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Mr C. S. GORDON

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OVERFISHED STOCKS,  
UNDERNOURISHED PEOPLE,  
AND UNDERBENEFITED  
COASTAL STATES OF WESTERN AFRICA

OPPORTUNITIES FOR MARINE FISHERIES MANAGEMENT AND DEVELOPMENT

by

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## EXECUTIVE SUMMARY

This report responds to a request from the Agency for International Development (AID) for basic documentation, conclusions and recommendations on whether AID should pursue an initiative in the development and management of West African marine fisheries.

After summarizing and analyzing the documentation relating to West African fisheries, and following synopses, analyses and evaluations of the relevant institutions, training programs and donor activities, and a discussion of the prospects for West African fisheries development and management is presented, it is concluded that AID should commence such an effort.

This report points out that:

- 3/4 of the fish are caught off the northern coast, but 2/3 of the people live in the south.
- while many details need to be filled in and many open questions remain, much of the basic information needed for management and development is at hand or in process.
- most of the fisheries are fully or overexploited, with foreign fleets taking nearly 60 percent of the total marine catch.
- the fish stocks are presently at risk, and reduction of fishing effort needs to begin in earnest.
- intervention in the market place inhibits fish distribution.
- artisanal fishing accounts for 70 percent of the total marine catch by the African states themselves.
- the fisheries development potential of West Africa is great, and it will take time to move through the successive stages of improvement.
- other donor countries and regional organizations welcome AID's entry, and do not foresee overlap or conflict.
- there is a need for up-to-date information relevant to West African fisheries in both Washington and West Africa.

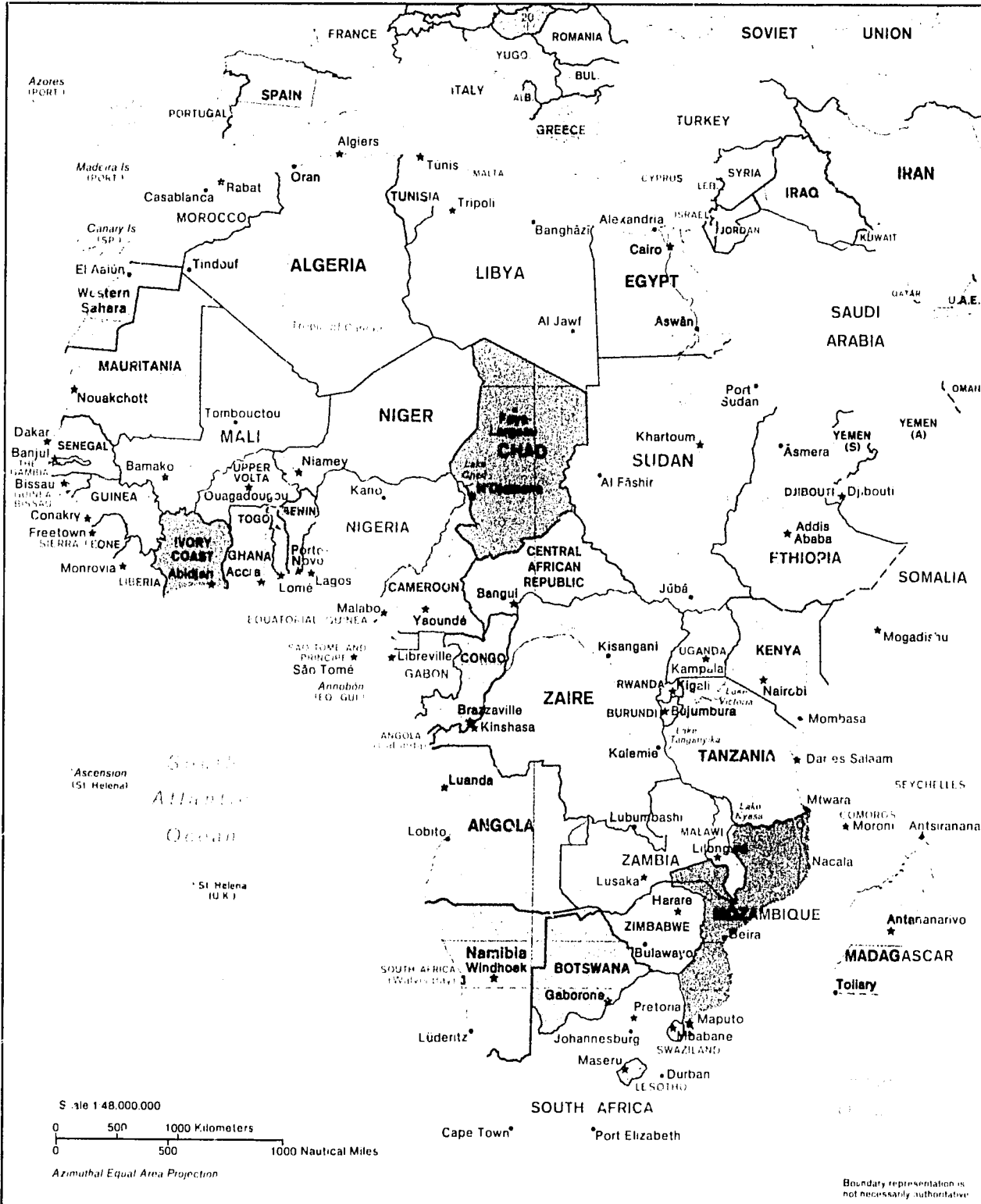
Consequently, the following recommendations are made for consideration and action by the Agency for International Development:

1. Establish a regional pilot fish management program for demersal species of finfish from Morocco to

Sierra Leone, because these stocks are stressed and accessory factors are favorable.

2. Create a highest-level seminar for a few of the key fishery figures (not necessarily ministers), mainly in northwest Africa because of the greater development there of both fishery and government infrastructures.
3. Implement a training program at doctoral, baccalaureate, on-the-job, and extension levels, in the subject areas of stock assessment, resource economics, fisheries management, post-harvest losses, marketing, decision-making, etc.
4. Establish a regional artisanal fisheries project for the reduction of post-harvest losses and to expand the distribution and marketing network. Preparatory research will precede an action phase.
5. Establish a two-way system for keeping current on West African fisheries literature and documentation and also providing the West Africans with a source of information on marine fisheries.
6. Long-range fisheries planning by the individual governments is essential.

# Africa



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## 1. INTRODUCTION

In March 1984, the decision was reached to explore the practicality, significance, and prognosis for an Agency for International Development (AID) fisheries initiative in West Africa. A scope of work was drafted (Appendix A) and one of us (GSP) was charged with gathering relevant documentation and information available in the United States. Both of us visited various sites in Italy and France (April 4 - 14, 1984) and one of us (JS) visited Belgium, meeting with representatives of major institutions and with key people.

The purpose of our discussions in Europe, as stated in the scope of work, was to verify and update information in the literature. In addition, and in particular, we sought and received those comments and in-house reports which are not a part of the published literature. Everyone was most cooperative and open with us.

The countries under consideration in this document extend from (and including) Morocco to (and including) Angola. Table 1 (Appendix) summarizes the general, relevant features of these countries.

This paper is separated into seven sections which divide into three major parts: observations, discussion, and conclusions and recommendations. The chapters on: Documentation, Institutions, Training and Donor Activities contain the most reliable information we have. The section on the Prospects of Fisheries Development and Management is a discussion of these and other facts.

It would be very difficult to name all the people, here and overseas, who have assisted us in this study. To all of them we are beholden. Responsibility for any and all errors is ours.

We were especially fortunate that Dr. Lamarr Trott (AID/S&T/AGR) was tasked to explore some questions in Africa whose answers were needed. His contribution, based upon a brief but intensive exposure, is greatly appreciated.

## 2. DOCUMENTATION

A major portion of the new fisheries initiative must focus on what is already known about the fisheries sector and its current status. Never a simple task because of the complexities involved in any natural resource, the job becomes even more difficult since it focuses on 21 countries, some Francophone, others Anglophone, a couple Spanish speaking and two speaking Portuguese.

The method used involved a computer search of several databases, examination of files retained by the Foreign Fisheries Analysis Division of the National Marine Fisheries Service, and consultations with regional and multinational organizations. In accessing the computer, 82 subject area, 17 taxonomic, 19 organization, and 30 geographic descriptors were used. The subject area titles dealt with all phases of the fisheries sector, from harvesting to retail sales, ocean currents to ocean climate, fish behavior to fish abundance, fisheries laws to patrol boats.

There are three types of documentation available to this study:

- items published in refereed journals;
- items published in non-refereed papers such as house organs;
- unpublished items.

The last category is especially interesting because it includes in-house reports with limited distributions, and is seldom included in bibliographies.

A subject breakdown of the computer search yielded the results shown in Table 2. This analysis of the literature shows an emphasis on stock assessment, and on the northwest coastal resources. Fisheries development is a second subject priority, with fisheries oceanography a surprising third. A bibliography based upon the computer searches can be prepared, but providing a list of the private literature would be harder to do.

With the exception of the unpublished literature, which by its nature often presents the conclusions of a small group or even a single individual, the documents available are mainly descriptive; synthesis and theorizing is at a minimum. It is beyond the mandate of this report to evaluate all of the various publications. However, generally speaking, articles in refereed journals have passed a level of scrutiny to which other documents are not necessarily subjected.



## 2.1 Fish Stocks

The scope of work does require an evaluation of the level of knowledge of the fish stocks off West Africa, and their current status. This information is discussed at length in the section entitled, "Prospects for Fisheries Management and Development." An evaluation of catch statistics is included in the country-by-country comments of Appendix D. Here the points are simply made that:

- there is a reasonable amount of stock assessment information on the handful of dominant species. These data are not as extensive in space or time as a careful monitoring of managed stocks requires, but an approximate, overall view is possible;
- there are very little data on the secondary species;
- Everett, et al. (1980, 1982) report that most stocks are fully to overexploited, and this position is generally accepted (Table 3).

In CEEAF document MR/V/83/4 (July 1983), written by Garcia, the following summary update of the state of the stocks is offered.

### 2.1.1 Northern sector (CEEAF areas 34.1.1, 34.1.3, 34.3.1)

Hake - reduce the fishing effort, enlarge the mesh. Consider the interactions between shrimp and hake. Progress is on track.

Seabream - stock considered seriously damaged. Replaced partially by the cephalopods (ie, exploitation shifted to cephalopods in 1960's when seabream abundance dropped). Reduce the fishing effort, enlarge the mesh, analyze the interactions with the cephalopods. Little progress.

Other demersal percomorphs - overexploited in terms of yield per recruits north of Cape Verde. Actual state of exploitation not known south of Cape Verde. Exploratory trawling has intensified.

Cephalopods - identify the separate stocks. Reduce the fishing effort globally. Actual efficient regional collaboration to be followed.

Lobster - analyze the interactions with the cephalopods. Watch very carefully the rebuilding of the stocks.

Shrimp (P. notialis) - control the fishing effort. Take into account interactions between the artisanal and industrial fisheries.

Sardines (along Morocco and Mauritania) - limit the effort in the region between Cape Bogador and Cape Barbas. Carefully track the resource. There is a risk of instability.

Coastal micropelagics (Mauritania to Guinea) - long term stability must be clarified. Analyze the interactions between artisanal and industrial fisheries. Control and track the level of effort. Survey and control the transfer of effort between fisheries (and between target species). Pursue biomass evaluations by routine acoustic studies.

Becasse de mer (Morocco) - disappearance of exploitable concentrations (1981).

### 2.1.2 Gulf of Guinea

Sierra Leone:

Demersal species - shrimp intensely and fully exploited. Demersal resources in general, condition unknown.

Pelagic species - general condition of the resource is unknown.

Pelagic species - no estimates.

Ivory Coast - need to analyze the problem posed for the management of the unstable pelagic resource exploited by the artisanal and industrial fisheries.

Ghana - pelagic resources are shared with the Ivory Coast and Togo.

Togo - see Ivory Coast.

Benin to Gabon - no conclusions.

Congo - overexploitation by successive reduction in the accessible zones (new law of the sea) and overconcentration of the available fleet.

There is some information in the published literature on almost any subject related to the resource that one can name, but its quantity and, sometimes, quality demands continuation and expansion of these studies. The most significant knowledge gaps concerning the resource at this time relate to management and development, and include (no priority indicated):

- stock assessment and ecology of lesser commercial species;
- regulating the rate of exploitation;
- management of cross-boundary stocks;
- improvement of sampling of artisanal fisheries;
- improvement in foreign fleet catch statistics;
- modern fishing surveys (to assist in identifying new stocks);
- ecosystem studies;
- multispecies fisheries.

## 2.2 Fishing Industry

The following attempts to summarize the state of knowledge about five sectors of the fisheries industry in West Africa. The sectors discussed are (1) harvesting, (2) processing, (3) domestic distribution and marketing, (4) international trade, and (5) consumption.

### 2.2.1 Harvesting Sector

In this, the primary production sector of the fishery, we are concerned with elements significantly related to development and management issues. The principal elements include:

- industry structure;
- vessel economics;
- fishing methods and patterns;
- employment income;
- supporting infrastructure;
- linkage with other sectors of the economy.

Industry structure is described by the numbers, types, and sizes of harvesting units, the share and composition of catches of principal harvestors, the nature of linkages among harvestors and between harvestors and downstream firms (such as processors, fish dealers), etc. Vessel economics is largely, but not entirely, concerned with costs and earnings of each type of harvesting unit. The meaning of fishing methods and patterns, and of employment and income patterns, should be self evident. Good knowledge of these four elements is essential for reliable forecasts and assessments of the effects of interventions in the fishery, such as through development and management projects.

Supporting infrastructure is described by the numbers and types of landing facilities, marine supply stores, ice plants, roads, and by the availability of electricity, telecommunications and freshwater. Other economic sectors with which there may be important linkages include agriculture, marine transport, and banking. Good knowledge of the infrastructure and intersectorial linkages is essential for determining the prospects for expanding fisheries production. Since fisheries typically are a small part of an economy, infrastructure and intersectorial linkages are exogenous to the fisheries planning and policy process. For example, it is rare that the costs of constructing a road (connecting a landing site with inland markets) can be fully offset by the added benefits to the fishery.

For each of the six elements above, the documentation is evaluated for the extent to which it contains information on (i) recent trends and current status, and (ii) assessments of the prospects for development and management.

2.2.1.1 National fishing operations. The domestic harvest sector of most coastal states in West Africa include industrial, semi-industrial and artisanal fishing operations. For the region as a whole, artisanal fishing operations produce most of the fish for domestic consumption and involve more vessels and employment than industrial and semi-industrial operations.

Industrial and semi-industrial fishing operations are reasonably well documented throughout the region. Artisanal fishing operations in Senegal and Ghana are well documented - an exception.

