plant and animal species, a detailed list of these is included in the report of the Green Balkans Movement

5 The possibility of giving the NGOs responsibility for maintaining, managing, and safeguarding some of the protected areas should recognized and considered

6 The emphasis in governmental policy making should be shifted away from policies that simply aim to gain popular approval to policies that give real consideration to the problems of nature con servation and environmental protection, and sub sequently involve the mass media to build broad public awareness of the issues

7 Special environmental education programs should be developed, both within and beyond the official education sector, that stress nature conservation Implementation of these programs should be promoted and facilitated

8 A strategy for development of the botanical and zoological gardens should be elaborated In the strategy the possibilities of managing maintain ing and using these gardens in accordance with environmental education programs to be imple mented by the NGOs should be recognized and promoted

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500 Opinions on Man and Biodiversity· Analysis of an Opinion Poll

Julietta Penchovska

INTRODUCTION

Bulgaria is now a stage upon which many differ ent processes are unfolding The public conscience has opened itself to the consideration of problems that have always challenged humanity, but that, for many reasons have not received high priority here Now as priorities are shifting we have begun again to approve of such values as the quality of life, the quality of edu cation the enjoyment of one's job, communication with other people freedom of choice, and democratic participation in decision making Within this realm of values are those that are shared by the new generation The quality of the environment has a special place on this scale of preferences, gaining a higher position among other indicators of the quality of life

Attitudes toward the environment – from which we cannot be separated and which is an inseparable part of our lives – and toward the natural world find a new place within the value systems of women and men It is first expressed in changing attitudes toward the cleanliness of the environment Once people have appraised the value of a clean environment, they gradually begin to understand the need to protect it and to protect its biological diversity

The starting point for this opinion poll was a basic question what are current attitudes toward the impor tance of biodiversity and the problems connected to its protection and preservation? The task of the survey was to assess and analyze attitudes toward the envi ronment at the personal and public level through the reaction of people to different public activities and their impact on biological diversity

PROCEDURES

We need to state at the outset that our conclu sions, judgments and recommendations have been made on the basis of a small sample of the Bulgarian people The survey is not representative It summa rizes the opinions of people living in small towns and villages near Bulgaria's protected areas

Five hundred respondents participated in the sur vey They were encountered at five different research points in different regions of the country Research points were selected according to the different types of protected areas and their value in terms of biodiversity protection For this reason the areas chosen were the Rhodope Mountains, the Central Balkan Moun tains the area along the Strouma River the area around the protected area Russenski Lom and part of the Strandzha Mountain region down to the Black Sea coast

SAMPLE

One hundred people per research point were in terviewed They were selected as representatives of large and small towns (approximately 80%) and vil lages (20%) (Final figures showed that 41 1% came from large towns 42 7% from small towns, and 16 2% from villages)

Every hundred people interviewed included, in addition to those selected on a random basis (54 1% of all interviewed), a smaller group selected from the membership of local units of the Bulgarian Hunters and Fishers Union, clubs medicinal plant harvesters mushroom harvesters, environmental protection activ ists and other groups These people have a specific concern with environmental problems and we will provisionally refer to them as the "committed" group They represent 27 1% of all the people interviewed

A third group was composed of people working in the local municipalities – officers mayors police staff of the regional inspectorates of the Ministry of Envir onment, etc This group represented 18 8% of all the people interviewed, and will be provisionally referred to as "administrators '

This diversity of respondents was no doubt impor tant in collecting from a broad base of information And because the survey is not representative, it also provided protection against distortion of the informa tion

METHOD

Information for this opinion poll was gathered through a questionnaire and an interview Combining the two methods provided us with the opportunity to incorporate information from both sources and in this way allowed us receive a more comp ete picture of the values and attitudes toward the environment of those surveyed

Additional open interviews (upon request of the interviewees) were held with the idea of gathering ad

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ditional information This allowed everyone an op portunity to say what they wanted to say and to ex press thoughts that they were unable to express in re sponding to the questionnaire Another important fact to point out is that the interviewers were members of environmental non governmental organizations They have thorough knowledge of the regions in which the survey was made, and the survey process helped them also in collecting valuable information for their NGOs This was a chance for them to contact people living in these regions and to introduce them to their organiza tions

RESULTS

The questions in the questionnaire establish indi cators for the investigation of attitudes on two differ ent levels The first level involves the personal value orientation of the interviewees, measured through their position on the protected areas close to where they live The aim was to define the priority that the inter viewee attributes among other values, to the environ ment Based on this value system a second level of attitudes is assessed the position of interviewees on the protection and preservation of wild nature and, in this connection their perspectives on possible threats to biodiversity and the source of these threats

Personal Value Orientation

The first set of problems discussed in the survey involves the attitude of the respondents toward their immediate environment and toward nearby protected areas

The survey data show that the interviewees know their immediate environment in terms of their daily needs The percentage of those who did not answer the questions about the cleanliness of the air soil and water was small But in most cases, the respondents added that these were their personal evaluations and that there is a lack of reliable information on environ mental conditions in official as well as local publica tions

One cannot help but notice that the answers to questions about the environment are expressed not only in terms of environmental quality or cleanliness (i e , pollution), but also in terms of the diversity of wild nature Of those surveyed 57% stated in their answers that there has been a decrease in the number, and even disappearance of animal and plant species In the follow up conversations these answers were made more specific by identifying actual species and the probable reasons for their decrease The group from Sozopol pointed to wild rabbits, water lilies and *Opuntia* cacti on Snake Island as species that may dis appear They see in the bottom trawling of fishing ships a threat to fish diversity The polluted air in Russe is not seen just as a threat to the people living in the city, many of those interviewed also expressed concerns about the effects on wild nature

Another major source of concern among respon dents (48 3%) is the high level of air pollution in re gions near the protected areas and in the protected ar eas themselves This percentage can be corrected by taking into consideration the fact that 93 5% of those in the Russe region think that the air in their region is polluted The situation in the Strandzha region (Sinemorez Veleka) and in the Rhodope and Central Balkan Mountains is quite different

The towns and villages where the survey was con ducted are, as previously mentioned, close to a large protected area or located within a national park The intent was to gain answers to questions about public attitudes toward, and knowledge of, these protected areas The information was used to determine how these areas are seen by the people nearby and how the "clean environment" value rated among other values

The first point that needs to be made involves the lack of sufficient environmental knowledge and infor mation about the protected areas A high percentage of the interviewees do not know what a protected area is, what its aims are, how it functions, and what rights and duties citizens have when they are within one In a number of cases, no distinction is made between a hunting reserve (which is considered to be a protected area, where hunting is allowed, but restricted) and a protected area The national parks are not seen as protected areas More widespread is the understand ing that some specific species or objects are protected (old trees with fences around them fish species that cannot be caught animals that cannot be hunted)

The need for ecological education – education on issues of the protection and conservation of the envi ronment – is obvious From the interviews, which were conducted by members of the environmental NGOs it is clear that this is an area where NGOs can be useful Possible solutions include the development of envi ronmental educational programs, establishment of "green" schools and the organization of "green' health camps

Emphasizing such educational programs and re lated activities would help to overcome the lack of in terest and understanding of the principle of protected areas and their role in the preservation of wild nature The fact that those interviewed in Russe and Svishtov do not know about the existence of the protected area Russenski Lom can only be cause for surprise and be wilderment Their answers in the questionnaire relate only to the national park in Russe The results were similar in the Rhodope Mountains, where one out of three persons does not know that she is living in a protected area

The situation is somewhat different in Pirin, where 95% of those surveyed not only know about, but even like to go into the protected area A possible ex planation for this is that the Pirin region has a long

tourism tradition and most local people are connected to it in some way In other words knowing the natural resources is of extreme importance for them The situation in the Central Balkans is similar

The data from the survey show that the relation ship between man and nature is not based only on consumption The consumer's attitude does not pre vail nature is also conceived of as something of aes thetic importance People go into the protected areas to enjoy nature to have a rest to go for a walk to perform some of their favorite activities

The frequency of park visits varies The percent age of those who answered "I go there often" (28 5%) and "I seldom go there" (39 5%) are almost the same At the same time one of every four persons who know about the existence of the protected area have never theless never been there The majority of those who have never been in a park did not answer the question about the ecological situation in their region

The reasons for not visiting protected areas can be quite different Some lack the inclination to commune with nature and hold a different understanding of what contact with nature should be A lot of those inter viewed – 6 4% – think that it is forbidden to go into protected areas Another 15 4% do not know whether visits are allowed If we add the number of those who did not answer the result is that one out of five have no understanding of the status of the protected areas This lack of knowledge is equal among all the three groups of respondents – 34 4% of the committed 31 3% of the administrators and 34 4% of the random sample

According to some the number of people going into protected areas should not be allowed to increase since many people would because of their lack of knowledge or care destroy valuable species Others hold an alternative opinion – that increasing the num ber of visitors would enrich the general degree of knowledge about environmental issues This would depend upon the type of activities that are conducted in protected areas or parks Some concerns were raised about the possibility of increased poaching (including the setting up of traps and pitfalls) and ran dom picking of mushrooms fruits and herbs, which destroy the flora and the fauna Some even suggested establishing a corps of eco police '

Further evidence of the non consumption way of thinking about nature comes in the answers to the question 'What did you like most while being in the park? Respondents were asked to cite four things Most answers are connected with some aesthetic expe rience Out of a total of 459 answers 325 expressed some sort of aesthetic feeling The highest percentage cited as one of their four choices the beauty of nature (110 frequency units) "animals" (77 f u) "plants (75 f u) and clean air' (56 f u) followed by such items as "quiet ' "peacefulness " "birds 'water ' etc In other words, aesthetic comprehension was according to the interviewees fundamental to the man nature relation ship This aspect of the human attitudes toward nature suggests that aesthetic considerations could and should be used in further efforts to develop a better under standing of nature As this better understanding of nature develops, it would also create a higher under standing of the needs and responsibilities for nature protection

The lack of knowledge about conservation of na ture is probably one of the reasons why there are no answers that mention other criteria besides the aes thetic ones Here we are referring to activities involv ing environmental protection and conservation, such as public information, guards transportation, places to rest places for garbage etc There are at least three explanations for that the interviewees have no knowl edge about or interest in these criteria, these things are entirely absent and thus do not attract attention or the organization is so good that nobody notices it

The answers to the question "What did you not like while being in the park (mention four things)?' again involve an aesthetic comprehension of nature (or the lack of such comprehension) One of every two interviewees pointed to pollution litter and waste lack of garbage cans, etc , as basic sources of discontent in their experiences One of every three points to the an nihilation of trees ("trees are cut off") (37 f u) and the lack of care for existing facilities (37 f u) Other an swers included "irresponsible attitude of visitors to wards nature," "poaching," "building activities which have a destructive and deteriorating effect," "bad safe guards," and even "bad habits of the local population pursuant to nature" (meaning the arbitrary interfer ence of man in nature, such as letting cattle go into the protected area etc) Such opinions are expressed ba sically by the group of the "committed "

Detailed analyses of the answers to these two questions establishes two types of attitude toward the environment The first is the aesthetic attitude noted above which has as its basis a specific object in nature contact with this object brings aesthetic delight Among the objects specified are mountain peaks caves, rocks, and lakes, plants (wild flowers, grass, for ests, duckweed edelweiss, etc), animals (wild animals insects etc), and birds (partridge sea gulls etc) This type of attitude typically places higher value on nature and the environment and gives a higher rating to this value among other values

The second attitude builds upon contacts with specific natural objects and is based upon previous knowledge about them Among these natural monu ments are the Cherven fortress the Vodenichkata Russenski Canyon Ropotamo, Haidushka Watermill, Suchuru Paraklitsa Liberators Monument etc

A third type of contact with nature is based on understanding of the opportunities provided by the protected territories such as rest relaxation, enter

tainment and tourism As noted previously under standing of these opportunities is relatively limited Interviewees also cited the opportunities for educating children preserving nature and conducting research in protected areas

These data and problems and the analyses and conclusions reached provide a general picture of the relationship between man and nature at the level of the personal value system They reveal the means of achieving better understanding of nature as a value within the value system of the person

Social Value Orientation

The second group of problems addressed by the survey involves the man environment relationship at the level of social values On the basis of their per sonal value system, interviewees were asked to evalu ate different social activities and their impact on envi ronment, and to identify the possible threats to the biological diversity of wild nature

Previous surveys, expert evaluations, and analyses carried out in the five regions covered in this survey have dealt with the environmental impact of large en terprises production processes, industrial wastes etc In contrast this survey looked at other existing and potential threats related to changes in the economic situation in the country These include the reesta blishment of private farms the opening of small enter prises, building activities and new forms of tourism

When asked the question "What will be the im pact of private farms to the biodiversity?," 50 3% of those surveyed saw private farming as a potential threat The highest percentage (67%) was in the Russenski Lom region and the lowest (42%) in the Strandzha region The threat of environmental pollu tion was the leading concern of these respondents

At the same time virtually the same proportion of people thinks that private farming may result in the reasonable use of nature However this percentage is subject to inexact interpretation due to the high num ber of those who did not provide answers Between 15% and 57% expressed support for the adoption of standards for agricultural activities The reasons for the relatively high level of indifference can be found in the lack of understanding and experience Another possible explanation is the significant lack of knowl edge in this area, which reduces the chance that peo ple would offer answers The most frequent offered explanations for not taking a stand on the question of standards are lack of grounds on which to base a comparison lack of legislative acts and rulings regu lating future agricultural activities and lack of knowl edge about new rulings in this field

It is a troubling fact that the lack of knowledge about the possible consequences of private farming is typical not only for the group of randomly chosen in dividuals, but also for the so called administrators One would expect that they as representatives of the executive would have more knowledge and better un derstanding of the issue

The lack of certainty and understanding also ap plies to questions about private agricultural land A high percentage of respondents – 25% – have not yet decided what to do with their lands Only 13 6% have decided to become farmers And this is the group that holds the opinion that private farmers can use biologi cal resources in a reasonable way The rest though they have not yet made up their minds how to proceed with their land have already formed attitudes about the influence of different activities on the environ ment Among this group, 49% think that the restitu tion of private owner ship of land is a way to protect the environment, while 64% express the opinion that development of the private sector is an opportunity for the reasonable use of natural resources There is an almost equal percentage of such answers in all three groups of interviewees

In future studies, it would be interesting to see how those who rate highly such values as a clean envi ronment and biological diversity view the potential for reasonable use of biological resources through private agriculture

Those who consider the environment as polluted are more optimistic that it will be used in a reasonable way Among them 47 8% are of the opinion that pri vate farming may provide opportunities for nature protection, and 61 1% think that through private farming biological resources can be used in a reason able way Many do not see a threat in cattle grazing (66 7%) or in agriculture (55 9%)

When the survey results are analyzed the per centages of those who gave both positive and negative answers to related questions are close It may be that in the different situations the lack of experience does not allow the interviewees to give more precise an swers

The preceding statement is supported by the an swers to the questions "Do you think that eco tourism is appropriate for your region? and 'If you think that it is appropriate, how what contributions do you think it would make?" Only a very small number of inter viewees did not answer these questions Because all the regions surveyed include a protected area that is of significant interest for tourism the interviewees have some experience with this activity and its influence on the environment 83 4% are of the opinion that eco tourism is appropriate for their region In the Pirin re gion the percentage is 94%, in the Rhodopes, 95% in the Central Balkans, 88 4% and in Strandzha, 81% According to them, eco tourism would create new jobs (57 3%), stimulate economic development and profit for the region (59 5%), and increase the level of eco logical understanding (56 3%)

But the interviewees would add that while all of this is possible if must be well organized supported by

good legislation and rulings, and involve fair allocation of tasks and responsibilities effective enforcement, and knowledge about rights and duties This state ment is illustrated by the fact that 26 7% of those sur veyed think that tourism is a possible threat to wild nature It is clear from the follow up conversations that they are referring to the behavior of tourists who pick fruits and herbs, cut trees, build fires, set traps for animals or (in short) damage the ecological balance in the park According to them, this threat can be avoided through the measures mentioned above

The greatest threat to biodiversity according to those interviewed are building activities This refers not only to governmental activities (roads industrial plants, etc) but also private initiatives (houses, restau rants cafes motels etc) The highest percentage of those expressing such concerns was found in the region of Russe (75%) next in rank were those from the Black Sea region and then the Rhodope Mountains and Pirin regions

Another potential threat to biodiversity cited by those surveyed was the restitution of private ownership and the lack of legislative regulation in this area In this respect they pointed primarily to the problem of forests and their protection However we should also mention that a large proportion of those surveyed (64 3%) think that restitution of private ownership will not have nega tive consequences for the environment if small enter prises (dairy farms, wood processing enterprises, craft industries etc) are established Among the activities mentioned as having a deteriorating effect were build ing activities (69 2%) restitution of private ownership (36 9%) small enterprises (35 7%) farming (27 7%), tourism (26 75%) and cattle grazing (26 3%)

The answers to the question "Have any changes taken place in the state administration and legislation concerning environmental protection?" reveal a trou bling picture regarding public opinion of governmental structures and legislation There is a deep mistrust of the authorities directly responsible for environmental protection The lack of changes at the municipal level is stressed by 91% of those surveyed Many do not even know about the existence of these local agencies And the majority of those who do know about their existence hold the opinion that the persons working on environmental protection in these local agencies are not qualified for this job

The attitude toward legislative changes is no less pessimistic 79 8% think that such changes have not occurred Unfortunately, neither the questionnaire nor the subsequent interviews can tell us whether this re flects a lack of knowledge about the effective laws in that field or a true lack of changes

The same holds true with regard to funds from the state budget for the conservation protection and de velopment of the reserves parks and other protected areas Among those surveyed 94% are of the opinion that there are no such funds Many of them realize that, notwith standing government funds, some addi tional sources must be found

Many different proposals were offered in answer to the question "Can you describe two different ways to use natural resources that will be profitable for your region?" Most are compatible with the protection of biodiversity Out of a total of 405 proposals, 233 in volve the development of tourism Most relate to eco tourism opportunities but there are also proposals for "eco education," "eco advertisement " "eco colleges " etc There are also many other tour ismrelated suggestions hunting, farm tourism fishing, sea tourism, etc Other less frequently mentioned pro posals involved small enterprises (23 f u wood proc essing, dairy farms, local crafts), cattle raising (17 f u), and agriculture (12 f u of particular interest were sug gestions to use greenhouses and natural hot springs for vegetable production)

Ideas were also offered regarding the develop ment of protected areas for entertainment tourism with entrance tickets, small motels nearby tourism guides, visitor centers, fines, and 'eco police " Also interesting were proposals to establish small water power stations and to develop sport activities From these answers, it can be generally concluded that leg islation is needed to implement these proposals

The commitment of those surveyed to the idea of biodiversity protection and the reasonable use of natu ral resources is also expressed in the number of pro posals regarding specific natural sites or protected spe cies It should be noted that many of these proposals relate to already protected sites and species There are two possible explanations for this either the inter viewees are unaware of their protected status, or they are poorly maintained

The many proposals fell into five groups One group consisted of proposals that focused on the pro tection of plant species

- lilac, yews, sycamore, rocky formations (close to the village of Sokolzi village), and forests in the Rhodope Mountains
- centuries old trees (Koritoto) Baikusheva white fir, the Big Fir Tree, thyme, and edelweiss in the Pirin region,
- wild raspberries, silver fir tree, alpine rose, high mountain cotton, edelweiss, and introduced se quoia in the Central Balkan region, and
- sand lily (Kavazite) and the dry tree in the Strandzha region

A second group consisted of proposals concerned with the protection of certain animal species

- partridge and fishes in the Black Sea region
- wild goat trout and deer in the Central Balkans and
- partridge wild pigs deer fishes, and otter in the Rhodope Mountains

The third group consisted of proposals concerned with the protection of rivers lakes waterfalls

- the Gorno Smolian waterfall and the waterfalls in the Rhodope Mountains
- the riparian areas of the Strouma River near Bla goevgrad as a bird migration site
- the waterfalls springs and reservoirs of the Cen tral Balkans
- the Veleka and Ropotamo Rivers and
- the environs of the Russenski Lom and Popovite Rivers and the Vardim wetlands

The fourth group consisted of proposals that per tained to rocks caves, and rocky formations

- the rocks in the Rhodopes, and the "Snezhanka" cave
- the Boichova cave near the village of Logondar,
- rocky grottos (near the village of Ivanovo) the caves near Pirgovo and Cherven, the "Orlova chuka' cave the rocks at the Beli Lon River and the rock "Mashulia "

The fifth group consisted of proposals that in volved particular areas

- the Rhodope Mountains, Karamush, Kormisosh Dzhenevra, Kemirov the Roman Bridges
- Rila and Pirin Parangalitsa the "Bodrost" area, the Kresna defile gorge and the "Ivan Kozarev" fishery
- Apostolova forest Suchuru, Dzhendema Kozia Stena Stara reka and Bashbunar in the Central Balkans
- Kalani Brohtersnext to Ispiritsa Snake Island the sand strip at the Kavatsi Koreniata, the Pearl the Sea Garthen, the Botanic Garthen the Aladzha Monastery Pobitite Kamani and Galata,
- the park Lipnik "Obraztzov Chiflik," Kaleto and Belenska forest next to Yantra river, connecting the Beli Lom protected area with the National Park next to Pisanets, Bear fishery, and the Saint Dimitrius Besarab monastery

People who have expressed a higher degree of commitment to the environment and its protection and who have also given specific advice and proposals are primarily between 35 and 45 years old In most cases their profession or other activities are connected with nature They are biologists foresters agrono mists, rangers, people connected with tourism, anglers hunters etc Represented to a lesser degree are those who work in the social sciences teachers, artists, pharmacists and physicians

CONCLUSIONS AND RECOMMENDATIONS

Based on the results and analysis of an opinion poll of 500 people conducted in five regions close to protected areas and valuable in terms of their wealth of wild nature we can draw the following conclusions

1 The environment is one of the basic values and among the main values in determining the quality of life

2 In most cases, individual attitudes toward the en vironment and biodiversity are influenced by the person's life needs Her first reaction is to evaluate the cleanness of air, soils and waters Only then will she pay attention to the problems of preserv ing biodiversity and achieving more reasonable use of biological resources

3 The survey indicates that there exists an aesthetic perception of wild nature among those inter viewed and that it may be possible to develop this perception into a cognitive attitude toward nature The development of a cognitive attitude toward nature is also the first prerequisite for forming a general understanding in favor of nature conser vation

4 The survey reveals a general lack of ecological knowledge The majority does not know what protected area are what their aims are or what rights people in these areas have Many of them do not differentiate between hunting reserves and a nature reserve and do not know that the parks are protected areas But the majority wishes to protect a number of animals, plants areas and natural monuments

5 In this respect, one can see clearly the need for ecological education and the development of ecological awareness This is where environ mental NGOs can play an impcrtant role by initi ating a wide range of activities (organizing eco schools green patrols etc) Their experts may organize seminars workshops, and discus sions and communicate information through the national media (some of the NGOs have already begun this)

6 According to those surveyed a reasonable way to use natural resources is to develop tourism A majority holds the opinion that the development of eco tourism can combine the need for eco nomic development of the regions where they live with
the protection and conservation of wild nature However there is some concern that the lack of legislation and regulations to develop eco tourism

opportunities may threaten some precious species

7 The development of private agriculture, farms and other private activities is controversial There is a clear cut division of attitudes Those surveyed are equally divided between those who see these activities as real threats to biological diversity and those
who consider private farming as a way to rea sonably use biological resources

8 The basic concern with regard to land restitution involves the protection of forests

9 The highest percentage of these surveyed identi fied building activities close to or within the pro tected areas poses as the greatest danger (among those threats enumerated) to biodiversity

10 There is also a clear cut opinion that imperfect (or totally non existent) legislation and rulings regulating ecological problems have had, and will have, the worst impact on protection of the envi ronment

11 Accordingly, the lack of changes in legislation and the lack of application of existing provisions are seen as hindrances to environmental protection by those surveyed They see no changes in the local administrative personnel, nor in the staff of agen cies in charge of the environmental programs In many cases, the staff personnel in the environ mental departments of the municipalities are lit erally unknown, or are seen in a negative light

Report of the Bulgarian Bird Protection Society

Peter Yankov

SUMMARY

The following report has been prepared by the Bulgarian Bird Protection Society (BBPS) the largest ornithological organization in Bulgaria It presents the BBPS' view point on the state of biological diversity – especially that of birds and their habitats – in Bulgaria the existing threats to it and ways to preserve it A considerable amount of information and expert knowledge has gone into this report ensuring that it is representative and objective

The first part of the report which has been prepared by ornithological experts begins with an overview of the current status and trends in the biological diversity of bird species, bird habitats, ornithological communities and protected areas established to conserve bird populations and habitats We present a detailed analysis of the major national scale threats to biological diversity including the misuse of natural resources privatization construction of public utilities, various agricultural activities, industrial air, water and soil pollution the generation and deposition of waste, and other activities Threats to particular bird species are examined through specific examples, with an emphasis on rare species and rare and vulnerable habitats and communities Special attention is paid to protected areas established to protect bird species

The overall state of biological diversity provides no reason for us to be optimistic A considerable number of species (outnumbering the positive trend species) are in real danger of extinction while habitats and communities that are valuable to biological diversity face great pressures In reality all of the activities that are analyzed pose a threat to globally endangered species and to the habitats and communities that are most valuable in terms of biological diversity

We provide a thorough analysis of the efficiency of protected areas management and its impact on the conservation of biological diversity The main reasons for the deplorable state of the majority of protected areas are enumerated the double standard of state control and protection of protected areas and the total absence of a system to maintain manage and provide security for the protected areas

We also assess the impact of protected areas on local economies showing that many possibilities have been left unexplored due to a lack of awareness of modern methods of nature protection and biological resource use and to the inadequacy of current economic structures The potential of strong incentives to encourage local people to protect their natural resources has also been left unexplored

The BBPS's viewpoint on important bird areas in Bulgaria (both protected areas and prospective protected areas) that require stronger protection is laid out The specific activities and measures to be taken are elaborated A special map of important bird places in need of stronger protection is included

Supportive arguments on the institutional changes that the BBPS deems necessary to conserve Bulgaria's biological diversity are provided The first of these is to put an end to the dualism in the control of protected areas (relieving the Committee of Forests of this responsibility and delegating it to a special agency or service of the Ministry of Environment) We propose that the NGOs, with government financial support be more extensively involved in the direct maintenance management, and security of protected areas,

We propose legislative changes to ensure the protection and conservation of areas of international and national significance – even if this entails bad feelings on the part of some local administrators We also propose that the government reimburse local people or authorities for any damages that may occur as a result of conservationaz initiatives

The BBPS also provides arguments in support of the idea that local revenues from "high quality" protected areas (e g , those with interesting bird and plant species beautiful landscapes, "wild" places, etc) will provide the strongest guarantee of, and both moral and pragmatic motivation to local people for, the defense of protected areas We also propose programs for sustainable development in regions that face difficulties in implementing the standard approaches to biological diversity

The second part of the paper deals with the results of the survey that the BBPS conducted among 100 people from Rousse, Svishstov, and Vardim We point out that the majority of people, although ignorant of specific elements of biological diversity (and they are not the ones to blame for this) are sensitive to the problems of the conservation of biological diversity and willing to participate directly in solving these problems

Expert assessments of the major threats to biological diversity in the regions where the survey was conducted were prepared by the BBPS and these are compared to the views of local people The major threats include the misuse of natural resources privatization construction of public utilities, agricultural activities, private initiatives, industrial pollution, and waste generation and deposition We also address

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questions involving the impact of protected areas on the local economy necessary institutional reforms to strengthen the protected areas network and possibili ties for integrating nature protection and economic development There are great similarities between the views of local people and the assessments of the BBPS

INTRODUCTION

The Bulgarian Bird Protection Society (BBPS) was founded in 1988 as a nongovernmental nonpoliti cal, and nonprofit organization Its currently has 602 members and branches in all of the country's larger towns and a number of smaller ones The main pur pose of the BBPS is to carry out activities involving the conservation of birds and their habitats An essential part of its work is educating people in nature protec tion The BBPS also works in close cooperation with other nongovernmental governmental and local or ganizations on matters of bird and nature protection in Bulgaria

Some of the BBPS's positive accomplishments in clude a sharp increase in the number of some rare and threatened bird species a weakening of the im pact of some negative factors on birds and their habi tats the raising of public awareness and the involve ment of young local people in nature protection The BBPS, because of its firm stand on a number of issues its healthy relations with related organizations and its willingness to cooperate with other organizations is highly respected both within the country and abroad The BBPS is a member of BirdLife International (the former International Council for Bird Protection, or ICBP) and represents Bulgaria in this organization

INFORMATION SOURCES

The following sources of information have been used in preparing this report

- the author's personal data and observations col lected systematically over the past 24 years,
- the National Ornithological Data Base at the BBPS
- various published works on Bulgaria's ornithologi cal fauna
- articles in the press about Bulgaria's ornithological fauna focusing on different species habitats and protected areas and their conservation problems
- the report for the National Nature Conservation Conference in Sofia in 1985, which has been pub lished in an abridged version (see Yankov P , "Fac tors threatening Bulgaria's ornithological fauna '),
- the BBPS's report on factors threatening Bul garia s ornithological fauna presented at the Az hen Meeting of the ICBP in 1992
- BBPS's Conservation Strategy,
- discussion with BBPS members experts from the institutes of the Bulgarian Academy of Sciences and other scientific institutions throughout the country the Ministry of Environment, the Re gional Environmental Inspectorates, as well as ex perts from leading international organizations for the protection of birds such as BirdLife Interna tional the Royal Society for the Protection of Birds IWRB and others
- the national and international nature conservation projects involving a number of topics in which the BBPS participates
- records of the Mid winter Count of Waterfowl in Europe,
- records of the Fall Migration of Dispersed Bird Species in the Bourgas Region
- the Atlas of the Breeding Birds in Europe
- the Dispersed Species Conservation Project in Europe (sponsored by the ICBP) the Important Bird Areas in Europe Project and other relevant projects
- information from local BBPS branches, individual members, nonmembers organizations, etc
- the public opinion poll conducted among 100 Rousse Svishtov and Vardim residents for the National Biological Diversity Conservation Strat egy

EXPERTS' REPORT

1 Trends in Biological Diversity

Bird Species

The present state of bird species diversity in Bul garia can be characterized by the 383 species that have been identified on the territory of the country Of these, four species (*Gypaetus barbatus Falco biarmi cus*, *Tetrao tetrix*, and *Tetrax tetrax*) are considered ex tinct in Bulgaria's fauna However, over 30 new bird species have been identified in Bulgaria in the last few decades It should be pointed out that this is due in part to the greater coverage of ornithological surveys, and to the fact that the status of the habitats of all 30 species is favorable Taking into account the fact that nearly all the rare or endangered species whose habi tats are threatened exhibit a negative population trend we can very well assume that the overall trend in or nithological diversity in our country is negative This assumption is supported by the fact that the 164 bird species that are endangered in one way or another (Yankov et al 1988) far outnumber the newly found 30 species These negative trends are easier to observe on a local scale where not only is the area smaller but the changes in the species' status more markedly visible

Bird Habitats

Of the major bird habitats listed in the CORINE Biotopes Project (Tucker and Heath 1992) 37 can be found in Bulgaria 8 Coastal and Halophytic Communities (nos 11 12 14 15 16 17 18, 19) 4 Non Marine Habitats (nos 21 22 23 24) 7 Scrub and Grassland Communities (nos 31 32 34, 35 36 37 38) 4 Woodlands (nos 41 42 43, 44) 3 Bogs and Marshes (nos 51 52 53), 3 Rocky Habitats (nos 61, 62 65) and 8 Agricultural and Highly Artificial Landscapes (nos 81, 82 83, 84, 85, 86, 87, 88) Twenty two of these are endangered in one way or another (from the point of view of their importance to birds) Ten habitats are threatened with extinction The ones that have been most badly hit are the few small unique habitats such as Mud Flats and Sand Flats Salt Marshes Coastal Sand Dunes Islets and Rock Stacks Lagoons and Standing Water (brackish) Even small scale regional economic activities can bring an end to their existence in terms of bird life This is of course very dangerous since their extinction can only be recorded post factum

There is another set of endangered habitats that falls into a different category the larger dry calcareous grassland habitats, pseudosteppe, humid grasslands and tall herb communities Impending changes in land use may partially or completely alter them Broad leaved deciduous woodlands and alluvial and very wet forests can also be considered threatened habitats due to massive uncontrolled deforestation and global warming There is no doubt that a negative general trend in bird species diversity can be observed The sharp reduction in their number (i e extinction on a regional scale) and the extinction of several species with strictly specialized habitats both point in this direction These specialized species include *Anthropoides virgo Grus grus Tetrax tetrax* and others

Ornithological Communities

The trends in the state of ornithological communities can only be broadly defined due to the lack of any data on the development of the various types of ornithological cenoses There are reasons for us to believe however that the diversity of ornithological communities is decreasing This is especially true for some wetland steppe, and petrophilic communities

Ornithological Protected Areas

It can definitely be concluded that there is a positive trend in ornithological protected areas They have increased in number since the early 1970s Nevertheless many ornithologically significant areas (some of them of international significance) are unprotected The example of Shabla Lake says much on this point This is the winter camp of some 100 000 (as of January 1993) wild geese and virtually the entire population of *Branta ruficollis* on earth – 69 000 individuals

2 Major Threats to Biological Diversity

Resource Utilization

a) *Bird Species*

It might sound paradoxical but there are species in Bulgaria's *Red Data Book* that are at the same time pursued as hunting objects Such is the case with *Tetrao urogallu* which can only be found in high mountainous areas and whose total population amounts to just 500 800 pairs The situation is the same with *Scolopax rusticola* whose population in the country is only 10 15 pairs and with *Gallinago gallinago* which is extinct as a nesting species in Bulgaria Hunting has also threatened the local subspecies of *Phasianus colchicus colchicus*, although the main threat it faces remains hybridization with foreign subspecies that have been introduced by the Bulgarian Hunters' Union

Hunting as an activity that uses natural resources is also an indirect threat to protected species which are often killed because of hunters' ignorance or poaching Poaching has recently become quite widespread Among the species affected are several globally threatened species *Phalacrocorax pygmeus Anser erythropus Branta ruficollis Marmaronetta angustirostris Oxyura leucocephala, Crex crex Numenius tenuirostris* etc (Grimmett and Jones, 1989) Hunting is one of the major threats to a number of other low population species including a number of the larger European birds (Code of Practice 1992) There are 19 endangered species from this group in Bulgaria 6 of which are hunted In the past few years there has been a trend toward the selling and keeping of song birds, which will inevitably affect some rare and endangered species

Some other harvesting activities, although not directly targeted toward birds, pose a threat to Bulgaria's ornithological diversity Detonation mining threatens the nesting population of *Gyps fulvus* one of the colonies of *Falco naumanni* nesting places of *Neophron percnopterus Buteo rufinus Ciconia nigra* and other species Marble mining and quarrying threaten a number of rock nesting birds, among which are some rare and vulnerable species The use of forests for timber production is a serious threat to some rare species of woodpeckers screech owls daytime birds of prey and others A special place in this list of threats can be assigned to fish breeding in breeding ponds which seriously threatens a number of highly vulnerable wading birds such as *Phalacrocorax pygmeus Botaurus stelaris* and the two pelican species, *Pelecanus crispus* and *P onocrotalus*

Salt mining poses a special kind of threat to the many species whose living has always depended on it

Typical representatives of this group include *Recurvirostra avosetta Himantopus himantopus* and *Charadrius alexandrinus* They may well disappear from Bulgaria's fauna if the conventional way of mining salt in the Atanasovsko and the Pomorisko Lakes is changed

b) *Bird Habitats*

The threat that some mining activities pose to bird habitats were only briefly discussed in the previous section Our observations up until now have shown that habitats are much more seriously affected by this set of activities than the species themselves Ranking these threats by their scope is not an easy task, but the timber industry is undoubtedly in the lead as the most dangerous The timber industry has been developing at an ever growing scale in the past few years and has hit hard the old primary forests along the Bulgarian border which were known to be in prime condition This is how the last nesting habitats of *Aegypius monachus* were destroyed in the Eastern Rhodopes back in the 1980s, which in turn was the main reason for the extinction of this bird as a nesting species This we can definitely speak of the massive unchecked over exploitation of forests in the past three years as the principal threat to habitats

The increase in marble and stone mining also comes as a threat to a number of rare bird habitats Unlike forests however, these habitats are destroyed once and for all Here we should also mention the felling of hollow trees in forests along river banks, and in other places This deprives a number of species including several that are rare and endangered of their nesting places Some of the affected species are *Columba oenas Aegolius funereus Strix uralensis* and *Coracias garrulus* Mining affects birds not only directly but in many cases indirectly For example, this can happen when relatively wild areas inhabited by rare species or species that require isolation suddenly become centers of activity (e g the valley of the Biala Reka River in the Eastern Rhodopes) Sometimes only one step forward in mining activity is required to ruin a unique habitat of a strictly specialized local species This is how one of the very few habitats of *Glareola pratincola* was destroyed near the salt mines in Pomorie

c) *Ornithological Communities/Ecosystems*

We have already discussed the destruction of a petrophilic community in the Eastern Rhodopes as a result of detonation activities in one of the mines The same can be observed with the mining of materials such as marble or stone (for example each year sand pits destroy populations of birds that nest under ground)

Populations of birds related to hyperhalinic reservoirs are particularly vulnerable (and among the most threatened) There are currently only two such populations in Bulgaria and even slight changes in mining technology will mean certain destruction for them

d) *Ornithological Protected Areas*

Unfortunately mining threatens even protected areas The most telling example is Vardim Island The island happens to be one of the last remaining habitats of colonial nesting wading birds It is also internationally significant in that it is one of Bulgaria's last two nesting habitats of *Haliaeetus albicilla* Some time ago, however, Vardim was classified as a lower ranking reserve and the strict controls on activities there were lifted At the moment, poplar trees are being planted on the reserve's territory and hunting and other activities are allowed, making it impossible for the pair of sea eagles to survive

Illegal wood harvesting activities in the 1980s inflicted considerable damage on the Valchi Dol reserve Mining is still a threat to Kovankay a natural landmark and other sites

Industrial fishing in Bourgas Lake keeps its protected west end from being the internationally significant ornithological area it can yet be

Privatization

a) *Bird Species*

It is difficult to assess correctly the threat that privatization poses to various bird species because the process has not yet reached its peak Therefore we still do not know what the impacts on wildlife will be If privatization leads to the disappearance of the huge blocks of monocultures and introduces shrub and tree zones into the landscape this will be favorable to some species and detrimental to others In any case, species of the vast open areas that cannot tolerate frequent or close human presence (e g *Otis tarda Aquila heliaca* and *Circus pygargus*) will be threatened

Privatization if it leads to the cultivation of new fields adjacent to existing ones or to the distribution of land to new people, will also have negative impacts on species such as *Crex crex Vanellus vanellus*, and *Falco vespertinus*

The possibility of privatization of pastures in Dobrudzha and along the Black Sea Coast and the potentially drastic modification of the steppe zones will place a question mark on the existence of a number of species that are typical for that region, such as *Melanocorypha calandra Calandrella brachydactyla* and *Burhinus oedicnemus* There will be problems with the damage that birds inflict on private farms and the harsh treatment of birds by farmers

The question of ownership of wild animals and plants that happen to occur within private property boundaries deserves special attention If new legislation

fails to settle this issue a number of bird species will be threatened especially those that live on agricultural lands, such as *Otis tarda*, *Aquila heliaca* and *Falco vespertinus* (as well as those that depend on fisheries for esis and other resources)

b) *Bird Habitats*

Privatization is equally dangerous to bird habitats The efforts of new owners to expand their cultivated land base will inevitably harm habitats of birds that live next to private lands or in open fields and pastures We have no reason to believe that farmers or other private land owners will care about wildlife birds in particular in the same way that they care about their own property Changes in the cropping patterns in Dobrudzha may affect the trophic structure of the habitats of wild geese and destroy their Shabla and Durankoulac wintering grounds The greater share of private property in the country's economy would lead to the maximum utilization of land "Obscure places that happen to be important bird habitats together with those that are considered to have no value would suffer or even disappear

c) *Ornithological Communities/Ecosystems*

Privatization may pose a threat to some rare or sporadically distributed bird communities Birds that depend upon salt have already been mentioned The privatization and subsequent technological modernization of salt production would definitely put an end to the communities there

d) *Ornithological Protected Areas*

If existing legislation is enforced (and not amended) protected areas should not be directly threatened by privatization

Construction of Public Utilities

a) *Bird Species*

The information we have indicates that the various public utilities pose a serious threat to the survival of a number of scarce and rare bird species For example, collision with utility lines accounts for 16% of the total number of deaths among *Gyps fulvus* (Yankov and Profirov 1991) Our many years of observations in the region of the Atanasovo Lake Reserve have shown that it only takes one high voltage wire running across an area that is densely populated with birds to kill hundreds of individuals that belong to rare species (e g *Larus genei Recurvirostra avosetta Sterna albifrons*) High voltage wires are a serious threat to the white stork (*Ciconia ciconia*) swans (*Cygnus* spp) both species of pelicans some birds of prey and other species

Transformers are equally dangerous to some rare bird species including *Tyto alba* Highways and other heavy traffic roads pose a threat to some owls (*Tyto alba Asio flammeus Bubo bubo*) some daytime birds of prey (*Falco columbarius Circus* spp , *Caprimulgus europaeus*) and during cold winters even *Botaurus stellaris* In most cases, these birds go to the roads to find easy food

Rare bird species can be led to total extinction by the construction of dams in the places they occupy One of the main reasons behind the extinction of the pink pelican (*Pelecanus onocrotalus*) was the transformation of Mandren Lake by a dam, thus changing drastically the species' habitat The Bulgarian fauna lost two nesting species in a similar way (*Grus grus* and *Gallinago gallinago*) when the Batik Swamp was turned into a reservoir Dams can also threaten birds indirectly, by attracting lots of people into secluded not easily accessible places – the habitats of large birds that are intolerant of human beings This is extremely dangerous in view of the further human invasion of the remaining patches of wilderness

b) *Bird Habitats*

Public utilities are, as a rule a large threat to the habitats of most bird species This is particularly true of larger scale facilities from the Black Sea coast all the way to the highest mountainous areas For example the Mandra dam and the Yasna Polyana dam disturbed greatly the hydrologic balance of the Ropotamo River Many other examples could be cited Sometimes small public utility projects turn out to be extremely dangerous because unlike big projects they may be built without any assessment by environmental experts may be located in secluded places or may be discovered too late for anything to be done about them

c) *Ornithological Communities/Ecosystems*

The above discussion applies in full to ornithological communities because of the close link between them and the bird habitats

d) *Ornithological Protected Areas*

Unfortunately experience has taught us that it is entirely possible to destroy completely a natural reserve (specifically the Baltata Reserve) by building a resort and constructing a road that cuts right through the middle of the reserve The Alepu Ropotamo and part of the Poda Reserve are threatened in a similar way The Alepu Swamp is in grave danger If construction work on the planned international college is completed there Alepu will find itself sandwiched between the college and the Duni resort village The

same college is also threatening the Ropotamo Reserve. Future intensive construction work will sorely tax the survival capacities of many protected areas in Bulgaria.

Farming

a) *Bird Species*

Many agricultural activities can be directly linked to the destruction of birds. It is well known that mowing and harvesting deplete the populations of birds that nest in the fields. Our data have shown that this factor is of particular significance for the survival of *Crex crex*, *Circus pygargus* and other species. Pesticides, fertilizers and other chemicals are directly responsible, too, for the destruction of birds. The campaign against rodents in the winter of 1988-89 is a sorry chapter that resulted in the deaths of thousands of birds. The laying of traps and the setting out of poisonous or sonorous baits for undesirable wild species can also be classified as direct threats to birds. Vultures, some of the large eagles, and other birds of prey are in particular danger. The extinction of some bird species, such as *Coracias garrulus*, in some regions in the country in the late 1970s coincided with the widespread use of pesticides. In some regions of the country (i.e. Bourgas), traditional wild hog breeding inflicts considerable damage on groundnesting species including *Recurvirostra avosetta*, *Himantopus himantopus*, *Glareola pratincola* and seagull species.

b) *Bird Habitats*

Of all agricultural activities in Bulgaria, the draining of swamps has had the gravest consequences for bird habitats. Hundreds of square kilometers of wetlands have been destroyed (the Straldzha Swamp alone once covered over 100 km^2). The wetlands that remain can hardly provide a secure future for the biological diversity of the bird species that are associated with them.

Other harmful agricultural activities include the use of fertilizers and pesticides that run off into reservoirs during rainy weather. The widespread burning of stubble fields in the last ten years has also had a negative impact on the habitats of a number of birds. Livestock breeding, to some extent, also poses a threat to some bird species. Goat breeding, for example, has led to extensive degradation of forest habitats. Pig farms and other farms located along rivers pollute the rivers and hence the habitats of a number of bird species that need clean water.

A new, quite serious threat might emerge with Bulgaria's closer ties to the European Community and the intensification of farming that is expected to result. Adopting the principle of maximum profit in farming might mean that no more insects and weeds, some of which are valuable food items for birds, will be tolerated. This will cause a sharp drop in habitat quality and will lead to a phenomenon that is well known in developed countries: the extinction of common, widespread bird species.

c) *Ornithological Communities/Ecosystems*

Practically all of the threats discussed above hold true for ornithological communities. Ornithocenoses and agricultural systems, of course, fall into the highest risk category, and in many cases other communities (mainly wading birds) will be affected.

d) *Ornithological Protected Areas*

The case of the Valley of Bustards Reserve is a well known one. This project was sabotaged by local people who had planned that this area would be farmed. We do not have in mind in this case the direct negative impacts of farming practices on protected areas, but such clashes of interests and the direct interference of farming with neighboring protected areas should not overlooked. For example, free ranging hogs in the Bourgas region damage populations of rare and endangered species, including those found in protected areas (e.g. Atanasovsko Lake and Poda).

Private Initiative

a) *Bird Species*

We have no data on the negative impacts of small private enterprises or establishments on bird species, but we bear in mind the possibility that some of them may endanger some rare species once this sector becomes more diversified.

b) *Bird Habitats*

The course of private initiative up until now makes it difficult to predict potential threats to bird habitats. Some observations, though, suggest that it is possible for some small private hotels or restaurants to threaten the nesting or roosting places of rare birds that are located right next to them. We have reason to believe that with rising public interest in wildlife, the negative impacts of this factor will increase.

c) *Ornithological Communities/Ecosystems*

We have no data on threats resulting from these activities.

d) *Ornithological Protected Areas*

The expected increase in private construction

projects will definitely lead to an increased threats to protected areas

Industrial Air, Soil, and Water Pollution

a) *Bird Species*

The main threat to some rare species comes from oil spills and so called oil traps These threats have been identified along the Black Sea coast, mainly in the Shabla Tuvlenovo and Bourgas regions and south of Bourgas where we have come upon dead birds from various species including *Tringa stagnatilis Halietor pygmeus Egretta alba* and *Larus melanocephalus* all dripping with oil This threat also exists within the country where oil related deaths have been reported for birds such as *Accipiter gentilis* Many birds die in the reservoirs outside of Bourgas and throughout the country that are heavily polluted with oil and other chemicals

b) *Bird Habitats*

Aquatic habitats and those near water suffer the most from pollution A considerable number of wet lands near Bourgas are impossible for birds to use for this reason Industrial pollution and other forms of pollution in rivers have destroyed the habitats of species such as *Alcedo atthis* and *Cinclus cinclus* We can definitely say that important habitats especially those close to industrial sites in the mountains are being severely damaged or destroyed

c) *Ornithological Communities/Ecosystems*

The poor quality of habitats as a result of industrial pollution inevitably damages ornithological communities The pollution of wetlands in and near Bourgas accounts for the poor diversity of the wading bird communities and for the absence of any of the most sensitive (hence rare) species The same holds true for other ornithological communities that reside near polluted reservoirs as well as inland bird communities in areas of industrial pollution

d) *Ornithological Protected Areas*

Of the protected areas that are threatened by industrial pollution the protected area in the western part of the Vaya Lake faces the greatest threat because of the oil refinery that heavily pollutes its waters The Poda protected areas and the Atanasovsko Lake Reserve are threatened by the same polluter

Waste Generation and Accumulation

a) *Bird Species*

We have no data available on the damage due to waste or the direct threat that waste poses for birds In some individual cases (rare vulture species seagulls etc) birds feed in the territory of landfills, but no deaths have been reported

b) *Bird Habitats*

The widespread practice (mainly in smaller towns and villages) of depositing household waste in reservoirs is a serious threat to the habitats of some rare species In many cases excellent wetland and aquatic habitats are clogged with waste (e g Novi Iskar and the sand quarries next to Slanchev Briag)

c) *Ornithological Communities/Ecosystems*

This factor is a threat to some ornithological communities near water including rare wetland communities and communities of species that nest underground

d) *Ornithological Protected Areas*

Although we have no data available on the direct threat that waste accumulation poses for protected areas the northern bank of the Vaya River was used as a landfill until recently (Remedial activities are now underway) The Poda Reserve near Bourgas is seriously threatened by the project (already completed) for draining polluted reservoirs through the protected area itself

Other Damaging Activities

a) *The capturing of rare species and foreign trade in eggs*

This is still a small scale phenomenon and threatens mainly rare birds of prey that are suitable for falcon breeding

b) *Efforts to remove the protection of some birds of prey in order to legalize falcon breeding*

A number of key officials in the Bulgarian Hunters and Fishermen s Union have been working in this area The legalization of falcon breeding and the lifting of restrictions on some species of birds of prey will inflict irreparable damages on the populations of all species of birds of prey in the country because of the inability of hunters to recognize different bird species

c) *Increasing numbers of stray dogs and other animals*

Stray dogs jackals, and wild boars which have become quite numerous lately seriously damage popu

lations of ground nesting species including those in protected areas The destructive eating of pelican eggs by wild boars in the Srebarna Reserve was brought to an end when the BBPS built a special fence around the pelican colony The situation is similar in the Atanasovsko Lake Reserve where artificial islands for the birds were built

3 Adequate Maintenance of Protected Areas and Preservation of Biological Diversity

It should be stated explicitly that with few exceptions there are no management plans for protected areas in Bulgaria, nor special managerial and maintenance staff assigned to them (In developed countries, the owners of the respective protected areas can take on some of these functions) It might sound paradoxical but none of the protected areas in Bulgaria have any security staff – even though "on paper" a forest trooper is held responsible for each of them and security personnel are obliged to report to the Committee of Forests Over the past 24 years we have repeatedly visited protected areas throughout the country – hundreds of times both individually and in groups – and we have never been approached by any security officer or been asked for any identification Protected areas, for the most part are protected on paper only It is a wonder that most of them still retain their valuable natural features At the same time many protected areas are in a severely bad state the Srebarna case is only the tip of the iceberg

It can be concluded from this situation that regulations are not in place to establish adequate ownership maintenance and management and security practices for the protected areas Under Bulgarian legislation part of Bulgaria's protected areas can be used for recreational purposes Most of them are highly valuable in terms of the landscape, ecosystems, and the animal species that inhabit them Nevertheless the use of protected areas for recreation has been widely abused These sites have not been appreciated for what they are People believe they are simply beautiful surroundings where they can carry out their normal activities (such as the building of resorts, hotels and restaurants as at Vitosha The Golden Sands Sinite Kamani), play sports just as in the park at home harvest any natural resource (such as mushrooms, berries and other fruits at Vitosha) or even annex illegally parts of them for farming (Rusenski Lom) There are very few people who do not seek tangible profits from such places This might be due in part to the usual Bulgarian pragmatism but the low level of environmental awareness and the lack of environmental education certainly plays a role For example one hardly ever sees people with binoculars out in the forests

4 The Impact of Protected Areas on Local Economies

The examples given above only show that most people now have a very primitive and narrow minded understanding of nature s resources and the appropriate ways to utilize them As a rule, they use those resources directly in ways that inevitably damage nature violating the principle of sustainable development People for the most part are unaware of modern ways of doing business without violating the integrity of natural sites International hunting tourism, for example, offers profound evidence in this respect, a somewhat sad fact (this does not apply to protected areas) Therefore it is not surprising that in reality protected areas do not bring any revenues to municipalities This explains the lack of interest among local people and local authorities It is paradoxical from a European point of view that local authorities would gladly transform a unique natural site into a pile of timber or a wagon full of fish as long as regulations do not get in their way This explains the widespread poaching that has affected protected areas as well

5 Sites in Need of Official Protection

A number of existing ornithological protected areas require additional measures to upgrade and maintain them The important ornithological sites that require further protection are represented in the chart (see Appendix 1) Protected areas of no ornithological significance together with some small ornithological protected areas (heron colonies single nesting places etc) are not listed even though measures are needed for their protection and maintenance Some of the areas to be protected are described in the system of Important Bird Areas in Europe (Grimmett and Jones 1989) and in BBPS' paper on important bird areas in the Rhodope Mountains (Petrov and Yankov in press) These two types of areas are marked with red and green It should be noted that Bulgaria's ornithological fauna has not been studied thoroughly and therefore it is quite possible that some other areas requiring protection exist

The first measure to be taken for the important bird areas is to ensure their protection In some cases when towns roads, and other human features make it impossible to designate large protected areas, a more flexible approach should be adopted Ways should be sought to combine the various categories of protected areas and to carry out the actual protection of the areas in line with the principles of sustainable development

Stronger protection of areas that are already protected can be achieved by defining clearly their ownership, management responsibilities and any other related functions by hiring management and maintenance staff and by adopting meaningful management plans

6 Institutional Changes Necessary to Facilitate the Conservation of Biological Diversity

The most serious institutional problems involving the conservation of Bulgaria s biological diversity come from the existing dualism in the legal status of the protected areas Because 70% of the protected areas belong on paper to the forest fund the Committee of Forests is responsible for their management security and control The Ministry of Environment, as the highest state nature protection institution also exer cises control over their conservation At the same time, the COF performs a number of economic func tions including forest harvesting (logging hunting international hunting tourism etc) What is more the Chairman of the COF has the power to make deci sions that enjoy the status of decrees and that can contradict the Ministry s stand on different matters (Such for example was Order 31/20 01 1993 of the Chairman of the COF, extending the hunting period for wading birds till the end of February His Order was based on the Law on Hunting despite strong dis approval from MOE specialists) This example illus trates well enough the deplorable state of protected areas management in Bulgaria

We firmly believe that an immediate end should be put to this paradoxical situation The COF should retain its economic responsibilities as an institution that plants and uses trees (protected areas excluded) and game animals (unprotected species only under the provisions of the new hunting law), and should retain its supervisory functions within its sphere The overall conservation of biological diversity and the protected areas should be the responsibility of the Ministry of Environment or its specialized agency It is extremely important that protected areas of national and inter national importance be managed and protected by the MOE or by NGOs that are capable of handling the task

We believe that NGOs should be involved a great deal more in managing maintaining and providing se curity for protected areas and should receive financial support from the state for this work This would not only ease the burden on the respective state institu tions but would allow them to concentrate their efforts on problems of greater magnitude

We also believe that legislation should be changed so as to guarantee the protection of areas of proven national and international importance despite the op position of local people and authorities – provided that the state reimburses the latter

We definitely believe that increased funding should be allocated from the state budget for the con servation of the country s biological diversity People working within institutions devoted to the conservation of biological diversity should in addition to being highly professional have strong inner drive and moti vation

7 Possibilities for Integrating the Conservation of Biological Diversity with Economic Development

We believe that protected areas and their biologi cal diversity can be protected most efficiently if local people receive direct revenues from them, provided that the areas are not damaged or destroyed in the process One possibility for this is ecotourism where tourists enjoy nature's beautiful sites experience wild nature and observe interesting plants or animals in non destructive ways It is quite natural for people to prefer sites that are the best preserved or that abound in specific local plants or animals If ecotourism de velops in such a way that it brings revenues to local people – through trade, hotels restaurants transporta tion services, guides etc (such possibilities exist since this is a more expensive kind of tourism and does not require any large investments) – they will be strongly motivated to protect their natural features The reve nues from these activities will be the best guarantee that biological diversity is preserved by the local peo ple themselves

Unfortunately even though international ecotourism began ten years ago in Bulgaria – BBPS has had ten years of experience with ornithological groups and other groups of nature lovers – it failed to become popular among local people