Pronounced weaknesses in or absences of documentation on artisanal operations exists for Nigeria, Equatorial Guinea, Cameroon and Liberia in the southern zone, and for Guinea in the northern zone. The remaining countries have modest levels of documentation on their artisanal fishing operations.

2.2.1.2 Foreign fishing operations. The documentation of foreign fishing operations in the region is very weak. Reported catch statistics are unreliable for some fleets; most likely the reported catches are low by significant amounts. Fishing patterns are not in the literature. The costs and earnings of some types of foreign fishing vessels are documented and analyzed. This element represents a highly significant gap in information.

2.2.1.3 Joint ventures. The situation with joint ventures in fisheries appears to change frequently, making it difficult to document meaningfully these activities. There is little in print of returns to coastal states from joint ventures and of the prospects for transferring technology and expertise through joint ventures in the region.

## 2.2.2 Processing Sector

In the processing sector we are concerned with the following elements:

- industry structure;
- firms' costs and earnings;
- processing methods and technology;
- employment and income;
- product flow patterns.

Recent trends, current status and future prospects for these elements are reasonably well documented for the industrial and more modern fish processing operations. Much less is known for the traditional, small-scale processing operations, which are responsible for the bulk of fish consumed locally. The latter are weak in the elements of wastes and losses in processing, costs and earnings, employment, and income. Information on the prospects for technical change and development in this sector has a significant gap.

### **2.2.3 Distribution and Marketing Sector**

The domestic distribution and marketing of fish and fish products are not well documented. Save for public sector systems, very little is known about this sector's industrial structure, firm's costs and earnings, employment, product flow patterns and efficiency.

Too often, public sector distribution and marketing systems are installed purposefully to displace private sector systems. Unfortunately, the conventional wisdom in West Africa, and in many other parts of the world, is that market intermediaries (i.e., middlemen or middlewomen) are exploiting fishermen and consumers. There is a need for reliable, comprehensive information on the performance of the private distribution and marketing system, which documents how well private entrepreneurs serve the interests of development. There also is need for reliable documentation on the performance of public sector systems, to establish the conditions under which such systems are appropriate. Such information may enable financial assistance to be given to private enterprises in this vital sector of the fishery.

A major problem in the fish delivery system is post-harvest losses. Such losses are especially difficult to measure, but estimates range from 35 to 80 percent of landings, due largely to insects. The documentation on the nature and extent of the post-harvest loss problem, and prospects for solving it, are very poor.

### **2.2.4 Trade**

A modest level of documentation exists on the international trade of fish and fish products. Significant gaps in our knowledge are in the following areas:

- methods and economics of transport;
- economic determinants of trade patterns.

Information in these and related areas is necessary to forecast trade patterns that likely would emerge under alternative development and management scenarios. Such information is also needed to assess means of moving the fish supplies of the northern zone to the markets of the southern zone where three-fourths of the human population lives.

### **2.2.5 Consumption Sector**

This sector is the least documented of all. Currently, only rough per capita consumption data are available, and they are unreliable for many countries. Many, if not most, development and management efforts are predicated on increasing consumption patterns (e.g., by income and ethnic groups). We have few reliable estimates of demand relationships for fish and fish products. Therefore, we cannot reliably predict who will consume an increase in fish supplies (the urban rich? the rural

poor?), nor the prices that can be sustained by the market. For targeted groups of undernourished, we do not know what would be necessary to enable them to increase their intake of fish protein. Such important concerns make this sector a high priority for future study and documentation.

### **2.3 Project Evaluation**

Another important set of information is the documentation of projects and programs for fisheries development and management, and their relative success. The description and evaluation of such projects and programs is essential for learning how best to design and implement projects which provide the greatest chance of success. Without this knowledge, errors in design and implementation are repeated, and success is elusive.

Documents containing systematic evaluation of projects and programs are virtually non-existent. The results of two unpublished studies are discussed below ("Donor Activities"). This is regarded as a critical knowledge gap, and work in this area should be given high priority.

### 3. INSTITUTIONS

Any commercial activity as complicated as fisheries has a life intertwined with that of governmental and multinational institutions. In this section the attempt is made at identifying and evaluating the relevant entities.

#### 3.1 Governmental Entities

As one would expect, there is no uniformity of structural treatment of fisheries by the countries of West Africa. If one examines the ministries for fisheries one finds:

- 1 country (Gabon) where fisheries is in a ministry for natural resources;
- 2 countries (Angola and Guinea Bissau) where fisheries is in its own ministry;
- 2 countries (Morocco and Mauritania) where fisheries is combined with the merchant marine;
- 4 countries (Senegal, Cape Verde, Togo, and Congo) where it is part of economic development; and
- 11 countries (Gambia, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Benin, Nigeria, Cameroon, Equatorial Guinea, Sao Tome and Principe) where it is part of agriculture or animal husbandry.

Whatever the historical reasons for so many fisheries departments to be housed within ministries of agriculture, fish must be viewed primarily as food.

Details are given below but, in the main, in West Africa, Morocco and Senegal (and the Ivory Coast, a proximal third) have governmental structures for fisheries, which are the most successful at interacting with the technical experts.

#### 3.2 Multinational Entities

If AID should pursue the West African initiative in fisheries management and development, as is proposed below, it will not be doing so in a vacuum. Even more than the financial contributions made by other donor countries (discussed in another section) there have been national and multinational agencies active in fisheries technical assistance to West Africa. In the following listing of such elements, the focus is on the possible usefulness of multinational groups to the Agency for International Development, rather than on a complete description of each.

The International Commission for the Conservation of Atlantic Tunas (ICCAT) became active in 1969, three years after its creation. Its functions are to promote research on the stocks of Atlantic tunas and to recommend methods for their conservation. Member nations are Brazil, Canada, Cuba, France, Ghana, Ivory Coast, Japan, Korea, Morocco, Portugal, Senegal, South Africa, Spain, and the United States. Although ICCAT was organized by FAO, the Commission is independent. Its current chairman is Carmen J. Blondin, Deputy Assistant Administrator for Fisheries Resource Management (NMFS) and one of the Principals of the West African Fisheries Initiative. For this reason and others, AID can count on the complete cooperation of ICCAT, should it be requested. The Commission has an excellent reputation and could do some training under the "research" rubric. Its main drawbacks are its limited memberships by African states and its specialized focus on highly migratory species.

The Centre National pour l'Exploitation des Oceans (CNEXO) is the principal, civilian, French agency concerned with oceanography. Established in 1967, the Centre is about to be subjected to a major transformation as it joins with the Institut Scientifique et Technique des Peches Maritimes (ISTPM). With this merger, the new CNEXO, renamed Institute Francaise Recherche et Etude de la Mer (IFREMER), will include its 3 major oceanographic laboratories, ISTPM's 10 fisheries laboratories, and their combined fleets. Staffs will be merged and Jean-Paul Troadec, currently head of ISTPM, will become Assistant Director of IFREMER for Living Resources, and will move to Paris. (De Lamare, a space scientist who has done satellite oceanography, will become head of IFREMER - Centre de Nantes, and sit in Troadec's current office with responsibility only for the Nantes laboratory.) With this change, CNEXO/IFREMER gains direct fisheries research responsibilities. For many years, CNEXO's research vessel CAPRICORNE has made an annual fisheries research trip to the eastern central Atlantic, turning the data over to ORSTOM (see below). By prior understanding, the latter will continue to be responsible for fisheries research in that area. The U.S.-France Cooperative Program in Oceanography, was established in 1973, is quite active. The lead agencies are NOAA and CNEXO, so AID would be in an excellent position to utilize this connection. Perhaps the best use AID could make of this arrangement would be by using a CNEXO vessel off Africa for training and/or research. An agreement under the Cooperative Program on exchanging or purchasing ship time is already in force. For example, the French currently have one month on CONRAD in the Caribbean. The French would be pleased to provide CAPRICORNE for one month off Africa in exchange.

The Office de la Recherche Scientifique et Technique d'Outre-Mer (ORSTOM) is part of the French Ministry for Science and Technology. Many of its personnel are technically trained, move from one foreign post to another, and receive their funds from headquarters in Paris. From time to time, a staff member is loaned to another country or FAO. ORSTOM sponsors centers at



Dakar (Senegal), Abidjan (Ivory Coast), and Pointe-Noire (Congo). The Senegalese have been more successful at getting useful information and training from the Dakar center than the Congolese or Ivoreans have been with their centers. The ORSTOM staff was encouraging, and expressed a strong interest in collaborating with AID on this project.

The Intergovernmental Oceanographic Commission (IOC), of the United Nations Educational, Scientific, and Cultural Organization, was established in 1960 to act as the international body responsible for the coordination of all scientific investigations of the oceans by the states concerned and the international organizations. IOC establishes working committees, groups of experts, etc. to handle a variety of specific activities. The now defunct Cooperative Investigations of the Northern Part of the Eastern Central Atlantic (CINECA) was such an action. Three IOC units of special interest are:

- the Working Committee on Training, Education, and Mutual Assistance in Marine Sciences (TEMA) established a Voluntary Assistance Program (IOC/VAP). There is no special focus on West Africa;
- the Ocean Sciences in relation to Living Resources (OSLR) is a new program with considerable potential to assist in staff assessment. It may well be that a West African state or two might be involved;
- the IOC Programme Group for the Central Eastern Atlantic (IOCEA) was established by action of the Seventeenth Session of the Executive Council of the IOC on February 8, 1984. Its terms of reference have yet to reach us.

Except for OSLR, which was not mentioned during discussions in Paris, the IOC is not involved in fisheries activities. All IOC activities are at the governmental level. The IOC staff is ready to cooperate in any way they can, but Mario Ruivo, Director of IOC, feels that the marine infrastructures in Africa have deteriorated over the past 5 to 10 years.

The Division of Marine Science (DMS) of UNESCO, limits its involvement to nearshore problems, and deals directly with local experts (usually university faculty) who have a precise project in mind. DMS only contacts governments to tell them about projects and as courtesy demands. Dale Krause, Director of DMS, feels that, with some setbacks, the marine science picture in Africa has improved over the past 5 - 10 years. As an example, he offered the recently completed study of the Saloum estuary. This project was planned, conducted, and reported on by 12 Senegalese specialists, from 11 different organizations. DMS welcomes the proposed presence of AID.

The Economic Commission for Africa (ECA) is one of five regional commissions under the general supervision of the Economic and Social Council of the United Nations. ECA is

responsible for promoting the economic development of resources in its respective regions. There are no reported activities regarding marine fisheries.

The Communaute Economique de l'Afrique de l'Ouest (CEAO) and the Comite Inter-Etats de Lutte contre la Secherese dans le Sahel (CILSS) are centered in Ouagadougou, have programs aimed at coordinating and strengthening the fisheries sectors of their member countries. The tariff situation is volatile, but among the CEAO groups (Mauritania, Senegal, Ivory Coast, Mali, Upper Volta, and Niger), seafood trade tariffs have been reduced giving Senegal and Mauritania some advantages. CEAO established an Institute Superieur des Sciences et Techniques de Peches (ISSTH) at Nouadhibou, Mauritania presumably with Iraqi funds, and was expected to found a fish trading company there also with multiple funding assistance. Both activities are believed to be moribund.

A Sub-Regional Conference of Ministers responsible for preservation, conservation, and exploitation of fisheries resources, meets annually. The member nations are Cape Verde, Gambia, Guinea Bissau, Mauritania, and Senegal and, in 1982, pursued matters related to surveillance fisheries data collection, and two methods for reducing the catch effort (net mesh size and minimum fish size).

The Economic Community of West African States (ECOWAS) was originally established by treaty in 1959 as the Customs Union of West African Countries and renamed in 1974. Its functions include promoting economic cooperation and development among its member states, the fisheries sector included. ECOWAS has issued a few fisheries - related reports (e.g. Golley-Morgan, 1981), is planning a West African fisheries conference in November 1984, and has received EEC funding for a regional fisheries institute at Nouadhibou, Mauritania. Nevertheless, ECOWAS has remained largely invisible to the marine fisheries community. Given the possibility of using ECOWAS to further an aspect of the program proposed below, several fisheries experts in Europe demurred and sought alternatives.

The Department of Fisheries of the Food and Agriculture Organization is advised by the Committee on Fisheries (COFI), itself established as an FAO standing Committee in 1966. COFI meets annually, and, in addition to receiving the work of the department, promotes international cooperation in fisheries and considers international fishery problems. The Department acts as the home base of the FAO - sponsored regional fisheries commissions, and is funded by FAO monies (the Regular Programme Budget) and extra budgetary funds from multilateral and bilateral donors. The ratio of the first to the second in 1982/83 was 1:4. Clearly, the Department is open to outside funding for specific projects.

The Fishery Committee for the Eastern Central Atlantic (CECAF), established in 1967, to replace the Regional Fisheries Commission for Western Africa, is one such group. It is

responsible for advising FAO on fishery programs in its area, encouraging national and regional programs of cooperative action in the investigation and management of fishery resources, encouraging training and proper assignment of fishery personnel, and for assisting in the collection and dissemination of data. Two features of its mandate unique to CECAF are that it is to assist member countries in formulating programs to be implemented through sources of international aid, and it may not allocate shared fisheries resources. The membership of the Committee includes all the West African coastal states plus Cuba, France, Greece, Italy, Japan, Republic of Korea, Norway, Poland, Romania, Spain, and the United States. In addition, Angola, Canada, German Democratic Republic, USSR, Portugal, United Kingdom, and the European Community attend as observers. The Committee meets every 1-3 years, and lists its achievements as:

- improvement of statistical data collection;
- organization of meetings to increase knowledge of EEZ stocks as a basis for resource management;
- limitation of mesh size used in demersal trawling;
- management of shared stocks;
- transfer to the region of CECAF Secretariat activities.

Although the secretariat of all other regional commissions is funded by FAO headquarters, the CECAF secretariat has always been paid out of U.N. Development Programme monies.

The Programme for the Development of Fisheries in the Eastern Central Atlantic (better known as the CECAF Project), established in 1975, is funded by the U.N. Development Programme (Inter-Regional Activities) and under the jurisdiction of the CECAF secretariat. The objectives of the project are:

- to improve fisheries statistics and biological data;
- to develop a system for monitoring the resource;
- to strengthen the capacity of the coastal states to manage their resources and do development planning;
- to train personnel for the above tasks;
- to promote, coordinate, and assist in research programs;
- to promote and assist country programs of significance to regional and sub-regional development.

In 1977, this listing was reorganized to focus on training, evaluation of fish stocks, management of the resource, and development of artisanal fisheries (in that order).

The Project points out correctly that its statistics and the conclusions of its ad hoc working parties are used by several coastal countries in determining allocations and in planning.