It is obvious that ecotourism must change so that local people become more involved This is in con trast to hunting tourism – something that can hardly be classified as a modern ethical or environmentally friendly kind of tourism – which has become widely popular in the country It is in a very favorable posi tion because it is organized and run by a state institu tion – the COF and its economic subdivisions (the Mourgash company, for example) – and by the well structured Hunters and Fishermen's Union in Bulgaria

Implementing sustainable development programs is another way of integrating the conservation of bio logical diversity with regional economic development Programs should be developed for each region by biological diversity specialists and by NGOs Public hearings and other ways of involving local people in the preservation of the integrity of protected areas are the best guarantees of success

SURVEY RESULTS

1 General Notes

The survey was conducted February 7 11 1993 in Rousse (protected areas in the region – Rusenski Lom and the Beli Lom Reserve) Svishtov (the Persinski Swamps Reserve Vardimski Oak and Kaikousha) and the village of Vardim (Vardimski Oak)

One hundred people were surveyed by question naire Thirty of these were people with special feelings towards nature (we will refer to them as "committed')

They were BBPS members nature lovers biology teachers tourists hunters fishermen and so forth Fourteen of them come from Rousse 12 from Svish tov and 4 from Vardim Another 20 people were lo cal administration representatives (we will refer to the as "the administration") They were local (municipal) council employees (including Rousse and Svishtov en vironmentalists) representatives of regional MOE subdivisions (i e the Rousse Regional Environmental Inspectorate) the COF representatives of the Na tional Police and so forth Fifteen of the people in this group were from Rousse and 5 from Svishtov The other 50 people were randomly selected (we will refer to them as "random" survey subjects) Twenty five are from Rousse, 17 from Svishtov, and 8 from Vardim

Our general impression was that people readily shared their views with us While no one in Rousse was skeptical of the usefulness of the survey many of those interviewed in Svishtov were

Many of those interviewed (with the exception of the committed and part of the administration) had only a slight superficial sense of what biological diver sity entails (we cannot speak of "knowledge " despite the fact that high school education is mandatory in Bulgaria) Still they felt positive about wild plants and animals, and in some cases showed genuine concern for their fate This shows that people are sensitive to the conservation of wildlife but still need to become actively involved in solving its problems

The survey gave evidence of how blatantly obliv ious ordinary people are to specific biological diversity sites including the protected areas next to the places where they live This is especially true of the larger towns Hardly anyone from the random sample knew that there was such a place as the Rusenski Lom Na tional Park What is much more worrisome is that people are totally ignorant about the essence and con cept of protected areas and in fact think off them as recreation parks or city parks

2 Major Threats to Biological Diversity

Use of Biological Resources

a) *BBPS Experts Assessment*

The main threats to biological diversity in the ar eas surveyed by the BBPS (Rousse Svishtov and Vardim) are logging and hunting (especially interna tional hunting tourism) These activities are carried out in close proximity to protected bird areas This is a threat to the nesting rare species on Vardim and Belene Islands and prevents the nesting of the sea ea gle on Vardim Island It is quite possible that logging and hunting take place within the protected areas themselves because of the fact that the inspectorate that is supposed to control protected areas and organ ize the above activities is one and the same the for estry office in Svishtov The situation is the same in Rousse Local people illegally log trees in the Beli Lom Reserve under the pretext that they are withered

b) *Survey Results*

The 118 answers to this questions can be broken down in the following way

7 6% logging in protected areas
5 1% poaching
2 5% hunting,
0 9% growing poplar trees (there are poplar clus ters on the unprotected part of Vardim Is land)

All of the above activities are viewed negatively by the people This adds up to a total 16 1% In our view the low percentage is due to the fact that most of those interviewed do not know about the existence of pro tected areas

Privatization

a) *BBPS Experts' Assessment*

While it is hard to draw any definite conclusions about the threat that private property may pose to bio logical diversity in the studied region there are rea sons for us to believe that such a threat does exist It is possible that the lands to be privatized include impor tant bird habitats and might affect some rare bird spe cies or their habitats Finally as a rule there will not be enough room for wild animals and plants on private lands because of the intensification of land use that is likely to ensue

b) *Survey Results*

Out of a total of 88 respondents 59 1% think that returning land to its previous owners threatens wild animals and plants in the region, and 40 9% think that it does not The ratio of "Yes' to "No" answers among the different groups was Committed – 66 7% 33 33% Administration – 63 2% 36 8% and Ran dom – 53 3% 46 7%

Construction of Public Utilities

a) *BBPS Experts' Assessment*

The construction of public utilities in the next few years might take the form of expanding the existing road network, erecting electrical lines expanding ex isting industrial plants (or building new ones) con structing international communication facilities be tween Bulgaria and Romania through the Danube

river etc In any case, these will have a negative im pact on biological diversity for reasons similar to the ones laid out above None of these projects though, compares to the possible completion and commis sioning of the nuclear power plant between Svishtov and Belyane

b) *Survey Results*

Of 90 respondents, 81 1% think that construction of public utilities threatens biological diversity, and only 18 9% think that it does not The percentage of those who consider public utilities a threat is highest among the administration (84 2%), 83 0% of the ran dom group and 75 0% of the committed considered public utilities a threat

Agricultural Activities

a) *BBPS Experts' Assessment*

The region is directly affected by the draining of swamps especially the Belenska Lowlands (where the region around the Kaikousha protected area is still being drained) Agricultural activities such as illegal grazing and attempts to use patches of land for farm ing are carried out in the Rusenski Lom protected area Fertilizers and other chemicals are used near sewer drains
which also pollute the waters in the region We be lieve that these activities together with other farming activities are a threat to the region's biological diver sity What is more some of the protected areas in the region are directly threatened by certain agricultural practices

b) *Survey Results*

The answers of the 88 respondents show a very small margin between those who see agricultural activ ities as a threat to protected areas (51 1%) and those who consider these activities safe for wild animals and plants (48 9%) The margin is greatest among the committed (56 0 44 0) There was there no differ ence among the administration people (who split 50 50)

Private Initiatives

a) *BBPS Experts Assessment*

The majority of private initiatives (other than ag ricultural and industrial) are currently located in towns Nevertheless there are large possibilities for recreational activities This is especially true for the Rousse region where there are many picturesque sites abounding in natural historical and cultural land marks There is also heavy tourist traffic between Bulgaria and Romania This is extremely favorable for the development of some services, such as private camps hotels and motels which threaten the places of the greatest natural importance along with their flora and fauna This will become extremely dangerous if these turn out to be only shortterm activities whose main purpose is to generate large amounts of capital On the other hand small private businesses might be linked with production processes (e g , wood processing) that destroy bird habitats and other or ganisms The impacts of people and environmental pollution will inevitably increase

b) *Survey Results*

According to 39 8% of 98 respondents, private en terprises threaten biological diversity and according to 37 8% they do not 22 4% of the people could not say
The majority of positive answers came from the random group (48 7%), followed by the administration (28 2%) and the committed (23 1%) Of those who think that private enterprises do not threaten biologi cal diversity 40 5% are from the random groups, fol lowed by the committed (37 8%) and the administra tion (21 6%) Bearing in mind the specific character istics of these groups, we think that the administration people might have the most realistic view on the role of private enterprises, since they know them best In general therefore, the respondents think that the im pact of small private enterprises on biological diversity will be rather negative

Industrial Air, Soil, and Water Pollution

a) *BBPS Experts' Assessment*

This is one of the most heavily polluted industrial regions in the country Rousse, Svishtov and even Dardim are affected by transboundary pollution from the Guyrguy and Zimnich plants The situation is most severe in Rousse, where pollutants include even chlorine gas We believe that these forms of air pollu tion have affected soil and water purity
In addition the valleys of the rivers that flow into the Rusenski Lom River are also seriously polluted from industrial plants including the Antibiotics Plant in Razgrad Despite evidence of decreases in water and (to a degree) air pollution, this region (especially the Rousse part) is still an "environmental" catastrophe zone Unfortunately there are no studies available on the impact of this kind of pollution on birds

b) *Survey Results*

We can infer what the respondents thought of in dustrial pollution as a threat to biological diversity from the things that they mentioned they did not like when they visited a protected area Out of a total of

118 answers 11 9% have to do with "environmental pollution' and 6 8% with the flow of polluted water into the reserve

Equally important are the answers to the questions about pure air, soil and water Out of a total of 96 respondents 99 0% definitely think that the air they breathe is polluted, 93 5% of 77 respondents say the soil is contaminated and 98 9% of 92 respondents think the same about soils

Generation and Deposition of Waste

a) *BBPS Experts' Assessment*

We have no evidence that waste or waste dumps in the region pose a serious threat to biological diversity We must however deal with the household waste which one (unfortunately) encounters so often throughout the country There is slightly more waste along the Danube River but it presents no serious threat to wildlife

b) *Survey Results*

Out of a total of 118 answers to the question about the things people dislike in protected areas 7 6% deal with this type of pollution There is no indication that this is seen to damage biological diversity This corresponds to our experts' assessment of the impact of this factor

Other Unfavorable Activities

a) *BBPS Experts' Assessment*

In the area surveyed, especially around Rousse there are additional threats to biological diversity because of the large number of historic sites (rock churches, fortresses etc) First, there is the high pressure on wild plants and animals exerted by tourists who are not aware of them and for whom conservation is not part of their value system (Moreover tourism in this area is carried out without any effective control of protected areas) Second especially with regard to some rare bird species insects plants, and reptiles there is the plundering of some natural landmarks by people who know quite well what their value is Treasure hunting is a similar type of activity that is responsible in some cases for the destruction of the nests of rare bird species

b) *Survey Results*

Out of a total of 118 answers to this question 3 4% refer to 'reckless tourists " 2 5% to "plant damage," 1 75% to treasure hunting and 0 9% to the gathering of protected species Thus, a total of 9 4% have named these activities as threats to protected areas in the region

3 The Impact of Protected Areas on Local Economies

a) *BBPS Experts' Assessment*

The region we surveyed is no different from other parts of the country In a word, protected areas are not seen as significantly important to the economic development of municipalities for reasons already discussed Basically, this comes down to the fact that people are unaware of modern methods of using nature's biological resources and that local economic structures are inadequate developed It has been observed that protected and unprotected areas have the reverse effect on local economies Svishtov, for example, profits from the planting and logging of poplar trees in the unprotected part of Vardim Island, and not from the neighboring Vardimski Oak protected area which in most people's minds is a waste of resources

b) *Survey Results*

Since there was no question in the survey regarding people's attitudes toward the economic benefits of protected areas we can only make indirect conclusions For example of the 129 answers concerning the things people liked when they visited protected areas not a single one mentioned or implied economic benefits from the protected area Moreover 43 4% believe that eco tourism has no future in their region or cannot say whether this is so This shows that people not only do not profit from the environmentally friendly use of protected areas but do not even consider the possibility of such profit

4 Institutional Changes Necessary for Strengthening the Conservation of Biological Biodiversity

a) *BBPS Experts' Assessment*

The reforms that have been proposed for the whole country should be enforced in this region Stronger measures to protect the protected areas should be enacted Rusenski Lom the Pursinski Swamps and the Staria Dub should be designated as important international areas, and the Kaikousha and Beli Lom as important national areas Their boundaries and status should be brought into compliance with the requirements for conserving their natural features More specifically the Staria Dub should be expanded in order to cover al of Vardim Island and its status as a reserve should be reinstated More funds should be allocated to finance environmental (nature protection) offices at the municipal level, and government financial support for protected area management and maintenance plans should be considered There is a pressing need to set up administrative offices for maintaining managing, and providing security at Rusenski Lom and Vardimski Dub and later on at the other protected areas in the region

b) *Survey Results*

Out of a total of 100 respondents 77 0% think that no legislative changes will be introduced, 92 0% that no funds are being allocated for nature protection, 91 0% that no reforms in nature protection have been carried out by local state authorities and 50% that no changes have been introduced in this respect (80 0% answered 'do not know" to certain of these questions) These numbers speak for themselves of the necessity of institutional changes in the region

5 Possibilities for Integrating the Conservation of Biological Diversity with Economic Development

a) *BBPS Experts Assessment*

There are excellent opportunities in the region to developing ecotourism because of the perfect combi nation of different landscapes (picturesque rock can yons along gorges marshy lowlands, islands, etc) and the great plant and animal diversity (the Rusenski Lom and the Belene Vardim areas are among the richest in bird species in Bulgaria) The BBPS strongly believes in the region's great prospects based on the first hand experience of British, Belgian Dutch and Italian ecotourism groups

b) *Survey Results*

Out of a total of 68 respondents 22 1% named tourism (visiting tourist sites) as one possibility for in tegrating protected areas with regional economic de velopment Another 22 1% believe ecotourism is such a possibility and 11 8% hunting tourism Out of a to tal of 99 respondents 56 6% think ecotourism has a future in the region and 89 6% think it will have a positive impact on the conservation of wild plants and animals (only 24 6% believe this will be a threat) Sev enty five percent think that ecotourism will lead to the opening of new jobs 64 9% that it will facilitate the development of the private sector, 87 7% that it will bring economic revenues to the region and 98 5% that it will promote environmental education

RECOMMENDATIONS

1 The Red Data Lists of various groups of organ isms should be updated (or drawn up) in compli ance with international categories for endangered species

2 All species in the national Red Data Lists, to gether with all internationally threatened habitats or habitats threatened in Europe should be pro tected by law

3 The species habitats communities, and protected areas that are essential to Bulgaria's biological di versity should be identified, and special programs for their conservation and monitoring developed

4 By law, all organisms, habitats, and communities that are globally threatened or threatened on a European or national scale should become the property of the state, with all subsequent legal consequences

5 Activities involving the use of natural resources, agricultural and industrial activities and construc tion and other activities (including smaller proj ects) should be regulated so that the negative im pact on biological diversity is minimized This should include requirements for expert environ mental assessments on small private projects, conducted by the respective authorities

6 Immediate restoration of severely damaged habi tats that are extremely valuable to biological di versity should be undertaken, following a system atic program (starting with wetlands that can still be saved)

7 The use of elements of biological diversity to make large profits should be prohibited by law

8 Special measures (including state incentives) should be taken to develop ecotourism and to turn it into a source of revenues for municipalities and local people

9 Sustainable development projects should be devel oped and implemented in regions that are crucial to biological diversity and where standard ap proaches do not work

10 Legislation should be changed so that areas of proven international and national significance for biological diversity are designated as protected areas, even if there is resistance from local authorities The state should reimburse the local administration

11 Government decisions on biological diversity should be regulated by law and should be made by the Ministry of Environment only, in coordi-nation with the Bulgarian Academy of Sciences and the respective nature protection organiza-tions

12 A unified national system for the management maintenance, and security of protected areas should be established, and specific management plans for each protected areas should be drawn up and implemented

13 NGOs should be ensured a considerable partici patory role in maintaining managing and pro viding security for protected areas with govern ment financial support

14 The COF should be relieved of its responsibility for controlling and protecting biological diversity, while its functions in maintaining and utilizing the economic sectors of forests where hunting and fishing are concerned should be preserved

15 A unified system of control over the conservation of biological diversity should be set up as a spe cialized agency or as a service to the Ministry of Environment

16 In dealing with the problems of nature protection greater emphasis should be placed on actively in volving all of the mass media and increasing pub lic awareness and commitment

17 Special measures should be taken to improve training in nature protection for people who are directly involved with biological diversity (especially hunters) and to require that they be able to recognize and distinguish species

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Report of the Bulgarian Union for the Conservation of the Rhodope Mountains

Jordan Danchev

INTRODUCTION

The Bulgarian Union for the Conservation of the Rhodope Mountains (BUCRM) was founded on March 9 1990 Its first General Assembly meeting took place on May 11 1990 The Union is a voluntary non political organization whose object is to support the preservation of the natural and cultural wealth of the Rhodope Mountains The Union works for the reasonable and ecologically sound utilization of the mountains as a living place as a tourism and recrea tion area and as a territory for the preservation of characteristic material civilization and arts natural at tributes and valuable animal genetic resources

Local branches of the BUCRM have been foun ded so far in Batak Velingrad Kovachevitsa Kardz hali Laki, Plovdiv, Smolian Solishta Sofia, Chepe lare and Shiroka Laka Plans are in place to establish branches in Devin Zlatograd, Nedelino, Momchil grad Krumovgrad, Yagodina, Trigrad Dospat Pesh tera, Rakitovo, Bogutevo Zaburdo Rudozem Smil ian Momchilovtsi and in a still larger number of towns and villages The Club and Museum of Speleol ogy in Chepelare the Society for the Revival of Batak, the United Fund for the Ecological Rescue of Kardz hali the 'Rodopski Vesti" newspaper the Raikovo Ci vil Society the Rhodope Dramatic Theatre the Ro dopa State Group the Geneological Club in Smolian and other organizations have also joined as group members of the Union All told, about 4000 people belong to the Bulgarian Union for the Conservation of the Rhodope Mountains including people from the United States Switzerland Germany Spain England France Czechoslovakia Austria Slovenia Hungary Greece and other countries

In addition to the many activities that are carried out by the local branches the BUCRM has a pur poseful program for the protection and sustainable de velopment of the mountains which it pursues before the Parliament the Presidency the Council of Minis ters the Ministry of Environment the Committee of Forests the Ministry of Education Science and Cul ture and other governmental bodies The BUCRM has worked with the World Wide Fund for Nature (WWF) and other groups to develop the on going Protection of the Rhodopes' project the International Center for the Preservation of the French Mountains and the International Commission for the Protection of the Alps (CIPRA) The BUCRM is a member of the "Ecological Bricks for the Common European Home" initiative and is coordina tor of the initiative in Bulgaria In 1992, the BUCRM held its first meeting with Greek non-governmental organizations to expand the Rhodope preservation initiative into a joint Bulgarian Greek effort The BUCRM has contacts and cooperates with still more organizations administrators, and private persons in Bulgaria and abroad

As a result of BUCRM activities various threats to the Rhodopes' natural and cultural wealth have been averted or halted the mountains have been in cluded in the list of significant Bulgarian natural and cultural heritage sites, and a strategy to preserve and sustainably develop the region has been formulated The BUCRM is in the process of developing an edu cational program on these issues

This report of the BUCRM was developed on the basis of scientific literature, editorials, reports propo sals recommendations and other materials concerning the natural and cultural heritage of the Rhodopes from the Union's archives It also draws upon personal con versations with various experts and specialists, mem bers and supporters of the Society and people from the local communities The opinions of the local peo ple of the Rhodopes expressed in the data from a sur vey of one hundred residents of two Rhodope towns and one village (Batak Smolian and Laki) situated within and near areas of rich biological diversity have also provided information for this report

Undoubtedly the personal opinions of the author formed during long periods of contact with the data from the literature and with the nature and spirit of the Rhodopes are also presented in the report In prepar ing this report we decided not to include detailed data on the biological diversity habitats typical ecosystems and protected natural areas of the Rhodopes All of this will have been inevitably provided by the individual ex perts engaged in working out other parts of the national strategy Our emphasis is on information about the spe cific problems and features of the Rhodope region This will be of real use in developing a national strategy that reflects the thoughts of local people and that is grounded

in the sphere of real life It will also serve the strategy well when the time comes to apply it

As an organization whose focus is the Rhodope Mountains our report will be indisputably useful in developing the national strategy Although our con tributions relate specifically to only one region of Bul garia we would like to make note of several broadly relevant points In as much as the development of global strategies takes a lot of time very often the ob jects of their concern – in this case biological diver sity valuable habitats and landforms and significant cultural monuments – are subject to merciless exploi tation and other pressures For example, while we are here thinking and working to develop a strategy to conserve the biological diversity of the country and the Rhodope Mountains, the National Electric Company and the monopolistic "Energoproekt" designers' bureau – with the support of some government institutions and international banks – have began work on the "Gorna Arda' dam project The project will erase the last 60 near virgin kilometers of the largest river in the Rho dopes from the world map, flood forests and plant and animal habitats, and turn the unique river landscape of meanders, gorges and meadows into a continuous se ries of reservoirs

Many excellent reports and perfectly planned strategies are left unrealized and the funds spent for their development wasted This is either because no provisions are made for their realization or because the strategies themselves are in some way inapplicable or fail to take into account many relevant factors In the case of some poor strategies, this has turned out to be our country's good fortune! In both cases, however the usefulness of the means and efforts has amounted to almost nothing I myself am familiar with many such strategies We wish strongly and will do our best to ensure that this strategy will not become one of these

THE RHODOPE MOUNTAINS

The Rhodope Mountains occupy a considerable part of the Thracian Macedonian massif, which is lo cated in the center of the Balkan Peninsula They spread over an area of about 18,000 km^2 – 14 737 km^2 in Bulgaria and the rest in Greece Their length from east to west is about 250 km and their width from north to south about 100 km The Maritsa River val ley is generally accepted as their northern and eastern border the Aegean lowland as the southern border, and the Mesta, Dreshenets, and Yadenitsa valleys as their western border They cover about 1/7 of the Bul garian territory and are situated in
its southern part, along almost the whole length of the border between Bulgaria and Greece The geological history of the mountains begins with the Precambrian and ends with the Oligocene

There are significant differences in relief and vegetation between the western and eastern portions of the Rhodopes For this reason we divide them into the Western and Eastern Rhodope Mountains The climate is varied A montane climate is typical in the higher western parts while the proximity of the Medi terranean is rather evident in the eastern portions Because of several biogeographic factors – the Rho dope Mountains are the oldest dry land on the Balkan Peninsula the continental and Mediterranean climatic influences meet on their territory and they were not glaciated during the quaternary period – the Rhodopes are home to a rather rich and varied flora and fauna This places the Rhodopes high among Bulgarian ter ritories in terms of biological diversity and hence for outlining and carrying out special conservation meas ures

About 1780 species of plants can be found in the Rhodope Mountains This diversity of species is the highest of all the floral regions in the country (by com parison the Stara Planina Mountains are home to 1727 species Rila Mountain 1504 Pirin Mountain 1486, and the Thracian Lowland 1497) The Rho dopes contain 211 rare and threatened plant species listed in the *Bulgarian Red Data Book* Fifteen species are tertiary and glacial relicts, 42 are Bulgarian en demics (15 of these are found only in the Rhodope Mountains), and 40 are Balkan endemics The Rho dope Mountains are thus recognized as the richest massif in the Balkan Peninsula in terms of plant taxa

The Rhodope Mountains are the stronghold of the spruce (*Picea excelsa*) in Bulgaria Seventy percent of Bulgaria's coniferous forests are situated there al most 30% of them natural primary forests of silver pine (*Pinus silvestris*) black pine (*Pinus nigra*) fir tree (*Abies alba*) and other species Deciduous species – European beech (*Fagus silvatica*) oak (*Quercus* spp) etc – are well represented in the lower elevations

High levels of diversity and endemism are also found among the Rhodope fauna The invertebrate cave fauna snails some groups of insects and other taxa are particularly rich in endemics The alpine triton (*Triturus alpestris*) is a glacial relict The Eastern Rho dopes, where 167 bird species nest, is the most richly populated ornithological area in Bulgaria Some of these bird species are rare and threatened in our country and in Europe The southern part of the Eastern Rho dopes, together with the Greek portion of the Rhodope Mountains, is the second richest region in Europe for raptorial bird species (after Spain) Unfortunately, the ornithofauna of the Western Rhodopes has not yet been well studied Nevertheless, the Rhodope Mountains are known to support about 70% of the Bulgarian popula tion of the wood grouse (*Tetrao urogallus*) and are the stronghold as well of the naked headed vulture (*Gyps fulvus*) The black vulture (*Aegypius monachus*) too likely nests only in the Eastern Rhodopes near the Greek border The Egypt vulture (*Neophron percnop terus*), the royal eagle (*Aquila heliaca*) the imperial ea

gle (*Aquila chrysaetos*), the white headed hawk (*Buteo rufinus*) the peregrine falcon (*Falco peregrinus*) and the black stork (*Ciconia nigra*) – all of which are rare or threatened species for Bulgaria or Europe – also nest in the Rhodope Mountains

Rare and threatened mammals – the brown bear (*Ursus arctos*) the wolf (*Canis lupus*), the wild goat (*Rupicapra rupicapra balcanica*), the otter (*Lutra lutra*) the marten (*Martes martes*), some bat species etc – are well represented in the Rhodopes

Fifty seven animal species listed in the *Bulgarian Red Data Book* may be found in the Rhodope Moun tains The red deer fallow deer wild boar hare, wild cat, and other wildlife species are also found there

In addition to being the most massive of the Bul garian mountains, the Rhodopes are also characterized by their soft rolling landforms and vast pastures of *Nardus stricta* About 860 caves, gorges, abysses, and rock bridges, and a great number of karst and mineral springs have been discovered and mapped there The Trigrad Yagodina, and Dobrostan Karst regions are well known, as are the Diavolskoto Garlo Yagodin ska, Ultsata Lednitsata, Snezhanka, and many other caves Other well known features include the Trigrad and Buinovo gorges the "Wonderful Bridges" (Er Kyuprıa) the Karadjov Stone nearby Mostovo the Devil Bridge near Borino the earth pyramids around Zimzelen Povet and Beli Plast the Hubcha Karst springs near the village of Sokolovtsi the Kleptuza springs near Velingrad, the Vrisia springs near Mugla, and the mineral springs around Varvara Vetren Mi halkovo Beden and Narechenski Bani The Chaira and Smolian landslide lakes, rich in biological diver sity are also situated in the Rhodope Mountains In numerable other natural features that have made the Rhodopes famous in Bulgaria and throughout the world may also be found there

In addition to their rich variety of natural features, the Rhodope Mountains have other characteristic features that distinguish them from other mountains They have no analog in Bulgaria, nor even in the rest of Europe The soft rolling form of the mountains, the low altitude (Perelik is the highest peak at 2191 m) the favorable climatic conditions and especially the nearby Aegean Sea result in a winter season that is not very long and not very cold

These characteristics together with the rich vegetation and vast pastures, create favorable condi tions for stock breeding, and account for the fact that the entire Rhodope Mountain region has been inhab ited since the remote past This also distinguishes it radically from the other Bulgarian mountain ranges (Pirin Rila and Stara Planina) where the settlements are situated mainly in the lower elevations – i e in their foothills That is why in addition to the consid erable natural wealth of the Rhodopes we find there a rich cultural heritage of national and international im portance For example the sanctuary of the Thracian god Dionysus is now being searched for, and its dis covery is expected to be the most significant archaeo logical event on the Balkan Peninsula and in Europe The ethnographic heritage the Rhodope architecture, and the local Rhodope dialects and folklore are also forms of cultural wealth

All of these characteristic natural and cultural features compel us to search for and employ specific ways and methods to realize our conservation strategy in the Rhodope Mountains That is to say, in devel oping the national biodiversity conservation strategy, it is *absolutely necessary* to recognize the *presence of the local population in the Rhodope Mountains* A con servation strategy for the Rhodope Mountains that is forced down from the top (i e , from the government), even one developed with a high level of expertise will be doomed and the money spent for its development irretrievably lost if it is incongruous with the traditions experience, and needs of the local population In our case it has not been advisable to proceed in the ac cepted manner (i e , creating and forcing the strategy from the top down) And so we suggest using the ex perience and traditions of the local population to de fine the strategy for that part of our country and de veloping and introducing the strategy with the aid of that population This is why we should adopt a "bottom to top" approach in the Rhodope Mountains

MAIN THREATS TO BIOLOGICAL DIVERSITY

It is clear that we are obliged to conserve not only the biological diversity and natural resources of the Rhodope Mountains but also their cultural heritage Moreover because the Rhodopes are inhabited by over 650,000 people, living in 33 municipalities and over 400 towns and villages, the natural and cultural heritage of the mountains are almost inseparable The fact that a rich diversity of plant and animal species still exists after such a long history of human presence in the mountains suggests that in fact the local people with their traditional activities (i e moderate utiliza tion of the natural resources, chiefly moderate pastur ing and cutting) have contributed to its conservation But technological advances, the modern idea of pros perity and different pressures directed toward the Rhodopes through distant administrative channels (e g mining, tourism hydro electric power develop ment) are the main threats to the rich biological diver sity and cultural heritage of the region Let us view the most important of them

1 Ore mining and processing

The mineral ore resources – lead zinc copper silver uranium and other ores – are among the natu ral resources of the Rhodope Mountains that we delib erately did not mention in the preceding section of the report

They are undoubtedly the reason that ore mining – one of the oldest crafts – has been practiced in the Rhodope Mountains since the Thracians and Romans

The Laki concession (near the village of Laki) created at the end of the last century, was the first state lead and silver ore concession in the Rhodope Mountains The private concessions near the villages of Hvoina, Madan Palas (Rudozem), and Boevo fol lowed But those activities developed slowly mainly due to the lack of roads The main threat to the vast virgin territories in the Rhodope Mountains that are important plant and animal habitats began in 1950 when the "Gorubso" Soviet Bulgarian mining enter prise was founded All lands in which it was possible to mine ore were reached, regardless of the natural features or any other preexisting conditions Those activities, which have been totally heedless of all natu ral phenomena and ecological laws, continue today almost in full force (it is expected that uranium mining will soon be completely closed down) The results

- The web of underground shafts and corridors spreads continuously penetrating every place where the mountains hide even a single gram of lead In these regions springs and streams sink into the galleries and the terrain over them drains underground
- More and more wild areas are reclaimed for towns and villages roads, technological develop ments structures, tailings ponds floatation facto ries depots etc The industrial socialist settle ments of Kardzhali, Madan Rudozem Zlatograd Laki Madjarovo Srednogortsi and Asenovgrad arose in the place of the small towns and villages As a result vast territories of the Rhodope Mountains were destroyed and urbanized, and the outskirts of these towns and villages covered with stone piles tailings ponds abandoned shafts and roads, eroded terrains and rubbish heaps
- The lead zinc works around Asenovgrad and Kardzhali not only set precedents for causing air and soil pollution and disturbing the biological balance but became dangerous to the living con ditions of the people
- The floatation factories in Rudozem, Madan, Srednogortsi Laki, and Madjarovo polluted per manently and destroyed the life in a number of streams The Arda River received the tailings from the Rudozem concentrating mill for more than 30 years and 'transported it free of charge" to the Kardzhali reservoir
- Conditions were created for the radioactive con tamination of soils and underground and surface waters

2 Mining of non metal mineral resources

Even a passing glance at a map of the distribution of precious gems and minerals in Bulgaria shows that many of the deposits are concentrated in the Rhodope Mountains More than half of the 85 deposits (43) are in the Rhodope Mountains Of the 31 described min erals 21 have been discovered in the Rhodope Mountains Almost the whole mountain region and especially its southeastern part is strewn with quarries The situation with the exploitation of the gemstones is somewhat better "Only' 11 (20%) of the 55 currently active quarries in Bulgaria are in the Rhodope Moun tains The destructive processes are divided between the two main parts of the Rhodope Mountains Five of the quarries – Lepenitsa, Vishteritsa, Katerovo dere, Sitovo, and Chepelare – are in the Western Rhodopes and six – Ardino, Dolen Momchilgrad, Kovil, Sveta Marina, and Zhelezino – are in the Eastern Rhodopes Abandoned and unreclaimed quarries are more com mon

3 Timber yield

The exceptionally great importance of the forests as a direct and indirect factor in the conservation of biological diversity is well known Even in regenerat ing forests the anomalous and excessive utilization of wood resources (timber and firewood in this case) threatens sometimes to the point of extinction a great number of plant and animal species During the last several decades legal and illegal cutting has brought about extremely poor conditions in the Rhodope for ests The dangers and problems may be reduced to the following

- The upper age limit of the forest has decreased considerably As old forest stands are cut down the younger forests become subject to exploita tion In addition to being inefficient this leads to a progressive and considerable reduction of tim ber volume and even destroys the processes of self regeneration in the forest ecosystems
- The present methods of timber harvesting and hauling totally spoil and destroy growing trees and damage older trees in the area of the cuts
- Over cutting in easily accessible regions also in creases the pressures on inaccessible ones
- High quality trees are cut for their yield of specific timber products regardless of the future impact on the whole forest stands This occurs rather typically at present (and the poachers even come from the state sector), because the offers from the companies in the mountains that export timber are very attractive

- Many forest roads are built and abandoned or badly maintained, creating conditions for soil erosion in the forest areas
- The introduction of seedlings that are not under control or whose genetic qualities are unknown and the neglect of indigenous timber species, may cause genetic problems in the forests

4 Uncontrolled harvesting of mushrooms, herbs, and wild fruits

During the summers of 1990 and 1991, the Rhodope Mountains were subject to an unexpected and unprecedented invasion of mushroom gatherers In addition to the local people organized groups and other people from different parts of the country took part in these campaigns leading to conflicts between the strangers and the local people That boom in mushroom gathering activities was generated by the strong interest of foreign mushroom processing enterprises in the cheap "raw material' and by the lack of legal restrictions It is not necessary to go into detail on the actual and expected effects of this practice – which spared no part of the Rhodopes including the reserves – on the conservation of biological diversity in the mountains Furthermore the same pressures are also expected to affect the Rhodopes' herbs, wild fruits teas pine tops, and other biological resources

5 Poaching

The liquidation of the state game reserves in the Rhodope Mountains and their transfer to the state forest administrations have created conditions under which poaching has become more prevalent This leads to disarray and destruction among populations of rare and valuable game species and contributes to degradation of the processes of self regulation in the natural environment

6 Privatization

The process of privatizing agricultural and forest areas in the Rhodopes and its relation to the conservation of biological diversity and natural resources should be approached with utmost sensitivity As has already been mentioned the Rhodopes are totally inhabited nobody wishes to depopulate it and it would be impossible to do so in any case In fact much of the region's rich biological diversity has been preserved up until now despite the presence of people since the most ancient times This indicates that strong native traditions conducive to the conservation of natural resources exist in the Rhodope Mountains We have only to revive them The nationalization and collectivization of land and forests in the mountains caused significant damage to the environment But long before that both lands and forests in the Rhodope Mountains were privately held Logic indicates that they should become private again

7 Hydroelectric power

Since 1946, the Rhodope Mountains have been extensively developed for hydroelectric power – more so than any of the other Bulgarian mountains – through the Batak, Ardino, Dospat Devin Vacha, and Belmeken Sestrimo dam projects Over twenty reservoirs already burden the mountains, causing many problems They make us ask whether the "concreting" of the Rhodopes, at a cost of billions of levs, was a reasonable investment The building of the Batak hydroelectric power system alone has spread over an area of 3600 km² (almost 1/4 of the Bulgarian Rhodope territory) and includes 4 reservoirs 70 water intakes 81 km of channels 72 km of tunnels The first stage of the Dospat Devin Vacha system includes 6 reservoirs 47 water intakes 50 km of channels, and 88 km of tunnels

This whole range of activities has taken place in the most forested part of the Western Rhodopes a unique center of endemic and relict plant and animal species Thousands of hectares of typical habitats of valuable rare and threatened species have been flooded or destroyed for construction activities The forest ecosystem typical of the region has been destroyed or flooded over a large territory The internal ecological connections among the species their populations habitats, and ecosystems have been permanently disturbed Streams have been transformed into standing water bodies over the course of tens of kilometers And that has led to fundamental changes in the animal communities connected with the river – full extinction of the species typical of running water and their replacement by species typical of standing water For example many fish eating species – the water starling the grey wagtail the black stork, the otter – are extinct As a result of increasing humidity, the Mediterranean type communities characteristic for the region and rare for the country are replaced by communities typical of the temperate climate The reservoirs have become over tens of kilometers an ecological barrier, and a great number of reptiles and mammals from both sides of the river remain genetically isolated This is one of the greatest threats to the species and their populations

In the spring of 1949, plans for hydroelectric power development began to be carried out in the Eastern Rhodopes The largest of the Rhodope rivers – the Arda – and its tributaries – the Cherna Malka Arda Davidkovska Arda Borovitsa Perperek Krumovitsa Boyuk Dere Varbitsa Oldjakdere Madanska Elhovska and some smaller rivers – were involved The plans provided for the construction of 15 reservoirs and the notorious Ardino project (divided into three parts – the Upper Middle and Lower Arda) In 1957 the first part, the Middle Arda cascade creating the "Studen

Kladenets" reservoir, was completed In 1963 the next dam creating the "Kardzhali reservoir was com pleted Construction of the Lower Arda dam which created the largest of the reservoirs the "Ivailovgrad " was completed two years later

After a pause of about 30 years the 2500 person staff of the monopolistic Energoproekt" organization began a drive to complete their enthusiastic plans for the Arda River A difficult fight to prove the benefit of the dams' existence has ensued The updated proj ect calls for constructing four new dams and reservoirs and five smaller ones along the remaining "uncorrected" part of the Arda River and its feeders The 'cultivation" of the last 60 km of the largest of the Rhodope rivers is now in progress

It is worth mentioning that the greater part of the river included in these plans passes through an unin habited inaccessible almost virgin region containing large continuous areas of plant and animal habitat It is an area, typical of that part of the Rhodope Moun tains that is extremely well suited for creating pro tected areas and opportunities for profitable ecotour ism For example one of the most dense and healthy populations of the symbol of the Rhodopes *Haberlea rhodopensis* (a Balkan endemic and tertiary relict) is found in this area on the river valley rock massifs

The Bulgarian Union for the Conservation of the Rhodope Mountains has taken an explicit stand against the illegal decision of the Supreme Ecological Expert Council at the Ministry of Environment for ap proving and passing along to the next stage the plans for the 'Upper Arda" cascade We have lodged a complaint against that decision in the Sofia Regional Court

8 Other construction

For decades buildings have been raised in the mountains illegally or semi legally but without any or der or plan

Resort complexes are developing spontaneously and uncontrollably Let us take the Pamporovo resort as an example It still has no officially formulated and approved town plan The number of the beds in the complex has increased more than 18 times over the last forty years and new building, reconstruction, and enlargement of the existing structures is now taking place in more than ten areas As a result the 4525 beds that now exist will increase by 1310 New sites for buildings are being prepared as well Trees have been cut down in the central part of the complex for holiday houses for the State Council Trees have been cut down and a road built in Raikovski Livadi area for holiday houses for the Plovdiv Engine Powered Truck Works New cuttings have been planned for the building of hotels At the same time, the ski trails are in miserable condition due to erosion while there is much quarrelling about their possession no one is maintaining them The huge ditch intended for a fu ture ski jump in the "Studenets" chalet region has been a gaping hole abandoned to floods and winds

The water supply of the complex is also an issue The resort buildings were constructed first – and then their water needs were considered At the cost of a cruel amount of nature destruction – the building of a highway like road for 30 km through native coniferous forests – all water sources along the northern slopes of the Perelik massif have been appropriated Only then was serious consideration given to the fact that these waters served the needs of the village of Mugla No body had been interested in the ecological results of the capturing of these waters

The most disturbing fact is that the building of the holiday houses, ski tracks lifts and other structures occurs chiefly on lands in the forest fund (85% of the complex' total territory) This takes place notwith standing the fact that the plantations are referred to as "Special Purpose Forests " Some of the trees in this area are used as seed sources because of their good genetic qualities Pamporovo *is* Pamporovo because of its forest – the chief environmental factor which in combination with the climate relief and high aesthetic value of the landscape provided the original purpose for building the resort But timber cutting in Pampo rovo continues and it has allowed the forest to come to resemble a torn rag, provoking the next tornado that visits to leave behind only the bare and protuber ant concrete palaces

The situation is the same with all the large resorts in the Rhodopes A number of wealthy agencies (and recently private individuals) have already come to dislike the noisy places, and so they build new retreats in the more remote parts of the mountains Conven ient tarmac roads are built to those places Three ille gal buildings have been raised this winter on Snez hanka Peak but nobody has yet established their ille gality And now after Snezhanka, the glances are cast towards Perelik and Persenk

9 Agricultural activities

In 1962 the cooperative farms in the Smolian Chepelare, and Momchilovtsi lands plowed up the al pine pastures and planted them with potatoes The senselessness of that act came to be understood two or three years later, and the potato fields were aban doned Thereafter those ridges of the mountains were subject to intensive erosion

In the lower parts of the Rhodopes where the former cooperative farms grew potatoes fertilizers and pesticides were applied aerially The damage to bio logical diversity especially the large vertebrates and fishes was considerable This problem will decease automatically with the privatization of the agricultural areas in the Rhodope Mountains

RECOMMENDATIONS

1 It is paradoxical that despite their unique natural and cultural values which rank first among the significant regions of the country, the Rhodope Mountains are the only part of the country where a significant protected area has not yet been created It is also a paradox that while national parks occupy from 30 to 100% of the territories of the Vitosha, Pirin Rila, and Stara Planina Mountains, there is not yet a national park in the most significant and easily accessible – and thus most vulnerable – Bulgarian mountains Furthermore protected natural areas in the Rhodopes comprise only 1 2% of the territory

That is why a national park should be declared at once in the Rhodope Mountains The park should include within its boundaries Batak Mountain Svutkia Trigrad Yagodino Karst and Mursalitsa, and should connect through the Pamporovo Rozhen, and Haidushki Poliani with the Prespan part of the Rhodopes including Manastirishte Krushevska Mountain Gradishte Dobrostan, and the Karakulas hills In this way the national park will unite the four Rhodope biosphere reserves – the Kupena Mantaritsa Dupkata and Chervenata Stena – as well as the Beglika Kastrakli Kazanite Shabanitsa Amzovo Soskovcheto and Momchilovski Dol reserves and even the Kazulcherpa reserve The Tumra Batashki Snezhnik, Sokola, Samodivska Poliana Baltaboaz, Trigrad Gorge, Livadite, and Rozhen protected areas as well as the Erkyupria and Buinovsko Gorge natural monuments will also be located in the park territory More than 200 caves will be protected including the Snezhanka Diavolsko Garlo, Lednitsata, Yagodinskata, Bisernata, and many others

The southern border of the park in the region of Trigrad and Pelerik will coincide with the Bulgarian national boundary This will afford the opportunity to create an international park that includes a great part of the Rhodopes' territory in the Republic of Greece A significant part of the eastern Rhodope Mountains as well as some of the westernmost parts may be further added to the park All primary forests that for different reasons, have not been cut down before now, as well as all valuable but unprotected territories will also be included in the park

The park will balance human activities as they affect the existing protected natural areas and will create conditions that promote natural regeneration processes and biological productivity for the ecosystem as a whole The national park will provide an opportunity to introduce scientific approaches to the regeneration and maintenance of forest ecosystems It will contribute to the establishment of a complete system of plant associations in which natural dynamics and mutual relations will predominate It will also contribute to the conservation of the Rhodopes' historical and archeological monuments, and the typical Rhodope culture and style of living

2 New, effective legal barriers need to be established as soon as possible to prevent such activities as over cutting, promiscuous building in all its forms, poaching, intensive mushroom gathering, and all other activities that contribute to the anomalous and unnatural use of natural resources and threaten the stability of the region's biological diversity

3 Means should be immediately secured to institute a broad educational program among the local people who need to understand plainly that, in the end by conserving biological diversity in the Rhodope Mountains they will ensure their own continued existence Without the involvement of the local population as direct participants in those activities many conservation concepts and measures will be doomed if not to failure, then to only partial realization

OPPORTUNITIES FOR UNITED CONSERVATION AND DEVELOPMENT ACTIONS

The soft rolling terrain of the Rhodope Mountains, with its vast pastures, is one of the main reasons they have been inhabited so widely and for so long From ancient times up to our own day stock breeding – principally sheep breeding – has been one of the basic occupations of the Rhodope people The most important quality for beneficial sheep breeding in the Rhodope Mountains is their proximity to Aegean Thrace where the numerous herds of the Rhodope people pastured during the winter Consequently stock breeders could raise their animals with almost no expenses for food – during the summer in the cool Rhodope pastures, during the winter in the region of the Aegean Sea In this way the Rhodope stock breeders have achieved cheap production and high quality

However the progressive destruction of traditional stock breeding practices in the Rhodope Mountains began to be observed after the coercive collectivization of the lands and animals in the Rhodopes after 1957 Now with the reinstatement of private ownership of land in the Rhodope Mountains the conditions are being created for a revival of this traditional occupation of the Rhodope people

Without question, the Rhodope tradition of sheep breeding lies at the base of the natural and cultural heritage that we have received from our ancestors Erosion due to overgrazing of defined territories never existed here because the Rhodope pastures have no boundaries and tacit consent has always existed for the distribution of the pastures among the herds The moderate level of pasturing has hindered the eventual return of the climax vegetation chiefly the forest community to the grass associations which

would otherwise destroy the diversity of species and endemic flora that are so typical of the Rhodope Mountains

Moderate hand mowing – in contrast to the mechanical mowing found in the Alps – also favors conservation of the grass associations, the sheep again being the critical factor

As for the cultural wealth of the Rhodope Mountains neither the fleecy rugs, nor the bells dairy farms woolen mills fairs barbecues camps bagpipes, or songs could exist without sheep

In addition to all that ecotourism may in the future find sheep to be a solid, ecologically clean food base Many of the local people may secure their living by receiving tourists and sheep breeding

RESULTS OF THE SURVEY

The BUCRM carried out a public survey in three Rhodope settlements to provide background information for the national conservation strategy One hundred people from three settlements – a large town, a small town and a village – were questioned The larger town was Smolian the smaller one was Batak and the village was Laki The questionnaires were distributed as follows

Smolian	40
Batak	35
Laki	25

These settlements were not selected accidentally When choosing them we were guided mainly by their proximity to rich centers of biological diversity, mainly protected natural areas (reserves, protected areas etc) The four biosphere reserves in the Rhodope Mountains (the Chervenata Stena Mantaritsa Kupena, and Dupkata reserves) the nature reserves Momchilovski Dol Soskovtcheto Shabanitsa, Kastrakli Izgorialoto Gyume Kazanite and Beglika, and many other protected areas where the floral and faunal wealth of the Rhodope Mountains is concentrated rare located in or near a triangle marked by Batak, Smolian and Laki

Our general impression from the survey is that despite the presence of these natural areas, almost all of those surveyed (excluding professionals and others some how involved in biology – foresters, biologists, etc) are unclear about the meaning and scope of 'protected areas and sites " Very often the term "reserve' even "nature reserve " is confused with hunting reserve " while the terms "protected area' and "national park are either unknown or are used without an understanding of their real meaning

The fact that questions 3 4, 5, 6 7 and 8 were left unanswered in many of the questionnaires is an indication of this low level of nature protection literacy Question 17 was also often left unanswered or was answered abstractly confirming the low level of ecological literacy and interest in at least half of those questioned

It should be mentioned here that the questionnaires were also offered to people of more extensive intellectual training Otherwise if we had relied on randomly chosen people most of the questions would have been left unanswered

That is why *educating local people* on ecological issues and nature protection, which we believe to be a basic need needs to be undertaken at appropriate levels People must be able to respond to the questions put to them (For example the animals and plants in Survey Question 1 are placed in the same sub question According to this logic, the animals should decrease and the plants increase, or vice versa, in a specific region)

It should also be noted that no one from the three settlements who was asked to fill out the survey refused to do so Moreover a definite interest in ecological and knowledge about nature protection exists in the people The most important aspect of this, in our view is that education of the local population in the direction of so called sustainable (ecological) development will help to conserve biological diversity and provide for the use of natural resources in a manner that is in harmony with nature

Our impressions from carrying out the survey were written before the questionnaire results were received and processed We provide this information without corrections, so that we may compare our direct first hand impressions to the results of the questionnaires The results themselves are provided here in the order of the questions

1 ***How do you appraise the condition of the environment in your region?***

The interesting fact is that regarding soil and air quality the number of people surveyed who consider their region polluted is almost equal to the number who consider their region clean But in terms of waters the number of the people who regard them as polluted exceeds by almost three times the number who consider them clear On this basis we may conclude that of the three basic components of the environment – soil air and water – the waters are the most polluted in the part of the Rhodope Mountains that was surveyed Sixty one percent of those surveyed are of the opinion that the animals in their region are decreasing Only 6% think that they are increasing The other 94% are certain that the animals have not increased The conclusion is indisputable according to the local people the animals are decreasing

2 ***Do you have hunting reserves in your region?***

and

3 ***Do you know about the protected natural territories in your region? (We unite the comments on these two questions because the first had been asked in order to distinguish hunting reserves and nature reserves)***

While 89% of those surveyed know about the hunting reserves, and only 8% were unaware that there

were such reserves in the region, only 69% know about the protected areas (which are much greater in number within the territories surveyed) Twenty per cent stated that there are no protected areas in the vi cinity and 8% did not know Our impressions about the low level of information and the urgent need for an educational policy in this direction was thus con firmed

4 ***If you have an impression, what would you estimate the number of visitors to the reserves to be?***

Notwithstanding the fact that this question in our view was not well formulated (visiting the reserves is forbidden but such is not the case with the national parks, protected areas, and historical places) only 3% know that entrance to the reserves is forbidden Most of the answers were along the lines of "little impres sion," "insufficient impression,' "no impression " or "I cannot appraise "

5 ***Do you visit the national park or the reserve?***

and

6 ***What do you usually do there?***

The survey revealed that 18% of the people visit the reserves frequently (as still there is no national park in the Rhodope Mountains), and 36% visit them rarely This proves categorically that the reserves are mistaken for recreation and tourism sites And most of the people enjoy nature (22%) or hiking (19%)

7 ***Please list four things that you liked most when you visited the park/reserve***

and

8 ***Please list up to four things that you did not like when you visited the park/reserve***

A multitude of interesting answers were received to both questions Twenty seven of the one hundred people surveyed enjoyed the virgin natural surround ings 9 enjoyed the silence 10 the animals, 9 the plants 7 the unpolluted air and 6 the beauty of nature Five people disliked the improper management of the area 3 the poor guarding 5 the cutting of trees 2 the throwing out of waste and only one mentioned poaching

9 ***What in your view would be the effect of privatizing the agricultural sector on the wild animals and plants in your region?***

The answers to this question (and subquestions) are rather contradictory Thirty three percent of those questioned shared the opinion that pollution would in crease after the extension of the agricultural sector (57% did not answer the question) Forty one percent of the same sample believed that privatization would increase the opportunities for reasonable utilization of the environment (48% did not answer the question) Twenty three percent thought that it would create pos sibilities for conservation of wild nature (66% did not answer the question) The answers to this question support in principle the stand of the BUCRM for the revival of sheep breeding in the Rhodope Mountains

10 ***In your estimation, do the small private enterprises (like dairy farms, woodworking and craft enterprises, service enterprises, etc) threaten the forests, wild plants, and animals?***

Sixty percent of those questioned were explicit that small enterprises do not threaten biological diver sity which coincides again with the stand of the BUCRM

11 ***If land is returned to you, how would you use it?***

Thirty two percent of those questioned have no land or did not answer the question Seven percent have not decided yet what to do with the land Nine percent will rent it, 11% will deal with agriculture, 4% will breed animals and 29% will join in a cooperative

12 ***Do you think that the development of tourism, connected with the protection of and education about wild plants and animals (ecotourism), has a fu ture?,***

and

13 ***If you think that ecotourism is appropriate for your region, what do you think it would contribute to?***

Ninety five percent of those surveyed believe that ecotourism has a future in the Rhodope Mountains That definitely coincides with the opinion of the BUCRM This statement is also supported by the an swers to the following question Respondents stated that ecotourism would contribute to

▪ conservation of wild nature	57%	(28%)
▪ protection of threatened wild animals and plants	18%	(55%)
▪ opening of new work places	60%	(34%)
▪ expanding of the private sector	37%	(53%)
▪ incomes for the region	61%	(38%)
▪ ecological education and culture	56%	(41%)

Only 4% answered that ecotourism is not appro priate In order to get the full idea about the answers to these questions the number of those surveyed who did not answer the corresponding sub question is shown in brackets next to the result

14 ***In your view, are wild plants and animals threat ened by activities like _____ ?***

The answers to this question confirm the stand of the BUCRM in favor of sustainable development of the Rhodope Mountains The following activities were not seen as threats to biological diversity

▪ tourism	51%	(24%)
▪ animal breeding	46%	(36%)
▪ agricultural activities	44%	(41%)
▪ small enterprises	39%	(34%)
▪ the returning of private property	41%	(32%)

Forty six percent (32%) of those surveyed an swered that construction threatens biological diversity

15 ***In your opinion, have any changes come in the state bodies and laws concerning conservation of the envi ronment?***

Eighty one percent of those surveyed expressed the opinion that there have been no changes in the laws Ninety one percent claim that no funds have been provided to protect the environment Eighty nine percent answered that no changes connected to environmental conservation have taken place in the local state bodies These answers allow us to state that radical changes are needed in the legal foundation funding and activities of the local state bodies as they concern conservation and the environment

16 ***Can you identify at least two ways to use natural resources so that they may yield a profit to your region?***

The answers here were interesting and rather varied but all support the position of the BUCRM in favor of sustainable development in the Rhodopes Thirty nine percent of the answers referred to tourism 10% to stock breeding and 2% to the wood industry Others were distributed among natural medicinal treatments herbs mushrooms wild fruits hunting fishing, etc

17 ***Is there a natural site (plant, animal, territory, cave, rock, etc) that in your opinion should be con served?***

The answers here are very interesting Two re sponses ranked first, with 5 citations each "the entire Rhodope Mountains" and "the wood grouse " Three people answered "the forests " Almost all the popular wood animals, the lilac, the caves and several natural and cultural sites typical of the corresponding regions received single answers The most frequent general answers (the entire Rhodope Mountains and the for ests) confirm the position of the BUCRM for con serving the Rhodope Mountains in their totality with regard for both the natural and cultural features One of the answers – 'the Kemer Bridge in the 'Dupkata' reserve" – is a revealing example of the situation in the Rhodopes The Roman bridge is so woven in with the wild landscape that it is considered a natural site

Copies of this report have been sent to all the lo cal branches of the Union The other NGOs involved in the development of the national biodiversity conser vation strategy, some international organizations (WWF, IUCN CIPRA, etc), and various other or ganizations and administrations will also receive it Appropriate extracts from the text will be published in the "Rhodope News " a daily newspaper in Smolian and in other regional Rhodope newspapers

The Biological Diversity of the Black Sea Shelf Along the Bulgarian Coast and Its Adjacent Landscape

Rumyana Peteva

INTRODUCTION

This report which has been prepared by the Independent Society Ecoglasnost Varna draws upon confirmed data about the biodiversity of the Black Sea coast The data have been collected by Bulgarian and foreign scientific experts who have investigated the dynamics, condition and threats inherent to this region Part I focuses on 1) the biological diversity of the Bulgarian Black Sea fish species, 2) the biological diversity of the Bulgarian Black Sea plankton and benthos and 3) the floral diversity of the Bulgarian Black Sea coast Part II examines the specific biotic factors economic and tourist functions, and anthropo genic pressures in three zones – the Black Sea coastal region the inland waters and the inland landscape, forest massifs, and protected areas – based on scientific data from experts and conversations with selected individuals In this report, the sea shelf and inland landscape are differentiated to allow discussion of the protected areas some of which are inland, and also of those regions where the ecological balance between the sea shelf and the adjacent landscape has been destroyed by a variety of human activities

PART I

1 The Biological Diversity of the Bulgarian Black Sea Fish Species

At present, about 46 families and 126 species of fishes have been described for the Bulgarian Black Sea Some of these however have been reported based on observations of single and unique specimens Therefore their actual presence in the Bulgarian Black Sea is doubtful The Bulgarian ichthyofauna could be more precisely specified through seasonal observations made annually or episodically

The Bulgarian Black Sea fauna consists mostly of seasonal migrating fish that spend winters in the Sea of Marmora or along the Anatolian Black Sea coast The classification made by Rass (1987) based on the catalog *North East Atlantic and Mediterranean Fish* (Kloffham 1973) is widely accepted as one of the most precise pictures of the Black Sea s fish diversity

According to the statistics the death rate among the Black sea fishes is affected to only a slight degree by the Bulgarian fishery with the exception of the anchovy (*Engraulis encrasicholus*) At the same time populations of some species have been significantly reduced due to extreme fishing pressures on the part of Turkey and the states of the former Soviet Union In particular the populations of anchovy, mackerel (*Scomber scombrus*) and turbot have been reduced over the last several years

The earliest research on the Bulgarian Black Sea ichthyofauna dates to 1920 There was at that time no specialized institute for marine research, and these first studies were mainly descriptive in nature intended to present the general outlines of the Bulgarian Black Sea flora and fauna (Drenski 1923) The treatise *Bulgarian Fish* (Drenski 1951) describes some species that were unique for the time *Squalus blainvillei* (Risso), *Asipensei nudiventris* (Lovetzky) and *Lichia amia* Specimens of these species were caught near Sozopol and Varna The contemporary species *Conger conger* and *Serranus cabrilla* are also exceptionally rare

In 1964 after extensive research into the taxonomy and biology of fish the work *The Black Sea Fish* was published (Stoyanov et al) The book listed 135 fish species belonging to 49 genera Twenty three (23) of these species were representatives of freshwater ichthyofauna whose habitat included the littoral lakes and the mouths of the rivers that fed into the Black Sea Especially notable is the family Gobiidae, which includes 19 representatives of 9 genera Since 1992 netting of fish from this family has been prohibited

Georgiev (1966) continued the tradition of scientific research on the Gobiidae and listed 23 species The species added by Georgiev to those listed in *The Black Sea Fish* were *Gobius buccichi* (Steindachner) *Neogobius platyrostris* (Pallas) *Neogobius kessleri* (Gunter), and *Benthophiloides steliatus* (Sauvage) The last two are representatives of the freshwater ichthyofauna and are found in the Danube River and in some littoral lakes

Manolov (1970) listed 11 species of the family Sparidae To the 8 species listed in *The Black Sea Fish* he added *Dentex dentex Pagelus erythrinus Diplodus vulgaris* (Geoffrey St Hilaire) and *Oblada melanura*

In *The Black Sea Fish* Stoyanov reported on the *Pagellos mormyrus* = *Lithognatus mormyrus* for the first time Since no one has seen this species in the last 10 years it is assumed to be very rare The same conclusion is valid for *Dentex dentex Diplodus vulgaris* and *Oblada melanura*

Prodanov and Chachev (1987) reported an immature specimen of *Merluccius merluccius* near Sozopol caught during the spring trawling

From these observations it can be concluded that part of the Bulgarian Black Sea fish fauna consists of unique and rare specimens that visit the Bulgarian waters only on occasion

Of the total of 126 species 24 are Pontic relicts 9 originated in the Atlantic Ocean, and 93 are Mediterranean migrants Only one species is catadromous while the anadromous fish are represented by 8 species Sixty two Black Sea fish species migrate between the open and coastal waters, while 64 species migrate between the southern and northern Black Sea The sum total of fish species that spawn in pelagic (open sea) waters is 66 About 27 29 of these spawn in Bulgarian waters 17 19 spawn near the coast and 10 in the open sea Forty nine species spawn on the sea bottom about 41 42 of them in Bulgarian waters There are three species of viviparous fish, two in Bulgarian waters – one close to shore and the other in the open sea Of the 7 species in which the males bear roe in sacks (located in preanal openings), 6 inhabit the sea shelf and only one occurs in the open sea With the exception of 6 species that spawn in the autumn and winter all the fish spawn in the spring and summer Most of the fish species spawn near the coast – making them more vulnerable to pollution

Thanks to detailed studies by many Bulgarian ichthyologists – Stoyanov, Nickolov, Georgiev, Ivanov Kolarov Kolemanova Karapetkova Prodanov Mihailov Daskalov etc – the main fish characteristics that determine their economic importance have been defined They are reproduction length increase of weight with the increase in age and the degree of interest in that particular fish species Continuous and regular observation and control of the size age, and sex ratio of the anchovy mackerel belted bonito (*Plamis sarda*) turbot and other species, and studies of the dynamics of the fishery fishing pressures the ichthyoplankton (eggs and larvae) and the structure of the Bulgarian Black sea fish populations have been conducted Based on these observations and studies concepts for the rational utilization of fish resources have been worked out During the last few years research has concentrated on the effects of anthropogenic pollution on the Black Sea and the effects of fishing on the most abundant species (such as anchovy) These studies have shown that the number of fish species has declined rapidly with the appearance and spread of the new species of ctenophore

International efforts focusing on the Black Sea show mixed results Measures to protect the Black Sea from pollution are not well coordinated A number of countries – Bulgaria, Romania the states of the former Soviet Union – have participated in developing and signing the Convention Concerning Fishing in the Black Sea (1960), and in setting fishing standards and undertaking scientific research Turkey has refrained from signing the agreement The Former Soviet Union did not have a representative attending the General Council on the Mediterranean Sea Fishery

2 The Biological Diversity of the Bulgarian Black Sea Plankton and Benthos

The so called secondary eutrophication of the Black Sea is due to the influx from the large deep rivers of great quantities of nitrogenous and phosphorous compounds as well as other components of organic and non organic origin These contribute to the rapid seasonal development of phyto and zooplankton blooms

Since the phyto and zooplankton are mainly represented by short lived quickly reproducing organisms, the accumulations of dead matter can be impressive As dead matter falls to the sea bottom or to a thermocline zone and begins to decay, it takes up oxygen and deprives organisms of the adjacent pelagic waters of the possibility for further development

As an ecological category the zooplankton includes that portion of the sea fauna whose temporal or permanent habitat is located throughout the water mass or is concentrated in part of it Consequently the zoo plankton are part of a pelagic biocenosis, assuming an intermediate niche in the complex trophic chain The different zooplankton species with their varied quantity distribution biomass, and productivity play a special role in transporting surface energy to the sea bottom Naturally the appearance and duration of conditions favorable for different phases of zooplankton growth depend upon changes in biotic and abiotic factors

The Bulgarian Black sea zooplankton fauna includes representatives of the Protozoa, Coelenterata Nemathelminthes Ammelides Mollusca Arthropoda Chaetognata, and Chordata The species that comprise each of these groups were not determined as of 1952 Subsequently (until 1959) all zooplankton typical for the Bulgarian Black Sea were identified and described with the exception of the Infusoria (Roussev and Dimov, 1959 Dimov 1960, 1963, 1964 1966) In 1976 the same scientists compiled a new list of the typical fauna again excepting the class Infusoria (Konsulov, 1976) Not until 1990 was a full fauna including the Infusoria drawn up (Konsulov 1991)

The spread of the newly arrived ctenophore *Mnemia mccradyi* (Mayer 1900) has been an important factor affecting the stability of the plankton community over the last four or five years These organisms are about 14 cm long They are predatory feeding on mesoplankton of all kinds and on the eggs and larvae of pelagic fish During the summer, this species reaches a density of 285 specimens per m^3 in inshore waters in littoral lakes (Varna Lake) it exceeds 450 specimens per m^3 (Konsulov, 1986) The high degree of eutrophication, which this species requires for its growth and rapid reproduction is the reason behind its settlement in the Black Sea and its invasion of the Black Sea inshore waters *M mccardyi* presents a serious threat to both fish and zooplankton

species diversity

In terms of species richness, the Black Sea zooplankton could be characterized as average The diversity within some groups, such as Ctenophora is low The incidence of rare species is also low *Pontella mediteranea* is one of the rare species The composition and quantity of bottom larvaton as part of the zooplankton (mesoplankton) has an important bearing on the maintenance of a rich variety of benthic fauna The mesoplankton are represented by *Lammelibranchia veliger Castropoda veliger Cirripedia cyprus Polichaeta* larvae and others

Trawler fishing, especially in the shallow shelf areas constitutes a great danger to the macro and mesoplankton The concentrated growth of zooplankton of the subclass Copepoda on the bottom layers causes a significant build up of detritus Bottom trawling disturbs the fine slime films of the gravelly sea bottom which kills the mesoplankton Later the silt settles and covers the eggs of the Cladocera and Copepoda This could explain the 80% reduction in the number of *P avirostris* over the last decade This type of fishing also leads also to the churning up and diffusion of radioactive elements that are buried in the fine sediments (Konsulov 1991)

The diversity of zoobenthos in the Bulgarian Black Sea is quite well known According to the latest data (Marinov 1990) the number of zoobenthic species amounts to 1370, belonging to 12 major taxonomic groups (Protozoa Porifera, Coelenterata Plathelminthes Nemathelminthes, Nemertini Annelida Arthropoda Mollusca, Tentaculata Echinodermata and Chordata) Arthropoda is the most diverse of these with 492 species (of which 204 belong to the Herpacticoida) The worms constitute the second most diverse group with 338 species (102 Polychaeta and 109 Nematoda) Taking into account the fact that some groups – Protozoa Oligochaeta Turbellaria etc – have not yet been well studied it can be assumed that the number of benthos species is actually much higher than the current total

Three biocenotic groups of species have been differentiated the supralittoral the mediolittoral and the sublittoral These are further divided into 12 zoocenoses identified by the species and quantities of zoobenthos within them The greatest variety of species has been observed in the sand sublittoral (142 species) and rock sublittoral (123 species), followed by the mytilusis slime (90 species) the phazeoline slime (60 species) and the inshore slime (47 and 42 species in two subcenoses)

The scientific literature provides ample data about the planktonic and benthic diversity of the Bulgarian Black sea region Several points are worth noting

- There are full lists of the variety of plankton and benthos species living in the shallow sea shelf However still too little is known about the micro pelagic fauna that plays such a great role in the process of eutrophication

- The rock sublittoral community is known to be one of the most species rich, but research in this area has been concentrated on the northern coastal region Consequently, very little is known about the southern coastal region

- The community of "cistus" type plants is also highly diverse Since its development depends on the spread of the kelp *Cystoseira barbata*, investigations should concentrate on discovering its exact contemporary range

- The construction of dikes has resulted in some negative processes that have influenced species richness

- The spread of the predatory *Rapana thomasiana* was long considered to be one of the important destructive influences on the mussel fields Since 1990, *Rapana thomasiana* has been collected as a food fish and for this reason its numbers and distribution should be examined This species is important in its relation to the black mussels and in terms of the structure of the benthic community

In terms of species diversity the Black Sea zoobenthos is of average richness when compared to the world's other large expanses of water The aquatic zones of utmost ecological importance are those occurring between the 10 15 m isobars These are shown in Map 11 These areas are easily affected by human activities, e g trawling and coastal constructions (including dikes piers etc) Such human activities present the most important contemporary threat to biological diversity both in the shallow shelf and in the hydrogen sulphide rich layers below 150 m These facts suggest the urgent need for protective and restorative measures To protect the biological diversity of the Bulgarian Black sea region

1) trawling should be prohibited
2) sea construction should not be permitted without ecological analyses prepared by marine experts
3) Bio filters should be implanted to support and shield benthic organisms and communities and
4) aquatic protected areas should be established in territories that are important sources of benthic and planktonic larvae

3 The Floral Diversity of the Bulgarian Black Sea Coast

The inland zone of the Black Sea includes the near shore landscape the inland area affected by the Black Sea (about 30 50 km) and the easternmost parts of Strandzha Mountain

The inshore flora includes 149 rare species 49 can be seen only in the Black Sea coastal region Thirty eight species are threatened by extinction and the habitat of 15 of them is the coastal region Three species are listed as extinct *Halimione portulacoides Tetragonolobus maritimus*, and *Veronice euxina* Out of a total of 190 species, the following are protected *Tulipa uromoffii*, *Tulipa hageri* ssp *thracia*, *Poncratrium maritimum*, *Anemone silvestris*, *Nympheae alba*, *Nupha lutea*, *Motiole voloratissima*, *Cercis soliquostrum Hippopnae rhamnoioles Trapatatans* sp Most of these species are of limited distribution, and thus require enforcement of strict measures for their protection

We recommend that the following Black Sea species be given protected status *Bromus lanceolatus*, found only near the village of Sinemorets, *Agropyrom litorale* found along the sea sand border *Aegolops lorentii*, found near Burgas Lake, *Schoenoplectus litoralis*, found near the marshes of Dourankoulak and near Varna Lake *Schoenoplectus triqueter* found near the inshore marshes, *Acorus calamus*, found near the mouth of the Kamchya River, *Cressa cretica*, found near the southern sea marshes, *Artemisia pedemontana*, found in the steppe region of Dobroudzha *Urospermum pitrocroides*, found only near the village of Sinemorets, and *Reichardia picroides* found south of Ahtopol

The following typical species could be classified according to phytogeographic influence

A Submediterranean *Carpinus orientalis*, *Ficus carica Paliurus spine christi*, *Colutea arborescus Jasminum fruticais*, *Ruscus aculeatus* var *ponticus*, *Plumbego europaea*

B Pontic *Fagus orientalis*, *Scilla bithynica*, *Trachystemon orientale*

C Steppe species (Southern Dobrudzha, near the Kaliakra Cape) *Stipa lessingiane*, *Peonia tenui folia Adonis volgensis Iris pumila*

D Euxinian and Caucasian species *Stachycus angustifolia* (Strandzha) *Astragalus cornutus* and *Astragalus glaucus* (the steppe region near the Kaliakra Cape)

A number of ecologically important plant and plant communities are found in the Black Sea coastal zone

A "Loggos" (Greek for "desolate spot in a forest") Forests *Fraxinus oxycarpa Ulmos minor Clematis vitalba Periploca graeca Hedera helix Vitus sylvestris Smilax excelsa*

B Psammophytes (sand areas) *Elymus arenarie Crambe maritima*, *Eringium maritimum Stachys maritima Cakile maritima*

C Halophytes (salted soils) *Suaeda maritima Bossia hirsute Solicornnte europea*

D Hydrophytes (water expanses and boggy areas) *Phragmites australis*, *Geratophyllum demersum*, *Nymphaea alba*

The oak species *Querus hartwisiana* is found only on some sites in the Strandzha region It has a peculiar understory companion – the evergreen *Rhododendron ponticum* The cerris oak and Eastern beech are found in the same region

One of the most aggressive of the "invader" species in the region is the so called "water plague " an American native that is found in the freshwater lakes, in the Danube and in the littoral lakes This species is now widespread, and presents a problem for shipping and fishing

PART II

This part of the report has been prepared on the basis of the information provided by the Independent Society Ecoglasnost Varna This information includes data from experts in different scientific fields and insti tutes whose activities directly or indirectly involve the environment from conversations with randomly selected people, and from conversations with people who are knowledgeable about and directly concerned with natural resources (e g , fishermen hunters herb harvesters pharmacists doctors)

This report is relatively subjective in that our judgments are organized on the basis of impressions from numerous discussions with the people mentioned above The nature of this report has also been influenced by the direct impressions and personal experience of the report's author As far as most of the issues are concerned, an effort has been made to gather information representing different points of view including those that are contrasting and even mutually exclusive Difficult and embarrassing questions have been asked and the information included here draws upon not only the answers received but upon evaluations of their authenticity In preparing this report, discussions were held with experts from the Regional Inspectorate of the Ministry of Environment (Water Supply and Sewage) the Institute of Oceanology, and the Regional Directorate of the Committee of Forestry – Varna, representatives

of the local and provincial authorities of the Ministry of Environment in Varna and Sozopol and ordinary people from the above mentioned towns and the villages of Rossen Izgrev Varvara, and Sinemorets

As a general conclusion it can be stated that the most complete scientific information is available for the Varna region the regions from Sozopol south, and the eastern parts of Strandzha Mountain Less information is available for the regions between Staro Oryahovo (the Black Cape) and the town of Sozopol The information about Bourgas and the adjoining region cannot be considered sufficient due to the presence of specific factors such as the large seaport and the salt producing and petrochemical plants In assessing specific biotic factors economic and tourist functions and anthropogenic pressures, three basic zones have been examined the Black Sea coastal region the inland waters and the inland landscape, forest massifs and protected areas

1 The Black Sea Coastal Region

In terms of its ecological status the Bulgarian Black Sea coastal region is quite overwhelmed To the east it includes the sea coast and its large shallow shelf the biological diversity of which has been studied relatively well To the west of the coast line lay the inland landscape, including the coastal lakes connected to the sea Blatnitsa, Shablenska Lake near Shabla the lakes near Varna, Vaya Lake and the Mandra reservoir The most important Black Sea areas from an ecological point of view are those 10 to 15 meters deep where the sand bottom and rocks are very rich in species

Kelp is especially important for maintaining biological processes and equilibrium It adheres to the bottom and creates a feeding environment through its cover of phytoplankton for zooplankton and for many fish species The zooplankton in turn, are food for fish and very important in the regulation of general biological processes The kelp and the biological communities of the sea bottom and rocks provide food and cover for the reproduction of many migratory and non migratory fish mussels, crustaceans, microorganisms and other forms of sea life The mussel fields are a powerful purifying filter of the sea waters

Several factors have contributed to the ecological disequilibrium and abrupt decrease in biological diversity in the Black Sea coastal region One critical factor has been the mass invasion beginning 20 30 years ago of *Rapana thomasiana* from the Mediterranean This organisms s massive destruction of mussel fields has brought about an acute shortage of the black mussel as an economic resource and as an active ecological factor As a result it has become necessary to create artificial mussel farms Since 1990 people have began to harvest *Rapana thomasiana* for use as food, mainly in the export trade That was the year that social factors became more important influences on the equilibrium of the Black Sea coast and inland habitats The active harvesting of the *Rapana* led to a great decrease in its biomass and made necessary the revaluation of its importance as a food source its relation to the black mussel, and its role in the structure of the benthic communities

Another new and very aggressive invader from the Atlantic Ocean is the previously mentioned species of Ctenophora (a special kind of medusa) Its populations grow very quickly and actively, creating vast biological masses (these masses can even impede navigation) Why does this Ctenophora upset the ecological balance? It feeds on zooplankton, which is also food for the fish (directly or indirectly) It thus becomes a great competitor with the fish for food At the same time, it also feeds on fish larvae, decreasing the reproductive capacity of fish populations

One of the main reasons for the Black Sea's present ecological disequilibrium is water pollution The pollutants include domestic and industrial wastes from ships, beaches and rivers, and organic and toxic elements (magnesium potassium, heavy metals, radioactive substances phosphorus nitrates nitrites, phosphates oil products) from freshwater basins rainwater underground waters and waters used to meet household needs For example 50 000 t of oil products flow into the Black Sea from the Danube every year The toxic elements decrease fish po pulations and drive out both the permanent residents and migratory species The organic macroelements – phosphates and nitrates – enrich the feeding envi ronment along the coast through eutrophication The resulting mass destruction of zooplankton allows the microflora to flourish Eutrophication and the rapid increase in phytoplankton biomass leads to a higher rate of decay and the removal of oxygen from the water (hypoxia) Eutrophication is considered to be the major reason behind the successful invasion of the Ctenophora, which is not native to the Black Sea Eutrophication has thus harmed living conditions for fish in three ways by fostering the appearance of an invasive rival, by increasing the level of destruction of fish larvae, and by allowing frequent repetition of the process of hypoxia Experts and fishermen think that some fish species such as sprat (*Engraulis encra sicholus*), react by accelerating their reproduction cycle – a kind of genetic response – to maintain necessary numbers

There is an objective burden upon the Black Sea that should also be mentioned – the presence of hydro gen sulphide in the water at a depth of about 150 m Life below this 150 m level is impossible Due to the movement of the sea waters, this limit is variable In this case, the west wind is of basic importance When it blows intensively for 7 10 days, large surface water

masses are moved far out to sea and the deep waters surface and reach the shore During these periods the hydrogen sulphide forces fish out If this process coincides with a phytoplankton bloom and a hypoxia event serious consequences can ensue In the autumn of 1992 people gathered whole buckets of turbot on the beaches

Another human activity namely coastal construction harms and destroys valuable biological communities near the shore that play very important roles in the maintenance of ecological equilibrium If strict controls and expert assessments are not required the construction of coastal fortifications, together with the process of privatization and the construction of coastal tourist projects, will increase pollution and direct destruction of coastal habitats

Along with eutrophication the greatest threat to the ecological equilibrium of the Black Sea is fishing and especially trawler fishing Notwithstanding the fact that bottom fishing is forbidden Bulgarian and foreign ships frequently fish with bottom trawls Equipped with nets whose meshes measure 6 mm the trawlers plow the sand and rocks, releasing the hydrogen sulphide The trawling ships gather mussels *Rapana thomasiana* seaweeds and the smallest fish, shrimps and spawn Divers say that there is no region along the coast that has not been plowed by trawlers Sometimes fishing ships from the north and south meet and thus gather up everything along the entire coast This is how young turbot and the spawn of other species of basic economic importance for Bulgaria have been destroyed

Out of a total of 126 fish species 64 migrate south to the Sea of Marble and the Anatolian part of the Black Sea and 62 reside permanently in our region The turbot is in its reproductive phase from 15 April to 30 May and should not be fished during this period Observations indicate that there is an abrupt decrease, to varying degrees, of almost all fish species Fishermen from the southern coast think that species like the turbot shad belted bonito blue fish and even the grey mullet and about 22 goby species have decreased and almost disappeared The Black Sea mackerel has certainly disappeared since 1969, due to the poor conditions for reproduction The Mandren goby faces the same situation The belted bonito and the blue fish have maintained their biomass levels but according to catch data from the Sea of Marble, their northern spring migratory population has decreased substantially compared with the southeastern population According to experts this is due to the fact that strong swimming predator species – such as the blue fish and belted bonito – are highly sensitive to water pollution

Scad and sprat are fished in our sea shelf region only during their migrations, but their numbers have also declined The sprat spend the winter along the Ukrainian and Anatolian coasts (in the north and south respectively) Industrial fishing is highly developed in these regions especially in the winter when the fish are not so mobile As a result of continuous over fishing between 1989 and 1991 the catch of sprat has declined drastically in these years There have been warnings of strange spots and wounds on the skin of some specimens (scad) These are thought to result from contact with radioactive or highly toxic substances

In summary, the Bulgarian Black Sea coast and adjacent shallow sea shelf are subject to intensive anthropogenic interference (especially trawler fishing and eutrophication) resulting in almost complete destruction of the sea bottom communities This results in changes in the diversity, quantity, and reproductive capacity of biological resources Anthropogenic pollution of the Black Sea, together with the preexisting burden of hydrogen sulphide places it first among the endangered water basins of Bulgaria Various measures have been proposed to address these problems including strict application of existing laws and statements establishment of efficient fishing controls and inspections the prohibition of trawler fishing controls on coastal construction establishment of protected areas in the sea (such as important larvae sources) formulation of a new international convention introduction of strict quotas and introduction of legitimate tenders at the fishing exchange

2 The Inland Waters

This category includes lakes dams rivers, under ground waters industrial and domestic waters and city sewers These waters are treated separately since they are major highways connecting various regions zones and habitats They are the major means of transportation for elements and substances of vital importance for the biota They are also major direct distributors of pollution

The problem of inland water pollution in the Black Sea region results from three main types of human activity The problem of industrial pollution is of greatest importance We will use Varna as an example since the information available about this area is detailed and can be taken as symptomatic of other areas The factories at Varna have low capacity sewage treatment stations and were not designed according to modern environmental standards The major pollutants are the chemical plants in Devnya, Belosslav and Povelyanovo There are also benzine flows coming from the Thermal Power Station at Varna (The one exception of all the plants in the area is the Sugar Plant in Devnya) The victims of these pollutants are the Varna and Belosslav Lakes which have long been biologically dead In addition however, their waters are directly connected with those of the Black Sea The Storage Battery Plant in Targovishte is a significant polluter (heavy metals) of

the Kamchia River

Cattle breeding is the second major source of water pollution and directly affects sources of drinking water Due to a serious lack of water purification stations on cattle farms non purified waste waters pour into the various water basins The same holds for the underground waters as nitrates, phosphates, and other macroelements used in farming are dissolved and washed away by rains to appear subsequently in water basins and mineral springs The Kamchia reservoir, which is the primary source of drinking water for Bourgas and a secondary source for Varna is an example Water and sewage experts have stated that the "Komounari hydro project should not divert waters from the highly polluted Gorna Kamchia River into the Kamchia reservoir This reservoir, as well as other sources of drinking water for Varna have old and low capacity purification stations During droughts drinking water is drawn from the reservoir that does not meet sanitary standards

The third main pollutant is waste water from everyday household activities in cities and small towns One of the major problems at the Kamchia reservoir is the lack of purified water provided to the town of Kotel The city of Varna discharges too much impure water Rainwater overflows onto the beaches In fact impure waters from Evksinograd to Sunny Beach pollute the Black Sea

3 The Inland Landscape, Forest Massifs, and Protected Areas

The different regions of the inland coastal envir onment have different ecological problems The most polluted areas are the urban and industrial zones in the cities of Varna and Bourgas The cleanest are the villages of Varvara and Sinemorets, where recent zoning efforts have restrained the development of tourism Other unpolluted regions are the eastern parts of the Stara Planina Mountains and Strandzha Mountain because of their extensive forests and lack of active industrial activity However the pollution of the beach line especially along the urban beaches and in the southern camping regions (e g Kavatsi the Eden Inlet and the protected Snake Island) needs to be pointed out

A specific problem in the town of Sozopol is construction with radioactive stone materials from the coal mines The gravel under the road asphalt in this region is also radioactive Another factor – the precipitation of radioactive particles along the shores – is due to constant flowing of the Danube and the Dniestar The whole situation although insignificant for tourists is serious for the people who live there They suffer the highest rates of illness – cancer diabetes high blood pressure – in the country

A boundary zone established to the north of the village of Sinemorets was abolished three years ago As a result during the last three years the beaches and especially the Veleca River have been polluted by all kinds of waste products from tourists The bottom of the river is covered with bottle glass People cast their nets from bank to bank all along the river The fish there are disappearing, as are the otter and various other kinds of aquatic animals

A major problem for all forests is urbanization – construction, development aggressive tourism Experts claim that this is has caused the desiccation of trees and bushes Several other factors contribute to this drying – polluted air, leaves falling parasites fires Many poor people, mostly minorities (Gypsies) cut down trees for firewood and some sell the trees at the market in Dobrich Another serious factor in the forests' destruction is the pasturing of wild pigs and goats Most of the forest massifs along the Black Sea coast are reforested artificially since the conditions for natural reproduction do not exist

The populations of tortoises, hedgehogs and especially hares have been greatly reduced due to the use of fertilizers in cultivating fields and farmland There is a recurrent increase in the number of fallow deer and red deer The greatest invader of the forests is the Strandzha jackal Its high population has allowed it to inhabit all forests even in Dobrudzha Abandoned and feral cats and dogs are also serious invaders of the forests Several rare plant species – the forest cyclamen, the torfaceous snowdrop the Caucasian cowslip many steppe species – have diminished The situation is the same for many birds of prey – the Cinereous vulture, the imperial eagle the buzzard The great bustard has almost disappeared near the villages of Zmeevo and Kremena but can be reintroduced if people stop cultivating the land with fertilizers The sand dune zone can also be restored if the natural status of the sand dunes remains the same

The protected areas along the Black Sea coast include the Sea Garden in Varna (a city park insuffi ciently protected from urbanization and pollution) and the Golden Sands and Kobaklaka National Parks near the town of Dobrich (which are highly urbanized) Another protected area in the Shabla Lake region is highly polluted by lead shot Dourankulak Lake is another marvelous natural feature The preserves along the Black Sea coast are Perla, Arkutino Ropotamo Kaliakra Cape Baltata, and Kamchia (a UNESCO Bio sphere Reserve) Other preserves in the Varna district are Tiganka, Varbov Dol, Kalfata, and Valchi Prohod Snake Island near Sozopol is also protected The real problem for the protected areas is that they are not actually protected from tourist assaults Protected natural sites like Lavskata Glava Suhoto Darvo and Malka Kaleitsa are not being preserved The very mouth of the Ropotamo River is enclosed by embankments blocking it to fishing boats and causing it to be covered with slime The river is gradually becoming marshy The water lily torfaceous snowdrop and white Kamchia lily are disappearing The new purification station on the Batova River emits smells from its purifying filters The unique cacti on Snake Island are pulled out and stamped flat by tourists Near

Albena resort in the dense forest there are large new tourist homes There are rumors about organized hun ting in some reserves and serious corruption among the foresters in the hunting husbandries

As a result of improvements of the Kamchia river, it no longer floods the dense forest This is responsible for the appearance of Dutch elm disease which causing great damage to elms and ashes

The legal basis for environmental protection in this region includes 1) the Environmental Protection Act, 2) the Nature Protection Act and 3) the Law For the Protection of the Air Waters and Soil From Pollution These matters are also partially discussed in the Law of Territorial and Settlement Structure and the Law of the Mines and Pits Environmental protection is also dis cussed in several international conventions, including the Ramsar Convention and the Berne Convention Some of the most urgent measures have already been mentioned Modern laws and acts are also needed, as is strict self control by the state of its economic and industrial activities in relation to ecological conditions Other needs include commitment to international conventions including the signing of the Black Sea convention by all interested countries introduction of 'ecopolice' and a system of controls to guard against corruption substantial international funding of environmental projects and the activation of ecological education programs

RECOMMENDATIONS

To protect the diversity of species in Bulgaria in cluding the Black Sea coast the following needs should be addressed

1 Construction along the Black Sea coast should be stopped

This type of activity obliterates the natural habitats of plant and animal species For example, the forest area in the "St Constantine" resort just above the "Geologist" resort hostel, was divided and distributed among people in accordance with the decrees of the Council of Ministers Afterwards villas were con structed in this area thus destroying the natural habitat of rare orchids and herbaceous plants The unending construction along the Black Sea coast is unacceptable from the point of view of ecology and landscape planning This process threatens the appeal and significance of the national resorts Typical examples in this respect are the "St Constantine" and "Albena" resorts

2 Pollution should also be stopped

Often pollution is caused by the high numbers of visitors at particular Black Sea regions Apart from halting the polluting process, the number of people that visit threatened regions should be regulated

3 Land (including agricultural land) management plans should be developed

The use of coastal forests is currently determined in the respective forest planning projects Only in urgent cases can amendments be made arranged according to the specific projects But plans for the use of all other threatened lands (including agricultural lands) have not been established so far

Land use plans should prohibit the lighting of fires which often causes burning of field borders (this process has increased in frequency during the last few years), the burning of reeds which destroys the natural habitats of many birds, the destruction of the natural topography of fields and rock formations that present opportunities for survival and protection of many species and illegal chopping of wood and cutting of shrubs, as well as the illegal gathering of wood fodder

Limits should also be placed on grazing practices Pasturing of goats, sheep, and sows has increased in the last two or three years and has penetrated not only the coastal regions but also the national parks Unregulated grazing of stock with its negative influence upon natural biological diversity constitutes one of the most significant contemporary problems and the implementation of effective administrative countermeasures is of utmost importance A typical example of this is the destruction of trees and shrubs in the industrial zone west of Varna, near the Vuzrazhdane district and in the Vinitsa district There are illegally built sheep and cattle sheds in the gullies in these districts The extreme grazing pressure activates erosion processes which are especially sig nificant in the Vinitsa district (as well as some other places)

4 Special attention should be devoted to the protection of ravines

Apart from protected areas and the lands for which management plans are applied, some ravines near Varna and along the Black Sea coast also require special treatment The protection of these ravines is of extreme importance for the preservation of the local biodiversity

5 Strengthen the role of zoos and botanical gardens

The greatest effort should be made to preserve Bulgaria s biological diversity through the strengthening of the nature protection functions of botanical gardens and zoos These organizations could administer reserves and protected areas on the condition that they receive practical assistance and could contribute greatly to the preservation and restoration of Bulgaria's biological diversity

Appendix 1 Protected Sites in the Black Sea Region

National parks
Zlatni Pyasutsi

Biosphere reserves
Kamchya Uzounboudzhak

Natural Reserves
Ropotamo, Silkosya, Arkoutino, Morski Pelin
Morski Lylii, Zmiiski Ostrov, Pyasuchna Lylia,
Vulchov Prohod, Vurbov Dol, Kirov Dol, Baltata,
Kaliakra

Appendix 2 Typical Species According to Habitat Types

Sand coast
Invertebrates *Ophelia bicornis, Tethina cinorea*
Vertebrates *Bufo viridis, Lorus orgentatus, Gelochelidon nilotica*

Rocky coast
Invertebrates *Littorina neritoides, Pachigraphius mormoratus Aphrosilus venetor*
Vertebrates *Notrix notrix, Locerta murelis, Columba linia*

Salted soils
Glenenthe ripicole, Lispe cosaguinea, Bledius spectabites

Steppes
Invertebrates *Bradyporus desypus, Cicindela hybrida C cunuleta*
Vertebrates *Aquiia orientalis, Perdix perdix, Testudo hermani*

Loggos ("Remote forests")
Invertebrates *Agrion scutulum, Pholcus ponticus*
Vertebrates *Rona dalmatica, Emys orbiculeres, C copeolus*

Beech forest with evergreen understory
Columber jugolaris, Certhia jannlitis, Glis glis

Mixed oak forest
Invertebrates *Acneria dispar, Scolopendra cingulata*
Vertebrates *Dryomys niteadule, Nerus lugoboris Lacetra preticola pontica*

Littoral lakes
Dephina longispina, Limocephelus vetulus, Artemia salina Nitocra jallaciole

Birds
Phelecrocorex pygmeeus Pelicanus crispus Acrocephelus orundineceus, Ardea purpurea, Ixobrichus minutus

Appendix 3 Rare and Threatened Species

Rare species
Polidiceps rubricalis
Phoenicopterus raieus
Monachus monachus

Threatened species
Pelobetes sicicus balcanicus
Clenis caspice erubata
Elophes setule
Phalocrocoran aristotelis
Ciconia nigra
Cignus alor
Pernis arivorus
Heliaeetus pernetus

Report of the Green Balkans Movement on the Bulgarian National Biological Diversity Conservation Strategy

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INTRODUCTION

In accordance with the objectives defined by the coordinators of the national conservation strategy the experts of the Green Balkans Movement gathered together to summarize their information on biodiversity in Bulgaria and to prepare the present report The structure of the report is such that, in addition to serving as a contribution to the NBDCS, it can be used as a guide for all of those who are interested in the protection of biological diversity in our country It may also be helpful for specialists and regional authorities of the Ministry of Environment (MOE) in carrying out their duties We hope that the new system for managing protected areas that we propose in this report will be taken into consideration by the executive and legislative bodies

The report includes summaries and proposals directed especially to the problems connected with protecting natural ecosystems and biological diversity in general in Bulgaria Because of time and space limitations emphasis is placed on the protection of rare endemic, and threatened taxa and on unique communities in the biogeographical regions of South Bulgaria and the whole Bulgarian Black Sea coast Section 1 discusses trends in the populations of threatened taxa of plants reptiles and amphibians, and bats, and proposes recommendations for their preservation Section 2 reviews the biogeographic regions of Bulgaria and proposes recommendations for improvements in the national system of protected areas Anthropogenic threats required legislative and constitutional changes, the possibilities for integrating conservation into planning and other topics are discussed on a national level in Sections 3 4 5 and 6 of the report We also present commentary on the results of a sociological survey of the population in Blagoevgrad Bansko and Dobrinishte

Information sources This report is based on studies (both published and unpublished) by the authors, expert evaluations, data from the published literature data from expeditions carried out by members of the Movement and other sources Preference has been given to new information about the state of the biota that has not yet been published and to expert evaluations that have practical application for the protection of biological diversity

Methodology for obtaining information The authors presented their information according to a preliminary plan developed by the managing editor This information was later elaborated and expanded

Criteria of selection and manner of presentation To realize better the goals of this report and to make it useful as a reference book for specialists in the field of nature protection we have made some changes in the order and titles of the assigned topics As noted above, we have focused on rare, threatened, and endemic species characteristic for South Bulgaria and the Bulgarian Black Sea coast We have adopted for the purposes of this report the regional distinctions presented by Gruev in his work *General Biogeography Science and Art* (1988), in which the basic regions are further divided into subregions The subregions are similar not only in the composition and origin of their biota, but because of their comparable climate and landscape are also similar in terms of the effects of anthropogenic influence

In discussing each of the groups – plants, amphibians, reptiles, etc – we have specified selection criteria Specific recommendations with regard both to legislative and institutional changes and to the actual habitats are given after the discussion of each group Using biogeographical divisions, we discuss the biodiversity for each region under the following format

- species richness, rare and threatened species species typical for the region, unique communities, seasonally important habitats ecosystems and large biocenotic complexes
- vulnerability to the anthropogenic factors specific to the region
- summary of information and recommendations for new protected territories (all territories recommended for protection are denoted with a code number and letter)

[1] The Council of Representatives of the Green Balkans Movement appointed Hristo Nikolov head of the author's body and managing editor of this report In addition to the other principal authors listed here assistance was provided by Martin Marinov Simeon Martin, Dimitar Dimitrov Elena Tzvetanova, Antonia Batchvarova Kalina Tzvetkova Jivko Djakov Kiril Bedev and Ivan Petrov Hristo Nikolov Petko Tzvetkov and Elena Tzvetanova served as editors of this report

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1 TRENDS IN THE POPULATIONS OF THREATENED TAXA AND RECOMMENDATIONS FOR THEIR PRESERVATION

A Plants

Bulgaria is an especially interesting countries from a floristic and phytogeographic point of view It is lo cated in the temperate continental zone but occupies a transitional position within it The country is under the influence of the Mediterranean climate from the south The Rhodopes rise against that influence, but it penetrates along the river valleys of the Maritsa, Mesta, and Strouma Rivers and in the region of Strandzha Mountain In these areas, the Mediterra nean influence is seen in the occurrence of evergreen brush communities (pseudo maquises), which include such species as *Phillirea media* L , *Quercus coccifera* L *Juniperus excelsa* Bieb and others accompanied by *Molineria minuta* Parl *Imperata cylindrica* P B , *Cory nephorus canescens* (Pourr) Breistr , *Parvotrisetum myriantum* (Bertol) Chrtek *Euphorbia apios* L *Pterocephallus paposus* (L) Coult , *Logfia gallica* (L) Cos son et Germ *Medicago coronata* (L) Bartl , and many other grasses

There are places called "Mediterranean oases' in our country where as a result of phytogeographic and orogeographic conditions the Mediterranean species play a dominant role in the formation of plant com munities Such places include the Tchepan and Golo Bardo Mountains in southwestern Bulgaria the Belo gradtchik Nimbus in northwestern Bulgaria, and Tri grad and Tchervena Stena above Batchkovo in the Rhodopes Areas with submediterranean vegetation occur along the valleys of the Maritsa, Mesta, Strouma Rivers and in the Gornotrakiiska lowlands The char acteristic woody species here include *Quercus pubes cens* Willd *Juniperus oxycedrus* L *Paliurus spinachristi* Mill *Fraxinus ornus* L , and *Jasminus fruticans* L , which form forest communities or grow in groups with a large number of Mediterranean grass species

Our flora is also influenced by our proximity to Asia Minor This accounts for the presence of Front Asian and Pontic species which form (especially in the Strandzha region) a distinctive flora and vegeta tion Most characteristic of Strandzha are the forests of *Fagus orientalis* Lipsky which and some species that have been classified as threatened in the *Red Data Book of the People's Republic of Bulgaria* Some species not in cluded in the *Red Data Book* or in the *Atlas of the En demic Plants in Bulgaria* are also discussed They are species new for our flora, having been identified subsequent to the publication of these books

The species are presented here in three groups annual and biennial grass plants, perennial grass plants, and trees and bushes Limiting factors degree of study, safety measures and proposals for protection are discussed at the end of each group's description

Annual and Biennial Grass Plants

1 *Silene caliacre* D Jord et P Pan A Bulgarian en demic It grows on rocky (lime) sites north of the estuary of the Rezovska River and along the Black Sea coast between the villages of Shabla and Kranevo

2 *Medicago bondevii* Koz A Bulgarian endemic It grows in the xerothermal oak forest zone in dry grassy and bushy places on eroded maroon forest soils and on chalky rock substrates It can be found in the Kresna gorge the eastern Rhodopes and in the Thracian plain

3 *Medicago coronata* (L) Bartl Can be found in dry grassy and stony places on leached maroon forest soils and chalky rock substrates It is known from the Strouma River valley (Kojuh hill), the eastern Rhodopes, and the Thracian plain

4 *Ammania verticilata* (Andr) Lam This species was found once in 1893 between the villages of Kamenovo and Ezerovo (near Bourgas) and was never seen again

5 *Astrodaucus litoralis* (Bieb) Drude Grows on the sands around Varna Ahtopol and the village of Sinemoretz (Bourgas region)

6 *Turgeniopsis foeniculasea* (Fenzl) Boiss Grows on talus slopes with a limestone rocky base Can be found in the Rhodopes (Assenovgrad) the village of Markovo the town of Kritchim and in the Thracian plain

7 *Verbascum purpureum* (Janka) Hub Mor Grows in sunny and rocky places in the xerothermal oak forest zone It is found along the Black Sea coast and in the Sakar hills

8 *Verbascum adrianopolitanum* Podp A Bulgarian endemic Grows in dry, grassy, and sunny places in thin xerothermal oak forests Small, isolated populations can be found in the eastern Stara Planina Mountains, the eastern Rhodopes and at Strandzha Mountain

9 *Aegilops dishasians* (Zhuk) Humpfries Grows in dry grassy and rocky places pastures, and along roads individually or in small populations It is found in the Sakar hills and in the Svilengard re gion

10 *Aegilopus comosa* Sibth et Sm This species was found in May 1992 by Professors St Dimitrov and D Delipavlov It is new for the Bulgarian flora Grows in dry grassy places with shallow soil on lime rocky substrates It can be found in the hills between the village of Pastusha and the town of Perushtitsa and between the Ognianovo train sta tion and Novo Selo in the Plovdiv region

11 *Parvotrizetum myryanthum* (Bertol) Chrtek A new species for the Bulgarian flora too Grows on the southern slopes of the Kojuh hill in Struma valley on dry rocky places with shallow soil

12 *Corynephorus divaricatus* (Pourr) Breistr Grows on sandy soils Can be found in the valley of the Strouma and near the village of Kulata in the Bla goevgrad region

13 *Anchusa macedonica* Deg et Dorfl Grows in dry grassy and rocky places on gravelly soils together with *Juniperus excelsa* Bieb It is a new species for the Bulgarian flora and can be found to the west of Kresna

Some of the species in this category are distrib uted along the Black Sea coast, while others are found in the interior of the country Important limiting fac tors for
the Black Sea species include excessive tourism tram pling of vegetation contamination of the beaches, and contamination of the soils As for their population dy namics we note that nearly all of these species are poorly investigated and the density and distribution of their populations are not well known The limiting factors for species from the other floristic regions are excessive grazing and trampling, the plowing of the natural grass communities, the draining of wetlands road resort, and industrial construction activities ap plication of chemicals in agriculture and the picking of herbs and flowers Studies of the reproduction, de velopment and populations of these species are inade quate, and in fact the degree of investigation generally of these species is insufficient In order to preserve the species listed above (which are not as yet legally pro tected) they must be added to the list of protected plants Protected areas should be declared in at least one of the locations for all of the mentioned species

Perennial Grass Plants

1 *Minuartia rumelica* P Pan A Bulgarian endemic Grows in dry rocky and grassy places on lime stone terrain between the town of Tchirpan and the village of Shishmantzi (Thracian plain)

2 *Minuartia bulgarica* Vel A Bulgarian endemic Grows in rocky dry places in the xerothermal oak forests above 1600 m a s l in the central and east ern Stara Planina Mountains Tchepan, Vitosha, Rila Sredna gora Sakar, and Iambol Bakadzhik

3 *Noccea rhodopensis* F K Meyer A Bulgarian endemic Grows on lime rocky terrains on hu mus carbonate soils in the xerothermal oak forest zone It is found in the central Rhodopes near Batchkovo and Asenovgrad

4 *Medicago rhodopaea* Vel A Bulgarian endemic Grows in dry grassy, and rocky places on lime substrates It is found in the central and eastern Rhodopes, the Thracian plain the Tundzha val ley and the eastern Stara Planina Mountains

5 *Bunium ferulaceum* Sibth et Sm Grows along or in small groupings in dry grassy places on the shallow gravelly soils of the eastern Rhodopes, neighboring the towns of Kurdzhali and Mom chilgrad In the beginning of this century it was collected by the Czech botanist Podpera in Chal tepe Eastern Rhodopes, but it has never been found there since then

6 *Apium noddiflorum* (L) Lag Grows in marshy and swampy places on the Black Sea coast, near Varna and Bourgas

7 *Centaurium maritimum* (L) Fritsch Grows in forest glades and shrubby places in the xerother mic oak forest belt It is found to the south of the town of Ahtopol in the region of Strandzha mountain

8 *Cressa cretica* L Grows in moist, salty clay near the village of Primorsko in the Bourgas region

9 *Convolvulus holosericeus* Bieb Grows in dry places with shallow, gravelly soils in the neighbor hood of the villages of Chouchouligovo and D Spanchevo, in the Blagoevgrad region It has not been collected since 1932

10 *Onosma thracica* Vel A Bulgarian endemic Grows in dry grassy places on limestone terrain on humus carbonate or leached soils in the xerothermic oak forest zone It is found at the Black Sea coast in northeastern Bulgaria, Eastern Stara Planina, the Znepolski region and the Thra cian plain

11 *Anthemis jordanovii* Stoj et Acht A Bulgarian endemic Grows in dry grassy places on shallow soil with lime base Found at Strandzha Mountain

12 *Achillea thracica* Vel A Bulgarian endemic Grows in dry grassy places in thin brush on maroon forest soils in the xerothermal oak forest zone It can be found in the Thracian plain and the Sakar hills

13 *Centaurea immanueles* – loewii Deg Balkan endemic Grows on eroded, shallow maroon forest soils in the southern Pirin Mountains and the Strouma River valley

14 *Colchicum diampolis* Delip et Ceschm A Bulgarian endemic Grows in damp glades and forests upon deep alluvial or alluvial meadow soils Found in the Tundzha valley (the Iambol and Aitos regions) and the Znepolsky region (Kiustendil)

15 *Tulipa splendens* Delip A Bulgarian endemic Grows in corn fields and field borders in the xerothermal oak forest zone on deep black earth (humus) soils on silicate base It is found in the area of Iambol

16 *Tulipa aureolina* Delip A Bulgarian endemic Grows in dry grassy places and thin brush in the xerothermal oak forest zone south of Aitos

17 *Liparis loeselii (L) Rich* Grows in damp boggy places A single community with *Osmunda regalis L* has been found It is found near the village of Eleshnitsa in the Petritch region (Strouma River valley)

18 *Hypericum setiferum* Stef A Bulgarian endemic Described in 1929 from Mladezhki halm Plovdiv It has not been seen since

The limiting factors for the representatives of this group from the Black Sea coast are the same as those affecting the annual and biennial grass plants For species from the interior of the country the limiting factors include excessive grazing trampling soil erosion channelization of streams, construction of resort villages mining activities extraction of minerals dam and dike construction and road construction Protection measures for the species in this group are the same as for the annual and biennial grass plants

Trees and Shrub Plants

1 *Ephedra campilopoda* C A Mey Grows on sunny rocks in the Strouma River valley (Damianovo) in the Blagoevgrad region

2 *Salix pentandra* L Glacial relict Grows in boggy places in the coniferous forest zone Found only on Vitosha Mountain

3 *Salix retusa* L Glacial relict Grows in rocky places in the alpine zone of the Rila Mountains

4 *Salix hastata* L Grows in the Rila Mountains on rocky places in the alpine zone

5 *Quercus coccifera* L Pre glacial relict Grows in the Strouma and Mesta River valleys and on the southern slopes of the Pirin Mountains It prefers dry slopes with erosive terrains of forest soils with silicate and lime base

6 *Quercus hartwissiana* Stev Pre glacial relict Grows on temperate damp soils along the rivers of Strandzha Mountain

7 *Quercus mestensis* Bond et Gan A Bulgarian endemic Grows on the southern slopes of the Rila Mountains to the west of the village of Belitsa in the Sofia region

8 *Spiraea salicifolia* L Grows in damp places by the Dospatska River near the village of Sarnitsa in the western Rhodopes

9 *Spiraea crenata* L Grows in gravel and rocky places on carbonate humus soils It is found in northeastern Bulgaria between the Kaspitchan rail way station and the village of Pliska

10 *Spiraea hypericifolia* L Grows among other shrubs in the xerothermal oak zone on humus carbonate soil Can be found on the Karasivria peak near Stara Zagora

11 *Pyrus bulgarica* Kutath et Sachok A Bulgarian endemic Grows on dry terrains in the xerothermal oak forest zone of the east Stara Planina and Strandzha Mountains

12 *Amygdalus webii* Spach Grows in dry rocky places in the southern part of the Strouma River valley on Kojuh Hill near the town of Petrich and west of the town of Sandanski

13 *Sorbus borbasii* Jav Grows on temperate damp soils in the beech forest zone It can be found in the central part of the Rhodopes (near Smolian), Sredna gora and in the central Stara Planina Mountains

14 *Sorbus mougeottii* Soy et Gord Grows in the beech forest zone on temperate damp soils It is found in the central Stara Planina Mountains at Korudere and near the village of Ravnogor in the Plovdiv region

15 *Genista pilosa L* Grows on dry grassy and rocky places mainly in the oak zone It can be found in West Stara planina and in Vitosha

16 *Genista germanica* L Grows in grassy glades on brown forest soils It is found in the western Rhodopes (Semiza peak and Shiroka poliana)

Important limiting factors for these tree and shrub plant species include the excessive cutting of the forest livestock grazing (especially as it affects the young plants) trampling soil erosion and occasionally fire The degree of research for some of these species is in sufficient To protect them, it is necessary to determine more precisely where they are located to secure some of these sites as protected areas

Summary and Recommendations

The unique Bulgarian flora includes about 3500 species of plants The endemic species are of greatest interest Bulgarian endemics amount to 128 species while there are another 36 species of Balkan endemics that are found most typically in Bulgaria We are of the opinion however that 10 15 more species that have been described in the recent years can be included in this list We have also included some endemic species discovered in the last few years that can be considered new for the Bulgarian flora In addition to the endemic plants some of the species listed as threatened in the *Red Data Book of the People's Republic of Bulgaria Volume I* are discussed in our work

Over the last 70 80 years, more than 30 species of plants have disappeared from the Bulgarian flora and an equal number of species are classified as threatened' due to a broad spectrum of negative factors The most critical of these are "meliorative' activities (such as the plowing up of natural grass communities and the draining of wetlands and river flood plains) extraction of minerals construction of dams and dikes logging industrial resort and road construction activities the application of chemicals in agriculture picking of herbs and flowers, soil erosion excessive grazing and trampling by live stock

1 The status of the following species of plants in the *Red Data Book of the People's Republic of Bulgaria* should be changed from 'rare to threatened" *Juniperus sabina Salix hastata Rhododendron myrtifolium Calluna vulgaris Saponaria stranjensis Erica arborea Amygdalus webbii Ilex aquifolium Daphne pontica D laureola Chamaecytisus frivaldzkyanus Astragalus aitosensis* and *A thracicus*

2 The locations of the following plant species should receive immediate protection by declaring new protected areas or expanding existing areas

- *Cachrys alpina, Astragalus wilmottianus Tulipa urumoffii Erysimum comatum*, and *Edraianthus serbicus* (on Tchepan hill, near Dragoman)
- *Turgeniopsis foeniculacea Gypsophila tekire, Aegilops comosa, Merendera rhodopaea* (in the Besaparskite hills between Plovdiv and Pazardzhik)
- *Noccea rhodopaensis Medicago rhodopea Turgeniopsis foeniculacea* (Korudere near the location of *Tulipa rhodopaea* at Lalebair),
- *Sorbus borbasii S mougeottii* (near the village of Tarnitchene village in the Stara Zagora region)
- *Allium montanum, Seseli bulgaricum* (Korudere)
- *Bunium ferulaceum Tulipa rhodopaea* (on Dambla peak near Momchilgrad)
- *Ribes nigrum, Spiea salicifolia* (near the village of Sarnitsa in the Sarnitza River valley)
- *Valeriana simplicifolia, Ligularia sibirica* (Krus cheto Pirin Mountains)
- *Lilium rhodopaeum* (at Livadeto near the village of Sivino the Smolian region and a small population near the village of Progled Pamporovo
- *Utricularia minor* (Dragoman wetland),
- *Taxus baccata* (central Stara Planina western and central Rhodopes and Strandzha Mountains)
- *Juniperus oxycedrus* (in the Vatcha River Valley, Kritchim),
- *Salix hastata* (on the Iosifitca and Riletch peaks in the Rila Mountains),
- *Rhododendron myrtifolium* (near the "Koziatastena" hut/chalet Stara Planina Mountains)
- *Hippophae rhamnoides* (at Galata near Varna)
- *Astragalus thracicus* (in the western part of Bakadzhitcite Iambol region)
- *Pyracantha coccinea* (in the region of Kosty Gramatikovo and M Tarnovo in the Strandzha Mountain area), and
- *Allium stojanovii* (the only location for this species is west of the village of Kiten)

3 *Ex situ* plant conservation efforts should be strengthened in the following ways

- The parks 'Vrania ' "Evksinograd,' and 'Krit chim" should be given the status of botanical gardens The Green Balkans Movement to gether with Plovdiv University and the Agri cultural University would be able to undertake management of the botanical gardens in Plovdiv and Kritchim

- The Ministry of Environment in cooperation with the Ministry of Education, Culture, and Science, and the Committee on Forests, and with the help of local and international spon sors and foundations, should provide means for creating new botanic gardens in Plovdiv, Varna and Sofia Such facilities will help to preserve the national genofund and will pre vent valuable plants from disappearing

- The Ministry of the Environment should in clude in its programs concrete projects, with secure financing, for realization of the above proposals

B Amphibians and Reptiles

With regard to the status and conservation of the two large vertebrate classes *Amphibia* and *Reptilia*, we believe that it is very important and necessary to stress the following facts

1 On the whole both of these classes have been studied to a very unsatisfactory and insufficient degree within Bulgaria The various local inves tigations of these groups do not give a clear and adequate description of their population and ecol ogy for the entire territory of the country

2 Most studies have been carried out using subjec tive and outdated methods

3 Nearly all studies have been concerned with specifying the species present their taxonomic classification, or their geographic distribution within the borders of Bulgaria Studies at a higher level (i e , population biocenotic, and ecological) on species within the two classes or on the classes as wholes have been occasional or do not exist at all

4 Most of the research data are relatively old and lacking in relevance to the current state of these classes

These facts give us serious reason to think that nearly all representatives of these classes are inade quately understood in terms of their ecological and population status in Bulgaria Because of these facts, their role in preserving biodiversity and the biological equilibrium of the natural and cultural ecosystems of this country cannot be specified

The most significant and general criteria for se lecting species from the two mentioned classes are

1) They have limited distribution within Bulgaria

2) They have a comparatively high degree of im perilment

3) They have low population density

4) The representatives of these classes have low eco logical plasticity and are specialized to certain changing but limited parameters and conditions of life

5) Because of the lack of typical Bulgarian relict and endemic representatives, we do not use these char acteristics as criteria for setting priorities We rec ommend, however, that in determining the strategy of nature protection with regard to animals from the classes *Amphibia* and *Reptilia* consideration be given to the presence in the Bulgarian herpetofauna of species that in Europe can be found only on the Balkan peninsula As examples we can cite *Pelo bates syriacus balcanicus, Mauremus caspica rivulata Ophisaurus apodus thracius Ophysops elegans ehrenbergii Typhlops vermicularis vermicularis, Eryx jaculus turcicus*, and *Coluber rubriceps rubriceps*

Class *Amphibia*

Order *Anura* Family *Pelobatidae*

Pelobates syriacus balcanicus

Few in number spotty distribution In addition to locations mentioned in the *Red Data Book of the People's Republic of Bulgaria* and in the specialized literature, three new locations have been discovered along the Danube and the northern Bulgarian Black Sea coast (Stoianov 1987 1989) For the country as a whole, the species is insufficiently known The brief study by Stoianov (1986) of the population in the Kresna region is an exception Limiting factors draining of wetlands, land recla mation, and destruction of the food base with in secticides Status considerably lower numbers than that of the other salientians in the locations Leg islative changes
changing the species status from "threatened" to "strongly threatened with extinction "

Order *Caudata* Family *Salamandridae*

Triturus alpestris alpestris

Present in isolated, spotty locations A glacial rel ict Not studied in Bulgaria Limiting factors draining and contamination of the lakes and pools it inhabits and the planting of these with perch (*Perca fluviatilis*) and trout (*Trutta furis*) Ac cording to personal observations and information from the literature the population in some of the locations is acceptably high, while in others it has been reduced to a dangerous minimum

Class *Reptilia*

Order *Testudinata*, Fam *Testudinidae* Fam *Emydidae*

We place highest priority on the species *Testudo hermanni hermanni*, *Testudo graeca ibera*, and *Mauremis caspica rivulata* The last has the most limited distribution in the country for species in this order The populations of the first two spe cies have decreased alarmingly in Bulgaria over the last decades (literature information and per sonal observation) Relatively well preserved habitats exist only in some of regions of Bulgaria The three species can be considered poorly in vestigated in terms of their biology and ecology over the Bulgarian portion of their range Data about their populations are imprecise Limiting factors poaching changes in the landscape in tensive development of transportation and others Legislative changes include *Testudo h hermani* and *T g ibera* in the category "threatened "

Order *Squamata* Suborder *Sauria*, Fam *Angulidae*

Ophisaurus apodus thracius

A species with limited distribution in Bulgaria There have been virtually no studies of it The information on newly found locations are the ex ception Limiting factors tourism poaching transportation development changes in the land scape It is listed as "threatened " Because of the absolute lack of information we recommend that the protection measures in the Bulgarian *Red Data Book* be adhered to until the populations have been better studied

Suborder *Serpentes*, Fam *Typhlopidae*

Typhlos vermicularis vermicularis

Sporadically distributed Knowledge about this species is very limited There are some reports that provide "by eye" evaluation of populations of the species and some information about its biol ogy Limiting factors changes in the habitats and transportation related developments This species is listed in the *Red Data Book of People's Republic of Bulgaria* as "rare " According to unsubstanti ated data, we can expect the boundary of its dis tribution to move north Regional measures for the protection of the biotopes inhabited by the species are required

Fam *Boidae*

Eryx jaculus turcicus

A sporadically distributed species Not studied at all in Bulgaria Probable limiting factors changes in the landscape and poaching The species is listed in the *Red Data Book of the People's Repub lic of Bulgaria* as "rare " Legislative changes in Europe, this species can be found only in the Bal kans, and its preservation must be a matter of the highest priority We recommend that all of its known locations be promulgated as protected ter ritories

Fam *Colubridae*

For the sake of brevity, we shall discuss six species from this family together *Coluber rubriceps Elaphe situla*, *E quatuorlineata*, *Malpolon monspessulanus*, *E longissima*, and *Telescopus fa lax* It is possible to discuss them together due to similarities in their biology Their distribution is quite limited and with some exceptions (*E q sauromates* and *E longissima*) they occur mainly in southern Bulgaria Information about some of the species and subspecies (*C r rubriceps*, *E q sauromates*, and *T f fallax*) can be considered completely lacking Some data on the biology and population of the other taxa can be found in the works of Beshkov which describe the populations at Malashevska Mountain On the whole, how ever, these species are unstudied In general the most important limiting factors are intensive trade poaching and various changes in the land scape they inhabit Three of the species have been listed in the *Red Data Book of People s Re public of Bulgaria* as "threatened" (*C r rubriceps E l longissima* and *E s situla*) and two as rare' (*T falax* and *E q quatuorlineata*) One (*M mon-spressulanus*) does not have protected status

Summary and Recommendations

It must be noted that the above mentioned representatives of the families *Typhlopidae* and *Boidae* and those from the family *Colubridae* which we have given high priority in this work, occur in only a few small populations as compared to all other species of the suborder *Serpentes* This plainly suggests that changes must be made in a future edition of the *Red Data Book of the People s Republic of Bulgaria Volume II (Animals)* We propose the following changes

1 The subspecies *Elaphe quatourlineata sauromates* should be listed in the *Red Data Book* under the category "threatened "

2 The species *Malpolon monspressulanus* should be listed in the *Red Data Book* under the category rare

3 The status of *Telescopus fallax* should be changed from "rare to threatened "

Because of time and space limitations we cannot present all of the available and required information on these and other species, or on this group as a whole
We believe that as the national biological diversity conservation strategy is prepared and implemented this information is not only desirable but obligatory The Green Balkans Movement has prepared a report in which all of this information is presented The experts of our organization have made a decision that this report should be placed at the disposal of all who would like to become acquainted with this information

The chief limiting factors for the amphibians and the reptiles are intensive human activity near their habitats poaching from foreign and native collectors burning of vegetation in the wetlands and other changes in the landscape

Another significant problem is that there have been no young specialists working in the area of field herpetology in Bulgaria for the last several decades We do not believe that there is a lack of people interested in working in this area However, there does not exist a scientific group for the study and preservation of amphibians and reptiles Neither can the necessary scientific literature in this area be readily found in Bulgarian Many enthusiasts with a desire to protect amphibians and reptiles gather rare species for artificial breeding and reproduction without having knowledge of the appropriate conditions

The economic crisis of the last few years has forced some people with limited environmental awareness to start trading in rare species of reptiles Not the least of these activities has been the gathering and breeding of vipers (*Vipera ammodytes*) for their venom This has taken place without any controls and in the absence of data about their populations The government has not made any effort to get this situation under control

The basic problems in preserving the herpetofauna result from the lack of an adequate foundation of contemporary legislation that takes into account faunistic and population studies It is urgent that penalties for killing amphibians and reptiles be increased several times over – enough to make them higher than the prices of the animals in the pet shops in western countries and to reflect the inflation processes in our economy We would not be mistaken in saying that the inspectors in
the Regional Authorities of the MOE lack the knowledge necessary to perform their protective functions In addition, the time they are able devote to this problem is insufficient due both to the lack of available time and the vastness of the regions for which they are responsible The border control checkpoints and customs procedures constitute a weak link in the chain of enforcement

We are not able here to discuss all the problems connected with the status and needs of the amphibians and reptiles, but we have specialists and volunteers available to participate in working on and carrying out a complete program for the study and preservation of the herpetofauna

C Bats

As a group the bats are poorly understood by the public They belong to the order Chiroptera More than 1000 species are known They can be found on all the world's continents and in a wide range of biotopes Of the 30 species that are found in Europe 28 are known to occur in Bulgaria This group, so important a part of our vertebrate fauna has been poorly studied due to its nocturnal habits the inaccessibility of its dwelling places and the difficulties involved in observing and catching them (which requires specialized tools and techniques) For these reasons the few studies that have been carried out until now concern mainly species composition and distribution Information about bat ecology (e g , density, dynamics of populations inter specific relationships) is extremely limited and for most species is entirely lacking

These unique creatures – as vulnerable and defenseless as they are – require our active protection!