The UNDP has reduced its assistance to the 9 FAO regional fisheries commissions by over 60 percent because of steadily reduced donor contributions to it since 1979. In 1983 and 1984

the United States made up the deficit, but this government will not do so in 1985. No African country has contributed to CECAF, except that Senegal provides space and utilities. Consequently, the Fisheries Department is seeking the following annual funds for the indicated purposes at CECAF beginning January 1, 1985:

Secretariat	\$150,000
Statistics	\$468,000
Stock Assessment	\$180,500
Management	\$124,000
Training	\$193,500
Coordination of Development Assistance	<u>\$150,000</u>
Total annual cost	<u>\$966,000</u>

In the face of the December deadline, Project staff are already being withdrawn from its headquarters in Dakar, Senegal. For these and historical reasons, the CECAF Project is open to specific projects funded by other agencies.

This discussion would be incomplete if no mention were made of the perception on the part of many, of CECAF's and FAO Fisheries' changing role. These experts argue that with jurisdiction over the stocks being given to individual countries, CECAF should not be "reporting to FAO and informing the specific countries," but rather the reverse: reporting directly to the individual countries. The subcommittee on Fisheries Management, with an all African membership, has functioned well. However, its future role is unclear. The chairman of the annual meeting of CECAF, traditionally an African elected by the African members of CECAF, was directed to speak with African leaders regarding improving their own country's fisheries department infrastructure and general governmental support to fisheries. To its subsequent embarrassment, FAO blocked this effort by refusing to provide travel funds.

The requirements for an assistance program to be successful are many (see the section on "Donor Countries"), but the right person is also important. In Appendix E, there is a listing of individuals, irrespective of rank, generally considered to be especially effective and helpful. The more obvious, governmental officials are not included unless they are not that visible in their own organization. This grouping is provided reluctantly since a person may be excluded more because of a deficiency in the writers than in the person. In short, consider this list tentative, preliminary, and incomplete.

#### 4. TRAINING

The ability of an industry and, indeed, a nation to take advantage of its natural resources undoubtedly relates to such factors as capitalization, technology, labor supply, energy costs, etc. Nevertheless, with no training to expand labor's skills the potential for economic growth and development is seriously constrained.

In the fisheries sector, where the fishery can be artisanal, semi-industrial or industrial, the diversity of the training needed is simply enormous. In his paper on fisheries training requirements for the Mano River Union, R. Ruppin (UNDP:RAF/79/033, March 1980) lists no less than 17 courses requiring at least 6 weeks or as long as one year (longer, if a degree is sought), and his entire focus is only on the most practical subjects and courses.

Everett, in a document dated March 16, 1984, lists staff deficiencies briefly in each country in the CECAF region, noting the need for trained statisticians, biologists, and economists. He also makes the important point that for such training to be of practical value, the necessary positions have to be established, funded and utilized, and the trained personnel need the related support services and facilities.

In preparation for the FAO 13th Regional Conference for Africa (July 16-25, 1984), a technical report, Trained Agricultural Manpower Assessment in Africa (TAMA), was issued in March 1984. With the assistance of the FAO Fishery Department, and through the use of Fisheries Country profiles, and information in the databank, the report estimates personnel needs for 16 countries for the year 2,000, and Table 4 summarizes the findings for West African states in their sample. The projections are based upon a modest estimate for increases in fish production, a ratio of professionals to technical staff of 1:5, and attrition. The estimates of future minimum requirements are based on the number of persons needed per 1000 of production.

If one grants them the validity of their data (they are based in part on country responses to a questionnaire) and premises, it is difficult to see a justification for any country in their list to have its own school of fisheries, except possibly for Mauritania and Nigeria. (It is unfortunate that the sample countries do not include Morocco and Senegal which have the most active fishing sectors.) An estimated required annual output of 25 and 82 technicians, respectively, implies

entering groups into the training schemes of about 100 and 328 (two-year course, 50% failure rate). These numbers would seem to justify each of these two countries having its own schools. One must also ask several questions:

- does Mauritania have the requisite interest?
- is there a need to confirm the estimates for Nigeria?
- what is the ratio of cost/benefits for study elsewhere to cost/benefits for in-country study?

There are some training schools already present in West Africa, and they are given in the appended country by country listing. However, of the few there are, most are enfeebled. The separation of Francophone schools from Anglophone ones is mostly based on the very different licensing and certification needs of the two systems.

A major problem regarding training in underdeveloped countries is that once trained such people stay with their jobs for only 1 or 2 years and then switch to much higher paying employment with private industry. Garcia, perhaps in an overly pessimistic mood, claimed that of the 200 people taught by CECAF only 20 were active in fisheries now.

Over the past five years (1979-83), AID has provided training for West Africans: nine from Morocco, five from Senegal, nine from Guinea Bissau, four from Sierra Leone, one from Liberia, and seven from Cameroon.

From Ruppin (1980) and the listing of knowledge gaps in Section 2, the training needs are seen to be broad, ranging from a few hours on engine repair to doctoral level training in stock assessment. The scope of work calls for no details on training requirements, but some specific recommendations are included later.

Recognizing that among lesser developed countries "marine science and technology" is read as "fishery science and technology", it is clear that the status of these skills at best in West Africa is below average for developed countries. Furthermore, infrastructure, people, training, etc. are important but political will is the controlling factor, and we have not evaluated the latter except tangentially by referring to the effectiveness of these institutions. Finally the serious lack of training for and trained manpower in the socioeconomic aspects of marine resources is obvious.

In spite of these problems we offer a broad ranking. We divide the twenty-one countries of western Africa into two groups:

- good to moderate potential for marine science and technology development: Morocco, Sierra Leone, Ghana, Senegal, Nigeria, Ivory Coast, Guinea, and Angola;

- limited potential for marine science and technology development: Benin, Cameroon, Cape Verde, Congo, Equatorial Guinea, Gabon, Gambia, Guinea Bissau, Liberia, Mauritania, Sao Tome and Principe, Togo, and Zaire.

The first group is typified by the presence of modestly effective institutions for training and research. The second group has far less infrastructure in place. Remember that the word, potential, as used above refers to the institutions and not the people. There are many people who could benefit from training in all these countries.

## 5. Donor Activities

Information on foreign assistance to marine fisheries in West Africa is incomplete and inconsistent. The amount of assistance appears to be currently about \$40 million per year. Indications are that the amount of foreign fisheries assistance has increased over the last 10 years, even after adjusting for inflation (CECAF/FD/81/Inf. 4).

### 5.1 Sources and Uses

Most of the assistance to West African Fisheries is in the form of bilateral aid (about 65 percent), while multilateral aid constitutes a much smaller share (about 15 percent). Other major sources of help include the EEC (about 15 percent) and OPEC (about 5 percent). The majority of aid goes to the coastal states in the northern zone (see Table 5, from Josupeit, 1983). See Table 6 for a listing of known donor activities by country.

The major bilateral donors (in terms of monetary value) are Japan, Norway, Sweden, France, Canada, West Germany, Denmark, the United States, and the Netherlands. According to FAO statistics (Table 7, after Josupeit, 1983), Japan is the single, largest bilateral donor to fisheries in all of Africa (\$8 million in 1981). Other sources indicate Japan also ranks first in the marine fisheries of West Africa. Some 11 percent of Japan's fisheries aid is allocated to Africa (1981 data), and, worldwide, is largely directed towards research (35 percent), and vessels and infrastructure (48 percent).

Norway, Sweden and France comprise a secondary group of major donors to fisheries in all of Africa (\$7 million each in 1981). Norway allocated nearly half of its total fisheries assistance to Africa in 1981, and, worldwide, directed it largely towards training (45 percent), and, worldwide, vessels and infrastructure (27 percent). Sweden allocated over three-fourths of its assistance to Africa, concentrating on artisanal fisheries (39 percent), and vessels and infrastructure (32 percent). France allocated over 90 percent of its assistance to Africa, worldwide emphasizing aquaculture (38 percent) and industrial fisheries (28 percent).

West Germany and Canada constitute a tertiary group of donors (between \$5 and \$7 million each in 1981). West Germany allocated nearly a quarter of its total fisheries assistance to Africa, and, worldwide directed it largely towards vessels and infrastructure (45 percent) and research (29 percent). Canada



gave nearly three-fourths of its assistance to Africa, worldwide concentrating on economics and planning (41 percent) and artisanal fisheries (21 percent). Other sources indicate Canadian assistance of \$15 million for a fisheries surveillance system in Senegal, during 1980-84. (The economics and planning category used by FAO includes fisheries surveillance assistance.)

The remaining major donors are Denmark, the United States, and the Netherlands (\$2-4 million each). Denmark spent over a fifth of its total fisheries assistance in 1981 in Africa, and directed it, worldwide, towards vessels and infrastructure (59 percent), and processing and marketing (24 percent). The United States allocated over one-fourth of its fisheries assistance to Africa, worldwide, concentrating on aquaculture (75 percent) and artisanal fisheries (21 percent). The Netherlands allocated one-fourth of its fisheries assistance to Africa, worldwide concentrating on vessels and infrastructure (69 percent).

As a whole, bilateral donors allocated a third of their fisheries assistance to Africa in 1981, and, worldwide, directed it largely towards vessels and infrastructure (44 percent).

Multilateral assistance is mainly from the development banks and the United Nations system. The World Bank devoted less than 10 percent of its fisheries assistance to all of Africa in 1981, and directed it towards vessels and infrastructure (46 percent), and, worldwide, aquaculture (22 percent). The United Nations system (principally UNDP) allocated two-fifths of its fisheries assistance to Africa, worldwide concentrating on research (29 percent), artisanal fisheries (23 percent), and aquaculture (21 percent).

According to Josupeit (1983), over half of EEC fisheries assistance was allocated to Africa in 1981, with worldwide concentrations in vessels and infrastructure (49 percent) and artisanal fisheries (23 percent). According to Clark (1984), over three-fourths of EEC fisheries aid currently goes to Africa, most of it to Western and Central Africa. Clark provides evidence showing EEC fisheries assistance moving away from infrastructure and capital investments towards artisanal fisheries (improving traditional fishing techniques).

OPEC, according to Josupeit (1983), allocates about a tenth of its fisheries assistance to Africa, and worldwide concentrates on vessels and infrastructure (53 percent).

Overall, the amount of assistance for the construction and acquisition of capital (vessels, ice plants, etc.) in West African marine fisheries has been two to three times greater than the amounts for technical assistance (experts, training, etc.) (CECAF/FD/81/Inf.4.). There are indications that the share of assistance going directly to artisanal fisheries in West Africa declined in the late 1970s and early 1980s.

## 5.2 Evaluations of Fisheries Development Projects

Most fisheries development projects in West Africa financed by the above donors have not been subjected to careful monitoring and evaluation. There are only two studies (both unpublished and preliminary) which attempt systematic, socio-economic evaluations of projects in the region. Thirteen completed projects in eight countries (Senegal, Gambia, Cape Verde, Guinea Bissau, Sierra Leone, Ivory Coast, Ghana, Benin) were examined. The projects were evaluated in terms of the extent to which they satisfied their stated economic objectives. These economic objectives include increasing production, protein supplies and incomes, and earning or saving foreign exchange.

Of the 13 projects, three met with mixed success, three were successful, and seven were unsuccessful. That is, more than half the projects failed to achieve their stated economic objectives.

The successful projects resulted in significant and on-going increases in production and greater incomes to target groups. These projects are characterized by being appropriate in scale, properly timed, well coordinated internally and with external events and activities, and conducted in a relatively healthy economic climate.

The unsuccessful projects resulted in no significant economic improvements. Most of the unsuccessful projects attempted to install operations that proved to be financially unfeasible. These financial problems were due, in part, to misconceptions or little knowledge of economic conditions affecting the projects (e.g., price controls). The unsuccessful projects were also characterized by being inappropriate in scale (e.g. excess cold storage facilities), improperly timed, poorly coordinated, and conducted where the infrastructure was not adequate to support a given project.

In all projects evaluated, bench mark data was inadequate and there was little monitoring of project effects. This makes learning - from both mistakes and achievements - difficult, if not impossible. There was little attempt to study and understand the socio-economics of the target groups and the economic realities faced by any single project.

Intentionally or not, the more successful projects tapped or did not impede the indigenous entrepreneurial capacity prevalent throughout the region. Projects which discouraged or attempted to displace private entrepreneurs, yielded no economic success. This is consistent with other evidence that policies of centrally planned economies are detrimental to economic development.

## **6. PROSPECTS FOR FISHERIES MANAGEMENT AND DEVELOPMENT**

The purpose here is two-fold: first, to argue that currently there are opportunities for significantly increasing the benefits West African countries receive from the exploitation of the region's marine fisheries; and second, to identify those areas which hold the greatest potential.

The discussion will be separated into three parts: the resource, its development and its management. As explained in Annex F, development and management efforts both attempt to increase benefits, but are implemented in different ways in fisheries. That is, the actual action projects are quite different, even seemingly contradictory at times.

In West Africa the expected benefits are usually stated in terms of increased food supplies and improved nutrition, added foreign exchange earned or saved, and greater employment and incomes. These and other types of benefits are not always jointly increased by development and management efforts. For example, selling fish abroad to earn foreign exchange can mean less food is available domestically. Similarly, increasing production - through either development or management projects - can reduce employment in the fishery. This fact implies that policy-makers are faced with trade-offs among the benefits and must often make choices which, in effect, place different weights on each type of benefit. This also implies that a preferred project (development or management) in one country or fishery may not be the choice in another country or fishery. Hence, regional approaches to development and management should be prepared to adapt to varied conditions, preferences and concerns.

### **6.1 The Resource**

#### **6.1.1 Fish Population Dynamics.**

Superficially, it seems very simple to understand a fishery. The number of individuals of a given species present at any given time depends upon the numbers present at the beginning of the year, plus the number of young they produced minus those which died. Migration either adds to or subtracts from the total number depending upon whether gains due to immigration exceed or are less than losses due to emigration.

Unfortunately, the picture quickly loses its simplicity. Oftentimes, survival of eggs, larvae, postlarvae, and adults all

differ. Mortality, itself separated into "natural mortality" and fishing, may be due to physical or chemical factors (such as temperature, salinity, oxygen, currents, pollutants, etc.) or biological agents (e.g., predation, availability of food, disease, competition, etc.).

Frequently the population of a given species can be subdivided into groups by age, called year-classes. By studying a year-class as it ages, one can estimate growth rates, survival rates, and even the intensity of fishing.

Here, the phrase, "intensity of fishing," is used in the inclusive sense of: the ratio of a year's catch to the average population, the fraction of the fish present at the start of the year that are caught during the year, and the fraction of a year-class big enough to be caught (the recruits) that is captured during all the years of its existence. Fishing intensity can be judged from: the recapture of marked individuals, trends in catch statistics, and by age ("cohort") analysis.

In general, when we plot recruitment (the members of a year-class who become big enough to be captured by the fishermen) against the size of the commercial stock, we get a dome-shaped recruitment curve (figure 1) whose exact curvature varies from species to species. Recruitment is greatest at intermediate stock sizes, with the fall-off toward lower stock sizes (that is, toward the zero point) especially critical because in this region recruitment represents such a large percentage of the stock.

The stocks are, by definition, the portion of the species population subject to fishing. Where fishing is proportional to the size of the stocks, it can be represented (figure 1) by a straight line going through the origin (0 recruitment, 0 stock, 0 fishing). The intersection of the line and the curve indicates a stable equilibrium yield and stock size. Vary the rate of fishing (the slope of the line) and the maximum sustainable yield can be achieved.

For pelagic fish (sardines, herring, etc.) fishing mortality is relatively independent of stock size, and the result is different. Figure 2 shows the same recruitment curve as figure 1, but here the fishing mortality is not linear and intersects the recruitment curve at two points (A and B). At "A" there is a stable equilibrium yield, but at "B" the yield is unstable and the tendency is for the system to move toward lower stock sizes and lesser recruitment.

In short, the dynamics of fish populations are complex, but the controlling factors can be measured and, within some limits of error, management can emerge from indeterminate values.

### 6.1.2 Fishery Statistics

The previous section makes obvious that several sorts of statistics are needed by the prudent manager: year-classes, recruitment, survivorship, natural mortality, fishing rate, fishing effort, catch size, stock size, etc. Furthermore, the data must be collected continually as each of these factors can vary from week to week or season to season.

The documentation discussion (Section 2) indicates that there are a substantial number of published papers on stock assessment, and some on the other factors as well. Among the most useful relevant data are the catch statistics published annually by the Food and Agriculture Organization (1984). The data on individual countries are supplied by those countries. CECAF makes some adjustments, and then forwards the results to Rome. There are four sources of error:

1. Adequacy of official reports. Official statistics worldwide have their doubters. (Texas shrimpers right now are not reporting their data to Federal Statistical Report Agents.) It is alleged that the catch of Nigeria has been overestimated by two or three times.
2. Inadequate collection methods. This error relates mostly to artisanal catches which, because of their numerous landing and marketing sites, are more difficult and expensive to record. Generally speaking, the artisanal catch is about 70 percent of the total domestic catch in most countries. This class of error is significant in countries with smaller total catches heavily dependent upon artisanal fishing (e.g., Togo, Benin, etc).
3. Failure to submit statistics. Several of the countries in question merely repeat their catch data year after year. (Equatorial Guinea has repeated its data for 9 of the last 10 years). Again, failures of collecting and reporting catch data are limited to the countries with small catches.
4. Magnitude of catches by foreign fleets. The foreign fleets report on their catches, but with varying obeisance to the truth. FAO, CECAF and some individual countries have tried to improve these statistics, and at least one official of CECAF has traveled unsuccessfully to Moscow for this reason. Foreign fleet report deficiencies are the biggest source of error. The one redeeming feature of this otherwise bleak situation is that the reported data are always an understatement.

### 6.1.3 West African Stocks

Despite all the problems enumerated above, and thanks largely to the CECAF project, the efforts of numerous experts at FAO Fisheries Department, consultants from various countries, specialists in some of the coastal states, and help from some

foreign fleets, there is an emergent picture of the West African fisheries catch and the condition of the stocks.

While two-thirds of the human population lives in the countries from the Ivory Coast to Angola (and mostly in Nigeria and Zaire) (Table 1), 72 percent of the fish are caught in the waters off the coast from Morocco to Liberia (Table 8). In 1982, the acknowledged catch (not to be confused with the real catch, which is undoubtedly larger) by foreign fleets in the waters off West Africa amounts to 56 percent of the total catch. The table shows that the East Bloc countries (Russia, primarily) take nearly two-thirds of the total foreign catch, concentrating on micropelagics (sardines, etc.).

Table 9 shows that the total commercial value of the CEEF fishery exceeded one billion US dollars in 1982. The catches off the coast from Morocco to Liberia accounted for 44 percent of the total value. Foreign fleets captured 80 percent of the total value of the CEEF fishery, with West Bloc flag vessels accounting for 60 percent and East Bloc vessels for 20 percent. That is, while East Bloc vessels catch more in weight, West Bloc vessels catch more of the more valuable species (cephalopods, tuna).

The total reported catch in the eastern central Atlantic in 1982 was 3, 191, 846 metric tons. Sutinen, et al. (1981) review catch trends, and these seem not to have varied much since their analysis. Gulland (1971) estimated the total actual biological potential as being between 3.5 and 5.0 million metric tons, and Everett, et al. (1980) fix on 4.2 million as the maximum real catch (presumably the maximum sustainable yield).

Despite all the problems associated with stock assessment, Everett, et al. (1980, 1982) have produced a statement of condition of the stocks (Table 3), which is generally accepted. In addition, some countries (Morocco, Senegal) and the European Community have issued stock assessments. Note that all the major, and many of the minor, species are fully fished or even overexploited. In these circumstances, what is the outlook? Is this situation dangerous or critical? And what, if anything, could or should be done about it?

The answers to these questions must be sought not only in these stocks but also in the circumstances in which they live.

Worldwide, there are only 5 areas of sustained coastal upwelling (i.e., regions where colder, deeper, nutrient-rich water is carried to the surface): off California, Peru, Northwest Africa, Angola to Gabon, and Namibia. Bas (1983) gives additional details, but, essentially, the West African sites are variable and subject to division into smaller cells of upwelling.

Upwelling regions are of particular interest to fisheries analysts because, by bringing large quantities of nutrients into surface layers, they result in greatly increased production of

plants and animals (Posner, 1957; Thompson, 1980). There is evidence (Boje and Tomczak, 1978) that upwelling zones are likely to behave as ecosystems. That is, the organisms tend to interact with their abiotic (i.e., physical and chemical) environment in a self-regulating, but not closed, way.

The consequences of upwelling are impressive. Most of the surface of the ocean produces less than 0.4 grams of carbon (as phytoplankton)/m<sup>2</sup>/day, but, in upwelling zones off Northwest Africa, this primary production varies between 2 and 5 grams of carbon/m<sup>2</sup>/day. Since phytoplankton (plant plankton) are the basic "wheat fields" of the oceans, their abundance is an estimate of the size of the potential fish stock.

However, the effect of upwelling on the quantity of living matter is no more impressive than on its quality (i.e., relative abundance of the different commercial species). Rounsefell (1975) pointed out that in 1968 sardines and herring represented 78 percent of the total catch in coastal upwelling areas, but only 22 percent of the catch in corresponding regions without upwelling. In 1982, on West African waters (Table 2), coastal pelagic (water column) species off the west coast of Africa accounted for 82 percent of the nearshore upwelling catch, while in comparable, non-upwelling areas, coastal pelagic species accounted for approximately 62 percent of the catch. Demersal (bottom living) fish species constituted 18 percent of the coastal upwelling fish catch.

This predominance of just a few, easily caught, schooling species is not an altogether good situation (although, as will be noted later, it has its economic, political, and social attractions). Of the five major coastal upwelling regions, three, Peru (Paulik, 1980), California (Radovich, 1980), and Namibia (Cram, 1980) have experienced sharp reductions ("crashes") in their principal clupeid fisheries. In all three regions, overfishing was the major cause of the decline, but, at least off Peru, a cessation of upwelling was a contributing factor (Glantz, 1980, and Glantz and Thompson, 1980). Rounsefell (op cit.) states that:

"The idea that one should place confidence in the annual production of enormous quantities of animal protein from a single species of fish is gambling with the future".

However, he also implies, as do others, that wise management could have eased, or even avoided, these catastrophes.

Consequently, there are several threats which can tend to destabilize a coastal pelagic fishery based upon upwelling:

- the upwelling can stop for a short or long period of time. El Nino of the west coast of South America is a classic example. No one has shown a similar phenomenon off West Africa, but occasional, sustained changes in winds do alter the presence and strength of upwelling

there. It should be noted that normally off Peru the sites of active upwelling are very consistent from year to year. This geographic precision is not true off the Moroccan coast.

- the tendency in pelagic fisheries for the fishing effort to be relatively independent of the stock size. As noted earlier, pelagic stocks are often taken in large aggregations, and the consequent non-relationship of fishing to stock size can result (figure 2) in an unstable and deteriorating situation moving toward ever smaller stocks.
- the fishes of eastern boundary currents are possibly (Walsh, 1975) not in good ecological balance with the lower trophic levels (phytoplankton and zooplankton). If this is true then restricting fishing of a badly overstressed stock might not be a sufficient stimulus for recovery. For example, dense fish populations may condition the water with their excretory products.

Under these circumstances it is impossible to predict the consequences of continuing the present level of fishing effort. Evidence does exist in Peru and California that population crashes will keep the damaged stocks at low level for years, but other commercial species are developing to fill the ecological niche of the declining species. One can reasonably argue that in view of the uncertainties, any overfishing is risky. On the other hand, Troadec (1984, Personal Communication), while concerned about the stocks, apparently feels that economic factors are limiting efforts to below dangerous levels.

To reduce the risk of a damaging collapse, it appears advisable to decrease the level of fishing effort on these stocks. There are several ways of limiting the fishing effort. Perhaps the best way, since it theoretically does not harm the local fishermen and local economy, is by excluding or restricting foreign fishing. To do this a country must have a surveillance and enforcement system. The country would probably also need to have a certain political and economic independence from the foreign nations.

## 6.2 Management

Directly or indirectly, fisheries management involves restricting catch rates in order to sustain larger resource stocks than would occur without management. Whether of foreign or domestic fleets, catch rates can be limited by one or more of the following (Beddington and Retting, 1984. Approaches to the Regulation of Fishing Effort. FAO Fish. Tech. Paper. No. 243, 39 pp):



- quotas;
- gear restrictions or value maximum;
- weight or size limits maximum;
- closed areas;
- closed seasons limits;
- territorial use rights.

Effective management can increase the long-run flow of benefits from the fishery by restricting (if not preventing) the tendency for benefits to be eroded away (often referred to as the "tragedy of the commons"). It can also be costly, although another factor (such as: politics, sovereignty, preservation, national will, etc.) can be the major consideration. The cost of management includes the cost of monitoring and assessing the status of the fishery (which usually requires substantial, on-going scientific research), the cost of making fisheries management policy (which can involve a complex, bureaucratic structure), and the cost of enforcing management policies (potentially the single, most costly element). Therefore, on an economic basis, management may not be justified on a cost basis since in some fisheries the benefits cannot offset the costs of management.

In determining the priorities for management of fish stocks one must consider the benefits and costs likely to be realized, although precise measurement of the benefits and costs of management will be difficult, if not impossible. However, the approximate magnitudes of each can be estimated. For example, Christy (1979) estimated that proper management of the cephalopod fishery could generate benefits of \$160 - 214 million per year (in 1977 dollars). The costs of other ways of managing cephalopods must be compared to this level of benefits in order to determine whether and how to manage the fishery.

Management of many canoe fisheries may prove highly costly and yield low benefits, therefore not justifying management. Of course, some management approaches may involve low or modest costs. Lawson and Robinson (1983) discuss using traditional tribal institutions for fisheries management, possibly the most cost-effective approach in some canoe fisheries.

As noted above, effective fisheries management requires three major elements: (1) regular and continual monitoring and assessing of the status of the fishery, (2) setting policy and regulations, and (3) enforcing management policies and regulations. We now turn to describing the recent status of these three elements in the region.

### **6.2.1 Monitoring**

As noted above, while there is ample room for improving the fishery statistics in FAO region 34, a fairly reliable and useful set of statistics exists. These and other statistics have yielded reasonably good, regular status reports on many of the region's important fisheries. Individual countries (e.g., Morocco, Senegal, and Ivory Coast) and donor groups (e.g., the

EEC) have also produced status reports on fisheries in the region. Overall, the ability to regularly monitor and assess the status of fisheries appears to be acceptable and getting better. However, as noted earlier, important improvements are needed in the areas of data collection (more usable statistics about more species), and analysis and dissemination of information (achieved by training and employing qualified individuals for fisheries management).

### 6.2.2 Policy

Setting policy and regulations requires both a legal framework and an institutional structure for governing fisheries exploitation. As of 1983, 16 coastal countries had proclaimed jurisdiction over their fisheries resources out to 200 miles, and two other coastal states to 50 and 100 miles. According to a recent legislative study (FAO, 1983), the laws of these countries state the objectives of fisheries management in very general terms (e.g., optimal exploitation, conservation of marine stocks, maintenance of sustained yields). Nearly all coastal states require motorized fishing vessels to be licensed (except in Mauritania and Ivory Coast where fishing is free to all nationals). Most artisanal fishing operations (presumably those without motors) are exempt from licensing. Only Gabon, Benin, Ghana, and Sierra Leone attempt to control the total number of licensed vessels. A few countries limit the size of vessels and a number of countries prohibit the use of certain gear in specified areas (to protect spawning grounds, and to reduce conflicts between trawlers and artisanal operations). The laws allow mesh size restrictions in all countries except Equatorial Guinea. In 1979, CEECAF recommended all states adopt a single mesh size of at least 60 mm for all demersal species (bottom fishes, shrimp and cephalopods). As of June 1982, nine of the 20 countries in the region (including Spain) had adopted, or were expected to adopt, the CEECAF recommendation. Weight or size limits are used for selected species in nine countries. Most countries make it possible for foreign fishing vessels to operate in their EEZs.

The institutional structure (i.e., policy making bodies) for fisheries management in the coastal countries is not well documented. See the section "Institutions" for a discussion of the governmental bodies concerned with fisheries. The available information (CEECAF/TECH/81/35) suggests that in many countries fisheries management policies and regulations are legislated. That is, there appear to be no entities which are continuously concerned with developing and modifying management policy and regulations.

There is considerable room for improving fisheries management policy and regulations. First, there is a need to set policies and regulations that reflect the best available scientific evidence. CEECAF has made significant progress in getting countries to adopt more appropriate mesh size regulations for demersals. However, other regulations are required; for example, restricting the numbers of gear or

fishing units in some fisheries. Second, management structures must be created with the flexibility to modify policies and regulations as conditions in the fishery change. Third, there is a need for a better understanding of the management structure in the coastal states. Additional studies and conferences in this area (such as those conducted by FAO) would help to provide the information base for formulating proposed changes in the structure of fisheries policy making.

### 6.2.3 Enforcement

There are a substantial number of governmental entities authorized to enforce fisheries laws (Legislative Study No. 27, FAO, 1983). Fisheries departments, police, customs and naval services are common examples. The legislation in most countries authorizes inspections, boardings, arrests, etc. Fines for illegal fishing by foreign fishing vessels, as set by law, range from U.S. \$540 to over U.S. \$2 million (for factory ships in Mauritania). Proceeds normally go to the State, and are often used for promoting fisheries development.

According to a variety of sources, most coastal states lack the capability to effectively enforce existing fisheries law and regulations. Clearly, more equipment and training for fishing surveillance and enforcement is needed. There also is a need to harmonize regulations in the region, in order to facilitate the enforcement task. For example, two different minimum mesh size regulations for adjacent zones make effective enforcement almost impossible in areas near the dividing boundary. Eliminating these differences will make enforcement efforts easier and more effective. There also is a need for cooperative arrangements in enforcement among coastal states (e.g., allowing enforcement authorities in one state to pursue a suspected offender into the waters of another state).