(Note the categories of threat used in the following species accounts – "threatened 'vulnerable " "rare " and "not threatened' – follow the definitions in R E Stebbings *The Conservation of European Bats*, London 1988)

Family *Rhinolophidae*

Rhinolophus blasii Rh euryale Rh mehelyi

These three species will be discussed together due

to of the similarity in their biology and distribution They can be found throughout the country, but more often in the southern parts Exclusively cave inhabitants they form comparatively large colonies often with other cave dwelling species Information about their distribution and biology is incomplete Status these species are classified as "vulnerable" because many dwelling sites can be easily approached

Family *Vespertilionidae*

Myotis myotis M blythi

These two species will also be discussed together because of their similarities They are distributed throughout the country are typically found in caves and are highly colonial species There are often may as many as several thousands of individuals in the colonies It is well known that they migrate between winter grounds and summer breeding areas Status "vulnerable" due to the destruction of their dwelling sites and (even more) because visitors to the caves kill them The populations of the colonies has strongly decreased in some regions of the country

Myotis capaccinii

This species is encountered relatively often, and forms large colonies (as many as ten thousand individuals) It undertakes long migrations between its winter and summer grounds Status we place this species in the "vulnerable" category It is listed in the *Red Data Book of the People's Republic of Bulgaria* as rare "

Myotis emarginatus

Found in the southern parts of the country inhabiting caves galleries and rock outcrops Often forms mixed colonies of 200 500 individuals In the winter it may migrate into Greece Status we are inclined to classify this species as "threatened" due to the easy accessibility and lack of protection of its dwelling places It is listed in the *Red Data Book of the People's Republic of Bulgaria* as "rare '

Myotis bechsteinici M nattereri M mystacinus M brandti and *M daubentoni*

These five species occur in Bulgaria but information about their distribution and biology is totally lacking We place them in the 'rare' category

Plecotus austriacus

Distributed throughout the lower elevations of the entire country Often inhabits buildings and, more rarely, galleries, hollows, and caves Studies of their biology have never been carried out in Bulgaria Status we place this species in the category "not threatened "

Plecotus auritus

Only a few representatives of the species have been identified in Bulgaria from the mountainous regions A "rare" species

Miniopterus schreibersi

Found throughout the country It is the most numerous of the cave dwelling species, forming the largest colonies found in the Bulgarian caves (into the tens of thousands) Migrates between winter and summer caves Status data from the literature indicates that the populations in many colonies are decreasing rapidly

Eptesicus serotinus

Occurs throughout the country Inhabits garrets hollows, and galleries There is no information available concerning its biology Status "not threatened," however the scarcity of information makes it difficult to define strictly its conservation status

Pipistrellus savii P nathusii, P kuhli and *Vespertilio murinus*

It is well known that these species do not form large colonies in Bulgaria They are found mainly in buildings and hollows and are dominant among the bat communities of the 'non cave dwelling" species Further studies of their distribution are extremely necessary

Nyctalus noctula

Found throughout the country It typically dwells in the hollows of old trees, or (more rarely) in habits buildings Usually lives in small groups Status 'vulnerable' based on the large scale cutting of old trees

Nyctalus lasiopterus N leisleri Barbastella barbastellus Eptesicus nilssoni, and *Tadarida teniotis* (the only representative of the family Molossidae)

For all of these species Bulgaria is on the boundary of their geographic range Further studies are needed of their occurrence and distribution in the country We place them in the category 'rare

Summary and Recommendations

The factors that currently limit or threaten bat populations in Bulgaria can be grouped into the following categories

1) Destruction of dwelling places and shelters (the felling of old forests and individual hollow trees, exploitation of the caves through urbanization, use of them for warehouses and dairies and other processes, detonation of caves during the development of quarries and roads, the plugging up of cave entrances destruction of old buildings and other human structures)

2) Disturbance of the colonies by people, which is especially damaging the reproductive period (causing newborn bats to fall to the ground and die)

3) Direct killing due to superstitions and ignorance, often by kindling fires in the entrances of the caves

4) Declines in the food base, including the destruction of insect populations with insecticides (an assumption that must be confirmed or rejected by competent officials) and declines in the quality of reservoirs, above whose open water surface many bats hunt

It is important to stress here that existing legislation dealing with the preservation and protection of these vertebrates is inadequate and inefficient The legal protection of more than 30 caves that are known to shelter bats is praiseworthy but this protection is absolutely fictitious At present all of the colonies are freely accessible, there being no doors or any form of control over admittance to the caves No one has been penalized as a result of encroachment on bat habitats, regardless of the fact that all 28 species are protected by an order of the Committee for the Protection of the Environment (the old name of the Ministry of Environment) – Order No 1021/04 11 1986 This order imposed a fine of 25 lv (approximately 1 $US) for a killed animal!

The following measures are recommended as necessary for the preservation and protection of the bats in general

Legislation

Updating of the present law is urgently needed to give meaningful protection to the bats and their dwelling places and to restrict all activities that threaten their existence All officials connected with nature protection should be acquainted with the legislation and take necessary measures for its strict and efficient enforcement This includes officials of the Ministry of Environment, the Ministry of Agriculture, the Committee of Forests the Regional Authorities of the Ministry of Environment and the Committee of Forests, local authorities and nongovernmental organizations for nature protection

Educational activities

Educational materials concerning the bats should be prepared, including printed materials, radio and TV transmissions lectures, and films Appropriate texts should also be provided for use in the secondary schools

Research

The poor state of knowledge about the Bulgarian bat fauna makes it difficult to determine the exact conservation status for each species Further investigations are absolutely necessary so that adequate measures may be defined and taken The training of specialists in this sphere of science is also necessary

Collaboration

Collaborative bat conservation activities should be encouraged at all levels, and should involve local nature protection organizations, school groups caving clubs, and others, specialists from neighboring countries who are working upon similar problems and international institutions such as the Chiroptera Specialist Group of the IUCN Species Survival Commission the European Bat Research Symposia and Bat Conservation International

As a part of the National Biological Diversity Conservation Strategy the study and preservation of the Bulgarian bat fauna will require that a complete program, treating all the relevant problems be developed This program must include concrete measures for the preservation of each species The Green Balkans Movement has the specialists necessary to develop such a program and is ready to begin its carrying out this work with volunteers if minimum funding can be provided

2 THE BIOGEOGRAPHIC REGIONS OF BULGARIA AND RECOMMENDATIONS FOR AREAS REQUIRING ADDITIONAL PROTECTION

Bulgaria is situated within the European West Siberian portion of the Palearctic biogeographical region and the biome of the mixed deciduous forests of the northern hemisphere

Using as a base the biota and biotic communities as conditioned by climatic, geographical, historical and other factors its territory can be divided into five biogeographical regions (see Gruev s *General Geography*) Northern Bulgarian Middle Bulgarian Southern Bulgarian, Bulgarian Black Seaside, and High Mountainous Situated as it is in a transitional climatic zone between the continental and Mediterranean

zones Bulgaria has many more plant and animal spe cies and also more endemic species when compared to Central Europe Its flora and fauna are composed of Eurosiberian Central European, Atlantic, Mediter ranean Pontic Subiranian, Euro Asian and other elements Endemic forms from different geological ages occur here

In this section of our report we provide brief characterizations of the different biogeographical re gions and stress the specific features of the biota and the communities in each of them We also discuss the active threats to biological diversity and make recom mendations for new protected areas

A Southern Bulgarian Biogeographical Region

This region includes areas in southern Bulgaria under the influence of the transitional Mediterranean climate This is the region where most of the repre sentatives of the Mediterranean floral and faunal ele ment can be found This is the only region of the country in which transitional Mediterranean plant communities very similar to those of the Mediterra nean itself are typical These are the so called pseu domaquises

Strumsko Mestensky Subregion

This subregion covers the Strouma River valley up to Simitly, the Mesta River valley up to the Ogni anovo Breznitsa border, and the foothills of the sur rounding mountains up to 900 1000 m a s l Because of the climatic peculiarities around Slavyanka and Belasitsa
the Mediterranean plants and animals in that area ex tend over 1500 m a s l – higher than in any other Bulgarian mountain region This is the only place in the country where *Quercus coccifera* L can be found among the other species of the pseudomaquises (near the villages of Kamenitsa Kulata Novo Hodjovo Girmen, Debren and Kalimantsi)

Small residual communities of *Quercus virgiliana* Ten *Q frainetto* Ten *Q pubescens* Willd *Platanus orientalis* L *Carpinus orientalis* Mill and relict forests of *Castanea sativa* Mill are very characteristic The re gion is the richest in Bulgaria in Mediterranean plant and animal species and is characterized by a very high level of endemism Endemic plants here include *Minuartia diliyanae* P Pan *Sedum collicoferi* Stef *An chusa macedonica* Deg et Dorfl *Centaurea im manuelis* Deg *Parvotrizeum myrianthum* (Berol) Chrtek *Hypericum setiferum* Stef and *Amygdalus webbii* Spach

Many representatives of the class Myriapoda and the order Lepidoptera and others are present among the endemic invertebrate animals *Galeodes graecus* is among the rare animals representative of the insects from the tropical order *Embioptera*

Rare amphibians and reptiles, including *Pelobates siriacus balcanicus* Kar *P fuscus* Laur , *Mauremys caspica rivulata* Gmelin *Thyphlops v vermicularis* Mer , *Eryx jaculus turcicus* Oliv , *Elaphe situla leop ardina* Bonaparte, *Elaphe q quatuorlineata* Laccep *Malpolon m monspessulanus* Herm , and *Telescopus f fallax* Fleischmann can be observed in scattered mi cropopulations

The region is very rich ornithologically Part of the data we used was provided by members of the Green Balkans and associates of the Bulgarian Orni thological Center at the Institute of Zoology at the Bulgarian Academy of Science (BAS) Of great inter est among the birds of prey are *Pandion haliaetus* L , *Circaetus gallicus* Gm , *Accipiter brevipes* Severtzov *Aquila chrysaetos* L , *Bubo bubo* L Nests of *Neophron percnopterus* L , *Buteo rufinus* Cretzchmer and others have been discovered in the region A mixed colony of *Glareola pratincola* L and *Sterna hirundo* L exists on the Strouma River islands

Burhinus oedicnemus L *Charadrius dubius* Scop *Petronia petronia* L , *Monticola solitarius* L *Sitta neu mayer* Mich , *Lanius nubicus* (Licht), *Sylvia cantilans* Pall , *S melanocephala* Gm *S hortensis* Gm , *Corvus corax* L nest in the region The migration path *Via Aristotelis* passes here As an example, waves of mi grating birds, such as the Falconiformes, Sylviidae Muscicapidae, Prunellidae, Anthus and others, can be observed in the "Rupite" protected area

The subregion is densely populated but there are still well preserved small natural communities in the river valleys and in the surrounding mountains The semiintensive character of agriculture in the area, along with its rugged terrain, have allowed for the preservation of its biological diversity

Important threats in the subregion include

- the forthcoming doubling of the Dupnitza Kulata railway line, which may exterminate valuable rep resentatives of the riparian biotopes,
- uncontrolled felling of trees (the "Rupite' pro tected area was destroyed in this way)
- goat breeding and inordinate grazing pressures which are responsible for the trampling and de struction of rare plants on the "Kojuha" hill and in the surrounding hills,
- frequent fires in the region
- desiccation due to cutting of the forests draining of wetlands, expropriation of natural water sources and so forth and
- uncontrolled hunting and increasing trade in rare species

The areas in this subregion requiring additional protection are

- The Kresna gorge This site contains pseudo maquise formations with predominantly Mediter ranean components fields of rare plants and lo cations of *Elaphe s leopardina E q quatuor lineata Telescopus f fallax Eirx j turcicus Thy phlops v vermicularis, Aquila chrysaetos B bubo* and others IUCN Category IV protection must be given to this area, and some of the well pre served communities and locations protected as Category III protected areas

- The region around the 'Rupite" area between Damianitsa, Muletarovo and Marikostinovo should be protected in appropriate IUCN catego ries IV to VI protected areas, and well preserved natural habitats in Category III areas The natu ral landmark "Kojuha" should be promulgated as a nature reserve (IUCN Category I) It includes a field of *Parvotrizetum myrianthum Amygdalus webbii, Dracunculus vulgaris* Schott and other rare plants This area also provides habitat for all the rare reptiles in the region as well as nesting habitat for *Monticola saxatilis, Sitta neumayer, Buteo rufinus* and other species It seems that it will be necessary to develop a program for the restoration of the forests around the mouth of the Strumeshnitsa River and to put to an end the in tensive goat grazing and poaching in the area

The following areas should be declared protected areas

- the "Pazlaka" area near the village of Ilinden in the Gotze Deltchev region (contains a field of *Tulipa pirinica*)

- the wetland at the eastern side of the town of Kresna (a site where *Pelobates s balcanicus* re produces)

- the fields of *Anchusa macedonica* in the area west of Kresna and

- the fields of *Quercus coccifera* near the villages of Kalimantsi Katuntsi and Novo Hodjovo

Eastern Rhodope subregion

This subregion includes the Yellow Branch river valleys on the west, the Tchukata Gorata" hill on the north and the Turkish border on the south and south west Submediterranean communities of *Quercus pubescens Carpinus orientalis, Juniperus oxycedrus Fagus orientalis Quercus cerris Q frainetto Q dalechampii* and *Pinus nigra* are present in this area

The pseudomaquises are found in the most east ern and northeastern parts of the subregion (Ivailovgrad Mandritsa Belopoliane) The subregion represents the western border of the range of *Fagus orientalis* Endemic plants found here include *Verbas cus juruk* Stef *Quercus thracica* Stef et Ned and *Astragalus thracicus* Griseb Endemic animals include representatives of the class Myriapoda and the order Orthoptera and others

Rare animals here include many species of rep tiles and birds Among the rare reptiles found in the area are *Malpolon monspessulanus, Elaphe q sauro mates* Pall *Typhlops vermicularis* Near the village of Mandritsa there are fields of *Ophisops elegans ehren bergii* and *Mauremys c rivulata* (personal observa tions) *Ophisaurus apodus* Pall is also rarely found

The subregion is very interesting from an ornitho logical perspective, being rich in rare species The data we present here result from our own observations and from joint expeditions with members of the Bul garian Bird Protection Society and do not pretend to be comprehensive Very impressive is the high num ber of *Ciconia nigra* L (18 nesting pairs) and *Neophron percnopterus* (10 pairs) In the area of the village of Madzharovo are the only known habitats in Bulgaria of *Gyps fulvus* Hablizl (10 12 pairs) (1992) *Aegypius monachus* L has been observed in the area, but its nests have not yet been found The nesting of *Aquila chrysaetus Buteo rufinus, Milvus migrans* and *Pandion haliaetus* is this area is certain A young *Haliaeetus albicilla* L has also been observed Here is also found the only known colony of *Ardea cinerea* in the country It is situated on the rocks and has 5 nests The area is also characterized by high numbers of *Corvus corax*

Agriculture and the livestock grazing in this re gion are semi intensive This and the closeness of the national border contributed to the retention of the subregion's biological diversity A sure threat how ever are the plans for the construction of the hydroe lectric complex "Gorna Arda " We hope that the Ministry of Environment will ban this project

From the point of view of protection, special at tention deserves to be given to the natural biological communities along the whole Arda River valley its tributaries and the nearby hills The whole region along the southern part of the watershed up to the na tional border should be placed within an appropriate IUCN Category V VI protected area All unique natural locations and communities must be mapped and must acquire the status of protected areas, re gardless of their size Examples include the Danbla peak near Momchilgrad (a field of *Bunium ferulaceum* and *Tulipa rhodopaea*) the well preserved ecosystems along the valleys of the Biala Reka and Malka Arda Rivers the lower valley of the Arda River and espe cially the territories with the highest densities of nest ing *Gyps fulvus* and *Ciconia nigra* and the *Ardea cinerea* colony

Dolnomarishko Dolnotundzhanski subregion

This subregion covers the lower valleys of the Maritsa and Tundzha Rivers On the west it extends to the "Tchukata Gorata" and the Harmanly River

On the east it extends to the Popovska River On the north it reaches the Harmanly the southern part of Sakar and the area between the Dervensky hills and the line from the Malko Sharkovo reservoir to Razdel

Transitional Mediterranean communities of *Quercus pupescens Carpinus orientalis Paliurus spin achristi* and others are characteristic for the area The pseudo maquises are best developed in the areas around the villages of Mezek and Sivata reka in the Svilengrad region In some places natural formations of relict *Pinus nigra* can be found Along with a great number of Mediterranean plants found only in this area some Tertiary relicts of the Balkan subendemic and Front Asia flora can also be found

The fauna is rich in southern and thermophilic species This is the only area where *Vipera aspis bal canica* a Bulgarian paleoendemic, has been found (Special studies of this species are necessary because of the possibility that small populations may yet exist)

The herpetofauna of the region is poorly known *Ophisaurus apodus* is found here more often and in Central Sakar than in the other subregions *Ophisops elegance ehrenbergii Eryx jaculus turcicus*, and *Maure mys caspica* are observed much more rarely Ex tremely rare is *Elaphe s leopardina* – known from just a single observation In all biotopes of the region *Testudo graeca* and *Testudo hermanni* can be observed

The ornithofauna of the region is relatively well known as a result of several expeditions that have been carried out by members of the Green Balkans Species rare for Europe and for the interior of the country can still be observed here These species are *Buteo rufinus* (14 pairs) *Milvus migrans* (7 pairs) *Aquila he liaca* (4 pairs) *Circaetus gallicus* (5 pairs), *Neophron percnopterus* (2 5 pairs) *Falco subbuteo* (3 pairs), *Bubo bubo* (2 pairs) and *Aquila pommarina* (4 pairs) The numbers of *Ciconia nigra* are good (10 15 pairs) Ex ceptional for the region are *Pernis apivorus* (5 pairs) *Hieraaetus pennatus* (1 pair) *Accipiter brevipes* (2 pairs) *Falco vespertinus* (22 pairs) and *Accipiter gen tilis* (2 pairs) *Hieraaetus fasciatus Aquila rapax Elanus caeruleus* – birds are not seen in the interior of the country – have been observed here at least once

Melanocorypha yeltoniensis was observed for the first time in Bulgaria in this region A small nesting group of *Falco naumanni* existing up to 1981 has been destroyed

The sand islands and sand bars along Maritsa River are the only consistent nest locations of *Hae matopus ostralegus* (7 pairs) *Burhinus oedicnemus* (2 3 pairs) and *Chlidonias niger* (2 pairs) in the interior of the country The rare *Charadrius dubius* and *Sterna hi rundo* still nest on the islands

Myomimus roachi bulgaricus and *Myotis emargin atus* are interesting representatives of the mammals

The natural ecosystems in the region have been completely destroyed but some small locations scat tered throughout the territory are preserved On the whole we can conclude that the diversity of species is relatively well preserved due to the weak anthropo genic influence, which in turn is due to the proximity of the border

The following areas require additional protection

- The whole southern part of Sakar and the Der vent hills and especially the border regions around the villages of Krainovo, Lesovo, Sladun Studena and Levka are of interest in terms of nature protection Interesting grass communities habitats of *Falco naumanni* and *Aquila heliaca* and potential habitats of *Melanocorypha yeltoniensis* can be observed in this areas The region is also important from a herpetological standpoint It is necessary to inventory and protect all the natural communities in this areas in order to pre serve their unique genetic diversity We suggest that this territory be placed within an IUCN Category IV VI protected area and that the most important habitats and communities be afforded stronger protected area status

- The communities in the hills around Harmanly are very interesting due to their herpetofauna and the locations there of rare plants and deserve pro tection

- It is necessary to protect all the islands along the Maritsa River valley and the natural communities of *Platanus orientalis* along the Maritsa and Tundzha Rivers

- The Tundzha River valley in the 'Darkaia" area in the region of Lesovo must be declared a protected area It provides habitat for rare birds including *Aquila chrysaetos*

Strandzha subregion

This region is unique from a biogeographic per spective This is the only region in Europe where rel ict plant communities of Colchis (south euxinian) spe cies are developed They include *Fagus orientalis Carpinus orientalis, Quercus delechampii, Q hartwissi ana* and a number of other *Quercus* The most im portant feature and one that makes Strandzha unique in Europe is the presence of evergreen and deciduous south euxinian plants Among them are *Rhododen dron ponticum* L , *Teucrium latifolium* D'Urv *Epime dium pubigerum* Morren et Decne *Daphne pontica* L *Vaccinium arctostaphylos* L Only in this region can the Mediterranean plants *Erica arborea* L *Trifolium ligusticum* Balb ex Loisel *Cistus salvifollius* L be found Likewise only here can the pre glacial relict *Mespilus germanica* and the arctic evergreen frutex *Calluna vulgaris* L (Salisb) be found A subendemic species for the Strandzha region is *Sapanaria stranjen sis* Bulgarian and endemics in the region are *Veronica*

turrilliana Stoj et Stef and *Anthemis jordanovii* Stoj et Acht The rare Balkan endemics *Oenanthe tenuifolia* Boiss and *Asperula involucrata* Wahlend can only be found here The Strandzha fauna is characterized by a high percentage of Mediterranean and Iranian Turanian animals Many relict and endemic inverte brates are found here Some of them are *Carpathica bielowskii* (from Gastropoda) *Lithobius macolipes* (from Myriapoda), *Poecilimon heinrichii* (from Or thoptera) The fauna of the Strandzha subregion is actually more similar to that of Asia Minor than that of neighboring Bulgarian subregions For example the only endemic mammal in Bulgaria (*Myominus roachi bulgaricus*), whose related forms are widespread in West Copetdak is found here

Rare species of Reptilia, such as *Elaphe longis sima longissima*, *Malpolon monspessulanus Elaphe q sauromates Ophisaurus apodus*, and *Lacerta strigata* are found throughout the region *Testudo graeca* and *T hermanni* can still be found in the region although their densities have decreased

Our studies in the region indicate that the ornitho fauna is relatively well preserved The high number of *Ciconia ciconia* is impressive As an example in some small Strandzha villages (Voden and Malko Sharkovo) up to 10 pairs can be found A very pleasing fact is that we have discovered nests of *Aquila heliaca* which is among the Threatened Birds in Europe " The re gion where the nests were found is a small one, cov ering the border forests on the south of "Malko Shark ovo" reservoir Single nests of *Aquila clanga* and *Hali aetus albicilla*
can be observed here The region is inhabited by such rare European birds as *Ciconia nigra Neophron percnopterus Aquila pommarina A chrysaetos* and *Pernis apivorus* In the area of the "Malko Sharkovo' reservoir *Elanus caeruleus Falco vespertinus*, and *Pan dion haliaetus* as well as a colony of *Circus pygargus* have been discovered On the shores of the reservoir nest *Charadrius dubius*, *Vanellus vanellus*, *Burchinus oedicnemus*, and possibly *Arenaria interpres* (5 individuals were observed) Intensive migrations of *Ciconia ciconia Pelecanus onocrotalus*, *Plegadis falcin ellus Cygnus cygnus*, *C olor*, *Recurvirostra avosetta*, *Chlidonias nigra*, and *Chl hybrida* have been observed in the area of the "Malko Sharkovo" reservoir

Among mammals, the steppe species occurring here (*Cricetus migratorius Myominus roachi bulgaricus*, and *Myotis emarginatus*) are of great interest

The Strandzha subregion differs from the others discussed up until now in its low human population density The region is sparsely populated and the an thropogenic influence is very limited especially in the border areas

The significant threats in the region are intensive logging the use of inappropriate tree species in af forestation road building in the heart of the region inordinate grazing, extensive livestock breeding and raising (especially goats and half wild pigs), and, most critically plans for the development of tourism in the region and the expected construction of resorts

All the preserved biotic communities of the subre gion deserve strong protection Of special interest are areas along the valley of the Veleka River the border area above Malko Turnovo, the areas around Zvezdetz Pania peak and Bosna Especially inter esting are the northwestern slopes of the mountain, the forest slopes south of the "Malko Scharkovo' reservoir and the small forested massif around Fakia All of these regions should be mapped and given the status of protected areas This method of preservation will however, not solve the problem of providing protec tion for the biological communities on the mountain The great value of this region as an important Balkan species formation center and as a unique European lo cation of ancient taxa and communities makes it nec essary to organize yet stricter protection

For these reasons we propose that a 10 km bor der strip of land from the valley of the Tundzha River near the village of Lesovo up to the village of Dolno Iabalkovo, and the entire area encompassed by a line from Boliarovo to Grudovo to Primosko be declared an IUCN Category IV protected area In the interior of this territory all natural communities and locations of rare species should be mapped and a system of protected areas and reserves organized with a strict re gime of protection (IUCN Categories I II, and III)

B Middle Bulgarian Biogeographic Region

This region covers the Gornotrakiiska plain with the sub Balkan basins and Sirnena Sredna Gora hills (except its higher elevations) the Tundzha valley on the north, including the Kazanlak, Tvirdishko and Sli vensko plains, the eastern Stara Planina Mountains and the Blagoevgrad, Kiustendil and Dupniska basins The climate is transitional continental, with consid erably more influence from the Mediterranean Sea in the southern part of the region

Gornotrakiiska Plain subregion

The region extends from Momina klisura and the Ihtiman basin up to the Topolnitsa reservoir on the west On the north it includes the Karlovo basin and the main part of Sirnena Sredna Gora On the east it includes the Blatnitsa and Sazliika valleys And to the south it extends up to the border of the South Bulgar ian region

Lowland forest communities are found mainly along the river valleys and are few in number Some what more extensive forests are found in the foothills of the surrounding mountains – the Sredna Gora, Stara Planina and Rhodope Mountains They are com posed of *Quercus cerris Q frainetto*, and in some places *Q pedunculiflora* and *Ulmus minor* Remnants of the former 'longos" forests are found along the Maritsa River near Kritchim

The Mediterranean climatic influence extends

into the region along the Maritsa river and its tributaries, and reaches up into the sub Balkan valleys and the valleys of the northern Rhodope rivers This accounts for the presence of many Mediterranean plants and animals along the valleys of the rivers Tchepelarska (especially between Asenovgrad and Batchkovo) and Vatcha Among the endemic plants in the subregion are *Merendera rhodopaea* Vel , *Minuartia rumelica* P Pan, *Cerastium velonovskyi* Hayer, *Gipsophila tekirae* Stef *Verbascum thracicum* (Vel) Murb , *Achillea thracica* Vel , and *Noccea rhodopensis* F K Meyer

The Bulgarian and Tertiary relict *Hypericum setiferum* occurs in this subregion The Balkan endemics are represented here by *Fritillaria stribrnyi* Vel

The considerably diminished area of natural vegetation and the widespread agricultural communities in this area account for the low density of resident fauna The fauna consists of mixed European, trans palearctic, Mediterranean, and Iranian Turanian elements Endemic fauna include members of the Gastropoda Myriapoda, Coleoptera Hemiptera, and Diptera *Rutius rutilus* is an endemic representative of the ichthyofauna The herpetofauna has been greatly diminished by the intensive agriculture dense transportation network, and lack of natural biotopes in the subregion Even traditionally abundant species such as *Bombina variegata Hyla arborea*, *Bufo bufo* and *B viridis* are found only infrequently Populations of *Testudo graeca* and *T hermanni* have been destroyed nearly completely *Emys orbicularis* and *Natrix natrix* can be found in some fish breeding ponds and clean water basins Even *Coluber jugularis* is not found often here In the foothills of the mountains surrounding the valley *Coluber najadum Coronella austriaca* and *Vipera ammodytes* can be found *Elaphe quatourlineata* is extremely rare, and *Eryx jaculus turcicus* has nearly disappeared from the subregion

The ornithofauna in the region is strongly affected by the lack of available habitats Thus, preservation of the small oases with natural vegetation on islands in the Maritsa River islands and its tributaries is extremely important

The data presented here are based on our long term studies of the Plovdiv area and the Maritsa River valley Many bird colonies settlements have formed in the subregion in the last fifteen years They include colonies of

- *Ardea cinerea* Up to 150 nests near Gereka and the village of Panitchery and two small colonies along the Maritsa River near Harmanly (9 and 26 nests)
- *Nycticorax nycticorax Egretta garzetta* and *Ardeola ralloides* Situated on Maritsa River islands near Parvomay and Popovitsa Several nests of *Haliaetor pygmaeus* can be found each year in the latter area – the only nesting site in the interior of the country
- Sand islands and bars in the river are interesting habitats of *Haematopus ostralegus* (20 30 pairs), *Charadrius dubius* (40-50 pairs), *Sterna hirundo* (10 12 pairs) and the rare *Chlidonias nigra* Along the river bank are situated four large colonies of *Riparia riparia* (with an average of 300 nests) Some also include nests of *Merops apiaster*

Some birds that disappeared from the plain have begun to nest there again *Milvus migrans* on the Maritsa islands near Parvomay (3 nests), *Coracias garulos* (a minimum of 15 nests in the area between Plovdiv and Simeonovgrad), *Falco vespertinus* (2 nests), and *Dryocopus martius* (2 nests) At the same time, other interesting habitats, such as that of the mixed colony of Ardeidae and *Plegadis falcinellus* in the Boliarino forest near the town of Rakovsky, no longer exist Better preserved habitat exists in the foothills of the mountains that surround the plain Rarely observed species there include *Ciconia nigra* (at the village of Bania and the Panitchery reservoir), *Dryocopus martius*, and *Corvus corax* We observed *Aquila heliaca* and *A chrysaetos* in the foothills of Sirnena Sredna Gora

The subregion has high value as one of the most interesting wintering areas of rare and protected birds in Europe as a whole It is the only known wintering ground of *Ciconia nigra* in the entire West Palaearctic one of the two known wintering areas of *Nycticorax nycticorax*, and an important area as well for *Egretta alba*, *Phalacrocorax carbo* and *Haliaetor pygmaeus Asio flammeus*, *Buteo buteo*, *Buteo lagopus*, and *Botaurus stellaris* regularly spend the winter in the area This is possible due to the combination of warm winter temperatures and the many open water channels and artificial reservoirs found in the vicinity of Plovdiv The rare swimming birds *Tadorna tadorna Aythya ferina*, *Anas penelope Anas acuta* also occur during migration Small flocks of the rare *Numenius arquata*, *Phalaropus fulicarius Tringa nebularia*, *Tringa glareola*, *Tringa stagnatilis*, *Philomachus pugnax* and *Himantopus himantopus* can be seen regularly

In general – and bearing in mind the strong anthropogenic influence – the richness of species in this subregion is very low Much richer in species are the small isolated habitats in the lowland woods and wetlands Intensive agriculture is the most basic threat to biological diversity in the subregion It affects species directly through the heavy application of chemicals The dusting of crops from the air is extremely dangerous, especially near the lowland woods Great damage is also caused by the burning of stubble, drainage of channels, repairing of dikes, and the development of quarries along the Maritsa River

Individual trees protected as century old trees remain from the lowland forest that existed several centuries ago Secondary forests 40 60 years old are preserved in some areas of the plain They are found in reserves and on the grounds of former residences Such are the reserves found by the village of Striama

("Tcherkvitza") along the Maritsa river near the vil lages of Vinitza and Gradina near Brezovo by Kritchim and by the village of Boliarovo

The close guarding of these areas up until 1990 protected the plants from cutting and preserved the characteristic species diversity In the last few years as a result of land restitution and other factors these regions have not been guarded and the first negative impacts have appeared – the colony of herons and the only habitat of *Plegadis falcinellus* in the Boliarino for est have disappeared People from the surrounding villages have initiated uncontrolled large scale felling of trees In 1990 we suggested to the MOE that a moratorium on the use of resources within the former residences and reserves be declared until the state of the natural eco systems and species diversity in these areas is fully investigated Despite the issuing of an order, nothing has been done up until now and there exists the risk that these little islands of life in the plain will be totally destroyed

The criteria for establishing protected areas in the plain must differ those developed elsewhere in the country For example the woods here (even if second ary) must be protected – especially if they are inhab ited by rare species – since only artificial plantations can be found for dozens of kilometers around In ad dition a number of these areas contain unique and rare plants that can exist only in this subregion and in this microclimate

We have information that in just the last five years 20% of the forests in the plains have been destroyed For example the moist "longos' forest on the islands near Vinitsa and Gradina was destroyed and replaced by poplars This affected the small heron colony a nest of *Milvus migrans* and locations of *Leucojum aes tivum* In 1986 a large heron colony on the island near Vinitsa was disturbed regularly by poaching and as a result the birds abandoned the island

The most interesting communities in the subre gion are the island biocenoses along the Maritsa River In many respects they are unique in the interior of the country The different ages of the islands allows us to study the stages of formation in the typical "longos" vegetation Unfortunately, the islands are not owned outright and are subject to repulsive violations from local people (felling of the forests the planting of melon fields etc)

For these reasons we recommend that

- All islands along the Maritsa river from Plovdiv to Svilengrad (even if they are just sand bars or 'longos" forests) and the river terraces in the vi cinity of Sadovo, Popovitza, Vinitza Gradina (which have small remnants of natural ecosys tems) be appropriately protected in at least IUCN Category IV protected areas This will not result in harm to anyone's economic interests Potential conflicts that may arise out plans to extract min eral materials can be solved by locating in ad vance the areas where this will take place All is lands with colonies of Ardeidae and nests of Fal coniformes *Haematopus ostralegus* and *Sterna hi rundo* should be protected with marked buffer zones in which visiting and hunting are prohibited during the nesting period (from March 1 to Octo ber 30)

- Controls in the "Boliarinska gora" protected area where the cutting of trees is being carried out in large areas be strengthened

- The former residences Tchekeritza" and 'Kritchim ' be given the status of protected areas

- The area of the Besaparsky hills (south of Pazard zhik) be given appropriate protected area status as floristic reserves and as the location of rare plants and endemics, including *Turgeniopsis foenicu laceae Gypsophila tekirae Aegilops comosa* and *Merendera rhodopaea*

- Protective actions be organized to preserve the only known location in Europe of *Ceratophilum muricatum* near the Filipovo station in the Plovdiv region and the location of the rare *Nymphoides peltata* (S G Gmel) Kuntze *Marsilea quadryfolia* L *Lemna gibba* L and *Potamogeton friesii* Rupr The Green Balkans Movement and the governing body of the Fish breeding Institute can organize their protection with the assistance of the MOE

- Protected status be afforded the locations of *Sor bus borbassii* Jav and *S mougeottii* Soyet Gord near the village of Trantchane village in the Stara Zagora region and the locations of *Allium mon tanum* F W Schmidt and *Seseli bulgaricum* Ball near Korudere (Kazanlak region)

- Protected status be afforded the communities of *Juniperus oxycedrus* along the valley of the Vatcha River near Kritchim

Tundzha Hilly Lowland Subregion

This subregion includes the area bordered by the eastern part of the Stara Planina Mountains on the north, the eastern border of the Gornotrakiisky subre gion on the west, the Dolnomarishky Dolnotundzhansky subregion on the outh, and the Bourgas portion of the Black Sea region on the east It includes the Tundzha hilly lowland Kazanlak, Twirdishko, and Slivensko the main (north) part of the Sakar hills, and Karnobatsko Aitosko, Grudovsko and Elhovsko Nearly all of this territory is under cul tivation – more than 80% The forest communities are few They are distributed along the river valleys among the interior hills or along the periphery of the area They consist of *Quercus cerris* U *Q frainetto Carpinus orientalis Paliurus spina christi* and other Mediterranean species along with *Quercus pedunculi*

flora Fraxinus oxycarpa and others Along the Tundzha the 'longos' forests of *Fraxinus, Ulmus Populus*, and *Salix* can be found

The plants *Tulipa splendes T aureolina* and *As tracantha aitosensis* are endemic to the subregion The Bulgarian endemic *Colchicus diampolis* can be found only in this region and in the Gorna Strouma region The Balkan endemics *Verbascum purpureum* (Janka/) Hub Morr and *Fritillaria stribrnyi* Vel are also found here

Among the rare animal species that can still be found here are *Testudo graeca* and *T hermanni, Elaphe q sauromates* and *Lacerta strigata* The Sakar hills, Bakadzhitcite and Manastirskite hills are rich in rep tiles In the northern part of Sakar populations of *Ophisaurus apodus* and *Malpolon monspessulanus* sur vive

The area of this subregion is vast and there are different numbers of species in its different parts There are well preserved communities in Central Sakar though the forests are secondary Nest of *But teo rufinus Haliaaetus albicilla Corvus corax Bubo bubo Aquila heliaca Accipiter gentilis Caprimulgus eu ropeus, Ciconia nigra Hirundo daurica* and *Circaetus gallicus* (personal observation) There are nests of *Hi eraetus penatus* and *Tyto alba* in the Manastirski hills *Clamator glandaris Falco subbuteo, Falco columbarius Circus pygargus* and *Lanius senator* can also be seen

Of special interest from an ornithological per spective are the only country's best preserved "longos" forests found in the Gorna and Dolna Toptchia re serves Here as late as 1979 there was a mixed col ony of Ardeidae and *Plegadis falcinellus Egretta garzetta Nycticorax nycticorax Ardeola ralloides* and *Ardea purpurea* nested here Between 1987 and 1989 the colony s population declined significantly and only about 30 nests of *Egretta garzetta* and *Nycticorax nycti corax* remained Officials of the Regional Authority of the MOE report that the colony no longer exists

In the "longos" of Gorna and Dolna Toptchia nest rare species of Passeriformes such as *Aegithalos cau datus* and *Remiz pendulinus* The only surviving heron colony is that of *Ardea cinerea* near the town of Niko laevo (15 20 pairs) Of importance in terms of their ornithofauna are the Ovtcharitsa reservoir and the nearby reservoirs of the Maritsa East complex where can be found *Anser albifrons* (about 6000) *Anas platyrhynchos* (10 000), *Anas penelope* (2000) *Pha lacrocorax carbo* (800 1000) *Haliaetor pygmeus* (500) many *Cygnus olor Egretta alba* and others (personal observation)

An interesting phenomenon in the subregion is the penetration of the species *Circus pygargus* in 5 breeding areas with 4 to 5 nests each near the Ovtcharitsa reser voir Up until 1986 there were no known nesting places in the country The subregion is also the westernmost extent of the range of *Phasianus c colchicus*

The threats to biodiversity in the subregion are the felling of trees in the Manastirski and Sakar hills forest fires and the burning of field stubble, excessive grazing (in the Sakar region for example this is one of the greatest threats to the interesting vegetation of the mountains) disturbance of heron rookeries the lack of awareness of the local population (expressed in the destruction of bird's nests, the gathering of turtles for food the killing of reptiles etc) and especially the intensive character of agriculture in the area

The most significant areas requiring protection are

- The western part of Bakadzhitzite (Iambol re gion) This area supports populations of *Astra cantha thracicus* and *Minuartia bulgarica* and should be declared a protected area

- The higher parts and forest regions of the Manastirski hills This area provides habitat for rare plants and serves as a nesting area for Fal coniformes, *Hieraetus pennatus, Buteo buteo* and other species

- The portion of Central Sakar between the villages of Planinovo Hliabovo and Ustrem This area should be declared an IUCN Category IV pro tected area This will not disturb any economic activities since there are no villages there The region is very interesting, with habitats of *Ciconia nigra Buteo rufinus, Milvus migrans Bubo bubo Aquila heliaca, Accipiter gentilis Circaetus gallicus* etc The rocky landscapes on the peak south of the village of Oreshnik also need protection This place is inhabited by *Testudo graeca, T hermanni Elaphe quatuorlineata sauromates* and *Ophisaurus apodus thracicus* Sakar also harbors very inter esting populations of endemic plants such as *Achillea thracica* an *Alkanna stojanovii*

- The colony of *Ardea cinerea* should be declared a natural landmark

C North Bulgarian Biogeographical Region

This region covers the area north of the main chain of the Stara Planina Mountains, from the Black Sea region in the east to the higher plains (Sofiisko Radomirsko etc) and the mountains surrounding them in the west The region is characterized by a temperate continental climate the Only Sofiisko Radomirsky subregion will be discussed here

Sofiisko Radomirsky subregion

We will not present a detailed discussion of the characteristics of the subregion but give only concrete proposals for new areas needing protection

- The Tchepan hill (near Dragoman) This area provides habitat for *Cachrys alpina* Bieb *Astragalus wimottianus* Stoj *Erysimum comatum* Panr *Edraianthus serbicus* (Kern) Petz *Allium cupanii* (Rafin) *Tragopogon balcanicus* Vel , *Trinia glauca* (L) Dumort *ssp corniolica* (Korn) H Wolfss, *Liserpitium siler* L a colony of *Vormela peregusna* and nesting pairs of *Buteo rufinus* and *Corvus corax* It should be declared an IUCN Category I protected area

- Dragomansko and Aldomirowsko wetlands These wetlands provide roosting and nesting habitat for Charadriiformes and Anseriformes, and habitat for such rare plants as *Utricularia minor* L *Elatine alsinastrum* L , *Hyppuris vulgaris* L , and *Jurinea tzar ferdinandii* Dav These should be protected as IUCN Category III protected areas and hunting prohibited in the area An appropriate type of protected area should be declared for the fish farms in the vicinity of Petirch and Tchelopetchene

D Bulgarian Black Sea Coast Biogeographical Region

This region covers a strip of land 10 15 km wide along the Bulgarian Black Sea coast and is heavily influenced by the Black Sea climate

The region is very specific in its biotic characteristics The vegetation consists mainly of psammophytes halophytes and coastal chasinophytes There are limited forest formations of *Q cerris* and *Q frainetto* "Longos" forests are found along the estuaries of the Batovska Kamtchia, Ropotamo, and Rezovska Rivers

Endemic plants here include *Silene caliacre Cardamine tuberosa*, and *Allium stojanovii* Many of the region s plants can be found nowhere else in the country The Bulgarian endemic *Pyrus bulgarica* and the Balkan endemic *Verbascum purpureum* occur widely in the region

Many of the widespread plant and animal species in the region are relictual, representative of the flora and fauna of the former Pontic Caspian basin Many Asian species and many endemics from Arthropoda and Gastropoda are found in the region

Among the rare animals of special interest are the reptiles *Coluber r rubriceps* can be found only in this area Distributed along the southern Black Sea coast are *Ophisaurus apodus*, *Elaphe situla Malpolon monspessulanus*, and *Typhlops vermicularis* There are populations of *Mauremys caspica* in the suitable biotopes around Ahtopol and the Veleka and Rezovska Rivers

The ornithofauna of the region is very specific Most characteristic are the herons, cormorants, and wading birds The region s natural habitats have been strongly influenced by human activities The nesting areas of *Phalacrocorax* have almost vanished as compared to their distribution in previous centuries Nesting Laridae, Sternidae, and Charadridae can be seen on
some islands and rocks on the coast Especially rich in birds are the sea lakes – Durankulashko Shablensko, Atanasovsko, the Bourgas lakes and others They provide resting and wintering grounds for more than 260 species of birds

Some wetlands of the Black Sea coast are situated along the eastern migration path that connects West Palearctica with Africa Of special interest are the wetlands near Bourgas They are used as a feeding base by thousands of migrating birds Enormous concentrations of birds form here, among which are rare species protected by international conventions and included in the "Threatened Birds in Europe" and the *World Red Data Book* – including *Pelecanus onocrotalus P crispus Egretta alba Platalea leucorodia Plegadis falcinellus Ciconia ciconia*, *C nigra*, *Phoenicopterus ruber Branta ruficollis*, *Haliaeetus albicilla Aquila heliaca*, and *A chrysaetus*

Rare Charadriiformes such as *Charadrius alexandrinus Tringa stagnatilis*, *Himantopus himantopus Recurvirostra avoseta*, *Glareola pratincola*, *Larus melanocephalus Sterna hirundo Chlidonias hibrida Gelochelidon nilotica*, and *Thalassus sandvicensis* nest in the region The coastal lakes are inhabited by rare fish species *Knipowitschia caucasica Gasteroste aculeatus Pinigitilus platigaster*, *Neogobius syrman* and others Interesting mammals in the region are *Microtus guentheri* and *Monachus monachus* The latter is considered extinct We propose that caves that are found to be inhabited by seals be immediately declared marine reserves along with the adjacent sea surface (to 5 km from shore)

The region is characterized by its rich flora and fauna In addition to the coastal wetlands along the northern Bulgarian Black Sea coast, there are unique plant and animal communities on the Kaliakra Baltchik, Emina and other rock capes The dunes of the southern Bulgarian Black Sea coast also have a unique biota Many insect species new to science have been found on specific dune plants

The equilibrium of these unique communities has been strongly disturbed by negative factors that are characteristic of the region resort construction and tourism, and associated road and industrial construction, industrial, petroleum, and chemical pollution of the sea coast and pollution due to influx of wastes from the towns and villages along the sea coast

General problems that have affected the biological diversity of the sea coast lakes include destruction of the channels that connect the lakes and the sea (this is the cause behind the pauperization and changes in species composition of the ichthyofauna), contamination of the waters with strong effluents (as in the case

of Mandra and Vaia Lakes), the proximity of live stock breeding farms (which are dangerous not only because they contaminate the water, but because the animals if left by themselves will destroy the nests of rare birds), repairs to dikes during the reproductive period of rare birds (this also directly destroys natural habitats) and the burning and mowing of reeds and other wetland vegetation

The following measures are recommended for the region

- Purification systems should be constructed throug hout the watersheds of all the rivers that enter the lakes and at the industrial plants that are near the lakes
- The connections between the lakes and the sea should be restored
- All small works along the lakes, especially the pig breeding farms should be removed
- The entire lake area together with a 100 200 m wide strip along the coast should be protected as an IUCN Category IV protected area
- All of Atanasovsko Lake, along with a maximally wide buffer zone as well as the "Poda" area should be declared an IUCN Category III protected area, and the territory of the "Atanasovsko ezero" re serve should be expanded as much as possible
- It is necessary to create a green (tree) zone around Atanasovsko Lake so that the noise and lights of Bourgas will not affect the orientation of migrating birds With the financial assistance of the MOE the Green Balkans Movement will con struct this zone with volunteer labor
- The reagents warehouse base of the "Tangra" company should be shut down The base is situ ated in the buffer zone of the reserve
- Designation signs should be placed at all crucial points around the lakes and protected territories of the region
- The locations of *Hippophae rhamnoides* near Galata, in the Varna region and of *Allium stoy anovii* on the west of the village of Kiten should be protected
- Durankulak and Shablensko Lakes – which are situated along the migration path *Via pontica* and provide wintering grounds for *Branta ruficollis* *Cygnus olor* *C cygnus* *Plegadis falcinellus* and rare Charadriiformes as well as habitats for *Pa nurus biarmicus* and *Acrocephalus agricola* and the colony of *Pelobates syriacus* – should be declared an IUCN Category II protected area, covering the largest possible surface area along the sand coast
- The seacoast from the village of Balgarevo to the village of Tiulenovo, and to a width 5 km inland from the sea, should be declared a coastal reserve This area has high faunistic value, comprising well preserved steppe formations used by *Falco vespertinus*, *F subbuteo*, *Galandrella rufescens*, *Melanocorhypha yeltoniensis*, *M calandra*, *Oenanthe pleschanca*, and *Sturnus roseus* and the most likely habitat of the probably extinct *Monachus monachus* In terms of floristic value it contains the only known locations of *Paeonia tenuifolia* L *Veronica caliacre* and *Pharopholis incurva* It is recommended that the entire territory be declared an IUCN Category II protected area and that certain areas by placed in Category I
- In connection with our recommendations for the protection of the Strandzha region and the neces sity of preserving marine ecosystems along the southern Black Sea coast we believe that it would be best to protect the area south of Mitchurin up to the village of Rezovo and a 5 km strip of the adjacent coastal waters, in an IUCN Category IV protected area, and the area from Sinemoretz up to Rezovo in an IUCN Category II protected area

E Bulgarian High Mountain Biogeographical Re gion

This region covers the mountainous parts of the country above 1000 m a s l It is characterized by a montane temperate and transient continental climate This is the only region where glacial relicts of northern and mountainous origin with arctic alpine, boreal montane, and montane areas can be found

Territories in the different high mountain areas that require protection are described below

Central and South Pirin Mountains

Subalpine and alpine parts of the following peaks Orelliak Tchala Baba Pilentzeto Sweshtnik Liask ovsky, Sw Elena and Suhi vrah All of these consist of limestone rocks and are important species formation centers where 55 species of rare and pro tected higher plants can be found Two local endemics are found in the floral complex of the Central and South Pirin Mountains *Festuca pirinensis* Acht and *Arenaria pirinica* Stoj Eleven Bulgarian endemics can also be found here *Festuca vallida* (Uechtr) Penzes *Bromus lacmonicus* Hausskn *Tulipa pirinica* Delip *Silene velenovskyana* D Jord et P Pan , *Erysimum drenovskyi* Deg , *Sedum kostovii* Stef *Veronica spicata*

L subsp *austrobulgarica* (Deg et Dren) D Peev *Jasionella bulgarica* Stoj et Stef *Chondrilla urumovii* Deg *Asyneuma kellerianum* Stef *Pulsatilla slavjankae* (Zimm) D Jord et Koz

Balkan endemics number 96 species, or 36 2% of the total of 249 Balkan endemics for the country (Kojuharov 1977) Out of a total of 143 species of rare and endangered plants in the Pirin Mountains these areas are known to contain 50 species (34 8%) Twenty nine plants are protected by law There are well preserved natural coniferous forests and forests of *Fagus silvatica* in the area This is an important nesting area for *Lanius nubicus*, *Sylvia hortensis*, *S cantillans*, *Monticola solitarius* *Sitta neumayer*, and other species rarely found in Bulgaria

For these reasons we propose that the following conservation measures be taken

1) The largest part of the discussed territory should be protected within an IUCN Category IV (or at least Category V) protected area and that it be united with the Pirin National Park

   - The 'Orelliak' reserve should be expanded to include in its territory the subalpine and alpine parts of the Orelliak Tchala Baba Pilentzeto Sweshnik Liaskovsky Sv elena and Suhy vrah peaks as IUCN Category I and II protected ar eas

   - The areas outside of the reserve where rare en demic species are found should be protected within IUCN Category III protected areas

2) The following should also be declared protected areas

   - he Trastenik site west of Belitsa (in the Rila Mountain) location of *Quercus mestensis*

   - the location of *Potentilla fruticosa* in the Beg lika forest,

   - the Korudere site in the Batchkovo region (where *Tulipa rhodopaea* can be found) and the Lalebair site (where *Noccea rhodopaensis* *Medicago rhodopaea* and *Turgeniopsis foeni culasea* occur)

   - the site near the village of Sarnitsa along the Dospat reservoir where *Ribes nigrum* and *Spirea salicifolia* are found

   - the Krusheto site (Pirin Mountains) where *Va leriana simplicifolia* and *Ligularia sibirica* are found

   - the Livadeto site near the village of Sivino vil lage in the Smolian region (the location of *Lilium rhodopaeum*)

   - land at the village of Progled village near Pam porovo where *Lilium rhodopaeum* can also be found
   - Persenk peak (in the Rhodopes) where well preserved populations of *Pinus peuce* are found and

   - Iosifitca and Riletch peaks (locations of *Salix hastata*)

3) Large parts of Ograzhden, Malashevska, and Vlahina Mountains, including territories from the Strumsko Mestensky subregion should be pro tected in IUCN Category V protected areas These are the only parts of the country known to support populations of *Erodium absinthoides* *Vi ola gracilis* and *Viola stojanovii* Many endemics among the Coleoptera and Orthoptera are also found here *Aquila pommarina* *Hieraetus penna tus*, *Accipiter brevipes* and *Bubo bubo*, among others nest in the area We have information that the valleys of the Ribnishka and Lednishka rivers have well preserved formations of *Platanus orien talis* as well as healthy populations of *Testudo graeca* and *Testudo hermanii* *Ciconia nigra* *Ac cipiter brevipes* *A gentilis* *Circaetus gallicus* *Bubo bubo* *Buteo buteo* and *Pernis apivorus* nest in the region and because of this the valleys of the rivers should be protected within IUCN Category III protected areas

4) We propose that Zemenska and a portion of the Koniavska Mountains be given protection under IUCN Category V and that the Zemensky gorge be protected under IUCN Category III Interest ing plants found at these sites include *Allium cu panii* Ratin *Lilium jankae* Kern *Fritillaria orien talis* Adams *Lathyrus grandiflorus* Sibth et Sm *T urumovii* Hayek , *Ferula heufellii* Griseb, *Aubrieta intermedia* Heldr et Orph eh Boiss *Sedum aetense* Tineo, *Stachys serdica* Panc *Campanula versicolor* Andrews and *Edraianthus serbicus* (Kern) Petr *Aquila chrysaetos* *Bubo bubo* and *Buteo rufinus* breed here as well

3 MAJOR THREATS TO BIODIVERSITY

The topic of threats to biodiversity is quite broad and so we will discuss here only those that are specific to our country and are actual problems at this moment We believe that *privatization of the forests and agri cultural lands* will have the greatest consequences The problem with the private forestlands will be espe cially acute since it will be difficult to secure effective protection for these areas and the owners will in many

cases go after quick profits New legal measures to safeguard the forests probably will not have much immediate effect because implementation of the new system of management will necessarily take several years The cutting will become uncontrolled and will fundamentally influence the biodiversity in these regions

The situation with the municipal forests is the same Even now they are being cut down in some places without any coordination among the relevant government institutions The changing status of lands and forests liable for restitution but included in protected areas will lead to acute conflicts especially in cases where the owners cannot be compensated with other lands from the forest fund Such is the case in one of our biosphere reserves – "Tchervenata stena" near Batchkovo in the Plovdiv region As a result of the last expansion of the reserve private cultivated lands were included within its boundaries The owners cannot be compensated with other cultivated lands because there are none in the village

Even more acute will be the problems involving the private forests within the reserves because they potentially constitute a large percentage of the protected territories It is unclear who will maintain the protected areas after privatization takes place – the owners the municipal authorities or the Ministry of Environment Especially difficult will be the problem of century old trees that exist on private cultivated lands For example in the village of Bania (Pazardzhik region) an owner burned a thousand year old oak even before his land was returned to him!