Those responsible for enforcement should be actively involved in setting fisheries regulations in order to (i) avoid setting regulations that are highly costly or impossible to enforce, and (ii) ensure that enforcement authorities fully appreciate the value of all the regulations in force. Some instruction in fisheries management would be an essential element in the training of enforcement personnel.

In short, conditions in West Africa clearly call for management of the marine fisheries. The fisheries - nearly all of which are fully to overexploited - are stressed by foreign fleets taking over half of the landings. Proper, effective management offers excellent potential for increasing food supplies, foreign exchange, incomes, and other benefits to West African coastal states. In recent years, there has been good progress towards improving relevant legislation and developing some capacity for fisheries law enforcement. Conditions have never been as favorable as they are now for moving into an effective fisheries management mode in some countries.

#### 6.2.4 Management Options

Our objective here is to identify the more attractive options for AID assistance to fisheries management in the region. We assume AID endorses the principles and guidelines for fisheries management set out in FAO's Draft Strategy for Fisheries Management and Development (WCFI/84/4, April 1984). Specifically, we assume that an AID supported management program would seek to achieve effective conservation and optimal utilization of fish resources (as determined by the best available scientific evidence and the needs of sovereign coastal states). To be effective over a long period of time, the initial program should develop a fishery management structure with basic expertise, experience and credibility. Furthermore, since most fisheries involve resource stocks shared by two or more countries, the program will need to strengthen international collaboration and cooperation among technical experts, policy-makers, and fishery user groups in the region.

One of the principal features of a fisheries management plan is the species group(s) encompassed by the plan. There are five major groups of species in the region: coastal pelagics (sardines, sardinella, mackerel, etc.), oceanic pelagics (tunas), demersals (hake, sea bream, etc.), cephalopods (octopus, cuttlefish, squid), and crustacea (shrimp). Since tuna require special management procedures, oceanic pelagics are not considered here.

Cephalopods accounted for the largest value share of these species groups in 1982 (36 percent of the total value). The stocks are overexploited, or nearly so, and bioeconomic analyses have demonstrated substantial benefits can be realized from effectively managing these stocks (Greboval, 1982). A regional management program would be best, involving Morocco, Mauritania and Senegal. The largest producer of cephalopods is Spain, followed by Japan and other West Bloc countries. Since they are marketed in Europe and Japan, cephalopods directly contribute little to West African food supplies. However, there is considerable potential to add to foreign exchange reserves if the coastal states act to appropriate the resource rents generated.

Crustacea (largely, pink shrimp) have the highest unit value of the species groups, but accounted for less than 15 percent of the total value in 1982. Shrimp stocks in both northern and southern zones are fully exploited. As an export product, shrimp have the potential of modestly adding to foreign exchange earnings through effective management. A principal management problem is the conflict between inshore artisanal fishermen and offshore industrial fishermen. A bioeconomic analysis of the Ivory Coast shrimp fishery (Griffin and Grant, 1982) shows significant gains to be realized from reducing artisanal fishing effort on shrimp. Controlling artisanal fishing operations likely will be difficult in the near term, which makes shrimp an unattractive candidate for an initial

management program. Foreign vessels produce about half the shrimp caught in the region, with Spain the single largest producer.

Coastal pelagics accounted for over half of the fish production in weight terms, and 16 percent of the total value of production in 1982. The stocks of coastal pelagics in the northern zone are heavily to fully exploited; in the southern zone the sardinella stocks off Ivory Coast to Togo are fully exploited, while others are not known or underexploited (biologically). Coastal pelagics are caught predominantly in the northern zone, and foreign vessels accounted for nearly 60 percent of the total catch in 1982.

The East Bloc flag vessels (primarily the USSR) are the major foreign operations fishing the coastal pelagics. Coastal pelagics accounted for 80 percent by weight and 45 percent by value of the East Bloc's catches in 1982. The West Bloc's catches of coastal pelagics are minor. African fishing operations are heavily dependent on coastal pelagics, which are caught by artisanal, semi-industrial and industrial vessels all along the coast. Effective management of foreign vessels fishing these pelagics appears to have the potential of significantly adding to African fish supplies. A principal drawback of initially attempting to manage coastal pelagics is the migratory nature of the stocks (and fleets), which makes them difficult to locate, study and manage.

Demersal finfish accounted for about one-sixth of the weight and over one-fifth of the value of total production in 1982. The stocks in the northern zone are fully to overexploited, and underexploited in the southern zone. About half the demersals are caught in the northern zone, and nearly half are produced by foreign vessels (two-thirds of this by East Bloc vessels, one-third by West Bloc vessels). African production of demersals in the southern zone is greater than African production in the northern zone. In the northern zone, where potential benefits from demersal management appear to be the greatest, there is little artisanal fishing for demersals.

In view of these considerations, there appears to be greater potential benefits from a management program focusing on stocks in the northern zone.

None of the four groups considered here is clearly superior as a candidate for a pilot management program. Cephalopods come close to being the most preferred candidate. They have the highest value share, are heavily exploited by non-African vessels (mainly Spain), and the value of added benefits (in the form of foreign exchange) from effective management is very high. Also, the foundation for management (laws, scientific knowledge) is relatively solid. The principal disadvantage of focusing initially on cephalopods is that the high monetary stakes involved may cause political confrontations which in turn would impede development of an effective regional management program. In addition, it may be possible to include (at a later

stage) cephalopods in a more general demersal management program. In summary, we rank cephalopods as a close second for a pilot management program.

While shrimp appear to warrant management we rank the group fourth on our list of candidates. Their low total value may imply modest management benefits, and the conflict between artisanal and industrial fleets poses a particularly difficult management problem. In addition, countries may best manage shrimp individually -- i.e., a regional management plan may not be necessary.

Coastal pelagics are ranked third on our list. According to the best available scientific evidence, coastal pelagic stocks are less heavily exploited than the cephalopods, shrimp and demersals. Managing and controlling foreign fishing operations on coastal pelagics may yield increases in local supplies, but the magnitude of the quantity and value of these added supplies is not clear. In addition, the foundation for management of coastal pelagics appears weak in comparison to the other species groups.

Our top candidate for a pilot management program is the demersal finfish group. Most stocks are overexploited, there is a fairly solid management foundation in place, the involvement of artisanal fishermen is low (especially in the northern zone), and there are moderately sizeable benefits (food supplies and foreign exchange) to be realized from effective management. Unlike cephalopods, demersal finfish appear more politically neutral, and several countries (Morocco to Sierra Leone) should participate in such a program.

### **6.3 Development**

Fisheries development efforts seek to increase the flow of benefits accruing to West African countries through infusion of more efficient technology, skills and methods. The principal benefits of concern are those directly associated with increases in food supplies and nutrition, increases in employment and incomes, and increased foreign exchange earnings. In general, West African marine fisheries possess considerable development potential. Our purpose here is to briefly survey sectors of the fisheries and comment on their potential for development.

#### **6.3.1 Harvest Sector**

Many of the fisheries in West Africa are currently over or fully exploited. Infusions of more efficient harvesting technology in such fisheries will not generate added benefits in the long run unless an effective management program is in place (see Annex E). Development of the harvest capacity in less-than-fully exploited fisheries can generate added benefits without a management program. Less-than-fully exploited fisheries cited by Everett, et al. (1982) include: the sardinella and horse mackerel from Morocco to Liberia; the sardinella off Gabon, Congo, and Angola; and most demersal fish

in the Gulf of Guinea, especially those in deeper waters. The task for development planners is to find ways to infuse feasible combinations of more efficient technology, skills and methods to harvest these stocks or to identify unexploited stocks or species. Without a great deal more information it is not possible to reliably estimate the nature and extent of benefits that would likely be generated by development in these and other fisheries of West Africa. Clearly, further field work and data analysis are needed in this area.

One of the most significant characteristics of the region is that fleets from non-West African countries harvest more than half of the 3.2 million metric tons of fish taken each year. Some West African countries are taking steps to control the catches by the foreign fleets operating in their waters and to collect benefits, in various forms, from foreign fishing operations. No comprehensive studies exist on the total potential benefits that may be derived from foreign fishing operations in the area. However, the conventional wisdom is that the present terms of several fishing agreements do not fully compensate the coastal countries for the fish being harvested in their waters. Tightening these agreements and improving the surveillance and control of foreign fleets can result in greater technology transfer and improvement of infrastructure (e.g., through joint ventures), as well as increase foreign exchange, domestic food supplies, employment and incomes.

Supplanting foreign with African fishing operations may offer promising prospects for some fisheries in the long run. The limited information available suggests that there is good potential for expanding West African harvest of coastal pelagics, especially in the northern zone where foreign fleets harvest the majority of the catch. Any substantial expansion of West African harvest would ultimately have to be combined with a reduction in foreign harvests in order to avoid further stressing of the stocks. Expanding West African production of coastal pelagics has the potential to significantly increase food supplies and improve nutrition in the region. Prospects for employment and incomes are not clear, and mixed for foreign exchange earnings (see Sutinen, et al., 1981).

Supplanting foreign with African fishing operations will likely mean developing local industrial and semi-industrial fleets. However, developing artisanal fisheries typically offers some advantages over industrial and semi-industrial development that should not be overlooked. Artisanal fishing operations are more labor intensive and, therefore, have the potential to generate relatively more employment. Furthermore, they usually produce higher quality fresh fish for local consumption, and the technology used is simpler and less dependent on foreign supplies (for spare parts, etc.) than industrial fisheries. Where stocks are not overexploited, and where they can be readily harvested by artisanal operations, there are several good reasons to favor artisanal development over industrial development.

### **6.3.2 Processing and Handling**

Improvements in the processing and handling of fish caught by artisanal operations likely would yield great benefits. Artisanal production accounts for 70% of total national productions of marine fish in the region, yet these fish are not utilized to make the greatest contributions to alleviating undernutrition in the region. Artisanal operations are plagued with high post-harvest losses - believed to be from 40 to above 60 percent of production. With such high losses, even modest improvements in handling and processing will significantly increase supplies throughout the region.

Any assistance program in this area should be coordinated with FAO's "Infopeche" program. Infopeche is intended to be a regional fish marketing information and technical advisory service for West Africa (similar to its sister programs in South East Asia and Latin America). The services will be directed towards expanding exports of fish and fish products. FAO officials state that Infopeche will not be able to provide assistance for solving domestic, or internal, product quality and marketing problems. Therefore, there is an important gap to be filled, and an opportunity to complement the Infopeche program. In our view, this neglected area deserves high priority in any program of fisheries development.

### **6.3.3 Distribution and Marketing**

The distribution and marketing networks which deliver fish to the consumer from artisanal fishermen is much less developed than the network for industrial landings in the region. This is a significant point for two reasons: artisanal fisheries supply 70% of the total African fish production in the region, and the lack of adequate markets is often a major impediment to expanding fisheries production. The specific nature and course of the distribution and marketing problem is not well documented; hence, specific remedies are not clear. What is clear is that fish distribution and marketing is an excellent candidate for a development program in the region.

### **6.3.4 Trade**

FAO's upcoming Infopeche program is expected to facilitate expanded trade of West African fish and fish products. Infopeche will seek to improve and control quality, and collect and disseminate international market information. Infopeche is not expected to work towards reducing barriers to trade (such as tariffs), nor to assist in reducing fish transportation costs in the region. The chore of reducing trade barriers might best be left to regional organizations (e.g., ECOWAS, which has a mandate in this regard), but a donor country may be an effective catalyst for gaining improved trade conditions in the region. Studies of transportation costs and other aspects of intraregional trade also may be useful for ultimately expanding the region's fish trade.



### 6.3.5. Consumption

The consumption of fish exhibits a rather diverse pattern throughout the region. For the region as a whole, per capita consumption is near the world average. Four countries (Morocco, Guinea Bissau, Guinea, and Zaire) have low levels of apparent per capita consumption (less than 10 kg per annum); six (Mauritania, Liberia, Togo, Benin, Nigeria and Cameroon) have modest levels (10 to 15 kg); three (Sierra Leone, Ivory Coast and Ghana) have moderately high levels (15.1 to 20 kg); and six (The Gambia, Sao Tome and Principe, Cape Verde, Senegal, Gabon, and Congo) have high levels (over 20 kg). There is no indication of a taste barrier to increased consumption of fish in the region. The principal constraints appear to be low incomes, low or irregular availability, and perhaps high price relative to other protein sources (say, in the interior, far from the coast). The prospects for increasing consumption of fish appear favorable, in general, and require no development program which attempts directly to increase consumption.

## 7. CONCLUSIONS & RECOMMENDATIONS

The evidence is substantial; donors and West African countries believe that management and development of West African marine fisheries is vital.

### 7.1 Conclusions

At present many of the commercial species are judged to be fully- to over- exploited. Even without regard to the specific stress on each stock, it is essential to reduce the risk of fish population "crashes" where, in a matter of one or two fishing seasons, stocks tumble from hundreds of thousands of metric tons to less than one tenth of that.

Because of the fact that nearly 60 percent of the total catch is taken by foreign fleets, the reduction in fishing effort could be achieved by restricting foreign fleets. The stocks under potentially the greatest danger are the cephalopods, micropelagics, and demersals off the northwest coast. Since any limitation must have either the cooperation of those involved or a means of enforcement, surveillance of the fisheries must also be improved. However, surveillance is outside AID's jurisdiction and is currently under scrutiny by the Department of Defense and the U.S. Coast Guard.

The first recommendation addresses the need to: protect species under risk, strengthen governmental infrastructures in fisheries, and encourage regionalism. Admittedly not addressing the most precarious stocks because the initial effort must succeed, in this recommendation the countries from Morocco to Sierra Leone would be helped initially to jointly develop a fishery management plan for demersal (bottom-dwelling) finfish (i.e., excluding cephalopods and crustacea). Following success with the demersal finfish, fishery management plans for other groups would be pursued.

Discussions should begin on technical matters, such as distribution, location of spawning grounds, migration routes, main fishing areas, fecundity, environmental factors, etc. because even where the countries may not get along, the scientists should be able to work together on specific, limited technical points, and because the process has already begun under CEEAF. The hope would be that this kind of collaboration will generate mutual respect and provide the circumstances necessary for successful joint actions on the more sensitive aspects of fisheries management and development.

To secure appreciation and protection of this valuable natural resource, for the African coastal states to develop and manage their fisheries wisely, and for low cost methods to be developed and applied, there must be:

- the political will to act (based upon a dynamic not a passive, awareness of the situation);
- the governmental structures essential to give reality to that political will; and
- a regional attitude of cooperation.