For years to come privatization of the forests and agricultural lands will be the fundamental threat to biodiversity in certain regions Even industrial activities will not have so extensive an influence on the natural equilibrium The planning of new industrial areas and the building of dams roads and structures will involve evaluation of their impacts on the environment and agreements with the concerned ministry However the process of privatization cannot be stopped and the fact that it will be carried out on such a large scale makes any control over its impacts impossible The only way to secure control over the protected areas is to organize an independent institution that is simultaneously responsible for the study management and protection of the areas

Another factor that poses a threat even in regions where the natural environment is well preserved is *tourism activities* Although this branch of the economy is at the moment in crisis it will recover quickly after privatization takes place Private initiative will penetrate areas that are still free from this kind of activity A certain answer to the problem has been development of so called ecotourism It must be obligatory for ecotourism to be undertaken with very strict safeguards so that it will not destroy natural areas It can not be based upon first receiving financial benefits and then thinking about the protection of natural areas

Although temporally stalled because of the country s serious economic crisis large development activities especially *construction activities* – highways railways industrial and resort complexes – still pose a danger to biodiversity The Green Balkans Movement will oppose the building of the "Gorna Arda" dam project which will destroy the few well preserved plant communities in that region, among which there are some endemic species The region is famous as a nesting location for rare and threatened birds of prey

The volunteers from the Green Balkans society in Bourgas will monitor the development of *petroleum production concessions* which unfortunately are situated near relatively well preserved marine ecosystems and species rich areas along the sea coast The *open pit mines and complexes* of the Thermo Electric Station 'Maritsa Iztok" converted vast land areas into a moon like landscape We will insist that the government recalculate the costs of this project and that it create green oases around the artificial reservoirs

A real threat is the *doubling of the railway line* from Blagoevgrad to Kulata It will cross protected areas and destroy unique landscapes

We will insist that precise ecological investigations be carried out and projects for the restoration of biodiversity implemented

The *application of chemicals in agriculture* is a great threat to biodiversity The use of pesticides and rodenticides and improper manuring destroys links in the food chains, and causes *eutrophication* of the interior aquifers and of the Black Sea

In the winter of 1988 89 one of the most profound crimes against nature was carried out Enormous quantities of chlorine and phosphorous organic rodenticides were spread over large expanses of cultivated land Forbidden in Western Europe these preparations were purchased and then spread from the air which is an absolutely inexcusable use of such poisons As a result nearly all the birds of prey in treated areas – many of which are protected by international conventions and spend the winter in our plains – were killed Using a variety of methods the Green Balkans Movement was able to perform a comparative study to evaluate the damage caused by this action The results showed that in the vicinity of Plovdiv more than 100 000 birds met their death – rooks (*Corvus frugilegus*) black storks (*Ciconia nigra*) herons (Ardeidae) geese (Anserinae), and others We would like to note that at the moment the wolf population is being regulated by the same methods The local forestry officials are given poisons baits are set and many birds of prey and rare mammals suffer along with the wolves And all this is being done after Bulgaria has signed the Berne convention

The *inappropriate organization of hunting* and the *hunters' archaic approach to nature* is one of the factors behind the current disturbances in the equilibrium of

the ecosystems especially because of the selective slaughtering of some species at the expense of others Thus biodiversity is directly affected and the natural self sustaining capacity of the biocenosis is diminished The current hunting season for waterfowl was extended to the end of February by the self willed decision of the Committee of Forests We consider this to be a violation of the Ramsar and Berne Conventions since this time of the year is the beginning of their reproductive period

The problems discussed up until now are only a few of the factors responsible for the decreases in biodiversity in the country These problems, as well as all the others are mainly a result of the *lack of a nature protection culture* among our people

4 DISADVANTAGES IN THE CURRENT SYSTEM OF MANAGEMENT OF THE PROTECTED AREAS

The value of any protected area depends mainly on the unique features of the biocenoses within it, and in some case on its inanimate natural features The effective protection of such areas depends greatly on sound knowledge about the biodiversity within them and appropriate management measures to maintain this biodiversity

Control over the status of Bulgaria's protected areas and the activities connected with their preservation is quite perfunctory at the present moment The commission of violations and the preconditions of their perpetration (e g lack of licenses burning cutting, hunting and so forth) are reported, but the main responsibility – observing the status of populations of rare or threatened species – is neglected even though it is the thing that determines the effectiveness of the protected areas

Who manages and controls the protected natural areas?

Directly responsible at the present moment are the owners the state forestry departments and the councils The officials appointed by them exercise control over the protected areas The people occupying these posts usually do not have the knowledge necessary to carry out systematic observations of the populations of rare and protected species, and they do not do so in any case This means that protection activities are ineffective from the very start while the connection between research and preservation is lost

The next weak links in the nature protection chain are the Regional Authorities in the Ministry of Environment (RAME) The quality of work on protected and rare plants and animals improved with the involvement of biologists in the RAME system But despite this improvement, the work of the chief specialists is mainly to manage and this does not allow them the opportunity to study in greater depth and detail the populations of biologically important species Moreover they are responsible for so many regions and objects that do not have the time to do so

All of this makes it clear that the failures connected with the preservation of biodiversity and the administration of protected areas are due first of all to incorrectly designed administrative structures, and to the confrontation between the contradictory interests of the Committee of Forests as an owner and the Ministry of Environment as the governmental institution responsible for the preservation of biodiversity

If we analyze the activities related to the preservation of biodiversity on all levels of management – from the forester to the Chairman of the Committee of Forests, and from the inspector in RAME to the Minister of the Environment – we shall ascertain that coordination is totally lacking as a result of different interests and perspectives This conclusion is not overstated

In how many of our reserves are complex floristic and faunistic studies being carried out – not to mention basic biological research for conservation?

How many of the reserves have personnel who are looking after biodiversity?

What is being done with regard to the unique endemic species in our flora? How many of the locations are really protected?

How many attempts are being made to reintroduce some of the thirty extinct higher plants?

This list of questions can be lengthened but there will not be a single positive answer to any of them The conclusions are clear to those who are interested in the problems of nature and nature protection They are (1) radical changes are needed in the biodiversity protection system, and (2) the personnel working on these problems need to be replaced

The Green Balkans Movement believes that there are enough young specialists with proper backgrounds in this field who are keen on working for the study and preservation of our unique flora and fauna However these people for one reason or another have not been involved in the MOE system or in the scientific groups dealing with these problems

As a further recommendation we must add that a change in the basic personnel policy of the MOE and in the attitude of the government toward the problems of nature protection is necessary

5 INSTITUTIONAL CHANGES REQUIRED TO STRENGTHEN BIODIVERSITY PROTECTION

Legislative Changes

The legislative and normative bases for the preservation and management of the protected areas are hopelessly old fashioned and cannot fulfill their basic objectives We are not going to comment upon the many legal disadvantages involved in protecting biodiversity (as for example, the contradictions between

the international obligations of Bulgaria under the Ramsar Bern and Washington conventions and the current national legislation) These contradictions and disadvantages in the legislative base can be eliminated only by immediate passage of the newly prepared laws concerning biodiversity the laws on protected areas, biodiversitv land restitution and game animals

Unfortunately the Bulgarian Parliament does not regard the passing of these laws as a priority and they are unlikely to be adopted in the coming year For this reason, we recommend that the government pass ur gent decrees to activate the signed international con ventions We will send to the government a written statement articulating our recommendations and pro viding concrete examples of the breaking of the con vention agreements If no measures are adopted we will look to international organizations for support

Proposed legal measures must be coordinated among those who are proposing them Priority must be given to the protection of biodiversity itself and all departmental and political interests must be put aside in this effort

Budgetary Changes

Up until now, minimal funds have been invested in nature protection and management The money for research work in the reserves for protection of rare species, for creating genetic banks and for studying the populations and their dynamics have been insuffi cient

The MOE and the nongovernmental organiza tions must urge the government to find new ways to fi nance projects concerning the preservation of natural eco systems and biodiversity Bearing in mind the se rious economic crisis we are in, the government must ask for assistance from international financial institu tions Some of the financial problems involved in the preservation of protected areas landscapes, unique genetic resources can be solved by the government using the debt for nature" principle

Other new ways to finance nature protection ac tivities must be found For example, private compa nies can help sponsor this work Unfortunately, this is nearly impossible at present because our tax laws do not provide any tax preferences for contributors It is not enough simply to recognize that money invested in ecological projects and programs are worthy expenses, extra preferences are necessary Encouragement of companies that invest in nature protection activities would alleviate the national budget of such expenses For example nongovernmental organizations might then have an opportunity to receive funds from private companies which is now almost impossible

Although the funds in the budget of the MOE de voted to the protection of biodiversity are not great even these are improperly distributed There is no competition to conduct ecological projects and no pro vision for the proper spending of money Projects are always assigned to the same people without engaging a wider circle of specialists

We insist that all projects and activities planned by the MOE be fully opened not only conceptually but financially Competitions must be organized to allow independent experts from nongovernmental ecological organizations to participate The quality of ecological activities will improve as a result of compe tition The MOE must not forget that there are non governmental ecological organizations in the country that have the necessary specialists and that can take part in the fulfillment of various scientific and nature protection projects These organizations are organized on a volunteer basis and thus can operate with fewer expenses

Structural Changes

In the last section we described the many prob lems associated with the existing state institutions re sponsible for nature protection The conclusions in that section show that a radical change in the system and its structures is necessary, and that a new person nel policy is also needed This will contribute to the preservation of biodiversity and of the integrity of the ecosystems for future generations

Here we express our opinion with regard to the structure and function of the nature protection system, and (to be more precise) the network of protected ar eas and the management of protected species This must be a state structure that combines (1) research on population dynamics and the influence of different en vironmental factors, (2) studies of the problems of restoration and maintenance of protected areas and (3) the security and safeguarding of protected areas This institution must be entirely independent of the MOE It will be better if it
is an independent committee for the preservation of the protected territories and biodiversity, with its own budget and development programs It is not necessary that the chairman of this committee be a member of the Council of Ministers He may be represented there by the Minister of the Environment

The structure of the committee must be built upon a biogeographical and not administrative basis, as is the case with the MOE system For example the bio geographical division of the country into five regions (Gruev 1988) can be used the South Bulgarian Central Bulgarian North Bulgarian Bulgarian Black Seaside and Bulgarian High Mountain Regions This division is based on the similarities in climatic oro graphic and anthropogenic factors and on the specific features of
the biota In the Black Sea region, for example, the similarity in the biotic communities will improve the quality of the research work and of the programs for restoration of the protected areas The similarity of

the anthropogenic factors – resort construction and the contamination of the marine ecosystems – will make it easier to realize an effective protection program

The advantages of this approach are apparent in other regions as well For example in the High Mountain region's forest and alpine ecosystems the predominant negative factors are logging and the con struction activities associated with ski resorts The Central Bulgarian region (Gornotrakiiska and Tundzha sub regions) is strongly influenced by inten sive agriculture and the natural biota present in small, scattered territories are preserved only in valuable plain and moist forests A regional management body of the proposed committee, including 2 3 experts, must be present in every region These experts and a tech nical team of 1 or 2 persons will carry out the research work They will manage the groups guarding the re serves the protected areas and the public parks and will study the dynamics of the populations in their re gion

This structure can successfully meet its responsi bilities with a small staff if the help of the nongovern mental ecological organizations is incorporated As an additional benefit this would have a strong educa tional effect All the occasional activities such as the marking of protected areas fee collection and other services can be done with the help of volunteers

6 OPPORTUNITIES FOR INTEGRATED CONSERVATION AND DEVELOPMENT

In our opinion, it is still too early to talk about integrating the conservation of biodiversity with the derivation of direct benefits from biodiversity We hold this opinion because an effective system for pre serving protected areas and biological diversity has not yet been still constructed However we will empha size some opportunities for integrative activities that can be initiated right now

One of these is the development of *specialized educational tourism (ecotourism)* To ensure that ecotourism works properly routes in the protected ar eas must be strictly controlled and groups must be ac companied by a guide who will oversee the behavior of the visitors The companies who would like to develop ecotourism must fulfill some requirements and prove that they have an appropriate attitude toward the pro tected areas and their genofund, and show that they understand how to preserve them

In the vast agricultural lowlands and plain regions of the country (Gornotrakiiska nizina, the Dunavska valley the Tundzha region and so forth) the natural communities are almost fully destroyed or if not, they are fragmented and isolated These are the reasons that the biodiversity in these areas is very unstable They are unable to retain their characteristic faunistic and floristic elements It is not possible to rebuild the representative biocenotic complexes in a manner that will preserve the genofund and maintain equilibrium A compromise must thus be reached and this may present opportunities for integration

For example the Thracian plain is densely cut through with *channels microdams and fish breeding farms* Around these places and on the river banks of the Maritsa and its tributaries there are naturally formed wetland communities that provide habitat for many nesting birds and birds of prey The value of these areas is very high For example a survey in Plovdivskoto of 700 km^2 of these biotopes found 250 260 species Here can be found the winter camps of *Ciconia nigra, Asio flammeus, Egretta alba, Ardea cine rea, Botaurus stellaris, Cygnus olor, Buteo lagopus, B buteo* and many others included in the *Red Data Book of People's Republic of Bulgaria* and the "Threatened birds of Europe " It is possible, without any damage to agriculture to preserve these territories in an appro priate way The integration of protection and use can be accomplished With a minimal amount of money it is possible to create along the channels (i e , in places not used by agriculture) plantations of broadleaved trees and bushes that will help to increase biodiversity

Of great interest for integrated conservation are the *fish breeding farms* with both intensive and semi intensive fish breeding facilities These farms can be found in nearly all the vast plain regions of the coun try They offer possibilities for combining fish breeding with the preservation of the genofund of rare breeding and migrating birds threatened fish and rare wetland plants The diversity of species is not threat ened during the winter and summer months, since there are no meliorative activities and fishing during these periods

Our observations and studies by other specialists show that riverside plantations of cattail reeds and other vegetation that are traditionally destroyed by fishermen do not affect fishing Even a strip 3 8 me ters wide will have no effect, because it creates condi tions for increasing zooplankton and decreasing the feeding coefficient The riverside plants are an extra food source for some fish species The only necessary condition is to keep low the number of fish eating birds These bases can also be used to reintroduce threatened and disappearing plants For instance the fish breeding farm by the village of Trud is inhabited by more than 200 species of birds and is the only win tering area of *Ciconia nigra* The Green Balkans Movement has proposed using this farm as a gene bank and for the reproduction of ten species of rare and threatened wild medicinal plants The purpose is first to both reintroduce them in their former loca tions and create new locations and second to support the production of necessary raw materials for the pharmaceutic industry

Another possibility is to cultivate striking rare bush and tree species that occur in single locations in the country These must first be introduced in spe cialized gardens and nurseries

7 RESULTS OF A SURVEY OF ATTITUDES TOWARD NATURE PROTECTION

The Green Balkans Movement agreed to carry out
a survey of attitudes toward the protected areas and biodiversity among the population in the vicinity of Pirin Nation Park The questions were developed by a consultant to the NBDCS organizers and the survey was carried out by members of the Movement One hundred people from the towns of Blagoevgrad and Bansko and the village of Dobrinishte were questioned

The survey was carried out using a quota method 26% of those questioned were citizens somehow engaged in activities connected to the preservation of nature (e g tourists mountaineers hunters herbalists mushroom gatherers) 16% were administrators (representatives of the local authorities, local officials of the MOE the Ministry of Internal Affairs, the Committee of Forests, and so forth), and 58% were randomly selected from the local population

The purpose of the survey was explained to all of those questioned Nearly all of them expressed interest in the survey It must be noted that despite the special attention devoted to explaining how to fill in the form many of the people questioned could not understand some of the questions We think that this is important because it is reflected in the answers Some of the questions were answered with certain stipulations, while other were not answered at all This made it more difficult to compare results and diminished the effect of the survey

We think that the survey should have included more simple and concrete questions This would have allowed people to answer more easily and to express more clearly their attitude towards nature protection The fact that the region of Blagoevgrad Bansko and Dobrinishte is situated in the foothills of Rila and Pirin and is relatively free of largescale pollution must be considered in interpreting the answers correctly In addition this area has no vast expanses of cultivated land, and the agriculture there is semi intensive

Many of the questions (1 8) aim to establish the level of ecological awareness among the people and the degree of their engagement with nature protection ideas It seemed that the level of knowledge is comparatively high For example, protected areas and other reserves were differentiated 93% of those surveyed knew of the existence of protected areas in their region This is supported by the high percentage of the people (54%) visiting these areas It is striking that most of the professionally engaged people (69%) and the local authorities (81%) were in this group

Notwithstanding the high percentage of visits those surveyed had little idea of the degree to which protected areas draw tourists

Few of those surveyed (6%) experienced a strict management regime in the protected areas but we can not accept this as precise since "reserve" and "national park" were united in the same question People connect these places more with recreation and tourism than with the preservation of rare species of plants and animals This is confirmed by the answers to the question concerning the purposes of their visits The largest percentage is connected with the observation of nature (34%) The high percentage of visits connected with hunting is troublesome (32%)

The lack of in depth understanding of the state of nature in the protected areas is illustrated in the answers to the questions about what people liked and disliked during their visits Out of a possible 400 answers the first question was answered by 217 people the second by 123 The answers indicate that the most important attraction is the general state of nature – the clean air and water (136 out of 217 answers to Question 7) and after that the animals and plants (49 out of 217 answers) The strongest negative impressions were of contamination, tree cutting, and the disposal of wastes but activities such as poaching, grazing, the breaking of statutes, the gathering of plants, and hunting left no impression on the people This can be explained by the great desire of people to manage nature and to use its resources

As a general conclusion we can say that the people in this region have a high level of ecological awareness and knowledge about the existence of protected territories The troublesome point is that they think of these places in terms of rest and tourism rather than the preservation of rare plant and animal species This is a potential danger for biodiversity in the protected areas The desire to use natural resources is greater than the desire to preserve them

The answers to Questions 9, 10, and 13 express the attitudes of those surveyed on problems connected with the privatization of agriculture and industry and its effects on wild animals and plants in the region While most expressed concern about the negative influence of this process on the richness of the plant and animal world the percentage of those who thought that privatization will result in the reasonable use of nature was almost the same

Unfortunately the percentage of those surveyed who think that activities such as cattle raising and cultivation of land can be a danger for biodiversity was low The difference in answering the two questions, as well as the high percentage of those who did not answer them (about 50%) show a lack of interest in these problems If a conflict should occur, and the interests of the local people confront the aims of reserve protection activities we cannot expect active support for nature protection

According to those surveyed construction activities can present a danger for wild plants and animals but smaller enterprises are not regarded as so dangerous (only 26% believed that this would pose some danger) The percentage of the people who did not answer or were not sure is high (50%) The is the same distribution seen in the answers to the question

concerning the restitution of private property Here we must note that the survey did not address such im portant issues as the return of private forestlands or attitudes toward hunting as a sport activity or as a danger for wild animals

Questions 12 13 and 14 concern the development of ecotourism Nearly all people think that in their re gion such activities can be developed (96%) They think that this kind of activity can stimulate the preser vation of wild nature provide new job opportunities raise incomes and improve the level of ecological edu cation and awareness Those surveyed who think that ecotourism does not pose a threat to wild nature are twice as numerous as those of the opposite opinion These results prove that the preconditions exist for de veloping ecotourism in the region of Blagoevgrad, Ban sko, and Dobrinishte This is a reflection of the local experience with tourist activities In the answers to Question 16 (38 of 70 answers), the development of tourism is treated as a way of gaining extra income It can be generalized that the local population sees tourism as a way to develop the local economy without con necting it with specific features and potentially negative results

The answers of those surveyed with regard to changes in the structure of the state authorities and laws show that the activities in this sphere are inadequate – the finances are insufficient (98%), the state structures have not changed (94%) and the laws have not changed (74%) The explicit nature of the answers shows that even people who are not well acquainted with these problems understand that the state institu tions have been inactive in this area

Nearly half of those surveyed (44 out of 100 possi ble answers on question 17) identified concrete objects that require protection Predominant among these were the Pirin Mountains generally

Analysis of the survey answers indicates that the state officials and the people who are directly engaged in nature protection are more aware of the problems than the randomly chosen people This result was ex pected due to the differences in the activities of the dif ferent groups and illustrates the need for more careful work with the local population with regard to biodiver sity and the activities in the reserves

SUMMARY

1 Trends in the Populations of Threatened Taxa

This section reviews the dynamics of populations of species and groups of species that have not been well studied in Bulgaria with priority placed on presenting new, as yet unpublished information Taxa belonging to better studied groups are not discussed in this chapter due to space limitations (new information on the status of populations of rare bird species is presented in section II)

Plants

The status of 46 poorly studied and threatened spe cies – among which are 16 Bulgarian endemics and 3 newly discovered species for this country – is discussed The species are placed into three groups (annual and bi ennial grasses, perennial grasses, and tree and shrub species) in order to make it easier to discuss the limiting factors and measures needed for protection It is re commended that 13 plant species in the category "rare" be included in the category 'threatened ' It is further recommended that efforts be undertaken to organize the safeguarding of the locations and communities of 32 species of plants, and to create appropriate protected ar eas for their preservation The problems of the botanic gardens in Bulgaria are discussed and recommendations for organizing new gardens are presented

Amphibians and Reptiles

Fourteen rare and threatened species are dis cussed Eight of them can be found only in Bulgaria among all the European countries The limiting fac tors are discussed, placing emphasis on the illegal trade in rare reptiles and amphibians For the first time in this country, the reasons behind our poor knowledge of this group are discussed Some of these reasons are the lack of interest within the state and scientific institutions, the lack of specialized group de voted to the study and protection of these organisms the lack of the necessary popular and scientific litera ture in Bulgarian Concrete legislative and institu tional changes that will guarantee the preservation of Bulgaria's unique herpetofauna are recommended

Bats

The most poorly studied vertebrates in the country Twenty nine species can be found in Bulgaria, out of a total of 30 that occur in all of Europe The status and limiting factors for 26 of them are discussed Recom mendations concerning the organization of protection efforts as well as the necessary legislative and institu tional changes are given

2 The Biogeographic Regions of Bulgaria and Rec ommendations for Areas Requiring Additional Pro tection

Section 2 is the main part of the report Using the biogeographical division of the country according to Gruev (1988), the characteristics of the biodiversity in each biogeographical region are presented The fol lowing format is used

- species richness endemism rare and threatened species characteristic of the region, unique com munities, seasonally important locations ecosys tems and large biocenotic complexes

- vulnerability to anthropogenic factors specific to the region
- concrete recommendations for new protected ter ritories

Following this format, 9 biogeographic subregions (out of a total of 20 in the country) are discussed, cov ering the territory of South Bulgaria and the Bulgarian Black Sea Fifty four recommendations are given for the establishment or expansion of protected areas For the sake of brevity and comparison, we use the IUCN Categories I VI to classify the proposed protected ar eas

A *Southern Bulgarian Biogeographic Region*

Strumsko Mestensky subregion

- establish a Category IV protected area for the Kresna gorge, as well as other protected areas for well preserved natural communities and locations or rare plants and animals
- protect the area between the villages of Dami anitsa Muletarovo, and Marikostinovo in a Cate gory VI protected area
- protect the "Kojuha" natural landmark, a location of endemic plants and rare reptiles and birds within a Category I protected area,
- declare protected areas in valuable locations of *Tulipa pirinica Anchusa macedonica* and *Querqus coccifera* (the locations and their boundaries are provided in the text)

Eastern Rhodope subregion

The entire territory of the southern watershed of the Arda River and especially the border area, should be afforded an appropriate level of protection, from Category V VI All natural communities and locations should be given the status of protected nature areas Especially interesting are the habitats of *Bunium feru laceum* and *Tulipa rhodopaea*, the nesting areas of *Gyps fulvus* and *Ciconia nigra* and the colony of *Ardea cinerea*

Dolnomarishko Dolnotundjansky subregion

The border regions in the southern part of Sakar and in the Derventski hills should be protected in a Category V VI protected area The interesting grass communities and habitats of *Falco naummani Aquila heliaca* and *Melanocorhipha yeltoniensis* should be de clared protected areas In addition

- the hill near Harmanly should be protected be cause of the presence there of interesting herpe tofauna and rare plants,
- the "Darkaia" area by the Tundzha should also be protected as a habitat of rare birds and nesting place of *Aquila chrysaetus*

Strandzha subregion

The high value of this region as a species forma tion center and as a unique European refugia of cen tury old species and communities demands very strict protection The whole territory within an area defined by the southern border of the country and the line between the villages of Lesovo, Dolno Iabalkovo, Boliarovo, and the towns of Grudovo and Primorsko should be protected as Category I, II, and III protected areas A system of Category I, II, and II reserves and protected areas should be organized and strictly en forced in the interior of the country

B *Middle Bulgarian Biogeographical Region*

Gornotrakiska Plain subiegion

Recommendations

- all of the Maritsa River islands from Plovdiv to Svilengrad, characterized by natural communities of "longos" type should be protected within mini mum Category IV protected areas,
- all islands with colonies of Ardeidae *Haliaetor pygmaeus Haematopus ostralegus, Sterna hirundo* and *Chlidonias nigra* should be declared natural landmarks, with buffer zones that cannot be en tered from 01 March to 30 October,
- the former governmental residencies "Tchekeritza" and "Kritchim" should be given the status of pro tected areas,
- the Besaparsky hills should be granted appropriate levels of protection as locations of rare plants and insects (locations are provided in the text),
- protection should be organized for the only loca tions in Europe of *Ceratophillum muricatus* and lo cations of the rare *Nimphoides peltata Marsilea quadrifolia Lemna dibba* and *Potamogeton friesii*
- the locations of *Sorbus borbassii S mougeottii Al lium montanum* and *Seseli bulgaricum* as well as the community of *Juniperus oxycedrus* should be declared "protected sites "

Tundzha Hilly lowland subregion

- the region of Central Sakar between the villages of Planinovo Hliabovo and Ustrem should be protected under Category IV, and the floristic and faunistic locations described in the text given the status of "protected places" or natural landmarks"
- protection should be given to the natural communities in the Manastirski hills and the Bakadzhitzite,
- the heron colony near the town of Nikolaev should be declared a "natural landmark "

C *Northern Bulgarian Biogeographical Region*

Only the Sofiisko Radomirsky subregion is discussed Recommendations

- the "Tchepan" hill by Dragoman which is the location of 8 rare endemic plants, *Vormela peregusna*, and *Buteo rufinus*, should be protected as a Category I protected area,
- the Dragomansko and Aldomirovsko wetlands – nesting places for rare birds and the location of 4 species of rare endemic plants – should be protected within a Category III protected area

D *Bulgarian Black Sea Biogeographical Region*

The problems of protecting the seaside lakes are discussed in detail The most significant recommendations are

- purification systems should be constructed throughout the river watersheds and the connections with the Black Sea restored
- all industrial plants should be removed from the lake shores
- all the (not yet protected) lakes should be placed within Category IV V protected areas, and the Durankulashko and Shablensko wetlands within Category I or II areas,
- two marine reserves should be organized

E *Bulgarian High Mountain Biogeographical Region*

Major recommendations

- expand the Pirin National Park to include areas in the Southern and Middle Pirins, or place this area within a Category IV V protected area (the floristic complex of the Middle and Southern Pirins includes 2 local endemics, 11 Bulgarian endemics and 96 Balkan endemics)
- expand the existing "Oreliak" reserve (the territory is described in the text)
- protect the Zemenska and Koniavska Mountains (where many rare endemic plants are found and where *A chrysaetus*, *B bubo* and *B rufinus* nest) in a Category V protected area and the Zemensky gorge in a Category III area

3 Major Threats to Biodiversity

Problems at the national scale are discussed here in contrast to section 2 (where threats and limiting factors are discussed at the regional scale) Concern has been expressed that the forthcoming privatization of cultivated lands and forests will result in conflicts between the local populations and biodiversity protection Because of the low level of ecologic awareness, biodiversity will be threatened

4 Disadvantages in the Current System of Management of the Protected Areas

In this section problems involving the current management of protected natural territories are discussed Some more significant of them are inappropriate administrative structures, confrontations between the different interests of the Committee of Forests and the Ministry of Environment the lack of systematic scientific studies of biodiversity, the improper personnel policy of the MOE and the lack of biologists employed in the administrative structures Recommendations are offered for improving the system of management and for involving nongovernmental ecological organizations

5 Institutional Changes Required to Strengthen Biodiversity Protection

There are apprehensions that the discussion and passage of laws relating to the preservation of biological resources will take a long period of time In connection with proposed budget changes it is recommended that new funding strategies be explored These may include financing from international institutions (for example through "debt for nature" agreements) and private sponsorship of nongovernmental ecological organizations It is further proposed that a new independent institution be created a Committee within the Council of Ministries with its own budget that will guard the protected areas develop management plans, and undertake research on the restoration of these areas The concept of creating local units of this Committee on a biogeographical basis is described

6 Opportunities for Integrated Conservation and Development

Several ideas are discussed in this section ecotourism and conditions for its safe development integrated use and protection of fish breeding farms in the Thracian plain, etc

7 Results of a Survey of Attitudes Toward Nature Protection

In this section, the results of a sociological survey among the population of the towns of Blagoevgrad and Bansko and the village of Dobrinishte are presented and interpreted The survey was carried out using the quota method that is described in the text The survey includ ed questions concerning the ecological awareness of the people the state of the environment in the region the attitudes of the local people toward the protected areas and toward wild plants and animals, the potential impact of land restitution on biodiversity, and the potential for reasonable use of biological resources

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Green Balkans Association, Council of Representa tives 28 February 1993

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Report of the Wilderness Fund on the Status and Conservation of Biological Diversity in the Central Part of the Balkan Mountains

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With the support and advice of the expert team of the Wilderness Fund

INTRODUCTION

This report synthesizes data on the flora vegeta tion vertebrate fauna and protected areas of Bul garia's Central Balkan (or Stara Planina) Mountains It has been compiled with the aim of describing the ecosystems and biological diversity of this relatively intact part of the country The status of the region's species and communities the anthropogenic impacts on them, and the attitude of the local people toward nature are analyzed This report includes recommen dations for more effective conservation of this moun tain territory and its exemplary natural attributes

In preparing this report we have reviewed the ba sic literature related to the relevant questions In ad dition, we have used unpublished data from experts as well as personal data and observations Finally to gain a better understanding of the attitudes of the local people toward biological diversity and the conserva tion of the mountains we conducted a survey in three communities in the region

PHYSICAL GEOGRAPHY OF THE CENTRAL BALKAN RANGE

In a geomorphologic sense the Balkan (Stara Planina) Mountains are divided into two parts the Main Range and the Fore Balkan The central part of the Main Chain from Zlatitsa Pass in the west to Vratnic Pass in the east, is the narrowest but most massive portion of the Balkan Mountains High passes (Ribarishka at 1,570 m, Troyan at 1,520 m Shipka at 1 200 m) split the ridge of this part of the Main Chain, which drops sharply to an altitude of 680 m in the Borushtensko Rodovsko area around the Republica Pass Along their total length of 185 km, the Central Balkan Range includes several sub regions Zlatishko Teteven (Vezhen Peak – 2 198 m) Troyan sko Kaloffer (Botev Peak – 2 376 m) Shipchen sko Tryavna (Isspolin Peak – 1 524 m) and Eleno Tvarditza (Choumerna Peak – 1 536 m)

The average altitude in the Central Balkan Range is 961 m The southern slopes from the ridges to the foot hills, are very steep The northern slopes are steep only in their higher parts up to the height of the hills that connect the Main Chain and the Fore Balkan The high est parts of the mountains, at altitudes of 1,800 1,900 m, consist of rounded (Paskal Peak and Botev Peak) and flat (Zhaltetz Peak) ridges, in strong contrast to the steep fault slopes below

Because of its location and relatively high altitude, the Balkan Range and its Central part in particular, form an important climatic barrier Its ridges consti tute the border between the European Continental and the Transitional Continental climatic zones This is responsible for the differences in temperature and pre cipitation between the northern and southern slopes The greatest average annual rainfall in the country during the years 1931 1970 was reco; led at Ambaritsa Chalet (1 360 mm)

A belt of the brown and dark mountain forest soils is found in the mountains within an altitudinal range of 700 800 m to 1,700 2 000 m This forms the Balkan Range Soil Province Light brown moun tain forest soils characterized by a shallow profile (up to 60 cm) and poor humus horizon (from 12 15 cm), are dominant Above 1,700 2,000 m is found the High Balkan Range Soil Province a part of the moun tain meadow soils belt Turf mountain meadow soils, developed under the meadow grass formations are characteristic of this soil province Their profile ex tends from 80 90 cm (in the lower parts of the slopes) to 40 cm (in the highest parts of the ridges) Black earth and secondary mountain forest meadow soils occur rarely (see *Geography of Bulgaria*, published by the Bulgarian Academy of Sciences in 1982)

BIODIVERSITY OF THE CENTRAL BALKAN RANGE

1 Flora and Vegetation

The flora and vegetation of the Central Balkan Range have been the subject of numerous studies This section summarizes the results of data published in the specialized literature, and also presents new data derived from research conducted by the authors Transect and semi stationary methods of sampling flo ral and phyto cenological diversity have been used Geobotanical descriptions have been used to define the plant communities and their basic characteristics using the methods specified in the *Short Field Guide for Geobotanical Surveys* (1952) and in the five volume work *Field Geobotany* (1959 1960 1964, 1972, 1976)

The Central Balkan Range plays an important role as a climatic border, and offers a wide variety of habitats on both its northern and southern slopes In addition the great altitude of the mountain ridge (Botev Peak – 2,376 m) allows for the appearance of vertical distribution in the vegetation

Flora

Many floristic studies have shown that the Central Balkan Range has a rich diversity of species and is an active species formation center Different populations of the same species as well as different species from northern and southern Bulgaria, have migrated and met in the Central Balkan Range As proof of this statement, we point out that in the terrain of the range 12 species and 1 sub species of local endemic plants have been classified They are found only in the Central Balkan Range These are *Silene balcanica* (Urum) Hayek, *Rosa balcanica* Dim, *Alchemilla achtarovii* Pawl *A jumrukczalica* Pawl *A asteroantha* Rothm *Trifolium pannonicum* ssp *jurkovski* Koz *Viola balcanica* Delip , *Seseli bulgaricum* P W Ball *Primula frondosa* Janka *Micromeria frivaldszkyana* (Deg) Vel *Betonica bulgarica* Deg et Neic *Centaurea karlovensis* Friv , and *Satureja pilosa* Vel

In the Central Balkan Range another 11 species and 2 subspecies of plants endemic to Bulgaria have been described These are *Minuartia bulgarica* (Vel) Graebn *Sedum stefco* Stef *Sedum kostovii* Stef *Sempervivum erythraeum* Vel *Chamaecytisus kovacevii* (Vel) Rothm *Trifolium medium* ssp *skorpilii* Vel *Epilobium alsinifolium* ssp *parviflorum* I Ganchev, *Veronica krumovii* Peev *Anthemis sanctijohannia* Turril *Centaurea kerneriana* Janka, *Alopecurus rilonensis* (Hack) Pawl *Luzula deflexa* Koz and *Jasionella bulgarica* Stoj et Stef

A full account of the endemic plants of the Central Balkan Range must also mention in addition to the Bulgarian 23 species and 3 subspecies, the 22 Balkan endemics These are *Pinus peuce* Griseb *Dianthus stribrny* Vel , *Sempervivum velenovskyi* Ceschm , *Alchemilla bulgarica* Rothm *A cathachnoa* Rothm , *A indivisa* (Buser) Rothm , *A asteroantha* Rothm *A gracillina* Rothm , *Acer heldreichii* Orph *Genista rumelica* Vel *Trifolium velenovskyi* Vandas *Armeria rumelica* Boiss *Carum graecum* Boiss et Heldr , *Angelica panciccii* Vand *Androsace hedracantha* Griseb *Gentianella bulgarica* (Vel) Holut, *Haberlea rhodopensis* Friv *Campanula moesiaca* Vel *Senecio panciccii* Deg *Campanula lanata* Friv *Festuca rilonensis* (Hack ex Hayek) Markgr , *Iris reichenbachii* Heuff

Of these endemic plants and some other rare and endangered plants from the Central Balkan Range, 8 species have been included in the "List of Rare Endangered, and Endemic Plants in Europe" (see Appendix 1) Many of the Central Balkan Range species are listed in Volume II of the *Red Book of the People's Republic of Bulgaria* (1984) The category "endangered plants" includes 11 species (see Appendix 2) 78 species are listed as 'rare plants" (see Appendix 3)

Many of the endemic plant species mentioned above as well as those on the "List of Rare Endangered and Endemic Plants in Europe' and in the Bulgarian *Red Book* occur rarely or their populations are small in number Man, with his economic activities turns out to be the main threat to the survival of these species The ecology and biology of some of these species have been studied other species have found their place on the List of Protected Plants of Bulgaria still others have populations within the existing protected areas However, the conservation measures undertaken have not yet covered the populations of all valuable species Large scale and extremely important work is needed in Bulgaria to further the study and preservation of this exceptional wealth

Vegetation

Due to the specific location of the Central Balkan Range within the phytogeographic divisions of the country, its vegetation falls into the European broad leaf forest region Iliric (Balkan) province Central Balkan County (*Geography of Bulgaria* 1982) The vegetation is characterized primarily by beech forests Durmast and yoke elm also occur and in the higher elevations spruce and silver fir forests are common The north and south facing slopes differ in climatic terms This is reflected not only in the number of distinct vegetation zones but also in the presence of different species with primary significance in forming the vegetation cover The distribution of vegetation along altitudinal gradients is clearer on the northern slopes where there are belts of xerothermic oak forest (up to 700 m) mesophylic and xero mesophylic oak and yoke elm forest (from 600 700 to 900 1 000 m) beech forest (from 900 1 000 to 1 300 1 500 m) partially developed evergreen forest (from 1,300 1,500 to 2,000 2 200 m) subalpine forest stands mugo pine scrub forests, and juniper bushes (from 2,000 2 200 to 2,500 m) Elements of the Alpine belt are also present

On the southern slopes, the upper border of the forest is considerably lower in elevation These slopes are to a great extent deforested There are only remnants of the first two vegetation belts and in many places the natural vegetation cover has been completely replaced by grass communities or by conifer and acacia plantations The belt of beech forests is fragmented and not fully developed Secondary grass communities now play a major role in the vegetation having replaced some of the beech forests and the totally extinguished belt of ever green forests The deciduous species *Quercus cerris*, *Q frainetto* *Q dalechampii*, and *Carpinus betulus* occur in the first two belts on the northern slopes, whereas on the southern slopes the more thermophilic *Quercus pubescens* *Q virgiliana* and *Carpinus orientalis* are present

Xerothermic Oak Forest Belt

The cerris oak forest is a basic formation on northern slopes It is found on silicate substrates with grey forest soils The terrain is plain and the lay of the land concave The natural vegetation includes stands dominated by cerris oak but we also consider *Quercus frainetto* forests to be natural Mixed tree formations with *Carpinus betulus Acer pseudoplatanus* and *Fraxinus excelsior* also occur Because of anthropogenic influences (logging and grazing), the tree formations are secondary, and the grass understory includes no rare or relict plants Ruderal plants are more common

The *Quercus frainetto* formation though of limited distribution due to its intensive exploitation occurs on areas of convex relief with southern eastern or western exposures The rock base of these forests is also mainly silicate with grey forest soils Most of the described communities are mixed tree formations and are natural forests, despite the changes they have undergone Derivative communities of *Carpinus orientalis* and forest grass complexes (of *Quercus frainetto Chrysopogon gryllus Festuca valesiaca* and *Dichantium ischaemum*) are also found They are used intensively for wood leaf fodder and grazing

A basic formation on southern slopes is that of *Quercus pubescens* Other trees occurring in this formation include *Quercus frainetto*, *Carpinus orientalis* and *Fraxinus ornus* The formation occurs on different soil types – maroon forest soils humus carbonate, etc – all of them more or less eroded These communities are found on sites with convex relief and sunny exposure Their distribution is very restricted due to their having been intensely used and destroyed

The *Quercus cerris Quercus frainetto* formation occurs on both northern and southern slopes Better preserved forests are to be found on the northern slopes on silicate terrains with grey forest soils On the southern slopes the soils are of the maroon forest type The sites are slightly inclined with convex relief and western, eastern or southern exposure *Crataegus monogyna Cornus mas* and *Cotinis coggygria* are found in the understory of secondary forests of this type In the grass understory *Brachypodium pinnatum Poa nemoralis* and *Dactylis glomarata* occur profusely and widely

The forest types described above play a definite environment forming role protect the soil from erosion, and have a transforming influence on the climate

Because of their proximity to human communities the xerothermic oak forests all have signs of anthropogenic influence Degradation has turned the vegetation from forest into shrub and grass communities In some places the terrain has been completely denuded Some are now abandoned after their having been used as arable lands

Derivative communities of the *Carpinus orientalis* formation occur widely The sites they occupy are, more often than not, steep, heavily eroded and fully exposed to the sun The rock substrate varies Dampness is meager Communities dominated by *Carpinus orientalis* predominate The stands of trees vary in density and height Still they are of some economic importance and play a role in maintaining the environment

The role of grass communities in this vegetation belt is quite large The most frequently occurring communities are those of *Chrysopogon gryllus*, *Festuca valensiaca*, *Dichantium ischaemum*, and *Poa bulbosa*

The *Chrysopogon gryllus* formation occurs widely on the slopes of the Central Balkan Range The communities are found mostly on sites with slight inclines and sunny exposures The rock substrates are either silicate or limestone The soils are well developed and belong to the grey forest maroon forest or humus carbonate soil types Of the different associations containing *Chrysopogon gryllus*, the mono dominant formation is found most frequently, especially on northern slopes Mixed grass formations – with *Festuca valesiaca Agrostis capillaris Dichantium ischaemum* etc – are also found The grass formations of the *Chrysopogon gryllus* communities are relatively rich in species They are used for grazing and hay growing The *Chrysopogon gryllus* communities perform environment forming water protection and erosion control functions They are sensitive to trampling and this has contributed to their deterioration

The *Festuca valesiaca* formation occurs on both northern and southern slopes but usually in places with sunny exposure It is characterized by a rich variety of species All these communities are of a derivative nature and tolerate the trampling that grazing causes The productivity and fodder qualities of *Festuca valesiaca* grass communities are good

The formations of *Dichantium ischaemum* occur primarily in this vegetation belt The sites they occupy usually have southern exposures The soils are primarily eroded and dry Mono dominant communities are most widely found The most frequently occurring mixed community is the *D ischaemum* and *Festuca valesiaca* association This formation is derivative and represents one of the last stages in the degradation of the vegetation cover

The degradation of vegetation in this belt due to the influence of human economic activities has had serious environmental consequences Climatic conditions have changed dramatically Accelerated erosion processes have been triggered Decertification processes have been initiated These negative consequences have stimulated the efforts to create new pine and acacia plantations

Mesophytic and Xeromesophytic Oak and Yoke-elm Forests

In this belt – especially on the northern slopes – the *Quercus dalechampii* formation is the most common The sites are silicate and moderately damp The soils are well developed of the grey forest type on the northern slopes and of the maroon forest type on the southern slopes In some cases these communities are also found on brown forest soils They prefer northern exposures Communities with mono dominant tree formations are most common *Quercus dalechampii* also occurs in mixed formations with *Quercus cerris*, *Carpinus betulus*, *C orientalis*, and other species Despite degradation by man, the *Quercus dalechampii* communities have the highest productivity of any of the oak forests

The *Carpinus betulus* formation is found in limited quantities on the northern slopes of the mountains The sites it occupies are moderately damp with northern exposures The soils are grey forest, with a silicate rock base The associations are mainly dense mono dominant tree formations The grass understory is poor in species composition and consists of typical sciophytes The *Carpinus betulus* communities are mainly secondary in origin and low in productivity

Rarely occurring in the Central Balkan Range – in damp ravines near rivulets, and on limestone terrains – are the communities of the *Ostrya carpinifolia* formation The grass understory consists of typical sciophytes such as *Poa nemoralis* and *Melica uniflora* The relict species *Haberlea rhodopensis* can be found in some places These communities play a definite water protection role

Secondary communities of *Corylus avellana* usually replacing *Quercus dalechampii* occupy moderately damp sites with well developed soils

Grass communities occurring largely in this belt are the associations *Chrysopogon gryllus Agrostis capillaris* and *Agrostis capillaris* These grass formations have good fodder qualities They are derivative in nature

The Central Balkan belt of mesophytic and xeromesophytic oak and yoke elm forests which once had an important environment forming function, has changed considerably It has been most seriously affected on the range's southern slopes In some places absolutely no vegetation remains The derivative vegetation in these areas has reached the last stages of degradation

Beech Forests

The belt of beech forests occupies a large area especially on the northern slopes of the mountains The basic formation consists of *Fagus sylvatica*, which was a component of the original vegetation It occurs on varied exposures and on different rock bases The soils are of the brown forest mountain type They are well developed and relatively damp The diversity of beech community types is great Most widely occurring are the mono dominant tree formations Mixed tree formations are formed with *Carpinus betulus Ostrya carpinifolia Acer pseudoplatanus* and other species The association *Fagus sylvatica Laurocerasus officinalis* is extremely interesting These relict communities with their ever green understory have been found on the northern slopes they occupy the largest area in the Gabrovo Balkan Everywhere in the beech forest belt the grass of the forest floor includes mesophilic species such as *Galium odoratum Poa nemoralis Dactylis glomerata*, and *Geranium macrorrhizum* In highly dense tree formations there is no grass on the forest floor The beech forests are of great economic importance for their timber productivity They influence climatic conditions, protect soils, and regulate water flow The extent of the beech forests has been considerably reduced, especially on the southern slopes, due to continuous exploitation

Fagus sylvatica also forms mixed tree formations with the conifers *Picea abies*, *Abies alba*, and, more rarely *Pinus nigra* These formations occupy quite damp thick, and rich dark brown forest soils The mixed beech evergreen communities have great productivity and are of high economic significance

In the belt of the beech forests, large areas are occupied by grass communities Most widely encountered is the *Agrostis capillaris* formation It occurs on brown forest grey forest and mountain forest dark soils, usually in places with a northern exposure The *Agrostis capillaris* communities are derivative in nature A number of associations have been described in this formation Subdominant to *Agrostis capillaris* are some species of *Trifolium Festuca nigrescens Festuca valesiaca*, etc All of these have good fodder qualities

Especially extensive are the *Pteridium aquilinum* formations replacing forests of *Fagus sylvatica Carpinus betulus*, and *Quercus dalechampii*

Vegetation in the beech forest belt has been under intense anthropogenic pressure, and serious degradation has taken place Many places have been stripped of forests, or the forests have been reduced to shrubs and grasses In many places, reforestation with Scotch and Austrian pine is taking place

Evergreen Forests

The belt of evergreen forests occurs only rarely in the Central Balkan Range Among these forests of definite interest is the *Pinus peuce* formation It is found in the Vezhen part of the mountains *Pinus peuce* is a Balkan endemic and this is the most northeastern habitat in its range The species occupies steep slopes with a northern exposure or exposures with a northern aspect The rock base is mainly silicate The soils are dark mountain forest quite damp, and rather stony Most associations are mono dominant The usual co dominant species in mixed formations is *Picea abies* These communities are rich in shrubs and bushes of all sizes such as *Daphne mezereum Vac*

cinium myrtillus Vaccinium vitis idaea, and *Juniperus sibirica* Among the grass species most frequently found are *Lerchenfeldia flexuosa Calamagrostis arundinacea* and *Luzula luzuloides*

The *Picea abies* formation covers limited areas with northern exposures or slopes with a northern as pect The rock base is silicate The soils are of the dark mountain forest type, strong and rich Moisture is great and evenly distributed In addition to the mono dominant tree formations *Picea abies* also oc curs in mixed tree formations with *Pinus peuce*, *Abies alba* and *Fagus sylvatica* Shrubs (*Vaccinium myrtillus*) and grasses (*Oxalis acetosella*, *Calamagrostis arundina cea Luzula luzuloides*) are also represented Mosses are abundant The *Picea abies* communities retain elements of the original vegetation Exploitation has greatly reduced
the area they cover

Abies alba forests occur mostly in the Zlatishko Teteven and Troyansko Kallofer regions They are not a major part of this vegetation belt The *Pinus sylvestris* formation is limited and includes primarily plantations

Tree formations of the evergreen forest belt have been removed and replaced by formations of shrubs small bushes and grasses Shrub formations of *Juni perus sibirica Vaccinium myrtillus*, *V vitis idaea Bruckenthalia spiculifolia* and other species are found Grass formations of *Festuca nigrescens* are widely en countered It is associated most frequently with *Agrostis capillaris Nardus stricta Lerchenfeldia flexu-osa*, *Bellardiochloa violaceae*, etc All these communi ties are derivative The grass communities are used for grazing

Subalpine Tree Formations Dwarf Pine, and Juniper Formations

The belt of subalpine tree formations occurs largely along the ridges and on the northern and southern slopes of the mountains Shrubs and small bushes play a major role in this zone

The *Pinus montana* formation is represented by isolated communities at certain spots on the ridges and on the northern slopes of the Zlatishko Teteven Mountain These communities are evidence that the formation was formerly more widely distributed

The *Juniperus sibirica* formation is the most exten sive in this belt and is found at elevations of between 1 500 1 700 and 2 200 m *Juniperus sibirica* communi ties can be seen on sites with various exposures and slopes The rock base is mainly silicate Subdom inants in the communities include *Vaccinium myrtillus V vitis idaea Bruckenthalia spiculifolia* and *Lerchen feldia flexuosa* Seven associations have been de scribed The wide occurrence of *Juniperus sibirica* formations can be attributed to its derivative origins i e , its development in the place of primary tree com munities that have been destroyed The *Juniperus si birica* communities are used for grazing Frequent fires have resulted in the formation of bush-and grass complexes of *Festuca nigrescens*, *S airoides*, *Belar diochloa violacea*, etc The *Juniperus sibirica* communi ties have a definite soil protection role to play

The *Vaccinium myrtillus* association includes 20 formations Prevailing are mixed communities with *Vaccinium vitis idaea V uliginosum*, *Bruckenthalia spi culifolia*, *Festuca nigrescens*, and *Agrostis capillaris* Almost all of these communities are derivative and have appeared in the place of destroyed forests

The *Vaccinium uliginosum* formation is repre sented by communities of limited occurrence The sites are silicate, with northern exposures The soils are damp, and of the dark mountain forest type It occurs in 11 described mixed communities with *Vaccinium myrtillus*, *Sesleria comosa Bruckenthalia spiculifolia* and others We assume that these communities repre sent remnants of the original vegetation

The *Arctostaphylus uva ursi* formation is repre sented by one association only The area it occupies is small and of no great significance for the vegetation of the belt as a whole

The *Vaccinium vitis idaea* formation is repre sented by only one association

The *Bruckenthalia spiculifolia* formation occurs on southern exposures, sites with convex relief, and eroded terrains Four associations have been de scribed

In this vegetation belt, formations of *Festuca air oides Juncus trifida Lerchenfeldia flexuosa Festuca balcanica Bellardiochloa violacea*, *Calamagrostis arundinacea*, *Deschampsia flexuosa*, and others also occur They make the vegetation of this belt highly specific and unique A limited number of these asso ciations have been studied

Definitely important, with its wide occurrence is the *Nardus stricta* formation Regardless of the expo sure altitude, moisture soil type, etc , these communi ties find favorable conditions for their development even under continuous grazing and hence trampling The deteriorated conditions for aeration allow for the expansion of the area of *Nardus stricta* communities Five associations have been described The species in clude these of *Festuca nigrescens*, *Poa media Festuca airoides*, *Bellardiochloa violacea*, *Agrostis rupestris*, etc It has been established that, despite the large area oc cupied by *Nardus stricta* communities, cattle avoid and do not graze the sharp leaves of *Nardus stricta* fur thermore these communities are low in productivity The *Nardus stricta* communities form dense grass mats, when cattle pass these are easily damaged and small portions of turf are torn away These communities play a definite role in protecting soils

Alpine Vegetation

As there are no areas in the Central Balkan Range with altitudes above 2 500 m the alpine vege tation belt per se has no clear or distinguishable pres ence However individual elements of this belt occur

in the Central Balkan Range at lower than usual altitudes This we suppose is due to cold air masses that come into the region without impediment from the north and northwest Vegetation communities typical of alpine vegetation consist of *Agrostis rupestris Juncus trifidus Sesleria comosa Festuca airoides, Alopecurus gerardii* and other species These are found only in limited areas but nevertheless are of special scientific interest They are not economically important

2 Fauna

According to most surveys performed in the region the Balkan Mountains should be placed in the so called Balkan Biogeographic Province (Spiridonov, unpub) The mountains are situated at a crossroads where animal and plant species of the European Broad leaved Zone, the Mediterranean, the Continental Steppes and the alpine regions meet In the Balkan Mountains the Central European and Euro Siberian faunal elements dominate The most typical groups of species are those of the Boreal and Arctic Alpine fauna

The fauna of the Central Balkan Range distinguishes it from other parts of the mountain chain This is due to the lay of the land and its relatively high elevation Owing to these characteristics the central range was less affected by human activities and primary biocenoses and species that no longer occur in the other parts of the Balkan Mountains have survived

Species Diversity

In the so called High Balkan Mountains 220 higher animal species breed 7 fishes 10 amphibians 15 reptiles 139 birds and 49 mammals These species are grouped into several faunistic complexes (FC) according to the elevations where they are distributed the low mountain FC the mountain beech and spruce beech forest FC the mountain coniferous forest FC and the subalpine FC (after Spiridonov 1983)

Many of the fish species occur in the low mountain FC while one appears in all the complexes

The amphibian species are also concentrated in the low mountain FC (8 of the 10 species occur there) Their diversity in the mountain beech and fir beech FC is relatively high and two species thrive in the subalpine FC One versatile species occurs in all of the complexes

The greatest diversity of reptiles also occurs in the low mountain FC (7 of the 15 species) Five species are found in the mountain beech and fir beech forest FC four in the mountain coniferous forest FC and two in the subalpine FC

Of the 139 bird species of the Central Balkan Mountain, 28 are threatened with extinction They are classified into several categories according to the degree of threat (Spiridonov 1983) as follows

Extinct and nearly extinct grey heron (*Ardea cinerea*) bearded vulture (*Gypaetus barbatus*) Egyptian vulture (*Neophron percnopterus*) griffin vulture (*Gyps fulvus*) Cinereous vulture (*Aegypius monachus*) imperial eagle (*Aquila heliacea*) saker falcon (*Falco cherrug*) ca percallie (*Tetrao urogallus*)

Threatened with extinction black stork (*Ciconia nigra*) lesser spotted eagle (*Aquila pomarina*) booted eagle (*Hieraaetus pennatus*) peregrine falcon (*Falco peregrinus*) northern hobby (*Falco subbuteo*)

Endangered sparrow hawk (*Accipiter nisus*) northern goshawk (*Accipiter gentilis*) honey buzzard (*Pernis apivorus*), stock dove (*Columba oenas*), white backed woodpecker (*Picoides leucotus lilfordi*), black wood pecker (*Dryocopus martius*)

Rare golden eagle (*Aquila chrysaetos*) long legged buzzard (*Buteo rufinus*) eagle owl (*Bubo bubo*) Ural owl (*Strix uralensis*), Tengmalm's owl (*Aegolius funereus*), wallcreeper (*Trichodroma muraria*)

The avifauna of the Central Balkan Mountains is characterized by the richness of forest species that have not yet been sufficiently studied In the different complexes the dominant bird species are determined by the types of forest ecosystems and their exposures which means that they are also determined by elevation In the Boatin and Tsaritchina reserves the representative bird species and the ornithocenological complexes and groups have been well studied In the beech forests of the Boatin reserve the chaffinch (*Fringilla coelebs*) wren (*Troglodytes troglodytes*) European robin (*Erithacus rubecula*) blackcap (*Sylvia atricapilla*) European nut hatch (*Sitta europaea*), and great tit (*Parus major*) are dominant (Spiridonov et al 1983) In the Tsarichina reserve, a little further east, the dominant species are almost the same except for the last two In addition to the four other species mentioned above two other species commonly occur in the mixed spruce beech forests of the Tsarichina reserve the goldcrest (*Regulus regulus*) and wood warbler (*Phylloscopus collybitus*) In the mixed spruce white fir forests of the reserve the chaffinch (*Frangilla coelebs*) firecrest (*Regulus ignicapillus*) chiff chaff (*Ph collybitus*) European robin (*Erithacus rubecula*) and goldcrest (*Regulus regulus*) are dominant (Spiridonov et al , 1987)

The ornithofauna of the subalpine zone differs substantially from that of the forest zone although half of the dominant and subdominant species are forest species Species of the open and semi open forests occur there – including rock pipit (*Anthus spinoletta*) alpine accentor (*Prunella collaris subalpinus*) tree pipit (*Anthus trivialis*), whichat (*Saxicola ruberta*) black red start (*Phoenicurus ochrurus*), and dunnock (*Prunella modularis*) The alpine pastures are less rich in species than the subalpine zone In the Tsarichina reserve for example only 13 species are found including the

dominant rock pipit (*Anthus spinoletta*) and shoe lark (*Eremophila alpestris balcanica*) (Spiridonov et al , 1987)

In the old forests of the Central Balkan Range large parts of which fall within the boundaries of the strict nature reserves and the National Park rare woodpecker species occur They are listed in the *Red Book of the People s Republic of Bulgaria* A repre sentative subspecies – the southern white backed woodpecker (*Dendrocopos leucotos lilfordi*) – deserves special attention Some one hundred pairs of this spe cies breed in the reserves of the Central Balkan Range It inhabits the old beech and mixed forests and feeds on xylophagous insects (Spiridonov 1985) The black woodpecker (*Dryocopus martius*) also in habits the old forests The last habitats of the caper callie in the Central Balkan Range are in the Tsarichina reserve, the most recent observation of this species dates from 1980

Among the birds of prey the griffin vulture (*Gyps fulvus*) is extremely rare It has been observed only occasionally over the last 25 years The golden eagle (*Aquila chrysaetos*) has bred in the Stara Reka reserve and the long legged buzzard (*Buteo rufinus*) has been observed there since 1982 during its nesting period

The nocturnal birds of prey of the Central Balkan ecosystems are of special conservation interest Re search in the late 1970s and 1980s (Spiridonov et al 1982 Spiridonov and Mileva 1988) verified for the first time the nesting of the Ural owl (*Strix uralensis*) in Bulgaria It is found in the Boatin Tsarichina and Steneto reserves in old beech and mixed forests The same studies also indicated the existence of Teng malm's owl (*Aegolius funereus*) thus establishing a new Bulgarian habitat for the species (it also occurs in the Rila Mountains) It is also interesting to note the data concerning the pygmy owl (*Glaucidium passerinum*) which is considered extinct in Bulgaria and in the past was observed only in the Rila Mountains The last ob servation took place in Rila in 1955 On the other hand sightings and calls between pairs were recorded in 1975 and 1983 in Tsarichina and Steneto (Spiridonov et al , 1987 Spiridonov and Mileva 1988) which suggests that the species likely inhabits the old coniferous forests of the Central Balkan Range

The small mammals are typical of the European forest mountain fauna The total number of species is 33 The number of species is different in the different forest formations Population density varies from year to year depending on environmental conditions Re search at Tsarichina (Zemanek 1987) suggests that in the old beech forests the density of rodents is low compared to that of the spruce forests but higher than that of the white fir forests On the other hand spe cies diversity
in the old beech forests is higher than in the other two formations

The distribution of the large mammal fauna indi cates that the low mountain FC the mountain (beech and fir tree forests) FC and the mountain (coniferous) FC are highest in value

The large mammals of the Central Balkan Range are represented by 14 species In addition, there are several species that occur only occasionally where conditions are suitable These include the marbled polecat (*Vormela peregusna peregusna*), which occurs in several rocky regions (Steneto), and the jackal (*Canis aureus*) which in recent years has only rarely been found in lower parts of the river valley The rac coon dog (*Nyctereutes procyonoides*) has been observed only once in the lower parts of Teteven Balkan Mountain, and this was probably a wandering individ ual In the past – up to the 1960s – the European lynx (*Lynx lynx*) was found in some parts of the mountains

Detailed studies in Tsarichina allow us to classify the characteristic large mammals into several catego ries according to the frequencies of their occurrence

- Occurring very often the roe deer (*Capreolus ca preolus*) and fox (Vulpes vulpes),
- Occurring often the stone marten (*Martes foina*), red deer (*Cervus elaphus*) wild boar (*Sus scrofa*) and weasel (*Mustela nivalis*)
- Occurring rarely the bear (*Ursus arctos*) and pine marten (*Martes martes*),
- Occurring very rarely the otter (*Lutra lutra*) wild cat (*Felis silvestris*) badger (*Meles meles*) and pole cat (*Mustela putorius*)

This classification does not include the Balkan cham ois (*Rupicapra rupicapra balcanica*) or wolf (*Canis lu pus*) It reflects the relative density of the populations and the occurrence of the species on the north slopes of the Central Balkan Range, and does not include its lower parts (mainly in the Boatin and Tsarichina Re serves) The last group of species – the wild cat badger and black polecat – have large populations

The north slopes of the mountains are character ized by high humidity, and are rich in terms of vegeta tion They are thus suitable for ungulate species The density of ungulates decreases in the upper parts of the forests even in the deciduous forests in winter Dur ing these periods, the animals graze on the south slopes, some of them even migrating to them across the main crest It is interesting to note that in addi tion to the mass migration of animals to the lower parts of the mountains, the reverse process can also be observed When the snow cover is deepest the fox and deer can also be found above the forest line (Spiridonov et al 1987) The deer also graze in the alpine meadows during the period when they drop their antlers Sometimes even the badger (*Meles me les*) can be found in the subalpine zone (it has been observed in the middle of May at an altitude of 1 900 m)

The breeding habitats of most of the large mam mals species are located in the forest zone Most of

the species use the forest and subalpine zones as a trophic base It is worth mentioning in this context studies of doe propagation at the Boatin and Tsarichina Reserves from 1988 to 1992, which determined that the main period of fawn births occurs from the middle of May until the end of June This is the earliest such period yet determined in Bulgaria (Spiridonov et al 1987) Early birth of the weasel (at the beginning of May) has also been determined in Boatin near the Komitsky valog (Spassov and Spiridonov unpub)

The absence of predatory animals such as the wolf (which since the mid 1980s has returned to these localities) and lynx, and the significant propagation of deer, wild boars, and especially roe deer, has resulted in disturbance of the balance of the primary ecological systems preserved in the national park Actually the predatory function of these animals is now performed by poachers only – recently without any scruples whatsoever The disturbance of predator prey relationships is possibly due to the ungulates' lack of experience with the permanent chase and their resultant inability to defend themselves against real predatory animals For example, dozens of roe deer were killed in one or two winter seasons by just one predatory animal – a wolf dog hybrid – in the valley of the Zavodna River in 1983 1984 (Spiridonov et al 1987) Another example of the degradation of predator prey relationships is the increase in the populations of roe deer and foxes in the absence of their traditional enemies The group hunting that has been observed among foxes is a consequence of this population growth

The Central Balkan Range provides habitat for a number of globally or nationally threatened species, including the wolf, bear otter, marten and Balkan chamois The populations of most of these species are healthy and typical for the region

Wolf (*Canis lupus*)

Listed in Bulgaria's *Red Data Book* This species inhabited the region until the 1960s, when it began gradually to disappear This decline coincided with the low point in its population in the country generally The restoration of the species in the Central Balkan Mountain began in the early 1980s It is likely that the region has been repopulated by migrants from the Sredna Gora Mountains The considerable density of roe deer and wild boar, and the inaccessibility of their habitats in the almost intact natural areas of the national park will ensure a stable population in the region

Bear (*Ursus arctos*)

Listed in Bulgaria's *Red Data Book* as rare It inhabits the central part of the Balkan Mountains but has disappeared from the eastern and western parts The population on the southern slopes of the mountains is 86 individuals (Raichev 1989) According to data obtained in a survey of the forestry departments the bears in the Central Balkan Range number approximately 210 (Spiridonov and Mileva, 1989 1990 unpub) Thus the highest density of the species is in this region Their traditional habitats are situated on the southern and northern slopes at an altitudes above 800 m (Spiridonov and Spassov, 1990) The dens are situated between 800 and 1 800 m but usually above 1 200 m (Spiridonov and Spassov 1990) Only pregnant bears enter true hibernation Early in the spring and sometimes in the autumn the bears will attack herds of domestic animals grazing in the mountain meadows For that reason, bears are hunted by people

In 1984, a bear hunting reserve was established and Carpathian bears were introduced there This has damaged the genetic purity of the bear population in the Central Balkan Range The release of captive bred bears and supplementary feeding of the animals has sharpened the antagonistic bear man relationship This has led to an increase in bear aggressiveness (Spiridonov and Mileva, 1987 Spiridonov and Spassov 1990)

This species was declared protected in January 1993 Securing suitable habitats and missing pieces in the reserve network would improve the situation for this isolated population It would also be useful if some of the bears introduced from the Carpathians were eliminated

Pine marten (*Martes martes*)

Listed in Bulgaria's *Red Data Book* Its habitats in the Central Balkan Range are very important for the survival of the species in the country A typical species of old coniferous and beech forests, it has perfect habitat conditions in the region The population in Bulgaria has decreased due to intensive hunting deterioration of its habitats in the plains, and anthropogenic impacts on the balance in its competitive relationship with the stone marten The stone marten (*Martes foina*) dominates the broad leaved zone but often occurs as well in typical pine marten habitats – old mixed and coniferous forests, mainly near huts and in rocky regions (Spiridonov et al 1987) It is possible, however that the preserved old forests in the national park will contribute to the long term survival of the marten in the Central Balkan Range

Otter (*Lutra lutra*)

This species is listed as threatened in Bulgaria's *Red Data Book* The otter's typical habitats are not found in high mountain regions it is found there mainly during the summer months For these reasons the otter population in the Central Balkan Range is not very large Over the last few years, however, otters have begun to spread to the mountainous regions For example, otters have been observed in the lowest parts of the Boatin Reserve and in the buffer zones of the

Tsarichina Reserve This is probably due to the contamination and decrease of fish food sources in the middle and lower currents of the rivers

Wild cat (*Felis silvestris*)

The only species examined here that has not been listed in Bulgaria's *Red Data Book* According to the available data however the species is vulnerable due to the potential for hybridization with the domestic cat (Spassov and Spiridonov, unpub) Studies indicate that in some regions of Bulgaria the degree of hybridization is very high and will affect the genetic purity of the population Because the Central Balkan Range is relatively poor and sparsely populated with unfavorable living conditions for people, the threat of hybridization in this area is considered insignificant As an inhabitant of forests with high rodent population densities the wild cat hardly occurs in the higher parts of the mountains On the other hand, their density in the mixed beech hornbeam and pure beech forests (at altitudes up to 1,000 1 200 m) is very high

Balkan chamois (*Rupicapra rupicapra balcanica*)

A subspecies listed in Bulgaria's *Red Data Book* It is of special interest as a Balkan endemic It is found on southern slopes mainly in the higher parts of the mountains In the beginning of the century the species was distributed from the Vezen to the Tvrdishki Balkan (Spiridonov unpub) Poaching has been the principal threat to the subspecies The population now numbers about 200 individuals (Spiridonov and Mileva, unpub) The Balkan Mountain population is concentrated in the Central Balkan National Park and is the smallest in the country It is therefore considered to be the most threatened (including the threat from genetic deterioration) The species is subject to hunting The *Bulgarian Red Data Book* identifies poaching, sheep flocks and the influence of tourism as negative factors Its status is regulated by law, and the Balkan Mountain population is effectively preserved within the boundaries of the national park The number of the population in the park is expected to reach over 500 (Spiridonov unpub)

Lynx (*Lynx lynx*)

A species of special importance to conservation for monitoring faunistic complexes and ecosystems in the Central Balkan Range is the lynx Unfortunately it has disappeared from the country According to available data (Spiridonov and Mileva unpub) the lynx was last observed in 1940 near the town of Karlovo The almost intact state of the potential habitats the existing vegetation the lay of the land the system of protected areas and the high number of the roe deer (the main prey of lynx in this region) will, it is hoped enable the species to be reintroduced in its previous habitats (Spiridonov, 1985) The first steps toward reintroduction have been taken by the Ministry of Environment including a visit from an expert from the National Hunting Service of France to assess potential habitats

Threats to Faunal Diversity

The system of protected areas in the Central Balkan Range ensures that good opportunities will exist for the preservation of the region's faunal diversity However, a number of different threats exist They vary according to the species and their ecological circumstances The degree of threat also depends very much on the relationship between the species and people, and on the attitudes of the local population Poaching, for example, is one the most serious direct threats

Measures Needed for Species Conservation

1 Establishment of an institution to provide effective control and safeguarding of the protected areas
2 Enlargement of buffer zones in the areas where hunting tourism has developed and around the protected areas

PROTECTED AREAS IN THE CENTRAL BALKANS

At present, a model system of protected areas exists in the central part of Balkan Mountains The Central Balkans National Park, designated in 1991 includes 9 large reserves (only one of them is smaller than 1,000 ha) The reserves, their sizes and their dates of designation are listed in Table 1 The total area of the reserves is 20 020 ha, and that of the national park 73,261 8 ha The location of the park was the result of a 20 year long process during which surveys and other steps were undertaken to expand the area of the reserves and to set up enforceable buffer zones (Spiridonov unpub) Eight of the reserves are within the park's territory

Nowhere in the rest of the Balkan Mountains (or the Sredna Gora) can such a high concentration of wildlife of such quality be seen This assertion is based on the fact that the greatest variation in altitude is observed here – from 600 to nearly 2 400 m a s l (including a well formed subalpine belt and an emerging alpine belt around Botev Peak) This creates conditions for the richest climatic biotic, and cenotic diversity Within the park s boundaries are both northern and southern mountain slopes with their rich biotic and cenotic diversity allowing for the migration of a large number of bird and large mammal species to the protected areas on a seasonal basis (Spiridonov unpub)

Within this area is also one of the three most important silicate base centers of species formation in

Table 1 Reserves in the Central Balkan Range, their sizes, and their dates of designation

Reserve	Area (ha)	Designated in
Boatin	1 597 2	1948
Tsarichina	3 519 0	1949
Kozya Stena	904 3	1987
Steneto	3 578 8	1979
Northern Djendem	1 610 0	1983
Peeshti Skali	1,465 7	1979
Stara Reka	1,974 7	1981
Djendema	4,220 2	1953
Sokolna	1 250 0	1979

Bulgaria – the Kalofer Mountain and Triglav Peak (Kozhuharov 1977) In the rest of the area endemic species are either rarely found or are scattered over a large area (as in the Sredna Gora) The Central Bal kan Range also has the richest flora of all the botani cal and geographical regions of the country – over 2 000 species and subspecies (Kozhuharov et al 1980) Rare and endangered animal species are more numerous here than in any other region of the Balkan Mountain and Sredna Gora region

The deciduous broad leaf forests of the Nemoral type are widespread in the areas over 800 1 200 m These are with minor exceptions European beech forests and form the upper boundary of the forest covering most of the mountains on both northern and southern slopes The Central Balkan Range, along with Vasilyovska Mountain to the north and the Sredna Gora to the south, form the most impressive beech bioclimatic zone in Bulgaria For natural or anthropogenic reasons, the other representative forest ecosystems have only limited fragmentary distribu tions in the region This holds true even for the com mon hornbeam (*Carpinus betulus*) and durmast (*Quercus daleschampii*) One exception is the spruce forest (covering over 500 ha)
in the Steneto Reserve and the pine spruce and oak forests in the southeastern end of the Ribaritsa State Forestry Department

The mixed broad leaf forests in the low moun tainous areas (up to 1 000 m on average) should be considered representative ecosystems Their commu nities consisting mainly of Micean and European oak hornbeam or durmast form a giant jigsaw mosaic

When the national park was designated a special effort was made to include the maximum number of the Central Balkan Range's valuable plant species (1800– 1900 out of a total of 2050 higher plant species and subspecies) the species formation center and its core (Kalofer Mountain and Triglav Peak) and the habitats of the maximum possible number of species listed in Bulgaria's *Red Data Book* (93 out of a total 110 in Central Stara Planina) Every effort was made to in clude within the park's boundaries all the Central Bal kan habitats of threatened and endemic species with limited distribution

Of the 228 vertebrate species (Spiridonov un pub) that breed in the Central Balkan Range 200 fall within the boundaries of the national park This is more than half of the vertebrate species (excluding freshwater fish) that breed within Bulgaria Rare and threatened species are protected in a similar way The park preserves 33 species that are listed in Bulgaria's *Red Data Book*, five of which are included in the *World Red Book* (1988) Another two species listed in the *World Red Book* are
not in Bulgaria's *Red Data Book* *Testudo hermanni* and *Nyctalus noctula*

The park plays a major role internationally in the protection of the brown bear (*Ursus arctos*) white backed woodpecker (*Picoides leucotos lilfordi*) wolf (*Canis lupus*) marbled polecat (*Vormela peregusna*), and otter (*Lutra lutra*) (Spiridonov unpub) The population of bears includes 50 individuals The long term protec tion of this population is ensured through contact with the rest of the Balkan Mountain population The park is the only way to provide large scale protection for the white headed woodpecker (around 100 pairs) in all its subspecies forms The park also provides important protection at the national level for the pine marten (*Martes marates*) Ural owl (*Strix uralensis*), pygmy owl (*Glaucidium passerinum*), Tengmalm's owl (*Aegolius fu nereus*) hazel grouse (*Bonasa bonasia*) golden eagle (*Aquila Chrysaetos*) black woodpecker (*Dryocopus mar tius*) goshawk (*Accipiter gentilis*) sparrowhawk (*Accipiter nisus*), honey buzzard (*Pernis apivorus*) eagle owl (*Bubo bubo*) stock dove (*Columba oenas*) long legged buzzard (*Buteo rufinus*) and Aesculapian snake (*Elaphe longissima*)

The population of the Balkan chamois (*Rupicapra rupicapra balcanica*), which was listed in the *World Red Book* 5 years ago remains isolated due to the size and character of its habitats

Nature Reserves and Other Protected Areas

The ***Boatin Reserve*** is located beneath the Tete venska Baba Peak on the land of the village of Cherni Vit Over 60% of the beech forests in the reserve are between 170 and 220 years old They are perfect ex amples of climax beech forest where trees 45 50 m high and 2 m wide are commonly found Beech for ests grow up to 1440 1680 m in elevation where the spruce belt begins This belt averages some 220 m wide in altitude while the age of the communities ranges between 80 100 years About 80 bird species nest on the territory of the reserve and its buffer zone (30% of all the breeding birds in Bulgaria) About 557 plant species and 17 animal species from Bul garia's *Red Data Book* have been found there (Mikhalic in press)

The watershed of the Bolovandzhika River forms the core of the ***Tsarichina Reserve*** The altitidunal variation between the watershed basin in the Ribaritsa Valley and the Vezhenski peak is 1350 m These is rocky impenetrable terrain with many 45O slopes The reserve includes 3 entire biotic belts and part of a fourth Alpine communities can be found above 2000 2100 m Beech fir and beech forests cover the largest area (about 70% of the forests) with some for ests reaching 1500 1700 m in altitude and 160 years in age Spruce and white fir forest (the only compact area of its kind in the Balkan Mountains) form a well developed belt at altitudes between 1500 and 1900 m Higher plant species number 600, 23 of which are in Bulgaria's *Red Data Book* Seventy seven bird species have been identified in the reserve 16 of which are in the *Red Data Book* There are 13 different species of large mammals including bear wolf, otter and mar ten

The ***Kozya Stena Reserve*** covers the northern slopes of the Boba and Colicon Peaks and Kozya Stena a natural landmark Its terrain is rocky and im penetrable and covered with ancient beech and fir for ests The rocky northern slope of the Kozya Stena Peak (1670 m) is a treeless 60O slope The rock face (stena) itself is perpendicular The limestone and dolomite rock tends to retain moisture and thus pro vides excellent conditions in the summer for relict spe cies and communities (more typical of treeless high land zones) to grow under 1 700 m At least 35 species are included in the Bulgarian *Red Data Book*

The ***Steneto Reserve*** includes the impressive can yons above the Cherni Osam river and the surround ing forests The largest area of virgin forest in the country is found there Beech forest covers about 2 000 ha 90% of which are old growth forests 1 400 ha consist of forests 150 250 years old Mixed beech forests (with fir common hornbeam and water horn beam) comprise a small area Mixed beech spruce forests are found in the highlands and above them 500 ha of spruce forest The flora of the reserve (which is also a Biosphere Reserve) is exceptionally rich Mik halic estimates that more than 1,000 higher plant spe cies occur there Some of the rare and threatened spe cies are *Taxus baccata*, *Juniperus sabina*, *Acer heldreichii*, *Daphne blagayana* *Saxifraga marginata* *Caraum graecum* and *Haberlea rhodopensis* The or nithofauna in the reserve is richer than that of the other Stara Planina reserves, 82 breeding species hav ing been identified so far (Spiridonov and Mileva, 1988) Four of the large mammals are in Bulgaria's *Red Data Book* marten, otter, wolf, and bear

The ***Stara Reka Reserve*** covers lands in the Stara River watershed above the town of Karlovo The veg etation is amazingly rich, the forests resemble the mixed forests of the Rhodope Mountains Over 45 plant species from Bulgaria's *Red Data Book* are found there, of which 20 are endemic species So far 65 breeding animal species have been registered, 11 of which are listed in Bulgaria s *Red Data Book* Most are birds of prey – honey buzzard (*Pernis apivorus*), long legged buzzard (*Buteo rufinus*), golden eagle (*Aquila chrysaetos*) hobby (*Falco subbuteo*) goshawk (*Accipiter gentilis*) sparrowhawk (*Accipiter nisus*) ea gle owl (*Bubo bubo*) Species from the *Red Data Book* include the Balkan chamois bear, and wolf

The ***Northern Djendem Reserve*** covers the water shed of the Byala River between Botev and Ravnets Peaks the headwaters of the Tundzha River and the gorge of the Tuzha river This is one of the largest and most inaccessible reserves in Bulgaria About 70% of its area is covered by forests, 2/3 of which are beech (or predominantly beech) forests Virgin forests cover nearly 500 ha in impassable terrains at 1400 1600 m In some places they are mixed with hornbeam and fir trees Most are around 150 years old Hornbeam trees grow in the forests both in the lower areas in the reserve (1 000 m) and up to 1600 m Most of these forests are between 100 and 150 years old The spruce and fir forests are ancient but cover only 100 ha Less than 1/4 of the reserve's area consists of sub alpine vegetation The flora of the reserve although it has only been partially studied so far is extremely rich Djendema is in the heart of a contemporary plant spe cies formation center based on the silicate rocks in the central part of Stara Planina The number of plants there that have been registered in the *Red Data Book* is even greater than that of the Stara Reka and Sok olna Reserves which are famous floral refugia

The ***Peeshti Skali ('Singing Rocks') Reserve*** covers the left initial tributaries of the Rositsa river Its beech forests are 145 165 years old on the average Of the rare animals the bear (*Ursus arctos*) pine marten (*Martes martes*) stone marten (*Martes foina*) Balkan chamois (*Rupicapra rupicapra balcanica*), golden eagle (*Aquila chrisaetus*) hazel grouse (*Bonasa bonasia*) and

Table 2 Representative ecosystems with areas over 100 ha in the reserves larger than 1,000 ha in the Central Balkan National Park

Reserve	Area (ha)	Number	He of arctic alpine type		He of boreal type	He of nemoral type		
			Dwarf pine	Others		Oak	Euc	Other
Djendema	4220	+6	–	500	100	1950	–	630
Steneto	3578	2	–	–	630	1970	–	–
Stara Reka	1974	6	–	–	660	750	–	300
S Djendem	1610	+1	–	600	–	900	–	–
Peeshti Skali	1465	+1	–	150	–	1000	–	–
Tsarichina	3419	+4	–	250	470	460	–	–
Boatin	1597	2	–	–	150	1110	–	–
Sokolna	1250	2	–	–	–	750	–	100

Notes + subalpine ecosystems

black woodpecker (*Dryocarpus martius*) have been identified

The ***Sokolna ("Falcon") Reserve*** is located in the southeastern part of the Triglav massif It is characterized by its sparse tree cover, which is scattered among impressive rocks around the canyon of the Sokolna River The predominantly limestone rocks create favorable conditions for salicylic vegetation, high species diversity, and a high number of rare and threatened species (around 40) Some of the animals included in the *Red Data Book* are the bear, Balkan chamois, golden eagle and black woodpecker

Table 2 provides data on the area of the representative ecosystems found in these reserves

There are relatively few protected areas outside the park The largest of these is the ***Kamenshtitsa Reserve*** (1018 ha) It covers the forested gorge of the Eninska River and its two tributaries the Stara Reka and Kamenshtitsa It is inaccessible and is inhabited by interesting rare plants and animals The number of higher plant species is about 250 15 of which are new for the Central Balkan Range, and 8 of which are endemic The vegetation includes 19 plant associations Kamenshtitsa is the most important bear habitat in the eastern part of the Balkan Mountains and is the most promising area for reintroducing Balkan chamois east of the Triglav massif It is also within the area of the plant species formation center that falls between the Ambaritsa Peak and the Triglav massif

The ***Leshnitsa Reserve*** (390 ha) is mostly covered with mature (70 150 years in age) beech forests The portion to the east of the Leshnitsa River is rocky and dry

There are a number of small reserves along the northern slopes of Eleno Tvardishkata Mountain ***Savchov Chair*** (102 ha) is about 800 m a s l Its forests are dominated by misian beech but 20% of its territory consists of coniferous forest Other small reserves in this area are ***Byala Krava*** (91 ha) (located in the Chumerna region) ***Haidoushki Chukar*** (34 ha) and ***Sini Bryag*** (40 ha)

The ***Chamdzha Reserve*** (65 ha) is several kilometers south of the Kozya Stena It preserves 40 ha of natural Austrian pine (*Pinus nigra*) forest in which most of the trees average more than 180 years in age

Botev-Zhaltets (580 ha) is the only protected site in the region

The region's natural landmarks are quite numerous both inside and outside the national park Most are
small waterfalls already included in a nature reserve ***Chertigrad***, located between the villages of Lopyan and Cherni Vit is somewhat larger It is a rocky abyss with an area of about 200 ha and a thin cover of beech ***Kozi Dol*** has been designated as a protected areas in order to protect the old beech forest that covers its 195 ha

Development of the Protected Areas

The process of designating protected areas in the Central Balkan Range began with the designation of the Boatin Reserve in 1948 It covered only 35 ha in its original configuration The following year the Tsaritchina Reserve (10 ha) and Zelenikovets Reserve (136 ha) were established In 1953 the Djendema Reserve (one of the key reserves within the national park network) was also designated Its initial size was 2,500 ha

A 20 year period of stagnation ensued

1979 can be considered a very successful year for the conservation of wildlife in the Central Balkan Mountains The Peeshti Skali and Sokolna Reserves were established The Steneto Reserve (1 607 ha) was also designated and then expanded (by another 1 028 ha), that same year Chemerikata (250 ha) was also protected as a natural landmark In 1981 the Stara Reka Reserve was established The Tuzhansko Zhdrelo (886 ha) and Severen Djendem (1,610 ha) Reserves were designated in 1983 The following year the small Sarpkaya Reserve was added to the newly established Leshnitsa Reserve (388 ha) and Konski egrek was added to the Kameshtitsa Reserve (1 018 ha)

Several natural landmarks with a total territory of 60 ha were designated in 1987 and the Kozya Stena Reserve (557 ha) was designated the following year

In 1991 when the Central Balkan National Park was established the Boatin Tsarichna, Kozya Stena Steneto Stara Reka, and Djendema Reserves were enlarged to their present sizes

At present the total area of the protected areas in the Central Balkan Range is around 78 000 ha, with approximately 1/3 of them under strict protected status

Threats to the System of Protected Areas

The system of protected areas in the Central Balkan Range provides a strong start for the conservation of biological diversity in this part of Bulgaria There are however a number of examples of conflicts between wildlife and the increasing greediness of humans

The current state of Bulgaria's economy has been, and still is driving many people to collect large quantities of herbs mushrooms, berries and other forest resources This would not have be a serious threat if those resources were being consumed in the forests But roads leading deep into the mountains make it easy for people to harvest huge quantities of different species – some of which are even listed in Bulgaria's *Red Data Book*) – and to take them home Mountain chalets play a role in this business as well since they facilitate mass herb collecting trips One of the most striking recent cases involved several people who were caught with thousands of edelweisses from the Kozya Stena Reserve People are encouraged to engage in such activities by the total lack of punitive measures for those who violate the law and by the absence of an active administrative body responsible for nature protection and the education of local people and tourists

Privatization should not pose a serious threat in this region of the country Only a small part of all the forests in the region once belonged to private individuals If the process of designating new protected areas maintains its pace and if adequate legislation and educational programs are put into place 'peaceful coexistence" between humanity and wildlife, profitable to both parties, is quite possible It is also possible that people moving away from cities and starting small private businesses – wood processing plants, dairies, small hotels, etc – could be a threat but only if the maximization of profits becomes the sole guiding principle

Construction associated with the public utilities also poses a potential threat to biodiversity in the region – if preliminary expert environmental assessments are not carried out and if strict government and public control is lacking A good example of the role that public opinion can play in such cases is the cancelled Cherni Osam dam project which was to have been built on the border of the Steneto Reserve Unfortunately quite a few roads had already been built in that area, cutting deep into and through the mountain prior to the project's cancellation Such are the roads to the Vezhen chalet over the village of Hristo Danovo, to the Djendema Reserve to the Mazalt chalet, to the Tuzha chalet, and to the Trojan Karnare Pass among others Most of these roads should be closed, and all departures from their routes prohibited

Agriculture is underdeveloped in the Central Balkans due to the specific features of the region, and has little impact on biological diversity Where conflicts exists, they are local in character and easily resolved There is some danger in giving land back to people since private owners might be totally ruthless toward wildlife The largest problems involve cattle breeders but if goat grazing is strictly prohibited and grazing limits set for the other domestic animals, it will be possible to preserve floral diversity The risks to the large predators, especially the bears and wolves are greater Reimbursement funds should probably be established to respond to damage claims

It is difficult to estimate the threat to biological diversity posed by the development of private businesses In the past the idea of mass tourism has been strongly embraced, and vacation trips to the mountains were quite popular This led to the construction and improvement of a huge number of mountain chalets Most of these chalets are now rented out, and the drive to make large profits from them might result in their being turned into hotels (especially the ones that have roads leading to them) One striking example is the road that was built to allow construction of a cable car line and a new hotel directly adjacent to the Steneto Reserve Fortunately this project has almost come to a halt, but the surrounding area has already been badly damaged

There would be additional risks if private entrepreneurs become interested in the idea of establishing hunting grounds or developing ski tourism

The Central Balkan Range is one of the cleanest areas in the country but the dangers of pollution – posed for example by the plant in Srednogorie the chain of plants at Sopot, Karlovo and Kazanlak and the plants in the industrial towns to the north – should not be overlooked Fortunately, there are no major pollution sources in the mountains themselves

International hunting tourism was a large problem until recently and to a degree still is For example the establishment of a specialized hunting ground for bears on Kalofer Mountain was incompatible with nature protection Thanks to the Law on Hunting the 1941 population of 90 individuals in the Balkan mountains had risen to over 200 (newborn cubs ex cluded) In 1984 bears were officially designated as game species Prior to this there was no threat to the species Only meat eating bears were killed just as always Subsequently however bears have been arti ficially bred and then set loose while 'wild" bears have been fed, losing their fear of people and even seeking contacts with them These contacts have often had fatal results for people There have been cases of "tame" bears in the Balkan Mountains entering houses, looking for food in backpacks, etc With the importa tion of individuals from Romania's Carpathian Moun tains bears have become more aggressive since northern bears tend to eat more meat Moreover the genetic purity of the Balkan subspecies of bears has been upset – an irreversible phenomenon

Legislation and Institutions

The Law for Nature Protection from 1967 is still in force A new draft law is due to be submitted to Parliament It will define the existing categories of protected areas introduce new categories to meet to day's needs and allow greater flexibility in categoriz ing the protected areas Work in now underway to pass other specialized laws such as the Law for Medi cal Plants the Hunting Law the Fishing Law and the Biodiversity Law Their quick passage by Parliament will facilitate greatly the conservation of biological re sources One further example of efforts in this area is Bulgaria's signing of a number of international con ventions in the past few years including those pre pared at the Rio de Janeiro conference on the envi ronment and development (UNCED)

Unfortunately it must be noted that the existing overlap in institutional responsibilities may prove fatal to the system of protected areas, which has taken dec ades to put into place There is a pressing need to set up a specialized institution responsible not only for the management and security of the protected areas but for the conservation of their biological diversity It is absolutely unacceptable for this institution to be a branch of an organization that carries out or profits from economic activities Its only responsibility should be the management and security of the protected ar eas based not only on compulsory measures but on extensive educational work at all levels

SOCIOLOGICAL SURVEY

A survey was carried out from February 7 to 10, 1993 in the town of Karlovo the town of Apriltsi, and the village of Ribaritsa These communities were cho sen due to their location in the Central Balkan Range and their immediate proximity to protected areas One hundred people were questioned as requested in the instructions Of those surveyed 67 7% live in Karlovo and Apriltsi and 32 3% in Ribaritsa The ra tio of men to women was 58 2 41 8 The age distribu tion was as follows up to 25 years old – 22 2% from 25 to 35 – 20 2% from 35 to 45 – 32 3% from 45 to 55 – 20 2% and over 55 – 5 1% The proportion of "committed" people – that is those having some direct interaction with natural features (e g tourists hunters mushroom gatherers chalet holders etc) – was 30% of administrators 20% and of those randomly chosen 50%

The first question sought an appraisal by the peo ple interviewed of the environment in the region On the whole, the people consider the air water, and soil unpolluted, although there was some evasiveness con cerning soils and waters In conversations conducted during the survey most of the people confided that they have no real information and rely only on their personal opinion

Answers to the question "Are wild animals and plants decreasing?" were divided between "yes' (57%) and "no' (43%) but the impressive fact was that al most 80% answered 'no to the question Are the wild animals and plants increasing?" This contradicts to a great extent the impression from the personal conver sations in which people complained about the in creasing number of the wild boar In Apriltsi the town council considered whether guns should be given to everyone who wants one after certification by a psy chiatrist The argument was that guns are necessary for self protection from the populations of wild ani mals However the wolf and other carnivores were not mentioned anywhere The only animals blamed were those that appeared to be rivals for potatoes fruit orchards and other agricultural products It was noted that people who have fenced their lands rarely have problems

Sixty five percent answered in the affirmative the question 'Do you have hunting grounds in your re gion?" – notwithstanding that the hunting reserves had recently been closed A great many of the people do not differentiate between the hunting grounds and the nature reserves The prohibition on visiting both types of reserves is a good reason to consider them one and the same thing The percentage of people answering "yes" was highest in the random sample (44%) and lower among the "committed" (36 5%) and the ad ministrators (19%)

The third question sought to ascertain the number of people who know about the protected areas in the region Eighty six percent answered that they did know with a understandably high correlation among the "committed" people and administrators It should however be noted that 14% of the people who an swered the question thought that no protected territo ries were in the area or did not know of any – notwith standing the fact that the borders of the protected ar eas were within 1 2 kilometers of the centers of the

three communities

Almost 60% appraised the number of visitors to the protected areas as "small" or "enough " Only 3 1% considered the number "great " The "committed" people and the administrators were more categorical in their appraisal while a large part of the random group answered "I have no view" or "I cannot appraise " But it should be mentioned that 70% of the people who held that visiting the protected areas was prohibited are from the random group (50% of the total sample), and only 10% were administrators The total percentage of people who answered that visiting was prohibited was also 10%

The fifth question sought to reveal how often the local people visited the protected areas Only 25 5% answered that they visit them frequently, and 62 5% of these were from the "committed' group The percentage of people who had never visited the protected areas was also 25 5%

The next survey question was "What do you usually do there?" Little preference was indicated for any of the activities Few engaged in 'tourism " "fishing 'bird watching, "hunting " "wood harvesting ' "resting," or 'visiting cultural and historical landmarks" negative answers for these categories were around 90% or higher Some preference was given to 'observing plants" (39 4% answered "yes") "enjoying nature" (36 4%), walking" (23 2%) "gathering herbs, mushrooms etc ' (21 2%) The people in the "committed" group were mainly fishing (100%) visiting cultural and historical landmarks (60%) observing plants (50%) or engaging in tourism (40%) The administrators hunted (50%), camped (55 5%) and harvested wood (50%)

Question number seven was an open question asking people to point out four things that they liked most during their visit to the park/reserve Out of a possible total of 400 answers 167 were received The answers given more than once were

27	the nature
16	the animals
16	the air
13	the water
12	the plants
8	the natural beauty
7	the calmness
5	the venerable forests
4	the silence
3	the birds
3	the rivers
3	the landscapes

Many of the other answers fall into two groups Nine mentioned places they liked and seven spoke (but with different expressions) of the natural beauty

The eighth question was also an open one list four things that they did not like in the park/reserve Out of a possible total of 400 answers, 89 were received Answers that were given more than once were

9	littering
6	irresponsibility of the visitors
6	inappropriate management
5	poaching
5	cutting of the woods
4	destruction of the forests
4	waste
3	destruction of the plants
3	injuring of the trees along the walks and destruction of the signs
3	non utilized fallen trees
2	looking after the animals

Some of the other answers fall into three general groups The first and most impressive consists of opinions disapproving of activities and the way of maintaining protected areas Sixteen people cited "cattle," "bad guarding,' "irresponsibility of the executive power " 'intervention in hunting grounds etc The number of people with these opinions would place this group first on the list, and the 29 who cited inappropriate ownership, poaching, pollution, cutting of woody species, and waste should be added to it Thus, the total number of people disapproving of the management and maintenance of protected areas reached 45 (50% of the people who responded to the question) The number of people who mentioned that natural features were being destroyed or natural resources decreasing was also considerable Seven people noted that trees had been damaged bushes set on fire herbs and mushrooms gathered waters decreasing etc A number of people in the survey (6) held that natural objects were not used enough Remoteness from towns and villages and the lack of secured transport and access were also cited by more than one person

The ninth question was "How would the extension of the private agricultural sector affect biological diversity?" Almost 90% thought that there was a direct connection between them There are no explicit opinions but 74 6% answered that plants and animals would be threatened with extinction and 58 1% believed that pollution would increase, while 65 1% were of the opinion that private agriculture would contribute to the reasonable utilization of wild nature The relatively high percentage of people who think that there is a risk is due mainly to the answers of the randomly chosen group (about 55% for each of the two questions) It should be noted that 72 7% of the administrators were of the opinion that private agriculture would not contribute to the conservation of wild nature The percentage of people not responding to the different question was significant – between 28% and 43%

Question number ten concerned the potential danger to forests wild plants and wild animals from small

private enterprises Although 62 2% thought there is no risk 37 7% were of the opinion that there is a dan ger or could not give an appraisal It is interesting that the administrators (80%) and committed people (77%) were more categorical in believing that there is no danger while the random group was more cautious (48%) In personal conversations, the prevailing opinion was that a lot depended on the type of enter prise and on the owner

Question number eleven was "If land is going to be returned to you, how will you use it?" Only 3 4% intend not to use it or sell it The percentage of people who plan to join cooperatives is highest (29 5%) An other 17% will engage in agriculture Notwithstanding the fact that the region is a mountainous one only 8% intend to breed cattle The number of people who have no land or who have not yet decided what they will do with it is comparatively high (35 2%)

The aim of the twelfth question was to establish people's opinions on the prospects for developing tourism opportunities connected to conservation of and education about wild plants and animals in the re gion (ecotourism) Almost 90% thought that such tourism has a future The administrators (90 5%) and the "committed" people (96 2%) explicitly supported the idea The people from the randomly chosen group were more reserved (84 6%) Seventy five percent of those who could not give an appraisal were from the random sample, which indicates the need to popularize ecotourism

The next question reconfirmed that ecotourism is expedient for the region (only 5 1% are against it) and would contribute to the incomes of the region (87 7%), to ecological education and culture (85 3%) to the conservation of wild nature (80 6%), and to the open ing of new work places (77 3%) But it should be mentioned that the people are not naive, 30% fear that ecotourism may threaten wild nature, and that per centage is evenly distributed among all the groups Another peculiarity is that, despite the high percentage of those who agree that ecotourism will present op portunities to open new work places and receive new income fewer people connect this with the expansion of the private sector (only 56 3%) Here the ratios for and against the contribution of ecotourism to the pri vate sector are almost equal for the random and committed" groups – 50% for and 50% against among the randomly chosen group and 57% for and 43% against among those in the "committed" group The high percentage of people who did not answer – about 30% – is important here

According to answers given to the fourteenth question tourism ranks lowest (23 8%) among the mentioned threats to biological diversity Livestock rearing was mentioned by 32 5% and other agricultural activities by 40 8% Small enterprises were appraised as a certain threat (54 9%), as were construction (58 9%) and the restoration of private property (59 5%) The distribution among the different groups was also interesting When appraising the risk to biological diversity from livestock the administrators and committed people answered firmly that there was no such risk while those in the random sample chance were 52 8% Regarding agricultural activities the opinion of the administrators was equally divided Small enterprises were seen as a threat by 72 7% of the random sample, 50% of the "committed" people, and only 25% of the administrators The appraisals of the threat from construction were similar 73 5% of the random sample, 60 9% of the "committed," and only 25% of the administrators considered it a threat The percentage of people who did not answer the question was considerable – about 25%

The next question tried to gauge people's thoughts about changes in the state authorities and the laws for conservation of the environment Most of the people answered "no" to all the offered answers The percent age of people who answered explicitly that "there are no any changes" is relatively small (46 5%), which may mean that there are changes but they were not men tioned in the survey or that people are not sure in their answers The relatively small percentage of those who did not recognize changes in legislation or in the local state bodies is due to the opinion of the adminis trators (46 7% and 50% respectively) among all those who answered that there had been changes

Question number sixteen was an open question "Can you point out at least two ways to utilize the nat ural resources so that they may be profitable for your region?" Out of a possible total of 200 answers 88 were received Answers given more than once were

24	tourism
7	ecotourism
5	livestock rearing
3	international tourism
2	ecological production
2	reasonable management
2	wide advertisement of the natural features

Five other single answers referred to different forms of tourism Thus, the total number of people citing tourism was 41 or almost 50% of all answers Some of the other answers can be generalized as economic measures – retaining the profits from hunting in the region more careful attention to the quality of drinking water creating a fishing industry, local processing of timber, etc Ten such answers were offered altogether It is significant that two other measures – the "introduction of ecology and tourism lectures in the schools" and establishment of "eco schools" – were considered necessary for the rea sonable utilization of natural resources

The final question sought to identify the sites that the local people thought should be conserved Out of a possible total of 100 answers, 45 were received An swers that were given more than once were

6	all natural sites
3	the edelweisses
2	Stara Reka river
2	"Praskaloto" waterfall

It is worth mentioning that recommendations for con servation were distributed almost equally among ani mate and inanimate natural features

This survey was not representative The purpose was not only to gain an idea of people's opinions, but to provoke conversations and a free and spontaneous exchange of opinions between the interviewers from the Wilderness Fund and the local people Great in terest was shown in the survey, and it that may serve as a good basis for future work with the local people

It is encouraging that many people go to the mountains and to the protected areas in particular, not so much for the material benefits as for the contact with original wild nature The opinions recognizing the true value of the natural resources and the need for their reasonable management are no less important

The great number of opinions against the current way of managing the protected areas is impressive Since it is not possible to separate the protected areas from the rest of the mountains, those opinions are also entirely valid for the management and maintenance of lands outside the protected areas Opinions concern ing the "exploits" of the poachers, not reflected in the survey but shared with the interviewers should be mentioned Grooved guns with optical sights are be coming more common, and even laser devices are now used at night Probably the manufacturing plants in the sub Balkan countries contribute to the easy access to such specialized equipment

The high percentage of people who did not an swer questions or who had no firm opinion about the risk to biological diversity from human agricultural ac tivities is also significant That questions is rarely con sidered even more rarely is anything done about it

Tourism is definitely considered to have very high potential Different forms of tourism are mentioned from the usual holidays in the holiday houses to mod ern forms of ecotourism (rural tourism photography etc) New tourism opportunities often involve tradi tional activities and are a good basis for future devel opment

Changes in legislation and institutions (as far as there are any) have brought about almost nothing at the local level Only the administrators know anything about these changes but they remain laws on paper only and the attitude toward local authorities is rather distrustful

SUMMARY AND RECOMMENDATIONS

This report of the Wilderness Fund summarizes some of the new and existing data on the flora and vertebrate fauna of protected areas in the Central Bal kan Range Its purpose is to analyze the region's natu ral features, the state of the species and communities in the mountain areas and the ways to protect them To this end, the major published papers on these top ics have been collected and reviewed Unpublished information, oral communications, and personal data and observations have also been used

A survey was carried out in three settlements in the region and numerous personal interviews were un der taken to determine the degree of anthropogenic impact on wildlife and the attitudes of local people to ward biological diversity in the region and the ways to protect it

Several facts can be cited in support of the value of the Central Balkan Range from the standpoint of biological diversity

- Twelve species and one subspecies of local en demic plants have been identified in the region Eleven species and 2 subspecies are endemic to Bulgaria and another 22 species are endemic to the Balkans Some of these species are included in the "List of Rare, Endangered and Endemic Plants of Europe " Of the species in the Central Balkan Range, 11 are listed in Bulgaria's *Red Data Book* as threatened and 78 as rare Com pared to all the other botanic and geographic re gions of Bulgaria, the Central Balkans contain the richest fauna, with over 2,000 species and subspe cies

- The Central Balkan Range, together with the Va siluyvska Planina on the north and the Sredna Gora on the south, form the largest unbroken ex panse of oak forest in Bulgaria

- There are more than 200 animal species (228 ac cording to the latest data) breeding in the areas over 1,000 m a s l Rare and threatened animal species are more numerous (48) than in any other region of the country

- The establishment of protected areas in the Cen tral Balkan Range began in 1948 with the crea tion of
the Boatin Reserve (35 ha) This process has gone through low and high points to reach a pres ent total of 78,000 ha of protected area (1/3 of that area being in strict reserves) The Central Balkan National Park (73 000 ha) was established in 1991 and includes 9 large reserves with a total area of over 20 000 ha This system of protected areas provides a good starting point for the long term conservation of biological diversity in the Central Balkan

- If the process of designating protected areas continues at its present pace and if it is backed up by adequate legislation and educational programs the network of protected areas may be considered a model for other regions

There are however a number of conflicts between man and wildlife in the Central Balkan Range

The harvesting of non timber products, in all its forms is facilitated by the existing systems of mountain huts and roads that reach deep into the mountains One striking example is the thousands of edelweisses that were recently picked in the Kozya Stena Reserve

It is difficult to assess the potential dangers of privatization Only a small portion of the forests in the region once belonged to individuals, but intensive land use by emerging private businesses does pose some risks Construction projects associated with the public utilities can also pose a threat if no expert preliminary environmental assessments are carried out and no strict state and public regulations are enforced Most existing roads should be closed, and all departures from their routes through the mountains prohibited

Agriculture in the region is underdeveloped due to the specific features of the landscape and has had little impact on biological diversity There are problems associated with cattle raising but they are not insurmountable

International hunting tourism was a serious problem and in some ways still is One example is the importation of Carpathian bears from Romania Official hunting departments do not exist in their old form but the willingness and financial motivation on the part of the state husbandries to develop this kind of tourism does exist Control over this activity should be extremely strict and hunting reserves should not be allowed to share boundaries with protected areas If this is not possible buffer zones that are large enough to protect the animal populations in the protected areas should instead be established

A few words about the questionnaire and survey The survey was not representative Its purpose was to give us an idea of the way local people felt about these issues and to challenge them to share freely their opinions with the interviewers

There are quite a few people who seek communion with wildlife Unfortunately there are also quite a few local people whose "exploits" did not register in the survey It is not uncommon for them to poach using essentially military guns with powerful optical sights These weapons were most likely obtained from nearby military arms plants

Legislative and institutional changes to the extent that they exist at all are not noticeable at the local level and caused no alteration in the way local governments operate They are known to the administrators of course but the laws exist on paper only and the local attitude toward the authorities remains skeptical

It can certainly be stated that all forms of tourism from common recreational tourism to modern tourism fashions like agricultural tourism photography, etc are considered to have extremely promising potential Some involve traditional activities and seem to provide a good basis upon which to build

The number of negative opinions about the style of managing protected areas is significant – about 50% of all the answers The responses to an open question on this issue were extremely valuable in formulating these general conclusions Since the boundaries of the park and the reserves in question are not clearly marked, the answers are also relevant to lands outside the protected areas

Many concrete recommendations could be made for the protection of biological diversity in the Central Balkan Range We believe that all of them can be subsumed under two major recommendations that if followed could directly or indirectly solve most of the existing problems It should also be pointed out that these recommendation upon analysis also hold true for other sites throughout Bulgaria

1 As a high priority, Parliament should pass new laws concerning the conservation of nature

2 An institution independent of any institutional or economical interests should be established to put an end to the existing dualism in the execution of executive powers It should be responsible for protecting biological diversity throughout the country and for managing and safeguarding the protected areas An important part of its obligations will be the development and implementation of educational and public awareness programs

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Appendix 1 Bulgarian plant species from the Red Data "List of the Threatened and Endemic Plants in Europe" (8 species)

1 *Anthemis sancti johannis* Stoj Stef et Turril rare
2 *Centaurea kernerana* Janka rare
3 *Primula frondosa* Janka rare
4 *Seseli bulgaricum* Ball endemic
5 *Elatine alsinastrum* L vulnerable
6 *Sedum kostovii* Stef rare
7 *Sedum stefco* Stef rare
8 *Dianthus stribrnyi* vulnerable

Appendix 2 Endangered plant species from the Bulgarian *Red Data Book* (1984) (11 species)

1 *Allium montanum* F W Schmidt
2 *Herminium monorchis* (L) R Br
3 *Arabis nova* Vill
4 *Alchemilla mollis* (Buser) Rothm
5 *Lathyrus montanus* Bernch
6 *Cortusa matthioli* L
7 *Gentiana punctata* L
8 *Gentiana acaulis* L
9 *Menyanthes trifoliata* L
10 *Galium rubioides* L
11 *Verbascum boevae* Stef

Appendix 3 Rare plant species from the Bulgarian *Red Data Book* (1984) (78 species)

1 *Diphasium alpinum* (L) Rothm
2 *Cystopteris regia* (L) Plesl
3 *Juniperus sabina* L
4 *Festuca rupicola* Heuff
5 *Festuca xantina* Roem et Schult
6 *Juncus acutifolius* Ehrh
7 *Luzula deflexa* Koz
8 *Lilium jankae* Kern
9 *Fritillaria pontica* Wahl
10 *Orchis globosa* L
11 *Spiranthes automnalis* Rich
12 *Thesium limophyllon* L
13 *Minuartia saxifraga* (Friv) Graebn
14 *Dianthus stribrnyi* Vel
15 *Aquilegia vulgaris* L
16 *Trollius europaeus* L
17 *Anemone narcissiflora* L
18 *Sedum stefco* Stef
19 *Sedum kostovii* Stef
20 *Sempervivum velenovskyi* Ceschm
21 *Saxifraga marginata* Sternb
22 *Rubus vepallius* Sudre
23 *Alchemilla plicatula* Gaud
24 *Alchemilla anisiaca* Wettst
25 *Alchemilla grossidens* Buser
26 *Alchemilla erythropoda* Juz
27 *Alchemilla bulgarica* Rothm
28 *Alchemilla achtarovii* Pawl
29 *Alchemilla jumrukczalica* Pawl
30 *Alchemilla catachnoa* Rothm
31 *Alchemilla indivisa* (Buser) Rothm
32 *Alchemilla asteroantha* Rothm
33 *Alchemilla gracilliana* Rothm
34 *Alchemilla pyrenaica* Dufour
35 *Linum ununerve* (Roch) Borb
36 *Acer heldreichii* Orph
37 *Tilia rubra* DC
38 *Daphne oleoides* Schreb
39 *Daphne blagayana* Freyer
40 *Daphne cneorum* L
41 *Viola balcanica* Delip
42 *Elatine alsinastrum* L
43 *Sison amomum* L
44 *Carum graecum* Boiss et Heldr
45 *Seseli bulgaricum* Ball
46 *Oenanthe angulosa* Griseb
47 *Oenanthe millefolia* Janka
48 *Meum atamanticum* Jacq
49 *Angelica pancicii* Vand
50 *Laserpitium silei* L
51 *Laserpitium krapfii* Grantz
52 *Rhododendron myrtifolium* Schtt et Kotschy
53 *Arctostaphylos uva ursi* (L) Spreng
54 *Androsace hedriacantha* Griseb
55 *Primula frondosa* Janka
56 *Gentianella amarella* (L) Born
57 *Gentianella praecox* (A et J Kern) Dostal
58 *Asperula capitata* Kit ex Schultes
59 *Micromeria frivaldskyana* (Deg) Vel
60 *Stachys bulgarica* (Deg et Neic) Hayek
61 *Atropa belladona* L
62 *Veronica austriaca* L ssp *neicevii* (Deg) D Peev
63 *Veronica chamaedrys* L ssp *kramovii* D Peev
64 *Pedicularis oederi* Vahl
65 *Rhynchocorys elephas* (L) Griseb
66 *Haberlea rhodopensis* Friv
67 *Valeriana montana* L
68 *Campanula latifolia* L
69 *Symphvandra wanneri* (Rochel) Heufl
70 *Phyteuma confusum* Kern
71 *Leontopodium alpinum* Cass
72 *Senecio pancicii* Deg
73 *Senecio umbrosus* Waldst et Kit
74 *Cirsium oleraceum* (L) Scop
75 *Centaurea kernerana* Janka
76 *Anthemis sancti-johannis* Stoj Stef et Turril
77 *Leontodon rilaensis* Hayek
78 *Taraxacum megalorrhizon* (Forsk) Hand Mazz