To enlarge and nourish the political will of the West African coastal states, it is necessary to go beyond the low-grade acknowledgement that something must be done some time to the conviction that action must begin at once. Hence, the second recommendation is for a "highest level seminar" which will build on the political will of the key fishery persons (whether ministers or not) to spread this determination to others in their own countries.

A third recommendation is for a regional program to reduce post-harvest losses and expand distribution of artisanal fish products. Having both study and action phases this effort will serve the development side.

The fourth recommendation relates to the provision of both mid- and basic-level professional training, the purpose of which is to enlarge the capacity of these countries to develop and manage their fisheries themselves. It does not begin in a vacuum but, rather, builds on the efforts of the CECAF Project and other donors.

Recommendation 5 is for the information update system requested in the scope of work, but enlarged to include the capacity to provide workers in Africa with literature not otherwise available to them.

The final recommendation is that some funds be used to prepare the West African nations to do long-range planning for themselves.

The action programs proposed above will complement and strengthen those already in place, particularly those of the CECAF Project (the highly respected, UNDP-funded, operational arm of FAO's Fishery Committee for the Eastern Central Atlantic). CECAF Project efforts at promoting regionalism have been limited by the makeup of the Committee. If the costs of fisheries management are to be kept low, the countries must band together on some regional (or sub-regional) activities. Experience in Africa and elsewhere has shown that sovereign nations will only accept what they initiate or, at least, feel comfortable with. The projected termination of the CECAF Project on December 31, 1984 because of the catastrophic reduction in UNDP funds is a serious challenge.

## 7.2 Recommendations

Specifically, we propose (not in any order of priority):

Recommendation 1. The development and implementation of a pilot fishery management plan for the northwest coast of Africa.

Objectives:

- achieve effective conservation and optimal utilization of fish resources.
- develop a fishery management structure with expertise, experience and credibility in the region to serve as a pilot for others to follow.
- strengthen international collaboration and cooperation among technical experts, policy-makers, and fishery user groups in the region.

Specifics:

The plan should focus on demersal finfish (i.e., excluding cephalopods and crustacea) ranging from Morocco to Sierra Leone.

Justification:

Effective management can significantly increase the flow of benefits to West African states. A pilot program is the best chance for successful management because:

- several countries already have adopted common mesh size requirements for demersal,
- there is little involvement of artisanal fishing operations, which are notably difficult to manage,
- demersals are less migratory than pelagic fishes and, consequently, easier to locate, study and regulate,
- foreign fleets take most of the demersal catch, implying African states may be more eager to cooperate with one another,
- being of lesser value than cephalopods and shrimp, demersal finfish are less likely to arouse serious confrontations.

Caveat:

Encourage CECAF Project to use their West African members as a steering committee.

Management:

The CECAF Project should be the principal responsible body for organizing the development and implementation of the plan by:

- building on and strengthening the existing framework in the region for fisheries development,

- conforming to the principles and guidelines set in FAO's draft strategy statement for fisheries management and development.

Everett, et al. (1983) states, "... a fisheries body such as CECAF... could assume fishery management responsibilities to the extent recommendations are systematically and regularly made ... ." These responsibilities do not require CECAF to be involved in the actual negotiation of quotas or the enforcement of regulations. Clearly, CECAF sees itself as a prime actor in fisheries management matters.

#### Recommendation 2: Highest level seminar.

##### Objectives:

- to improve the dynamic awareness of the participants regarding fisheries (a major goal of the upcoming World Fisheries Conference) so they may communicate this comprehension to others in their countries;
- to bring influential people together so that they might gain a better appreciation of one another's problems;
- to increase the interest of the participants (each one a key figure in fisheries in his/her country) in the wise management and development of their marine fishery resources;
- to increase the feeling of regionalism;
- to increase the cross-boundary flow of information.

##### Specifics:

Assemble three times yearly, for 1 week each time, the same 6, or so, key figures in northwestern African fisheries. The presentations must be extremely well prepared, innovative, and minimize lecturing or "talking down". They could use a variety of techniques including the Harvard Business School approach. The participants will each give a seminar in their own country.

##### Justification:

Without highest level support for fisheries development, effective management will not occur. The World Fisheries Conference is an open admission of a general malaise regarding fisheries in most countries. Secondly, the cause of regionalism would also be advanced.

##### Caveat:

Obtain the cooperation of key persons (in shadow cabinets, etc.) even if they are not technically in fisheries. If necessary, use pressure generated by the U.S. and E.E.C.

## Management:

CECAF could be funded for sponsorship but design and delivery of the seminar package should be assigned to a U.S. institution.

## Recommendation 3. Mid- and basic-level training.

### Objectives:

- increase the capacity of the coastal states to develop and manage their own fisheries as they deem best.
- improve the ability of the West African countries to participate meaningfully in international (both bilateral and multilateral) activities related to fishery resource exploitation.
- increase the sensitivity of trainees to this natural resource and the seas in which it dwells.

### Specifics:

Recommended training is at these levels:

- doctorate (stock assessment, fisheries economics), 6 graduates over a 5-year period.
- baccalaureate (fisheries science, resource economics, political science, sociology/anthropology), 16 graduates over a 5-year period.
- on-the-job (management and development planning, joint ventures, data handling, reduction of post-harvest losses, fisheries oceanography), 100 graduates over a 5-year period.
- extension (post-harvest losses, marketing, maintenance and repair), 400 graduates over a 5-year period. The term "extension" as used here means that the training occurs in neither a college degree nor an on-the-job setting. The training could be presented in a "classroom" in a store or church or meeting hall. Or it could occur on a boat or dock. It could be for one two-hour session, or meet weekly for six months, or indeed, follow any other pattern. Subjects could include stock assessment, net repair, handling of catch, available markets, engine repair, beach repairs of boats, etc.

### Justification:

- stated training needs of the countries of West Africa.
- needs reported by FAO Fisheries Department.
- a well-trained person can always train others, and so become an initiator rather than an end in him/herself.

### Caveat:

AID must coordinate carefully with its overseas missions and other donor countries to avoid overlap.

## Management:

The CECAF project should manage this training program, where possible using U.S. universities.

## Recommendation 4. Regional program to reduce post-harvest losses and expand distribution of artisanal fish products.

### Objectives:

- help alleviate undernutrition.
- insure fishery resources are utilized to make the greatest contribution to local food supplies.
- reduce waste.
- increase income to the artisanal fishermen.

### Specifics:

A regional program with two components, each of which has research and action phases as follows:

- reduction of post-harvest losses
  - research:
    - o develop new, low-cost fish products.
    - o develop cost-effective handling and processing methods.
  - action:
    - o training people in the artisanal sector in the use of these new methods.
    - o introduce and promote new, low-cost fish products among the target groups.
    - o educate consumers of food value, taste, selection, and preparation of seafood.
- expand distribution and marketing network
  - research:
    - o analyze distribution and marketing network to evaluate its efficiency and new ways of expanding it (especially to reach low-income people).
    - o identify consumer attitudes and preferences regarding fish and closely related food products.
  - action:
    - o promote expansion of private distribution and marketing system in accordance with above research.

### Justification:

- artisanal production accounts for 70 percent of the total West African production of marine fish.
- artisanal production currently not utilized rationally to contribute maximally to relief of undernutrition and hunger in West Africa.
- major defects are excessive post-harvest fish losses and inadequate distribution and marketing networks away from the coast.

- solution of these defects will significantly improve protein intake by those on deficient diets.
- this program will complement nicely an FAO project (INFOPECHE) which will consider international marketing problems only.

**Management:**

The research and action aspects for each component can be carried out by research institutes.

Recommendation 5. Information update system.

**Objectives:**

- keep abreast of latest information on West African fisheries.
- establish as automatic a system as possible.
- provide African participants with a source of relevant information.

**Specifics:**

Have an information research center familiar with fisheries development and management track the published and unpublished literature on West African fisheries. To obtain the latter, a subject-area expert would have to make an annual trip to the region.

**Justification:**

- to retain the advantages of the literature study on which this document is based.
- to provide a flow of information to Africa which will encourage the coastal states to actively assist in the program.
- to provide planners in both Washington and West Africa, and developers and managers in West Africa the most current and complete information available.

**Management:**

CECAF could conduct this activity, but they do not have a librarian, again lack power to push, however mildly, a recalcitrant individual or agency, would have trouble disseminating the information in a timely fashion, and would have this information in Africa and not readily available to planners in Washington, D.C. Therefore, the tasks should be assigned to a U.S. university with necessary expertise, and the capacity to respond instantly to requests from Africa.

*Don't need*



## Recommendation 6. Long-range planning.

### Objective:

assist West African countries to do long-range fisheries planning for their own countries.

### Specifics:

The recommendation is kept open because it is beyond the scope of work. For completeness it had to be listed, but nothing further is said here.

## **7.3 Budget**

Based upon the above analysis, the attached budget is proposed. It describes only proposed FY 85 operations in some detail, and leaves questions regarding possible shifts from mostly training to action-oriented programs, from technical to concessional activities and from regional to bilateral considerations in AIDs and its future consultants' hands. However, the proposed budget does include length-of-program totals for each recommendation (and the final year of the program is in parentheses).

The budget does not include one category of cost which can be significant. When one trains someone in a certain activity (say fishery statistics) there is the implication that the equipment, supplies, and even salary necessary to perform the task will be forthcoming. These colligative costs can be assigned to the country, or assumed by AID, or shared. If shared, then salary and supplies might be the country's contribution, while AID would provide equipment. The budget does include funds for office equipment, microcomputers, and equipment which should be adequate for AID's portion.

The budget includes payments to the attendees at the highest level seminars because they will do some of the teaching themselves, will have homework assignments, and will lead seminars at home.

The field-based project manager will supervise the project in Africa and this position is intended for the life of the project. This person will be directly responsible to AID/RA and, in time, to one or more of the AID missions in West Africa. The resident technical expert will be the on-site leader for the fishery management plan and responsible to the field-based project manager. This expert will be in Dakar for one or two years, but thereafter in the U.S. and with regular field contact.

The vessel will have the multiple advantages of providing some much needed information (e.g., spot checks to a limited resource survey), allowing specialized training, and establishing a pattern for sub-regional cooperation.

Costs are based upon the assumption that the costlier training, management and development activities will involve Morocco, Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone either exclusively or preferentially. Expenses will not change much if Cape Verde is added and/or Sierra Leone is deleted.

Returning to an earlier theme, the budget for FY 85 includes \$2,360,000, mostly as pass-through funds for specific programs, and \$307,000, as overhead, for CECAF. The magnitude of the project and these numbers reinforces the earlier statement that the CECAF Project must remain viable and intact. The experience, knowledge, contacts and reputation of this superior group must be retained for AID's needs.

A final point about the budget: it must retain flexibility so that this initiative can adapt to changes in needs as they emerge over a six-year period. The life-of-programs total of \$21,200,000 is solely for the programs suggested here. Others would doubtless need to be phased in during the third, fourth, and fifth years, and their costs are not included here.

**BUDGET**  
(costs in \$ thousands)

	FY 85	Program Total (Year Ending)
<u>Project Administration</u>		
Program Officer (1/3 time, Wash. D.C.)	20	
Field-Based Project Manager (in Dakar)	100	
CECAF Management (incl. secretary, aides)	50 *	
CECAF office equipment	40 *	
CECAF books, journals	30 *	
Consultants, technical	100 *	
		340* 1,900 (1990)
<u>Fishery Management Plain</u>		
Resident Technical Expert	70	
Economist	60	
Biologist	60	
Assistants	25	
Travel	75	
Sub-Regional Fisheries Research Vessel	700	
Microcomputer	35	
Development of Shallow-Water Stock Assessments (cooperatively with AID's CRSP)	100	
		1,120* 8,800 (1990)
<u>Highest-Level Seminar</u>		
Seminar preparation	300	
Seminar attendance	30	
		330 1,100 (1987)
<u>Training</u>		
Doctoral: stock assessment	45	
resource planning	45	
Baccalaureate: fisheries science	60	
resource economics	60	
political science	30	
sociology/anthropology	30	
On-the-Job: management and development		
planning	75	
joint ventures	75	
data handling	75	
reduction of post-harvest loses	75	
fisheries oceanography	75	

Extension:	post-harvest losses	75		
	marketing	75		
	maintenance and repair	75		
			870*	6,000 (1990)
<u>Market Development</u>				
	Bioeconomist/Socioeconomist (P4/5)	80		
	Research: post-harvest losses, alternative seafoods	50		
	Equipment (cold chains, chilled holds, etc.)	20		
			150*	900 (1989)
<u>Information Update</u>				
	Librarian	5		
	Management and Development Expert	10		
	Subscriptions	5		
	Travel	20		
			40	300 (1990)
	Subtotal		2,850	19,000
	*CECAF			
	Overhead (on \$2,360,000)		307	2,200
	Grand Total		\$3,157	21,200

**APPENDIX A**

**SCOPE OF WORK**

II. Scope of WorkObjective:

To provide consultants for a literature review and discussions with experts on fisheries development in West Africa, and with donor agencies with past and current activities in fisheries development in West Africa.

Statement of Work:

The services of a marine resource economist or equivalent are required for up to 5 weeks (beginning April 2). The consultant will begin work in Washington, D.C. in collaboration with a marine biologist/oceanographer from NMFS. The consultant and NMFS representative will then travel to Paris and Rome (for approximately 2 weeks) to consult with experts in fisheries development in West Africa and with donor agencies on documentation and on past, present, and possible future training programs on marine resource management and development in the West Africa region. If deemed necessary by AID/W, either or both members of the team may need to travel to West Africa for about 1 week following the visit to Europe.

The marine biologist/oceanographer from NMFS will act as team coordinator. The consultant and the NMFS representative will carry out the following tasks:

- evaluate documentation compiled or housed by NMFS and AID related to resource management and development of marine fisheries in West Africa. Special emphasis should be given to reviewing documents providing data related to stock assessments, harvest, productive capacity, quality control, etc. Also, particular attention should be given to two other areas: (a) national and sub-regional institutions which have previously or are presently involved in training activities pertaining to the development and management of marine resources, including data management, in West Africa; (b) successful and unsuccessful past and present training activities directed to resource planning, development, and information management in West Africa.
2. identify areas of strength and gaps in the documentation, especially as regards availability of quantitative and qualitative data on the geographical region. Also, to prioritize the location, type, and amount of information necessary to complete the gaps in documentation.

3. identify the marine fisheries institutions in West Africa which have the capability to contribute to training and data gathering on living marine resources, and outline the activities of and resources available to each. Also, to recommend which institutions would provide the best training development programs on specific topics associated with marine resource management and development.
4. describe West African governmental organizations with principal responsibility for marine fisheries.
5. expand the documentary review by travel to Paris and Rome (about 1 week each) to gather available documents and discuss materials with concerned organizations (e.g., FAO, ORSTOM, IOC, CNENC, etc).
6. critique documents gathered: special emphasis will be given to ascertaining areas of strength and weakness in resource management information, sub-regional and national institutions, training opportunities and assessment of accuracy, viability and quality of information.
7. meet with CEECAF liaison officer in Rome to discuss CEECAF network, documentation and information gathering and training activities.
8. identify and gather information on past and present marine fisheries management and development activities of other donor organizations in West Africa.
9. propose a system for maintaining current documentation on West African marine fisheries resource management and development activities.