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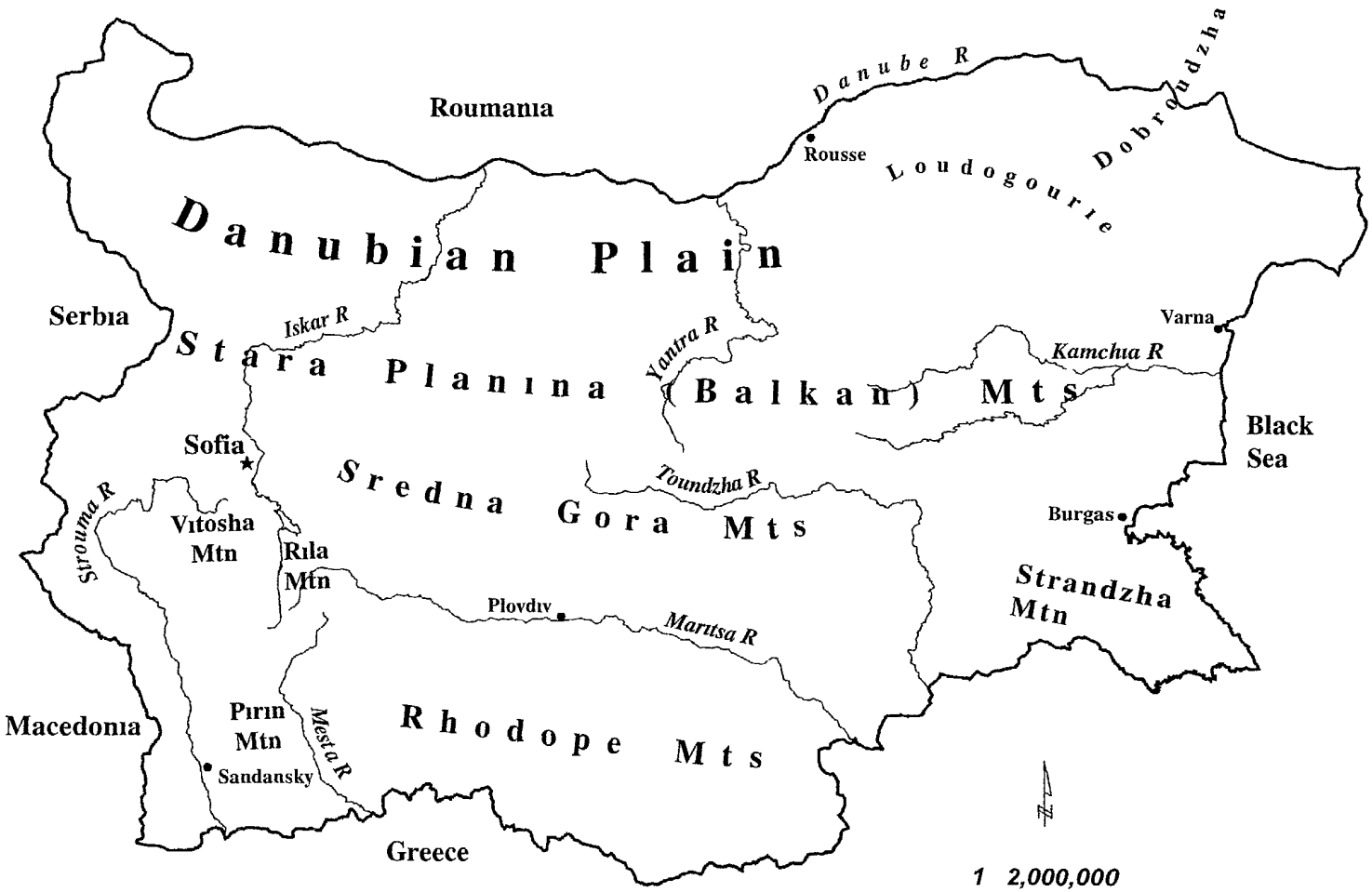
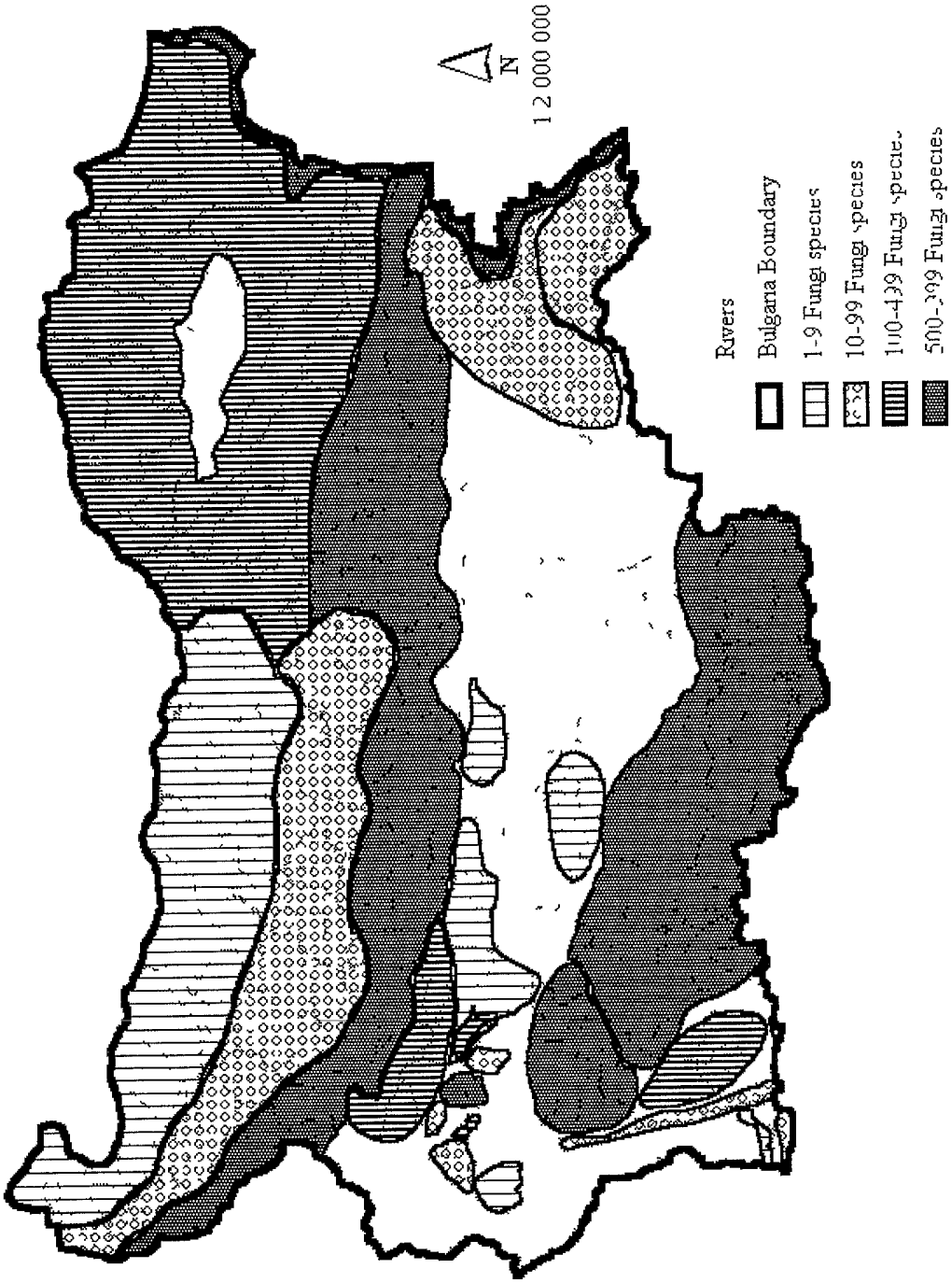
Section Five
Selected Maps

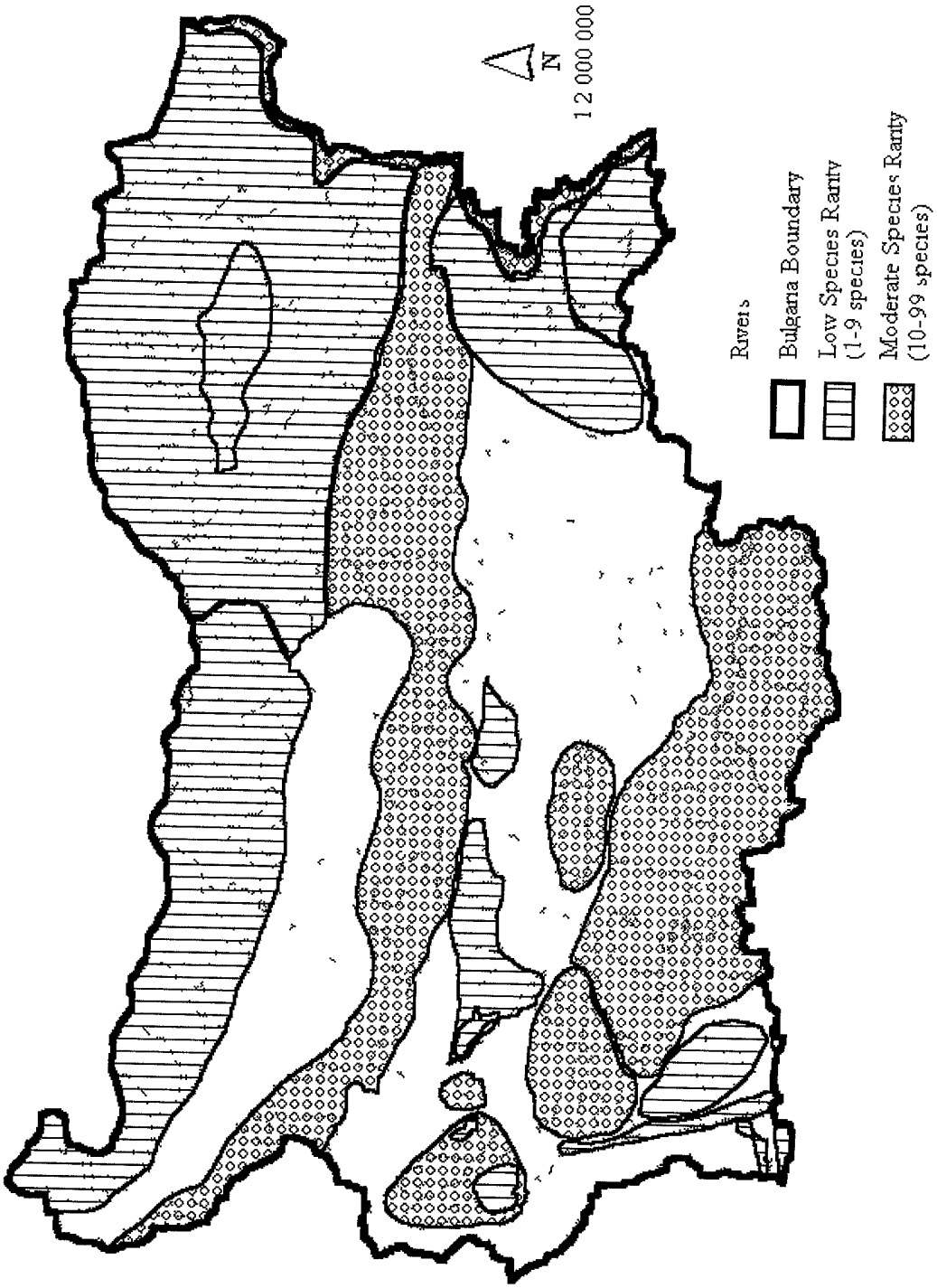
Map 1 Selected Features of Bulgaria



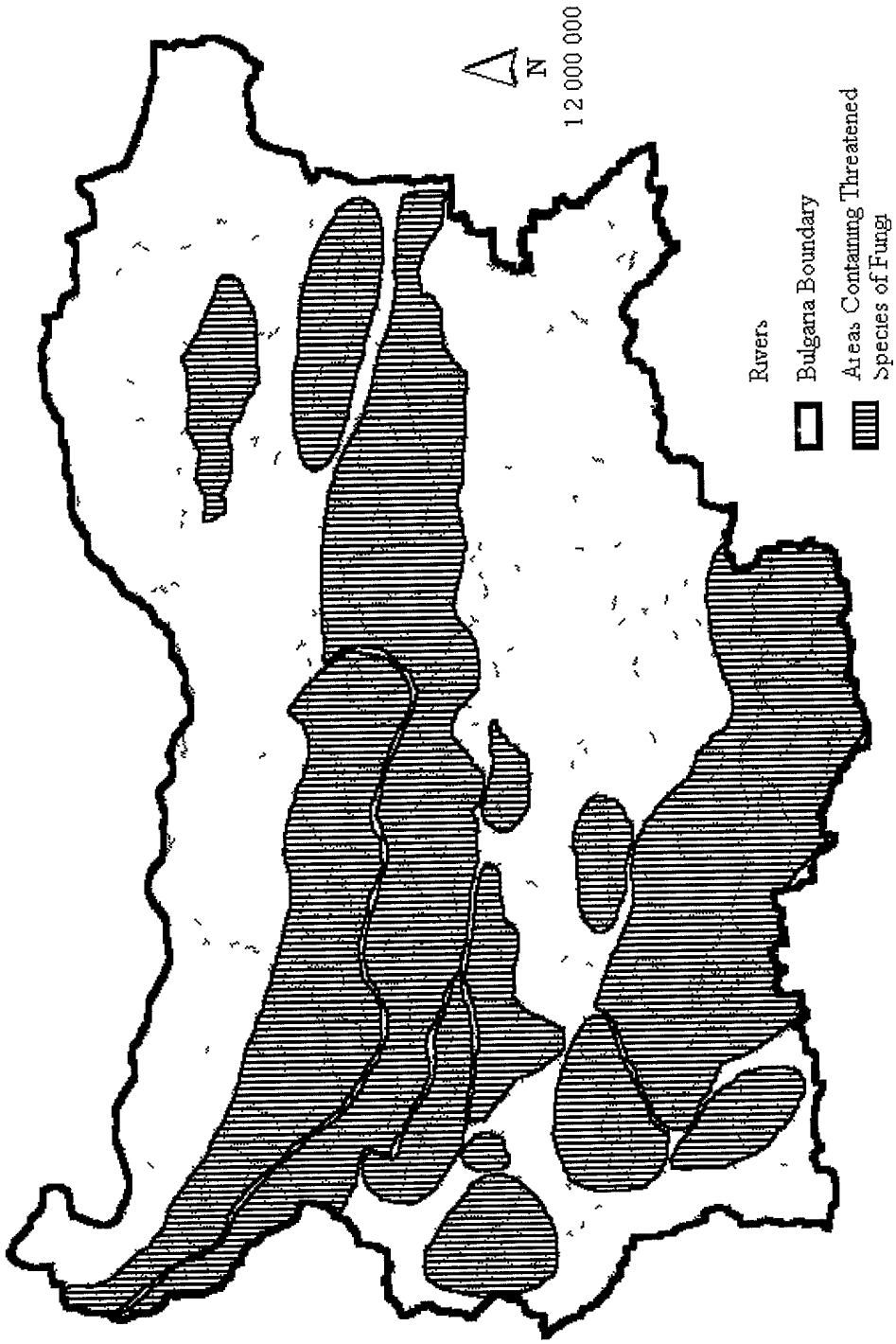
Map 2 Macromycetes Areas of Species Richness, Further Study Needed



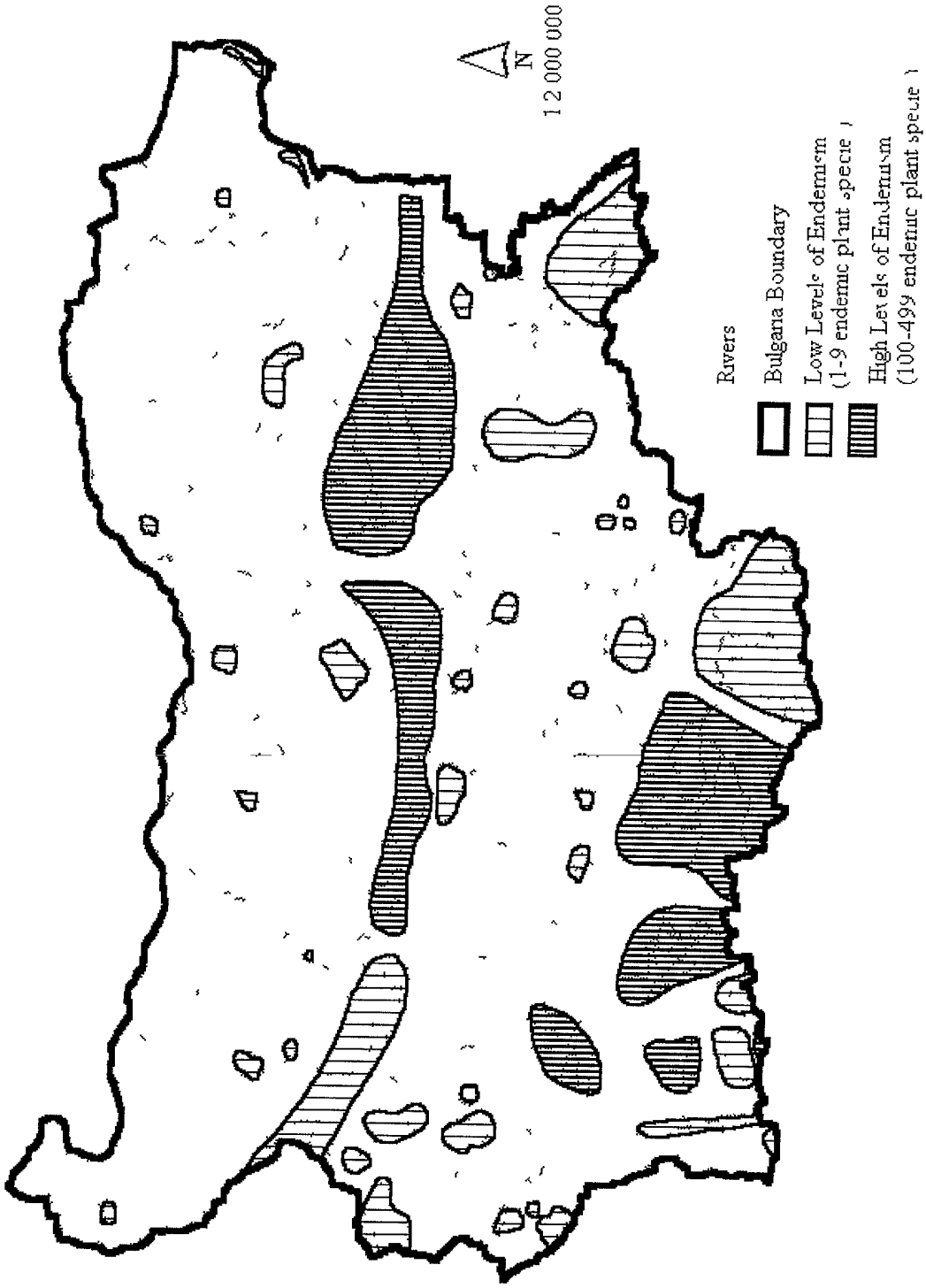
Map 3 Macromycetes Areas with Rare Fungi Species



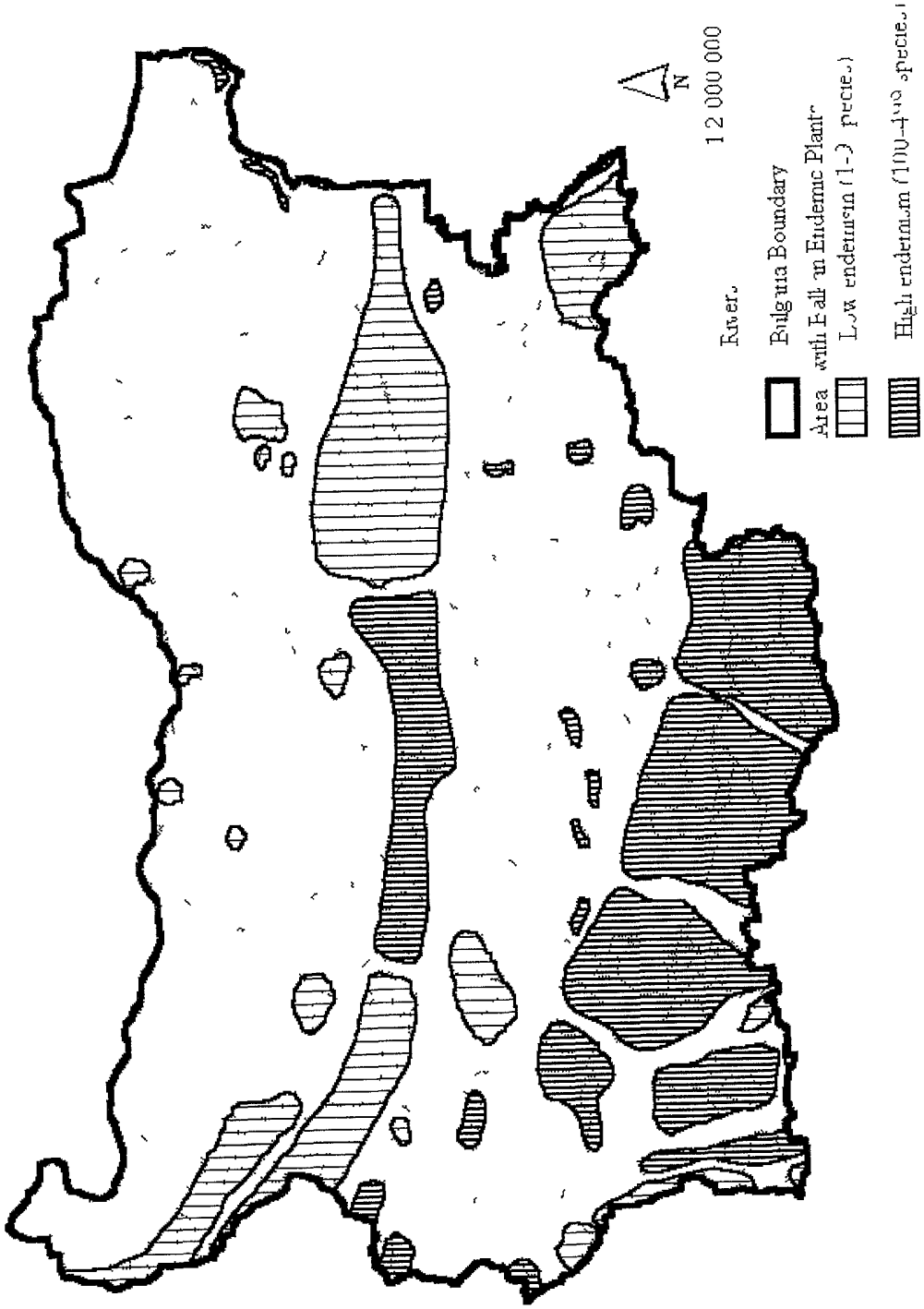
Map 4 Macromycetes Areas with Threatened Species of Fungi



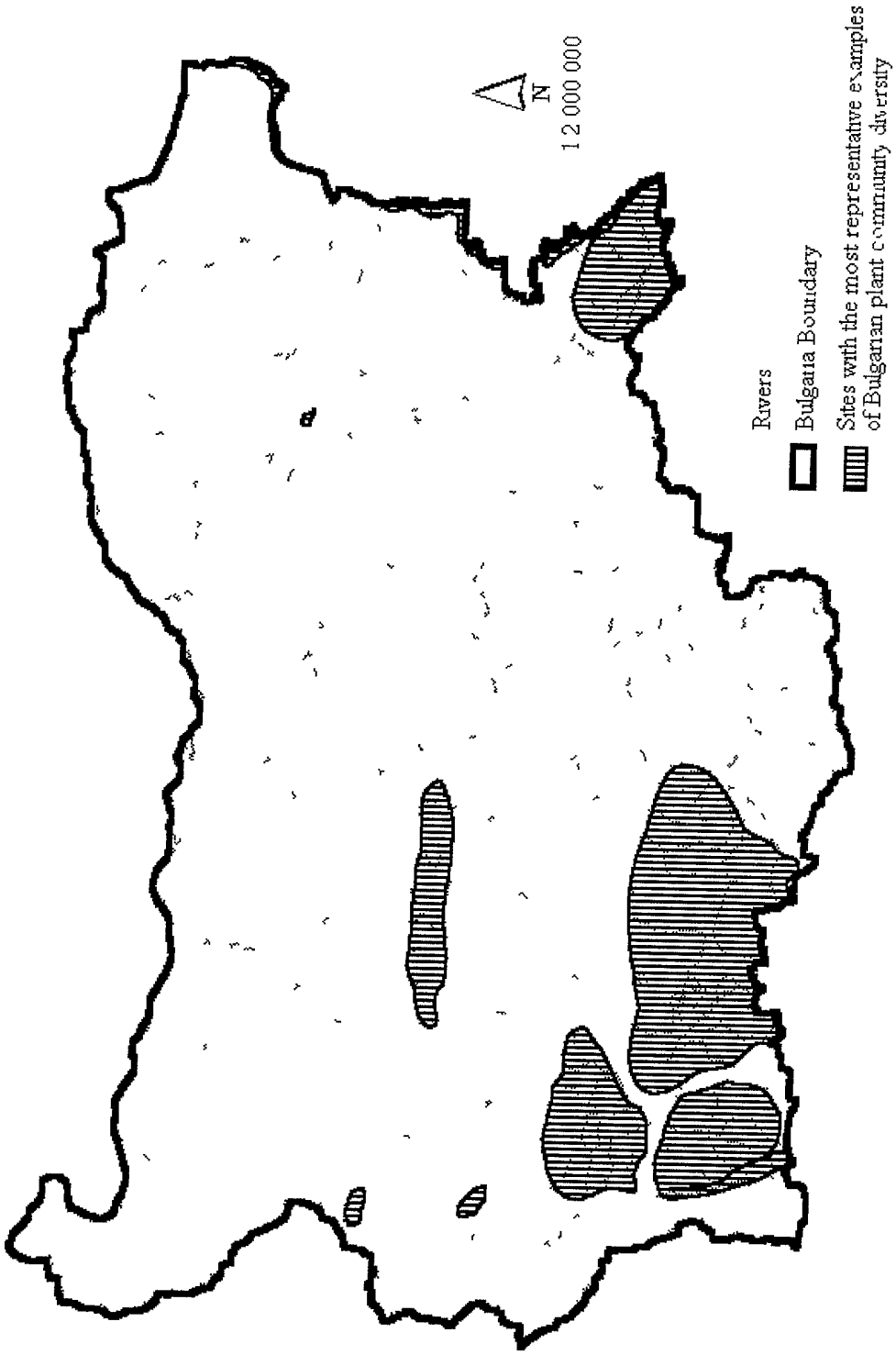
Map 5 Vascular Plant Ecology Distribution of Bulgarian Endemic Plants



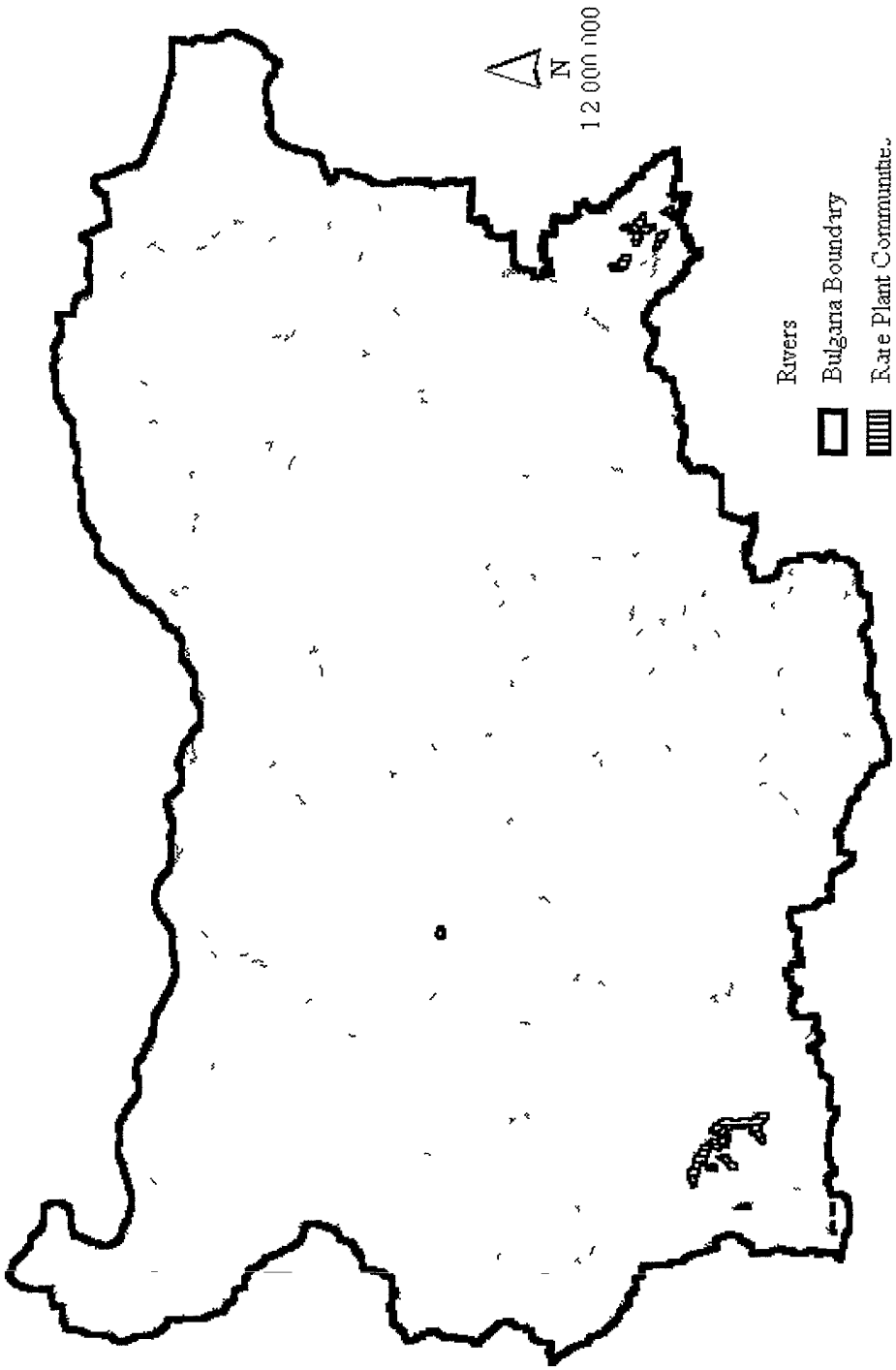
Map 6 Vascular Plant Ecology Distribution of Balkan Endemic Plants



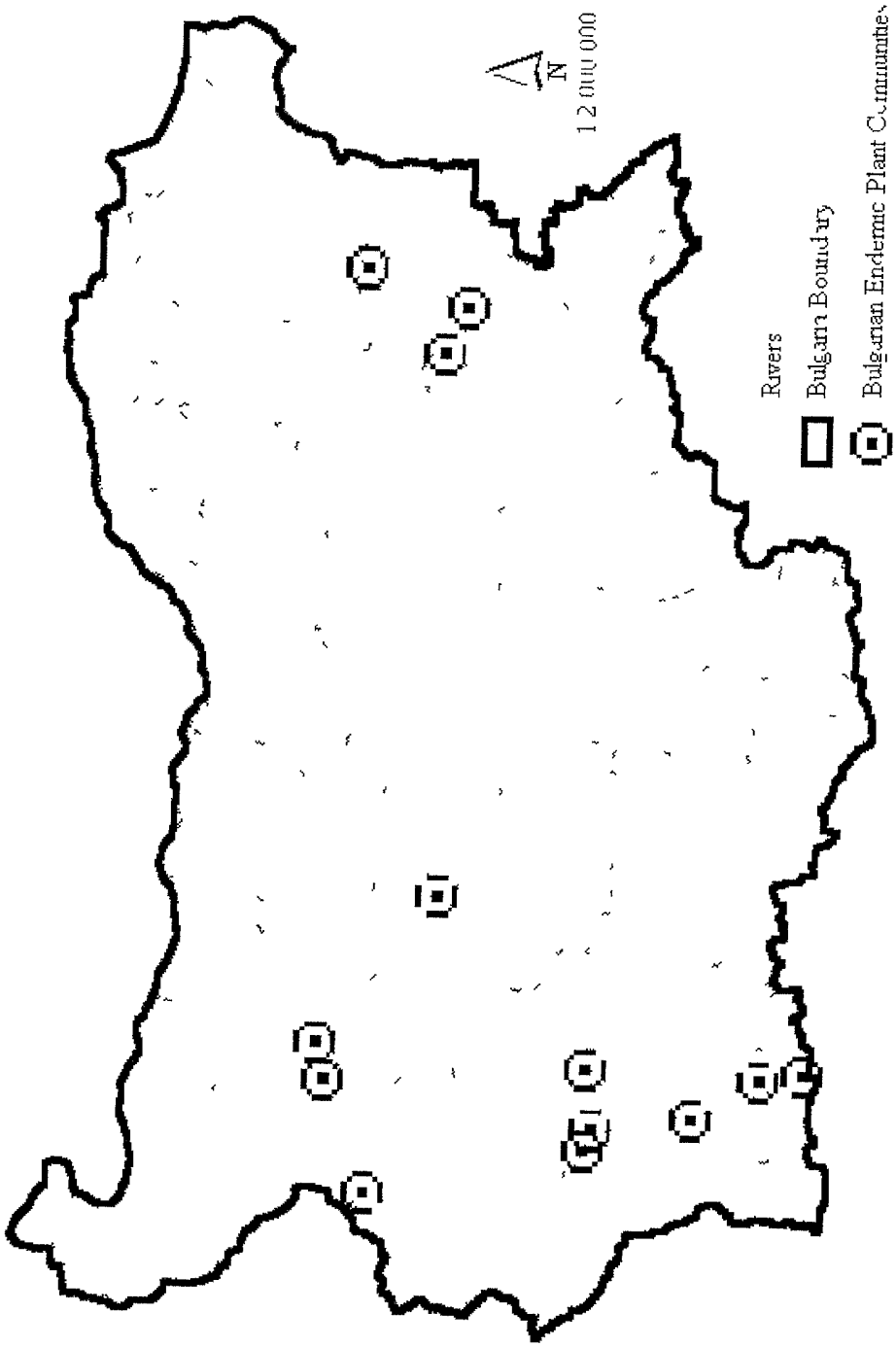
Map 7 Plant Community Ecology Distribution of Representative Plant Communities



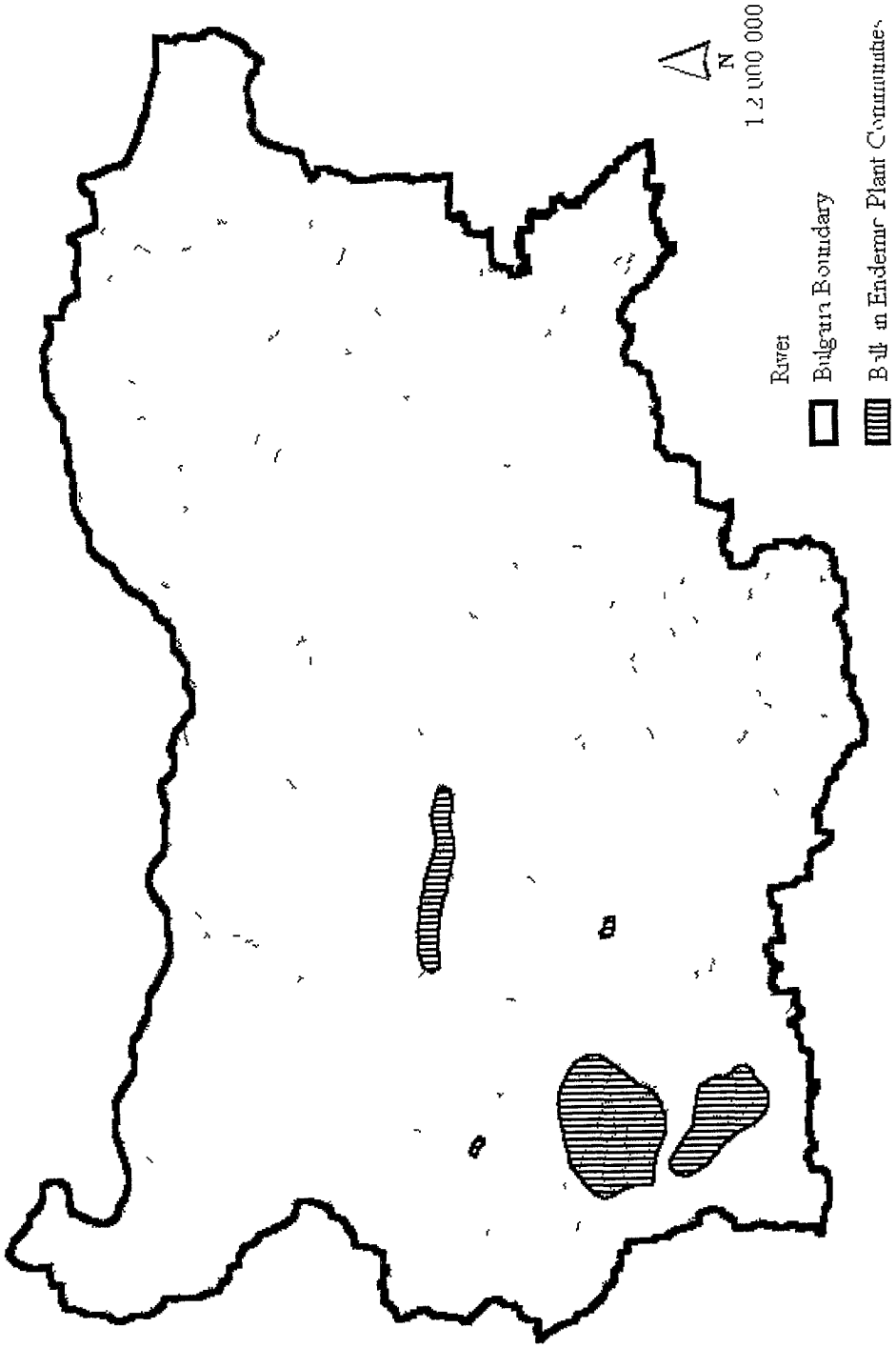
Map 8 Plant Community Ecology Distribution of Rare Plant Communities



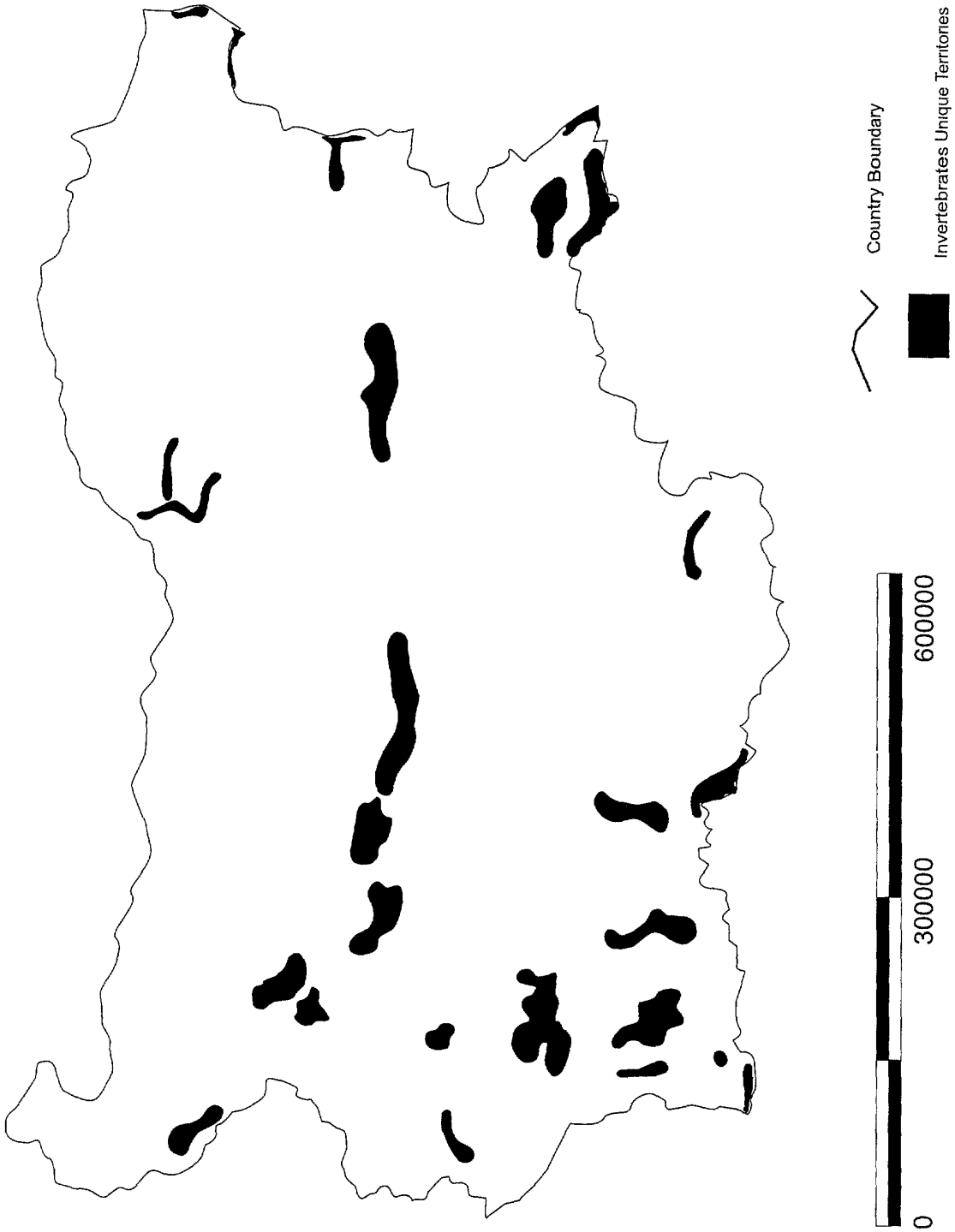
Map 9 Plant Community Ecology Distribution of Bulgarian Endemic Plant Communities



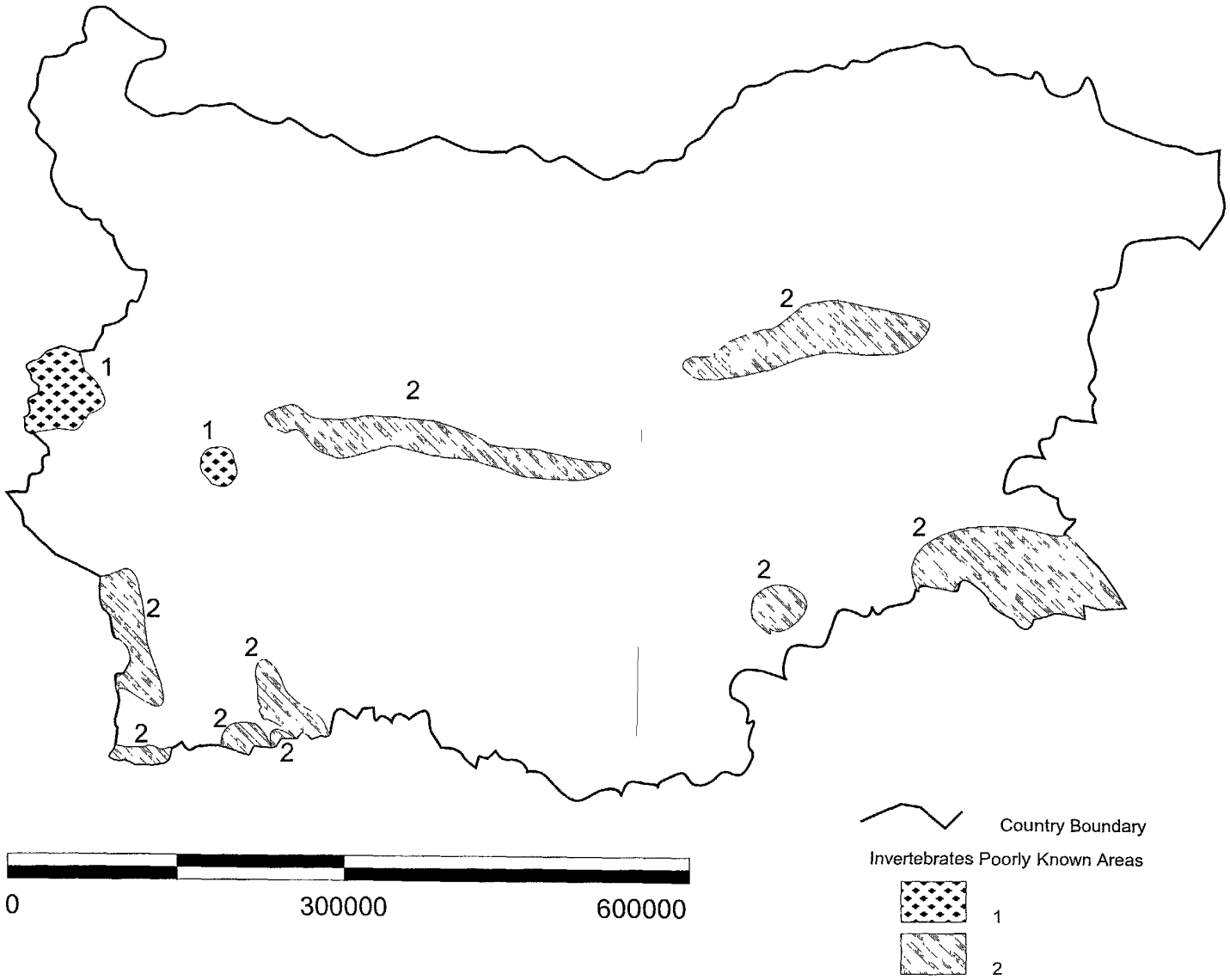
Map 10 Plant Community Ecology Distribution of Balkan Endemic Plant Communities



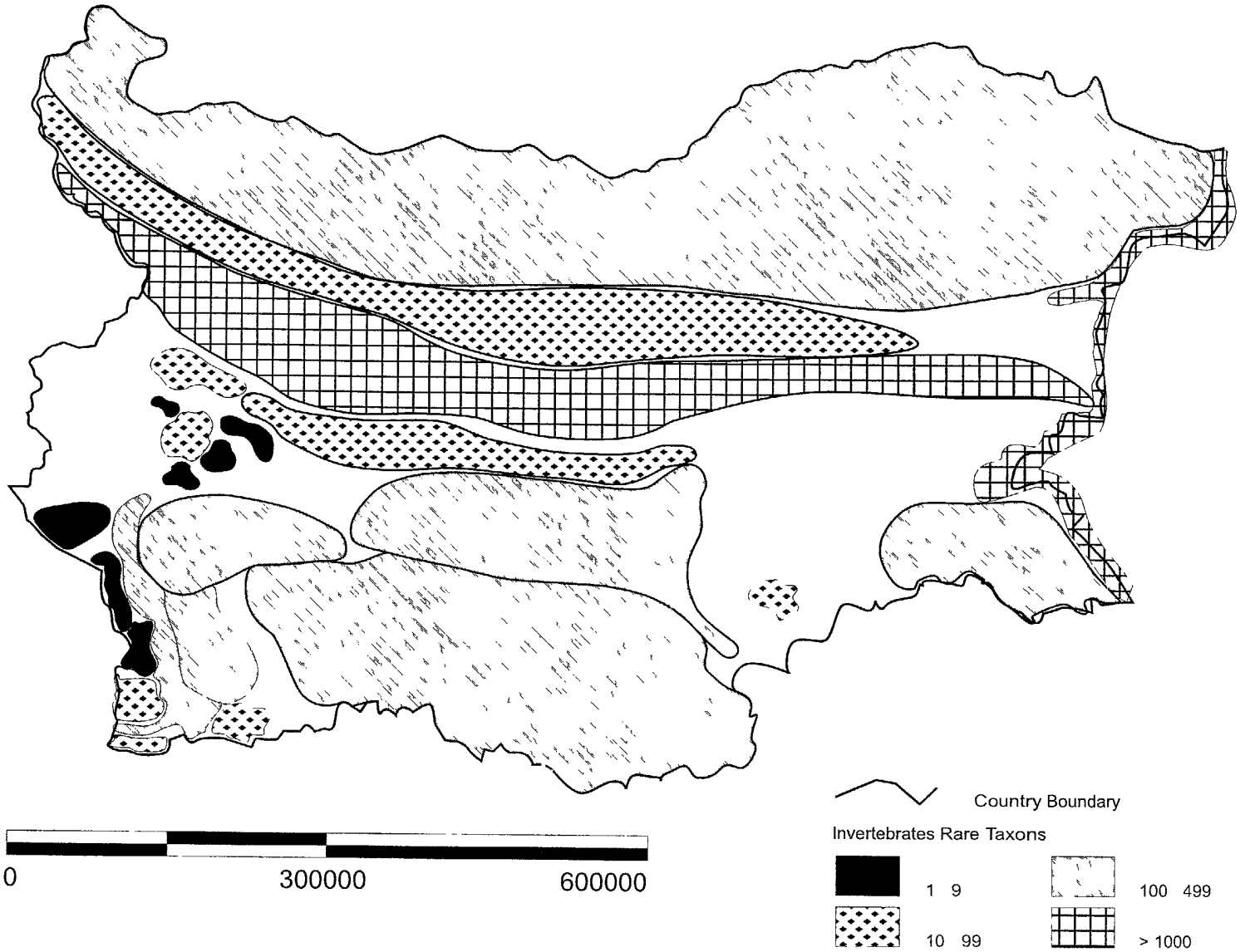
Map 11 Invertebrates Unique Territories



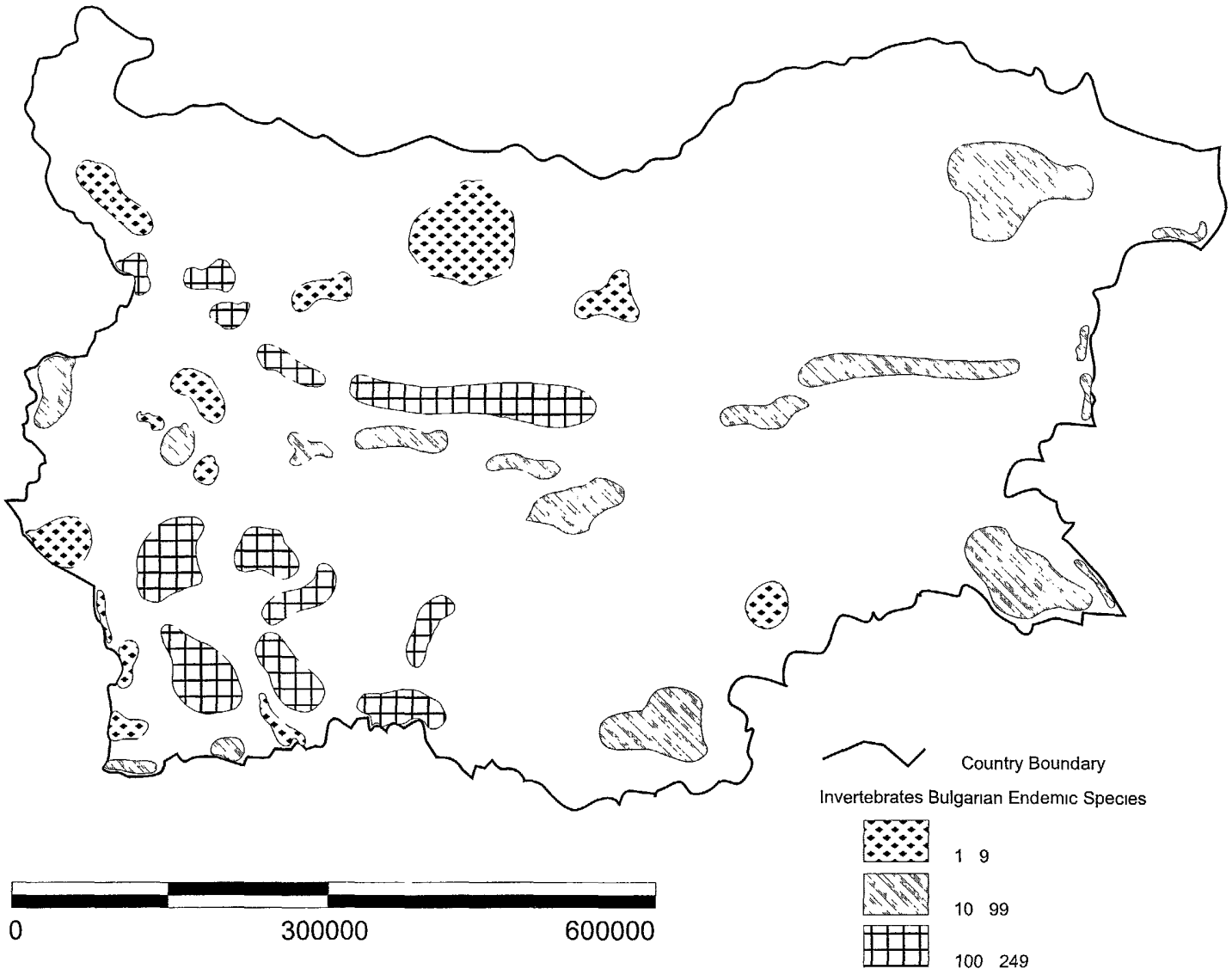
Map12 Invertebrates Poorly Known Areas



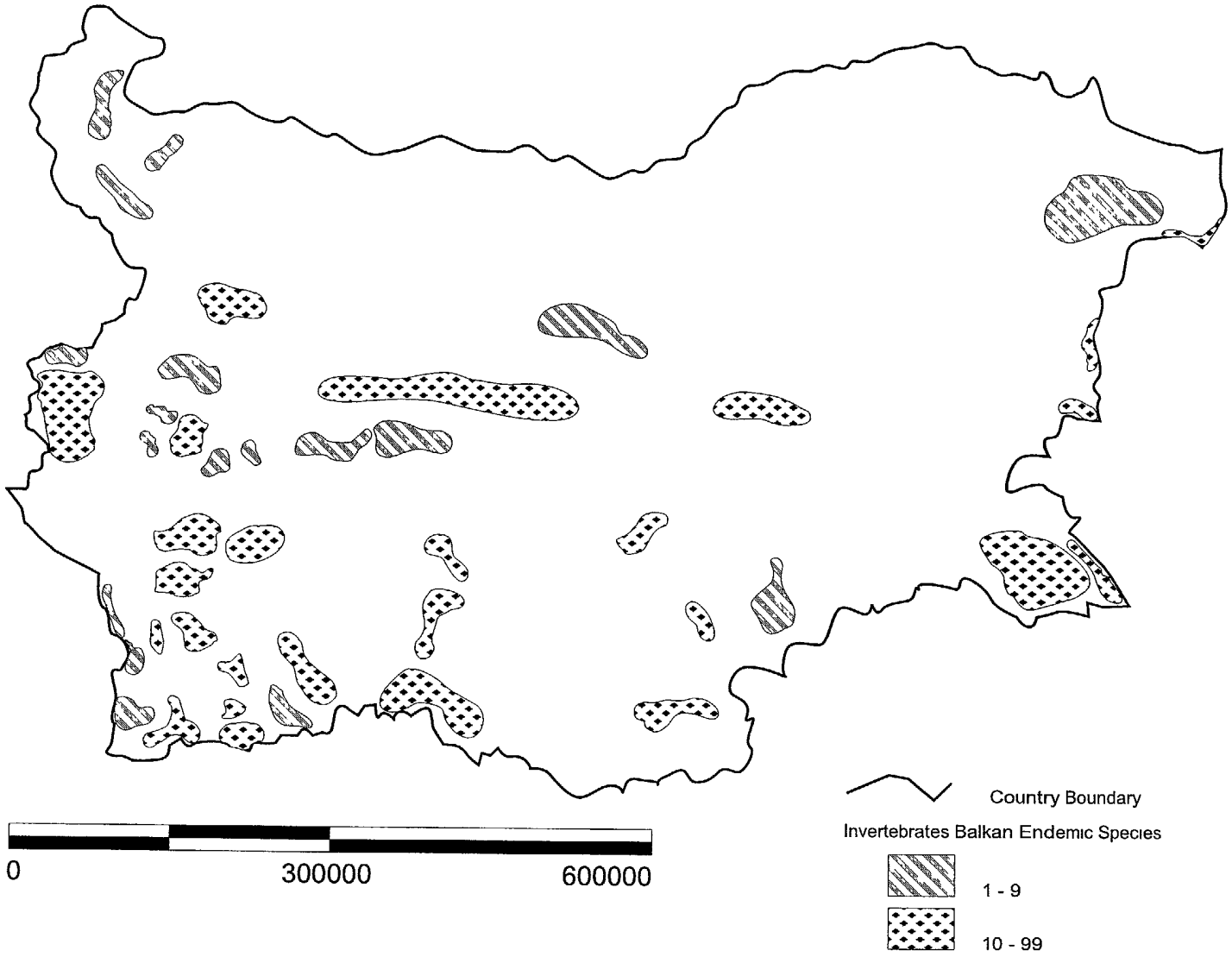
Map 13 Invertebrates Rare Taxa



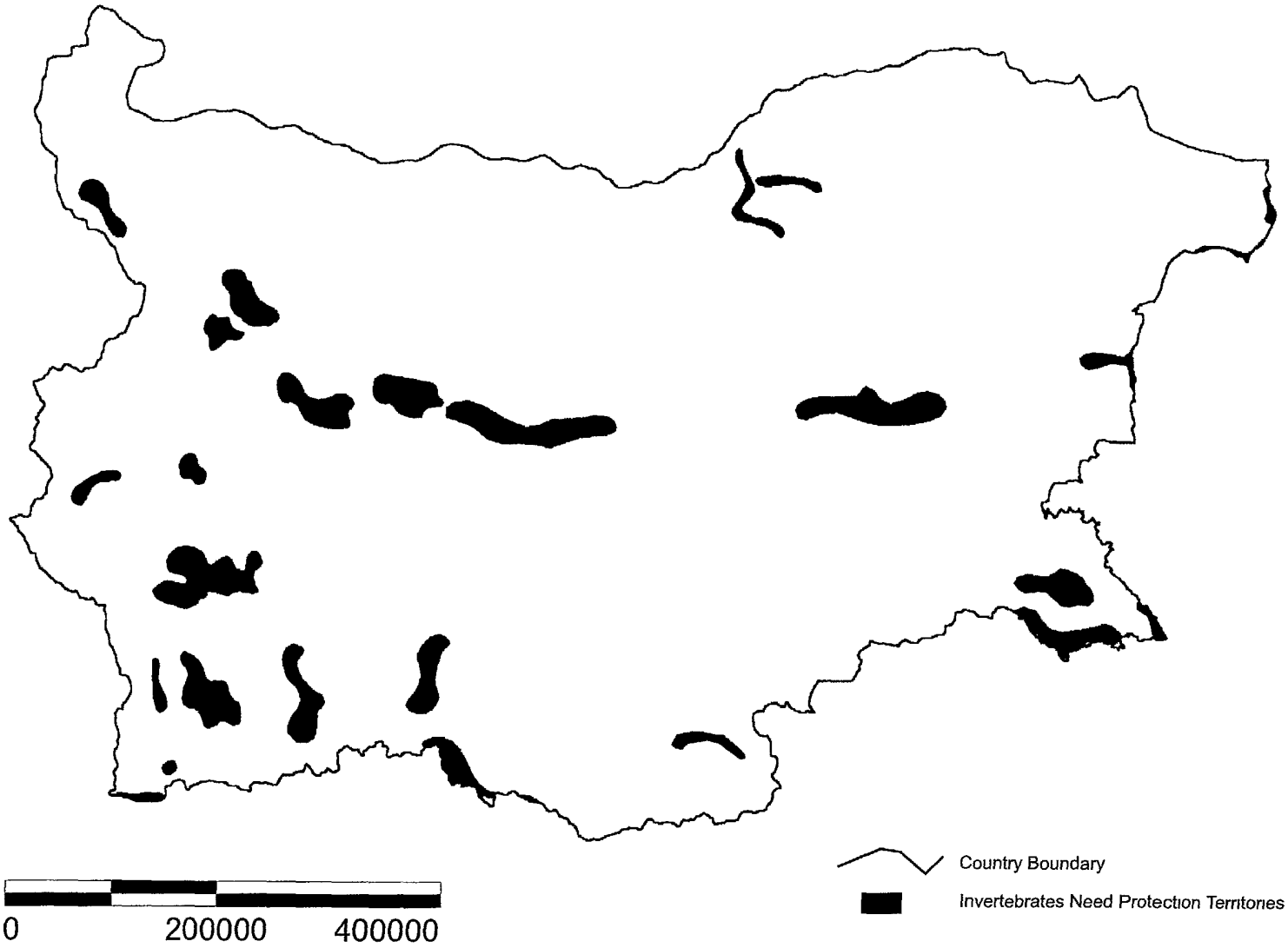
Map 14 Invertebrates Bulgarian Endemic Species