REPORTS:

Outputs will include: 1) oral reviews with project officials; 2) a report responding to items 1-9 above, and including a bibliography of available materials and sources; comments on the quality of information, including strengths and gaps; analytical information as indicated above; recommendations on keeping the documentation current; and illustrative technical and administrative training activities at policy, management and operational levels; 3) where possible, recommendations regarding what specific training in fisheries resource management and development would be most useful to West African countries and what the geographical and topical priorities in implementing this training should be; 4) recommendations regarding which organizations would be most appropriate for implementing this training; and 5) informal consultation with AID during AID's preparation of the Project Identification Document (PID). No language requirement is required for this assignment.

**APPENDIX B**

**TABLES**



Table 1. General country characteristics. (Where: mill. = million, km= kilometers, km2= square kilometers, m.t.= metric tons, kg/year= kilograms per year. Data are from: Central Intelligence Agency 1983. The World Factbook. FAO Fishery Profiles. FAO 1983. 1981 Yearbook of Fishery Statistics: catches and landings. Volume 52. NMFS 1983. Fishes of the United States 1982. Per capita consumption is based on a 1975-77 average.)

	Population (mill.)	Gross National Product (mill.)	Gross National Product Per Capita	Coast Line (km)	Continent Shelf (km2)	Annual Catch (m.t.)	Per Capita Consumption (kg/year)
Morocco	22.9	\$14,900	\$722	1,750	60,000	381,464	9.7
Mauritania	1.6	\$800	\$536	720	34,000	21,170	46.3
Senegal	6.3	\$2,300	\$397	718	23,770	206,728	89.3
Cape Verde	0.3	\$565	\$225	2,000	10,150	11,105	-
Gambia	0.6	\$100	\$173	70	3,900	11,055	30.0
Guinea-Bissau	0.8	\$100	\$141	274	-	3,729	-
Guinea	5.4	\$1,100	\$221	350	50,180	17,453-	10.4
Sierra Leone	3.7	\$800	\$232	506	24,800	34,205	59.1
Liberia	2.1	\$1,130	\$660	537	18,400	9,004	45.9
Ivory Coast	8.9	\$9,000	\$1,075	500	12,200	64,880	45.6
Ghana	13.4	\$9,400	\$752	528	23,700	200,427	60.8
Togo	2.8	\$900	\$346	48	1,200	6,825	25.4
Benin	3.8	\$1,200	\$330	120	3,100	4,852	25.1
Nigeria	85.2	\$60,800	\$763	669	37,934	313,070	23.4
Cameroon	9.3	\$7,000	\$845	346	12,920	19,421	22.9
Equatorial Guinea	0.3	\$100	\$417	410	10,500	2,500	-
Sao Tome & Principe	0.09	\$40	\$490	209	-	1,500	-
Gabon	0.9	\$3,300	\$5,500	739	35,400	38,675	44.8
Congo	1.7	\$1,600	\$1,065	156	8,600	19,926	54.9
Zaire	31.3	\$6,000	\$158	40	1,150	615	13.7
Angola	7.6	\$3,900	\$591	1,650	51,000	123,457	14.8

Table 2. Results of computer documentation search

<u>Subject Area</u>	Number of Items by		<u>Geographic Location</u>	
Rules	24	In the CECAF region	114	
Foreign fishing, surveillance and enforcement	23	Northwest Africa	192	
Reports and surveys	23	Gulf of Guinea	85	
Vessels	10	ICSEAF	82	
Artisanal	5	Other	52	
Stock assessment	130			
Age and growth	44			
Fisheries biology	47			
Plankton	22			
Fisheries oceanography	61			
Pollution	2			
		Total References	493	
Development and planning (gen'l.)	89			
Economics	31			
Statistics	48			
Data processing	4			
Training	5			

Table 3. State of the stocks (after Everett, et al., 1980, 1982)

<u>Coastal Pelagics</u>	<u>State of Exploitation</u>
Northern Zone	
Sardines (Morocco, Mauritania)	full
Sardinella (Morocco to Sierra Leone)	heavy-full
Mackerel (Mauritania to Sierra Leone)	full-over
Horse Mackerel (Mauritania to Sierra Leone)	heavy-full
Southern Zone	
Sardinilla, bonga (Sierra Leone to Liberia)	no estimate
Sardinella (Ivory Coast to Togo)	full
Bonga, anchovy (Ivory Coast to Togo)	no estimate
Mackerel (Ivory Coast to Benin)	no estimate
Sardinella (Gabon to Angola)	moderate-low
<u>Ocean Pelagics</u>	
Yellowfin (Central Atlantic)	heavy
Skipjack	no estimate
Bigeye (Whole Atlantic)	full
<u>Demersals</u>	
Northern Zone	
All Demersals (S. Mauritania to Liberia, to 50m)	full-over
Sea Breams (Mauritania to Guinea)	over
Hake (Morocco to Sierra Leone)	over
In-shore Mixed (Mauritania to Guinea)	over
Bigeye (Senegal to Gambia)	over
Southern Zone	
Mixed (Sierra Leone to Liberia)	nearshore species may not be over-fished; offshore species harvest could be more than doubled.
Mixed (Ivory Coast)	
Mixed (Ghana to Benin)	
Mixed (Nigeria to Cameroon)	
Mixed (Equatorial Guinea to Zaire)	
<u>Cephalopods</u>	
Octopus (Morocco to Senegal)	near-over
Cuttlefish (Morocco to Senegal)	over
Squid (Morocco to Senegal)	over
<u>Crustaceans (pink shrimp)</u>	
Northern Zone	full
Southern Zone	full

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Table 4. Training needs in fisheries: current situation, year 2000 estimates and annual estimates of output requirements.

Country	Level	Currently			Minimum Needed by 2000		Required Annual Output	
		A	B&C	D	A	B&C	A	B&C
Benin		17	56	*	22	71	1	4
Cameroon		16	129	*	27	161	2	9
Ghana		26	87	178	69	219	5	17
Mauritania		40	57	97	120	302	9	25
Nigeria		451	928	1,726	577	1,315	34	82
Sierra Leone		24	52	136	43	111	3	8
Togo		6	17	*	12	36	1	3
Zaire		15	53	*	123	386	11	33

\* - none reported

A - professional personnel with the baccalaureate or equivalent

B - senior technical personnel with post-secondary technical training or equivalent

C - junior technical personnel with 1-2 years of specialized training at the secondary level or equivalent

D - vocational or artisan personnel with 6 months or more of vocational or on-the-job training

Table 5. Fisheries Assistance, From Josepuit, 1983

The tables which follow are based exclusively on countries' projects, thus excluding global, inter-regional and regional projects, in view of the difficulties that would have been encountered in properly allocating the aid so provided.

## AFRICA

The tables below present the data for Africa according to seven sub-regions, of which the first four are sub-regions of coastal countries, the last three land-locked. The first group - North-East Central Atlantic - includes the West African coastal countries from Mauritania in the North down to Sierra Leone. The Gulf of Guinea countries include Liberia in the West and Nigeria in the East. The third group - South-East Atlantic - lists all remaining Atlantic coastal countries. The fourth group - South-West Indian Ocean - is defined as all African countries which border the Indian Ocean. In the Southern land-locked countries group Botswana, Lesotho and Swaziland are listed, while the Eastern land-locked group contains Burundi, Rwanda, Zambia, Uganda and Malawi; the remaining land-locked countries are defined as the "Central African land-locked countries".

Table AF.1

Fisheries assistance in Africa ('000 US\$), at current values

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
TECHNICAL ASSISTANCE	15,479	24,253	25,537	26,541
Multilateral	7,885	11,174	10,757	9,058
EEC	322	539	643	2,143
OPEC	100	108	108	108
Bilateral	7,172	12,432	14,029	15,232
CAPITAL AID	35,017	49,176	54,312	70,458
Multilateral	5,748	9,986	9,525	9,425
EEC	1,126	3,259	5,664	5,664
OPEC	2,600	2,600	1,999	1,799
Bilateral	25,543	33,331	37,124	55,369
Total :	50,496	73,429	79,849	98,798

Table AF.2

Fisheries assistance in Africa at 1978 prices ('000 US\$)  
and annual variations (%)

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Technical Assistance	15,479	21,850	20,931	19,956
Annual variation (%)		+41	-4	-5
Capital Aid	35,017	44,302	44,520	52,976
Annual variation (%)		+26	-	+19
Total :	50,496	66,152	65,451	72,932
Annual variation (%)		+31	-1	+11

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Table AF.3

The subregional allocation of fisheries aid ('000 US\$)

North-Central Atlantic (Western Africa)

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
TECHNICAL ASSISTANCE	6,441	7,711	8,516	10,016
Multilateral	2,912	3,750	2,741	1,967
EEC	322	322	322	1,822
OPEC	100	100	100	100
Bilateral	3,107	3,539	5,353	6,127
CAPITAL AID	17,888	27,667	29,203	25,035
Multilateral	3,000	4,738	2,500	2,500
EEC	0	1,500	3,100	3,100
OPEC	2,400	2,400	1,799	1,799
Bilateral	12,488	19,029	21,804	17,636
<b>Total :</b>	<b>24,329</b>	<b>35,378</b>	<b>37,719</b>	<b>35,090</b>

Gulf of Guinea

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
TECHNICAL ASSISTANCE	1,149	1,801	1,621	1,318
Multilateral	1,111	1,495	1,355	1,035
EEC	0	217	217	217
OPEC	0	0	0	0
Bilateral	38	89	49	66
CAPITAL AID	1,460	4,347	1,969	3,518
Multilateral	0	0	111	111
EEC	0	0	0	0
OPEC	0	0	0	0
Bilateral	1,460	4,347	1,858	3,407
<b>Total :</b>	<b>2,609</b>	<b>6,148</b>	<b>3,590</b>	<b>4,836</b>

South-East Atlantic

	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
TECHNICAL ASSISTANCE	1,321	5,197	5,738	6,254
Multilateral	0	0	0	516
EEC	0	0	100	100
OPEC	0	0	0	0
Bilateral	1,321	5,197	5,638	5,638
CAPITAL AID	1,323	2,433	3,355	5,845
Multilateral	48	48	48	3,648
EEC	0	0	522	522
OPEC	0	0	0	0
Bilateral	1,275	2,385	2,785	1,675
<b>Total :</b>	<b>2,644</b>	<b>7,630</b>	<b>9,093</b>	<b>12,099</b>

Table 6. Donor Activities in West African Marine Fisheries

<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
Regional Projects	UNDP	1980-81	1.5	TA/support CEECAF
	Norway	1981-	1.0	TA/assistance to CEECAF
	Norway	1979-81	0.2	TA/EEZ regional fisheries law advisory program
	Norway	1981-	0.1	TA/study of joint ventures
	Norway	1979-82	0.1	TA/economic assesment of trade and demersal fisheries
	France	1980-81	0.01	TA/stock assessment
	EEC	1981-82	1.3	TA/fisheries development study for congo, Sao Tome & Principe, Gabon, Equatorial Guinea

TA denotes technical assistance; K denotes capital aid; N.A. denotes not available

<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>	
Mauritania	USSR	N.A.	N.A.	TA/Fishermen's training	
	USSR	1978-	2.5	TA/Oceanographic research center	
	France	1977-	N.A.	TA/fisheries institute assistance	
	Kuwait	1977-	0.5	TA/industrial fisheries development	
	Japan				TA/gear, training, coldstores
			1978-	N.A.	TA/experts in fisheries development
			1981	4.7	TA/fisheries promotion
		1980-83	N.A.	TA/training centers for artisanal fishermen	
	W. Germany	1980-82	0.3	TA/advisory services to Direction des Peches	
Japan	1981-83	1.0	K/artisanal fishing equipment		



<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
	France	1980-82	3.0	K/equipment and salaries for stock assessment
	Japan	1980-	4.0	K/N.A.
	UNDP	1981-84	1.5	TA/artisanal fishing techniques
Senegal	Canada	1972-76	3.0	TA/motorization of canoes
		1978-84	10.4	TA/assistance to cooperatives in processing, distribution and marketing
		1980-84	15.0	TA/surveillance and protection system for EEZ
	Italy	1977	0.5	TA/testing
		1979	0.5	TA/fisheries development and fisheries agreement
	USA	1980-82	0.2	TA/equipment for fishing cooperatives
		1981	0.2	TA&K/equipment for stock assessment
France	1979-	0.2	TA/construction of small boats, artisanal fisheries	

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<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
		1977-	0.3	TA/construction of handliner boats
		1980-81	N.A.	TA/artisanal fisheries study
		1977-	1.2	K/nine boats for coastal fisheries
	Netherlands	1981-83	0.3	TA/small-scale production of fish protein concentrate
	BADEA (Arab Bank for Economic Development)			
	USSR	1965-	6.5	K/fisheries loan
	Japan	1978	1.0	TA/K motorization of small boats
		1977	1.3	K/exploratory fishing vessel
		1979	2.3	TA/fisheries development project
		1979-	3.3	K/loan financing purchase of fishing equipment
		1980	2.5	K/cold storage
	Poland	1976-80	3.1	K/fishing trawlers, repairs, etc.