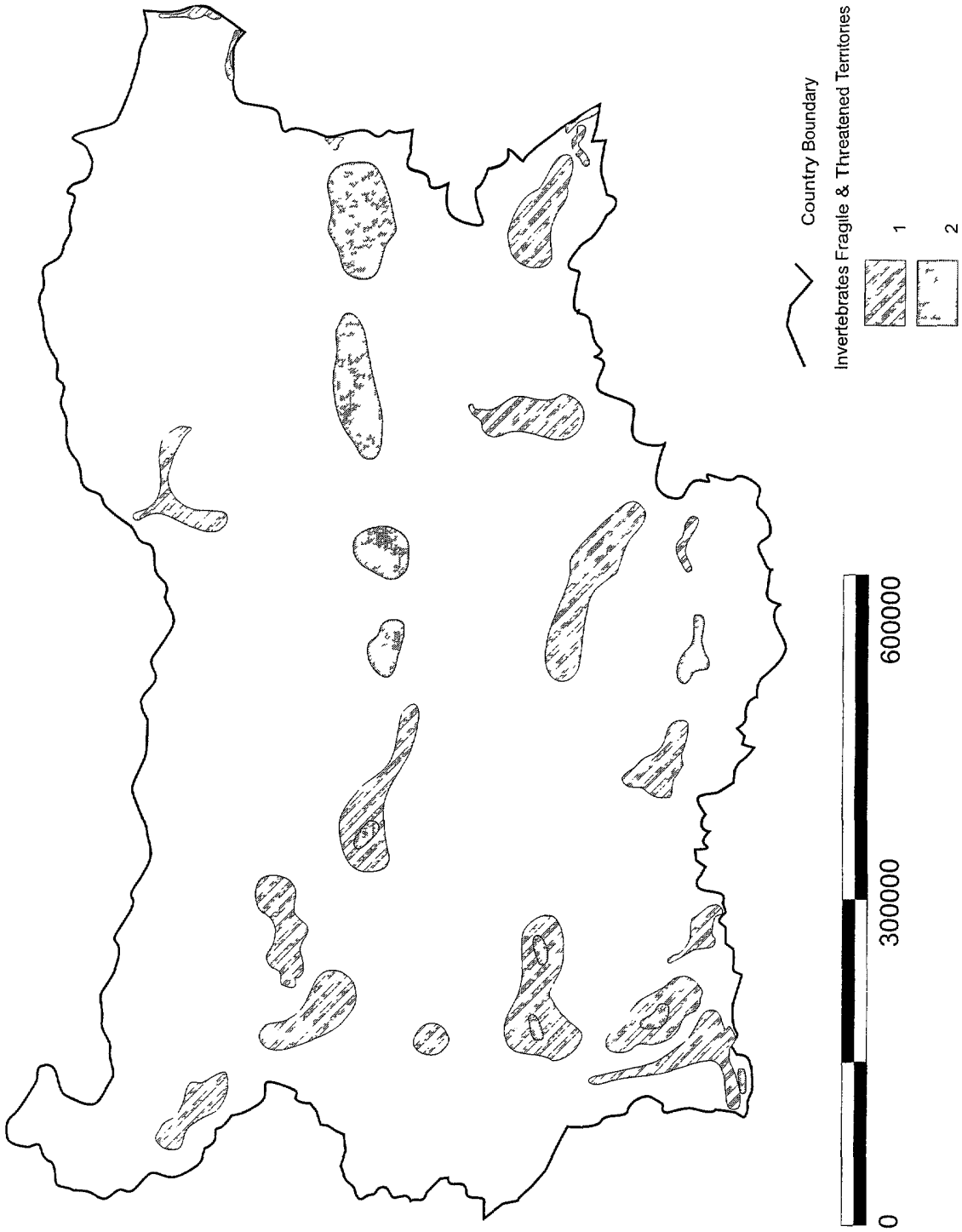
Map 15 Invertebrates Balkan Endemic Species



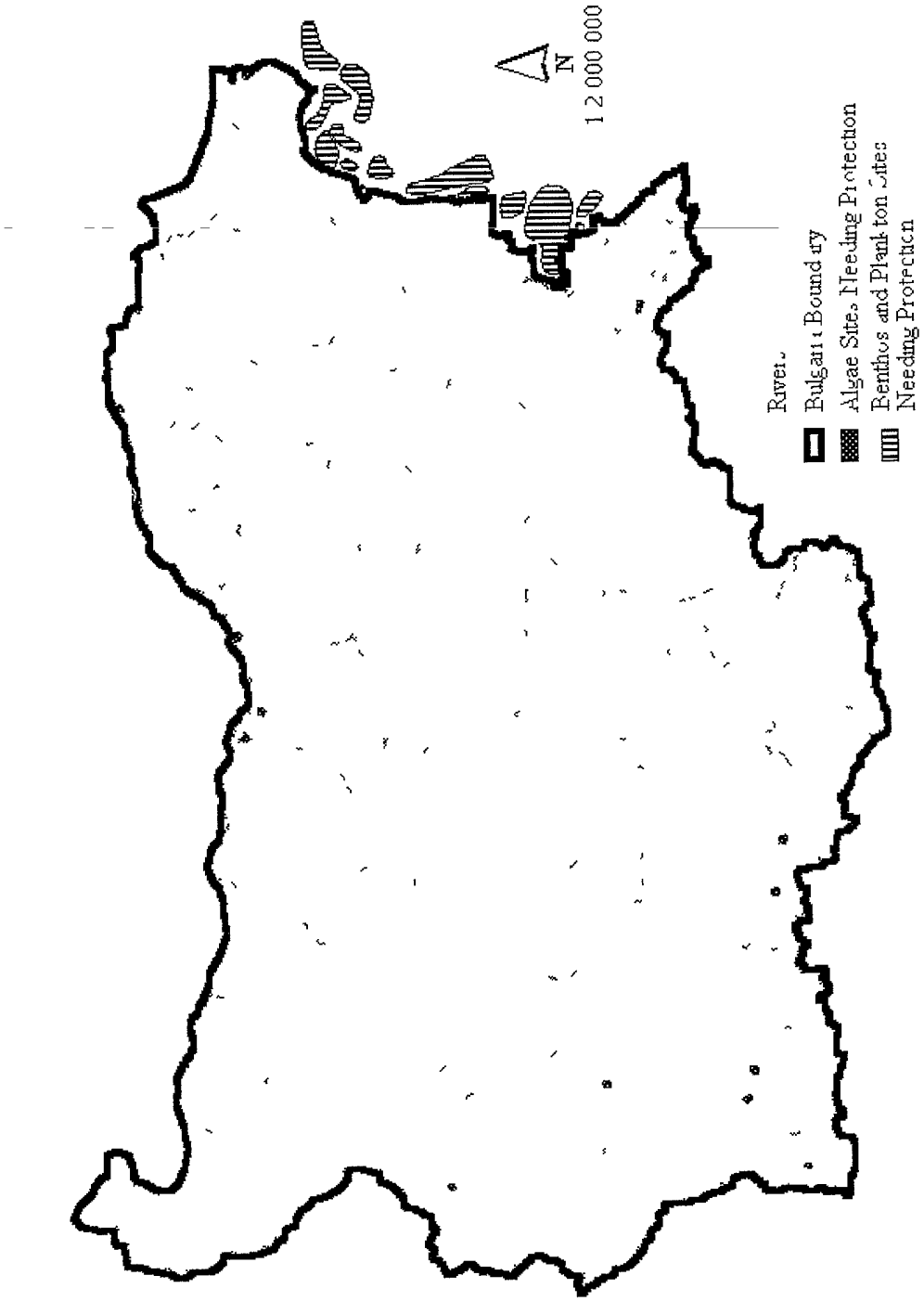
Map 16 Invertebrates Threatened Invertebrates Requiring Protection



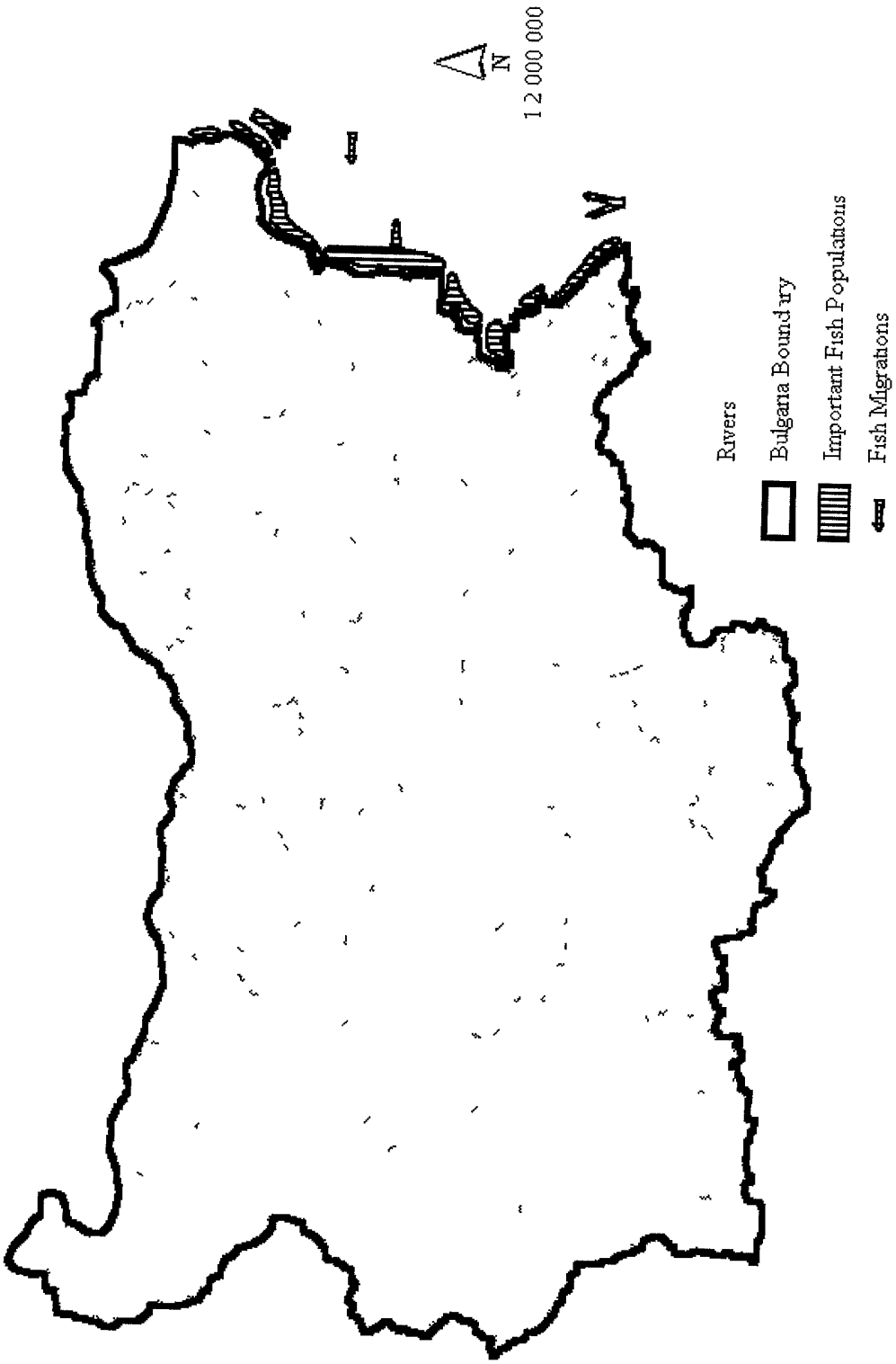
Map 17 Invertebrates Fragile and Threatened Invertebrates



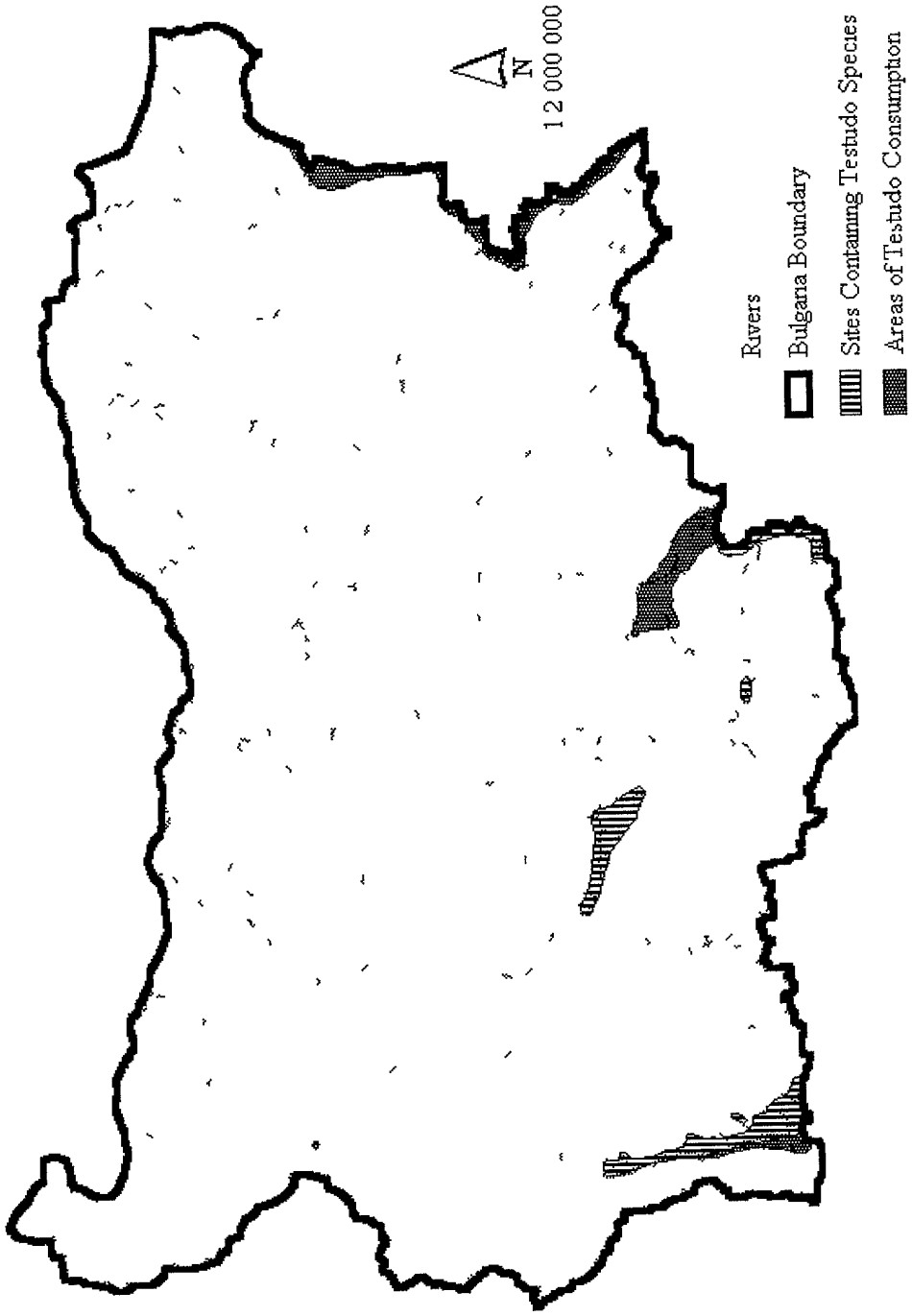
Map 18 Freshwater and black Sea Ecology sites with Algae, Benthos and Plankton Species in Need of Protection



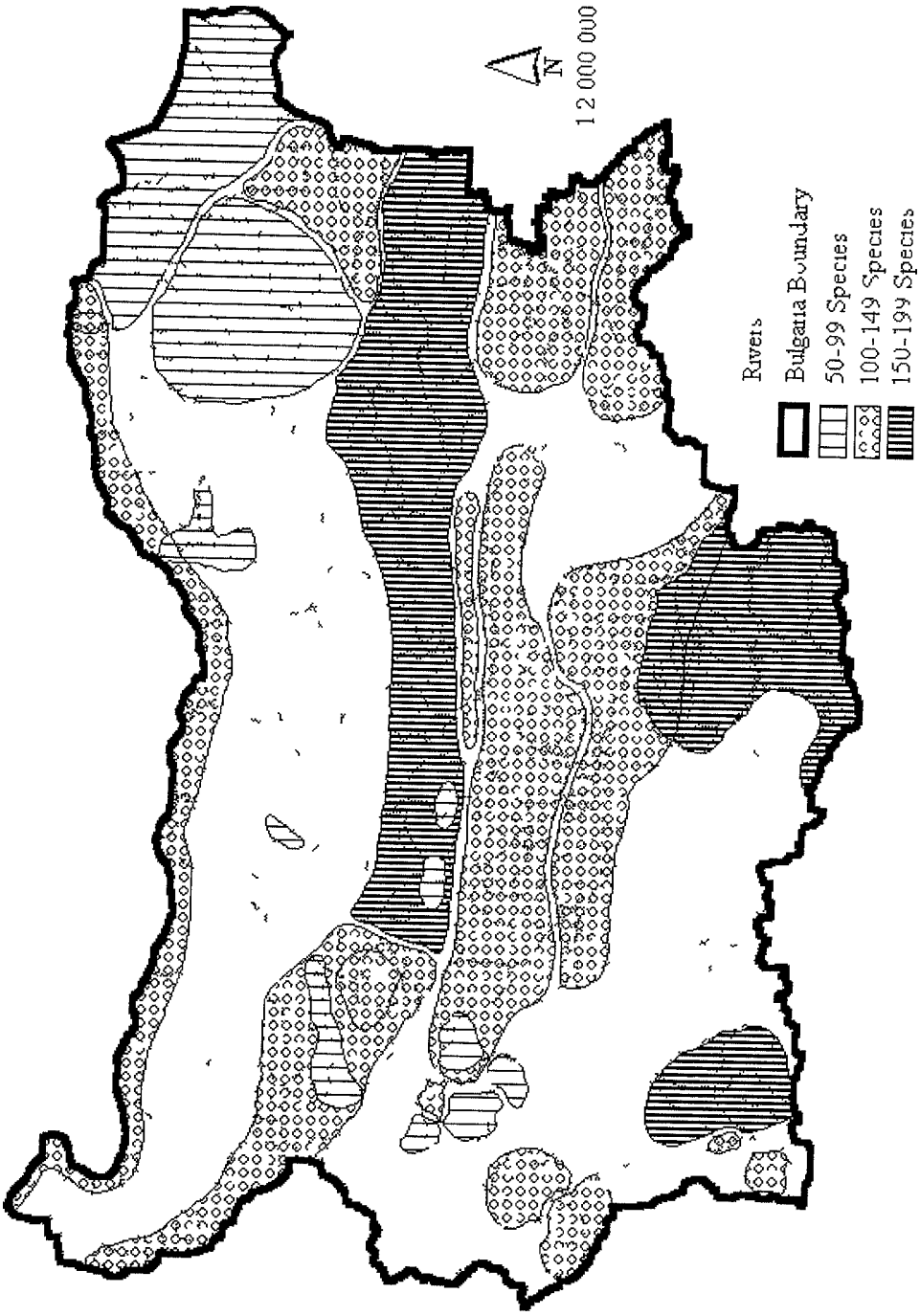
Map 19 Black Sea Ecology Distribution of Bulgaria's Fish Populations



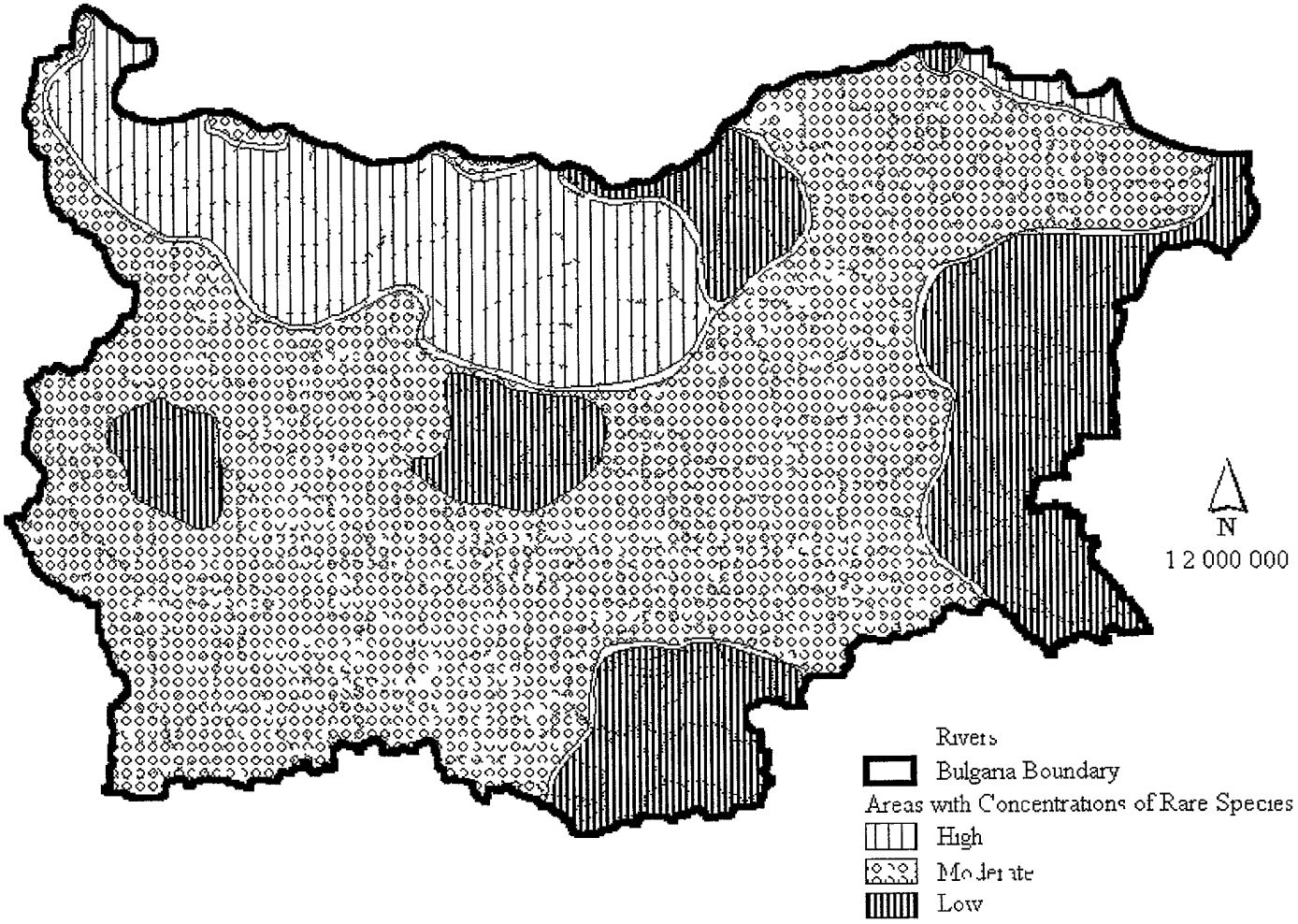
Map 20 Reptile and Amphibian Ecology Distribution and Consumption of Tortoise (*Testudo*) Species



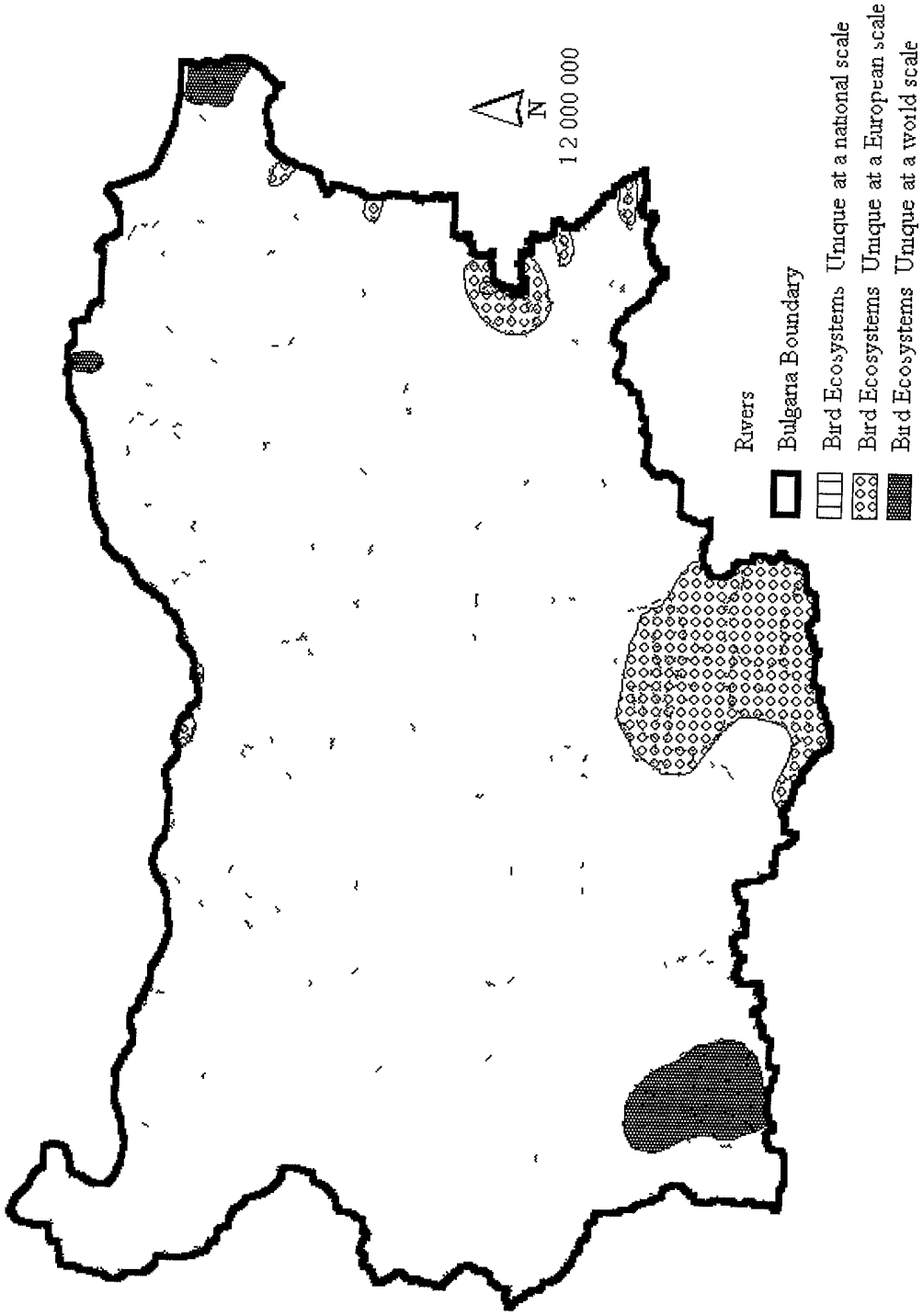
Map 21 Bird Ecology Distribution of Bird Species



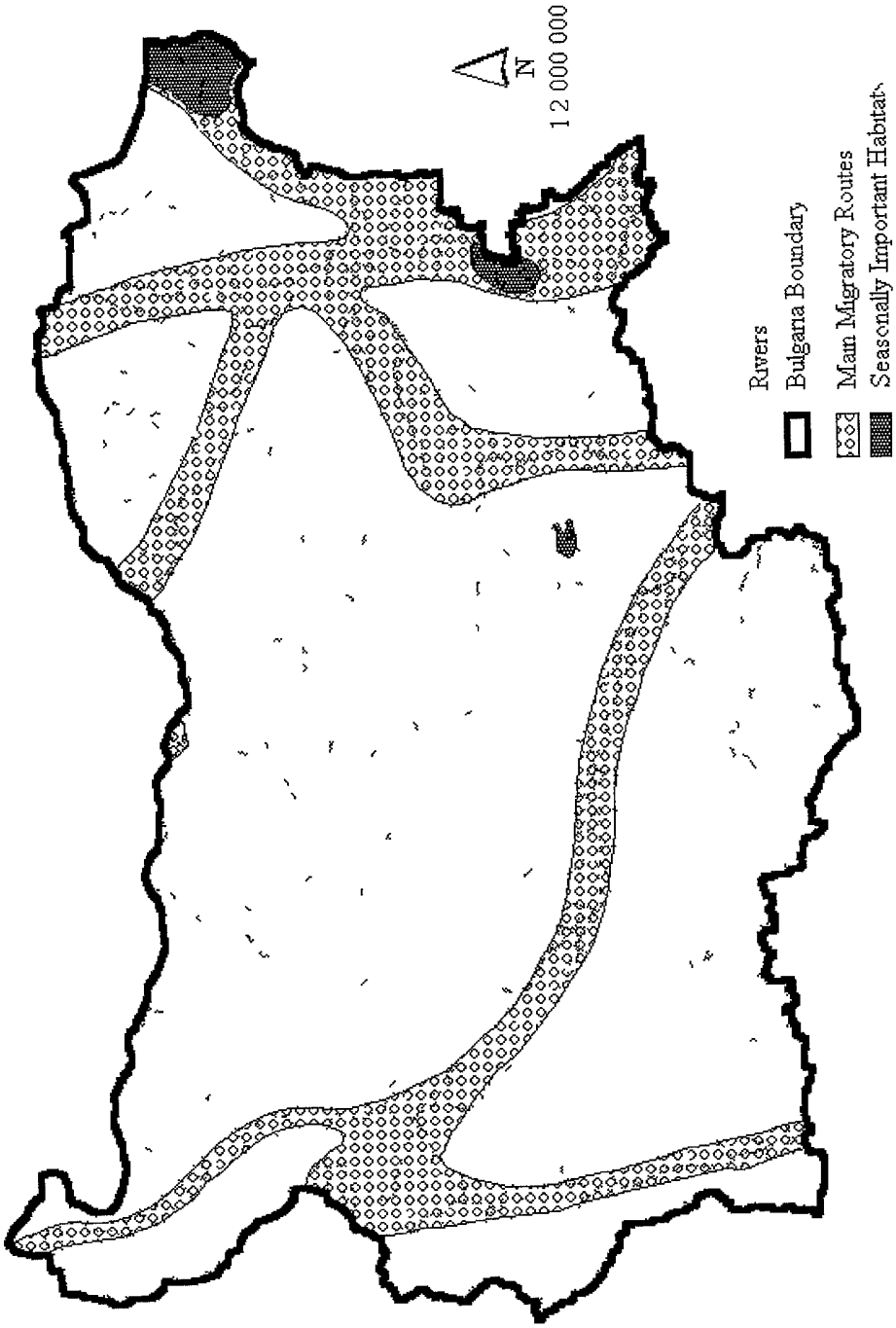
Map 22 Bird Ecology Distribution of Rare of Bird Species



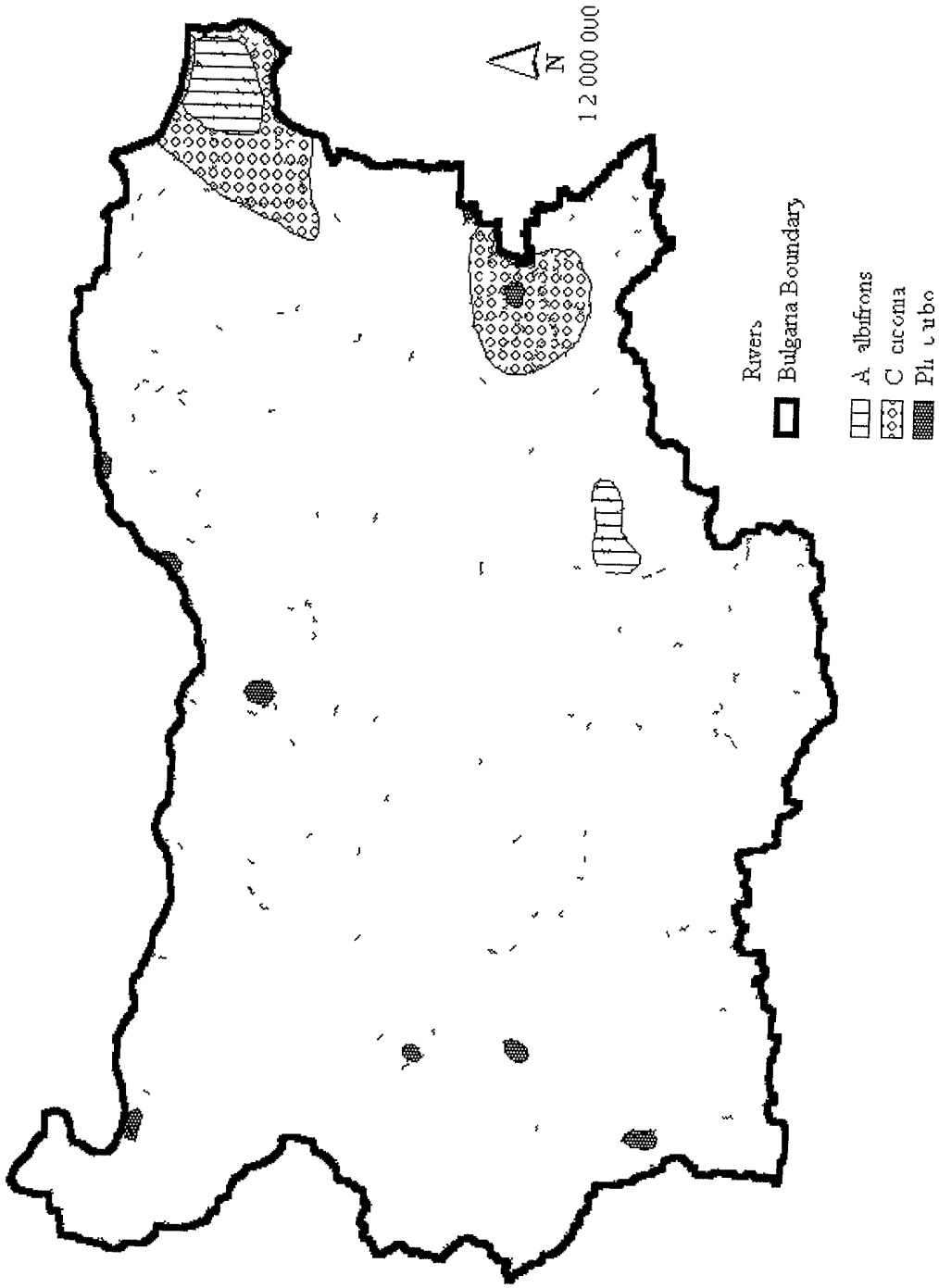
Map 23 Bird ecology Distribution of Unique Ecosystems and Habitats for Birds



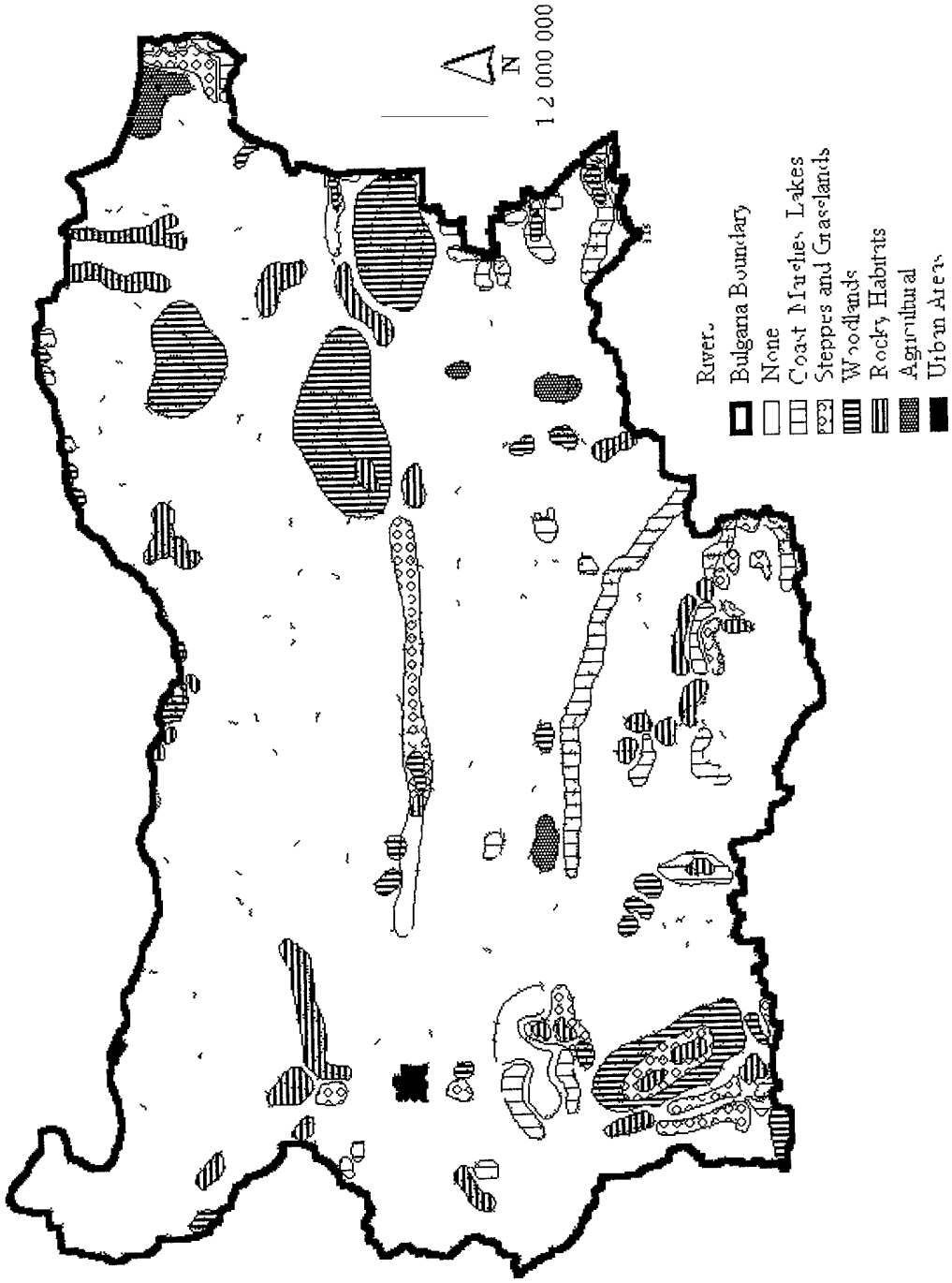
Map 24 Bird Ecology Bird Migration Routes



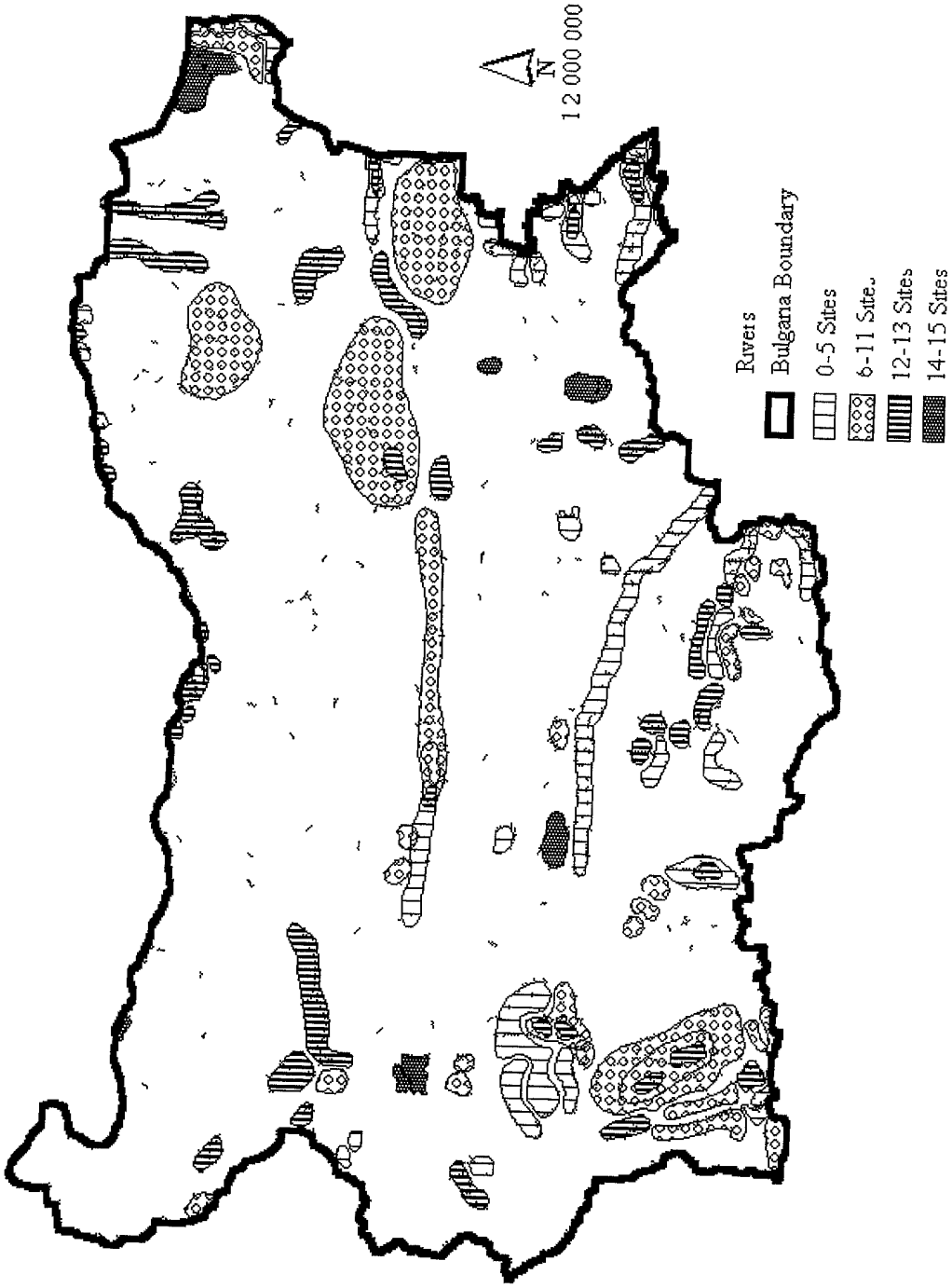
Map 25 Bird Ecology Threatened or Fragile Bird Sites



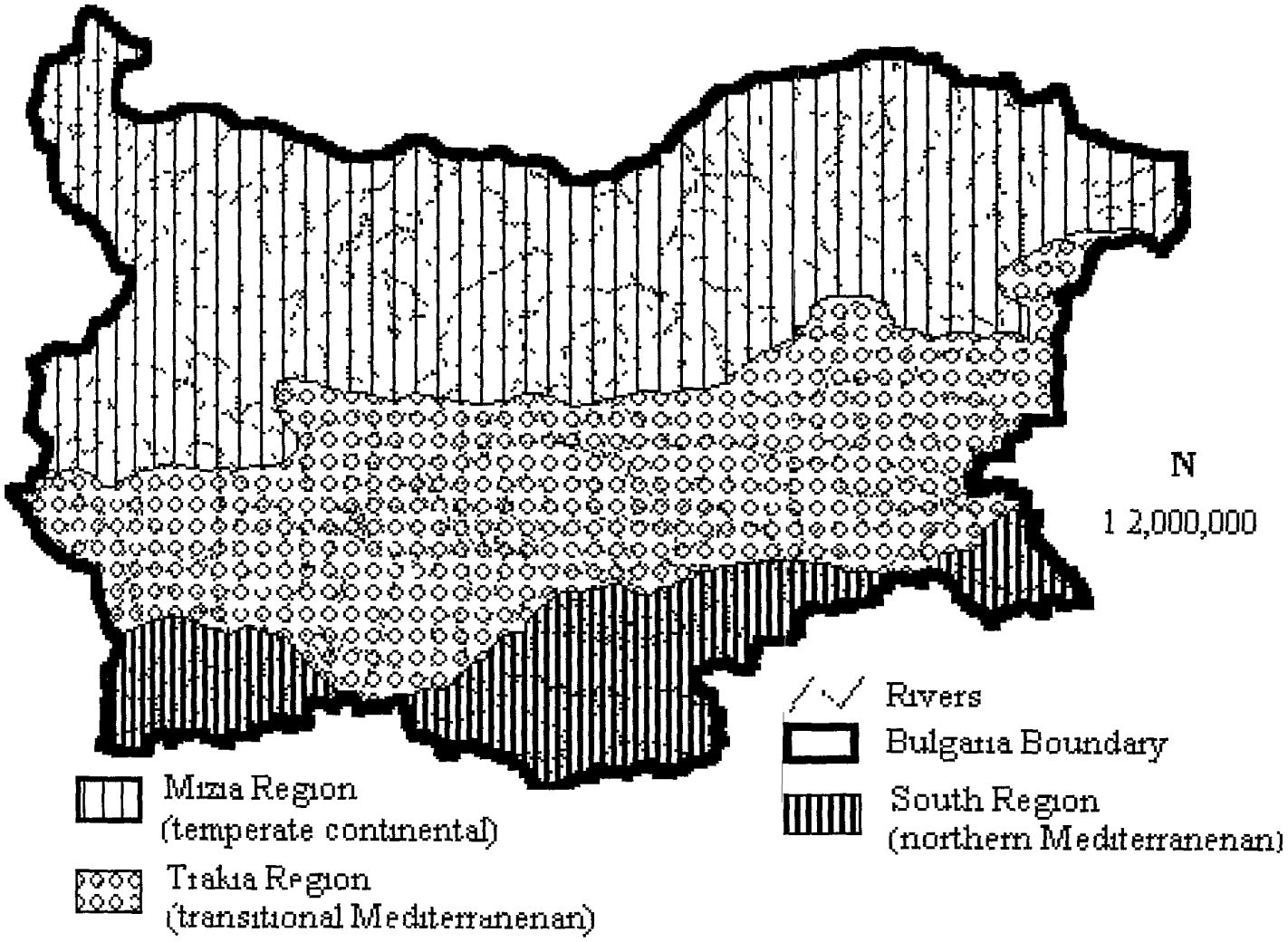
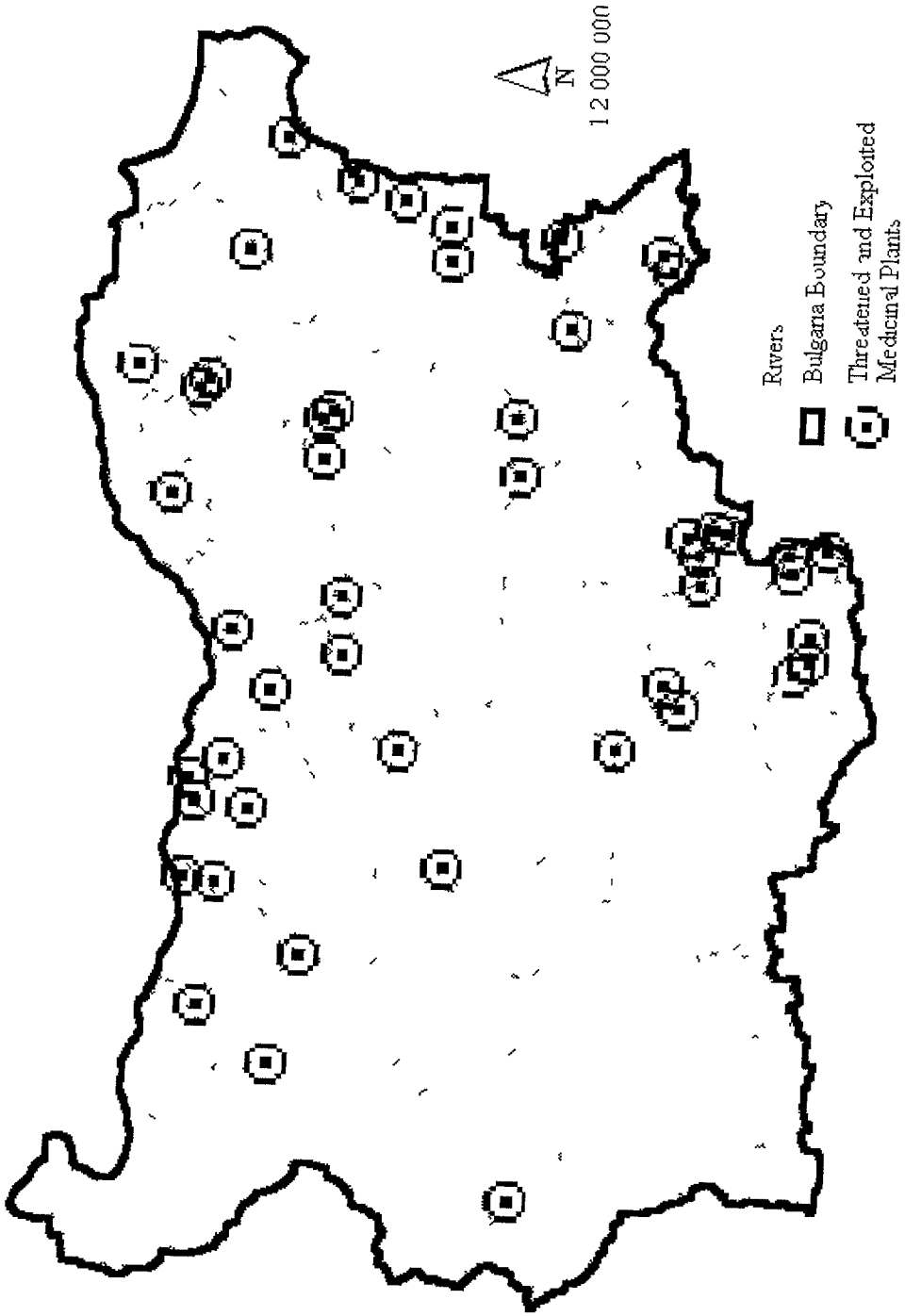
Map 26 Bird Ecology Distribution of Bird Habitat Types



Map 27 Bird Ecology Sites with the Most Representative Examples of Bird Diversity



Map 28 Forest Ecology Forest-Climatic Regions of Bulgaria



Map 29 Economic Species Sites of Medicinal Plants Under Threat