<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
	BOAD (West African Development Bank)	1981-86	1.2	K/credit for industrial and semi-industrial fisheries
	World Bank	1977-80	22.2	K/improvements in Port of Aakon for industrial fishing fleet
The Gambia	USA	N.A.	N.A.	TA/study effects of barrage on mangroves and fisheries
	Japan	1976-	1.7	TAGK/fishing vessel and promotion
	EEC	1981-83	3.0	TA/assistance in traditional processing methods (smoking and drying)
		1977-	1.2	K/roads and ice plants
	UNDP	1977-82	1.1	TA/economic study of fishing industrialization
Cape Verde	Iceland	1980-81	N.A.	TA/industrial fishermen's training
	Portugal	1979-81	N.A.	TA/fishermen's training
	Cuba	1979-82	N.A.	TA/fishermen's training
	Japan	1980-	0.8	TA/experts, motors & gear for artisanal fishery

<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
	USA	1981-85	6.	TA/motorization, equipment, processing & market & trade
	W. Germany	1978-	0.2	TA/ motors, training
	Switzerland	1978-81	0.8	K/motors, ice plants, equipment
	Netherlands	1979-84	1.3	K/motors, equipment, ice plants, experts
	France	1979-81	0.9	K/motorization, equipment
	Norway	1981-82	N.A.	K/boat building
	EEC/BAD	1979-82	12.0	K/repair yard for deep-sea fishing boats
	Arab countries	1980-82	5.4	K/harbor, ice plants, etc.
	UNDP 1978-81		0.7	TA/equipping artisanal fishery, to improve processing & distribution
Guinea Bissau	USA	1981-82	0.5	TA/Artisanal fisheries (cacheu)
	Sweden	1977-	2.3	TA/motors, experts
	France	1980-81	N.A.	K/loans for purchase of shrimp trawlers

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<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
	Brazil		N.A.	TA/vessels & administrative expertise
	EEC		N.A.	TA/continuation of USAID project in Cacheu
Guinea	USSR	-1980-	N.A.	TA/oceanographic research
	Canada	1977-	1.2	TA/canoe motorization
	Denmark			K/cold store & freezing facilities
	China			K/vessels & ice plant
	BAD	1977-82	6.0	K/fishing port
	EEC	1978-	1.0	K/equipment for training school
	UNDP	1975-81	1.6	TA/studies, modernizing artisanal fisheries, research service, processing & marketing
Sierra Leone	Canada	1977-81	0.2	TA/oyster culture
	W. Germany	1980-83	2.9	TA/pilot artisanal fisheries project (Tumbu)
	W. Germany	1981	N.A.	TA/expert in marine biology

<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
	USSR	1976-	2.5	TA/research, utilization, training
		1980	N.A.	K/patrol vessel
	Japan	1981-83	2.5	K/vessels, motors & equipment for artisanal fishery
	Denmark	1981	N.A.	TA&K/research vessel & experts
	France	N.A.	N.A.	K/loans for landing facilities & vessel purchases
	EEC	1983-	na	fisheries development (Kambia District)
	UNDP	1980-82	0.3	TA/training
Ivory Coast	France	1979-83	0.6	TA/oceanographic studies
		1979-	0.7	K/artisanal fishing
		1980-83	0.4	TA/stock assessment & lagoon study
		1981-83	4.7	K/lagoon aquaculture
	France	N.A.	N.A.	K/loans to expand tuna fleet
	UNDP	1978-81	(1.0)	TA/aquaculture including lagoons & freshwater lakes

<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
Ghana	Canada	1972-	0.2	TA/harvesting and processing methods; socio economic study
	UK	1979	0.1	TA&K/catamaran vessel
	Japan	1978-	4.1	TK/artisanal fisheries, research vessel
	UNDP	1972-76	0.5	TA/testing semi-industrial vessels
Togo	EEC	N.A.	N.A.	K/fishing terminals
Benin	Cuba	1977	0.1	K/ferrocement vessels
	UNDP	1979-83	0.2	TA/artisanal fisheries
	UNCDF	1978-81	0.1	TA/artisanal fisheries
	UNFDW	1982-84	0.2	TA/equipping and training women in processing
	BOAD/Switzerland	1980-83	0.7	K/boats for UNDP artisanal fisheries project
Nigeria	Japan	1981	2.3	TA/fisheries promotion
	UNDP	1977-82	1.5	TA/establish fishery training school
		1973-	0.5	TA/fishermen's cooperatives

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<u>Country</u>	<u>Donor/Source</u>	<u>Dates/Duration</u>	<u>Assistance (mill. US \$)</u>	<u>Type of Project</u>
		1983-	1.3	TA/fishermen's cooperatives
Cameroon	Canada	1978-85	7.9	TA/modernization of artisanal fisheries
	France	1979-81	2.2	K/coastal fisheries development
	World Bank/IDA	1971-81	(25.0)	K/part of larger project which included fishing harbor and access roads
Equatorial Guinea	EEC	1980-81	1.0	K/canoe construction, purchase of nets & motors
Gabon	EEC	1981	1.3	TA/feasibility studies for fisheries development projects
Sao Tome & Principe	Cuba	N.A.	N.A.	TA/assistance & training
	EEC	1981	0.5	TA/cold store installation
Congo	France	1961-	N.A.	TA/studies of artisanal & industrial fisheries
		1968-	N.A.	TA/hydroclimate studies
	Italy	1981-85	18.0	K/construction of Pointe-Noire fishing port (joint venture terms)

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Table 7. Allocations of Fisheries Assistance to Africa as of 1981

Source	In Africa	Research	Artisanal Fisheries	Industrial Fisheries	Vessels & Infrastructure	Processing & Marketing	Aquaculture	Economics & Planning	Training
World Bank	(7)	15	6	11	46	0	22	0	0
UN	(41)	29	23	3	1	3	21	11	9
EEC	(53)	0	23	0	49	2	18	0	8
OPEC	(11)	1	15	32	53	0	0	0	1
Bilateral Agencies	(34)	19	9	6	44	6	8	2	6
Japan	(11)	35	9	0	48	1	3	0	3
W. Germany	(24)	29	4	0	45	11	3	5	3
Denmark	(21)	13	1	0	59	24	1	0	1
Norway	(48)	7	2	0	27	19	1	0	45
USA	(28)	1	21	3	0	0	75	0	0
Netherlands	(25)	1	7	2	69	9	12	1	0
Sweden	(78)	7	39	11	32	0	0	0	11
Canada	(71)	5	21	3	0	19	0	41	11
France	(91)	19	5	28	9	0	38	0	0

Source: H. Josupeit, "A Survey of External Assistance of the Fisheries Sector in Developing Countries,"  
FAO Fisheries Circular No. 755, FIP/C755, June 1983.

Table 8. Reported catch in 1982 in the eastern central Atlantic Ocean (in metric tons), listed by habitat and major groups according to country statements.

	Local	Other African	West Bloc	East Bloc	Total	
<u>34.1.1 Morocco Coastal (Morocco)</u>						
Demersal Fishes	13,858	0	1,398	0	15,256	
Coastal Pelagics	233,531	0	1	11,010	244,542	
Marine Fishes NEI	31,188	0	29	0	31,217	
Crustacea	1,173	0	0	0	1,173	
Mollusca	35,769	0	3	0	35,772	
Subtotal					327,960	
<u>34.1.2 Canaries/Madeira (Spain, Portugal)</u>						
Demersal Fishes	284	67*	8	0	359	
Coastal Pelagics	3,550	652*	0	0	4,202	*Ghana
Marine Fishes NEF	153	0	15	0	168	
Crustacea	1	0	0	0	1	
Mollusca	7	0	28	0	35	
Subtotal					4,765	
<u>34.1.3 Sahara Coastal (Mauritania)</u>						
Demersal Fishes	12,120	0	9,504	38,575	60,199	
Coastal Pelagics	7,160	0	443	556,841	564,444	
Marine Fishes NEI	5,790	0	16,812	29,045	51,647	
Crustacea	0	0	136	4	140	
Mollusca	550	0	24,000	3,100	27,650	
Subtotal					704,080	
<u>34.2.0 Northern Oceanic</u>						
Demersal Fishes	N.A.	0	2	0	2	
Coastal Pelagics		0	0	186,496	186,496	
Marine Fishes NEI		0	11	9,815	9,826	
Crustacea		0	0	0	0	
Mollusca		0	0	0	0	
Subtotal					196,324	

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	<u>Local</u>	<u>Other African</u>	<u>West Bloc</u>	<u>East Bloc</u>	<u>Total</u>	
<u>34.3.1 Cape Verde Coastal (Senegal, Gambia, Guinea-Bissau, Guinea)</u>						
Demersal Fishes	48,607	240**	7,978	97,241	154,066	
Coastal Pelagics	124,254	413**	1,902	124,879	251,448	**Ghana and Ivory Coast
Marine Fishes NEI	49,007	0	4,522	4,131	57,660	
Crustacea	5,861	0	39	0	5,900	
Mollusca	6,983	0	5,265	6	<u>12,254</u>	
Subtotal					481,328	
<u>34.3.2 Cape Verde Insular</u>						
Demersal Fishes	0	0	15	0	15	
Coastal Pelagics	0	0	0	0	0	
Marine Fishes NEI	5,360	0	58	0	5,418	
Crustacea	25	0	0	0	25	
Mollusca	0	0	0	0	-	
Subtotal					5,458	
<u>34.3.3 Sherbro (Sierra Leone, Liberia)</u>						
Demersal Fishes	7,783	400	363	18,262	26,808	
Coastal Pelagics	32,724	0	2	41,591	75,317	
Marine Fishes NEI	2,323	0	330	319	2,972	
Crustacea	754	0	3	0	757	
Mollusca	1,014	0	351	650	<u>2,015</u>	
Subtotal					107,869	
<u>34.3.4 Western Gulf Guinea (Ivory Coast, Ghana, Togo, Benin)</u>						
Demersal Fishes	39,708	0	14	0	39,722	
Coastal Pelagics	157,110	0	0	0	157,110	
Marine Fishes NEI	36,492	0	65	0	36,557	
Crustacea	645	0	0	0	645	
Mollusca	527	0	0	0	<u>527</u>	
Subtotal					234,561	

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	<u>Local</u>	<u>Other African</u>	<u>West Bloc</u>	<u>East Bloc</u>	<u>Total</u>
<u>34.3.5 Central Gulf of Guinea (Nigeria, Cameroon, Equatorial Guinea)</u>					
Demersal Fishes	144,902	0	0	0	144,902
Coastal Pelagics	126,657	0	0	0	126,657
Marine Fishes NEI	92,697	2,688***	0	0	95,385
Crustacea	4,436	0	0	0	4,436
Mollusca	104	0	0	0	<u>104</u>
Subtotal					371,484
<u>34.3.6 Southern Gulf of Guinea (Gabon, Congo, Zaire, Angola)</u>					
Demersal Fishes	28,810	0	0	0	28,810
Coastal Pelagics	35,957	0	0	0	35,957
Marine Fishes NEI	2,166	0	0	0	2,166
Crustacea	1,857	0	0	0	1,857
Mollusca	29	0	0	0	<u>29</u>
Subtotal					68,819
<u>34.4.1 Southwest Gulf of Guinea</u>					
Demersal Fishes	0	0	10	30	40
Coastal Pelagics	0	0	0	0	-
Marine Fishes NEI	0	0	58	0	58
Crustacea	0	0	0	0	0
Mollusca	0	0	0	0	0
Subtotal					98
<u>34.4.2 Southwest Oceanic</u>					
Demersal Fishes	0	0	121	197	318
Coastal Pelagics	0	0	0	0	0
Marine Fishes NEI	0	0	950	0	950
Crustacea	0	0	0	0	0
Mollusca	0	0	0	0	0
Subtotal					1,268

\*\*\*Sao Tome and Principe

	<u>Local</u>	<u>Other African</u>	<u>West Bloc</u>	<u>East Bloc</u>	<u>Total</u>	
<u>34.9.0 Not Known</u>						
Demersal Fishes	0	0	45,622	0	45,622	
Coastal Pelagics	0	0	97,560	0	97,560	
Marine Fishes NEI	0	0	96,990	0	96,990	
Crustacea	0	0	14,360	0	14,360	
Mollusca	0	0	114,634	0	114,634	
Subtotal					369,166	
<u>34.0 Total Tuna Catch</u>						
Oceanic Pelagic Fishes	N.A.	62,939	212,947	26,812	305,097	(incl. NEI = 2,399)
Subtotal					305,097	
<u>34.1.1 Northern Sub-Area</u>						
34.1.3 Demersal Fishes	74,585	240	28,098	135,816	238,772	
34.A.A Coastal Pelagics	364,945	413	2,399	692,730	1,060,487	
34.C.Q Marine Fishes NEI	85,985	0	23,383	33,176	142,580	
34.X.Y Crustacea	7,034	0	1,376	4	8,414	
Mollusca	43,302	0	30,276	3,106	76,684	
Subtotal					1,526,937	
<u>34.3.3 Southern Sub-Area</u>						
34.3.4 Demersal Fishes	221,203	400	377	18,262	240,242	
34.3.5 Coastal Pelagics	353,448	0	2	41,591	395,041	
34.3.6 Marine Fishes NEI	133,678	2,688	395	319	137,080	
Crustacea	7,692	0	3	0	7,695	
Mollusca	1,674	0	351	650	2,675	
Subtotal					782,733	

	Local	Other African	West Bloc	East Bloc	Total		
34.1.2	<u>Oceanic Sub-Area</u>						
34.2.0	Demersal Fishes	284	67	156	227	734	
34.3.2	Coastal Pelagics	3,550	652	0	186,496	190,698	
34.4.1	Marine Fishes NEI	5,513	0	1,092	9,815	16,420	
34.4.2	Crustacea	26	0	0	0	26	
	Mollusca	7	0	28	0	35	
	Subtotal					207,913	
34.0.0	<u>CECAF Area</u>						
	Demersal Fishes	296,072	707	74,253	154,305	525,370	(incl. 33 NET)
	Coastal Pelagics	721,943	1,065	99,961	920,817	1,743,786	
	Oceanic Pelagics	0	62,939	212,947	26,812	305,097	(incl. 2,399 NEI)
	Marine Fishes NEI	225,176	2,688	121,860	43,310	393,070	(incl. 36 NEI)
	Crustacea	14,752	0	15,739	4	30,495	
	Mollusca	44,983	0	145,289	3,756	194,028	
	Subtotal	1,302,926	67,399	670,049	1,149,004	3,191,846	(incl. 2,468 NEI)

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Table 9. Reported catch in 1982 (in million U.S.)  
in the eastern central Atlantic Ocean.

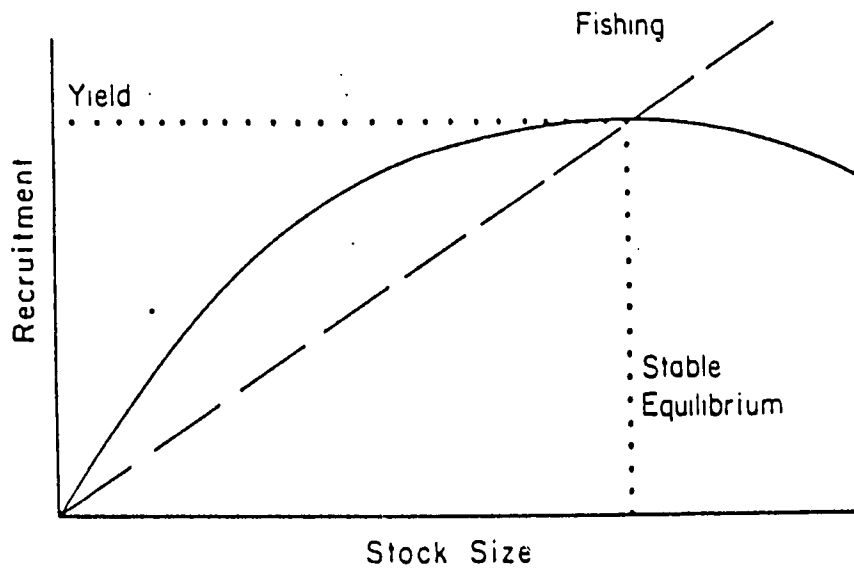
	Unit Prices*	CECAF Region	Coastal Morocco- Liberia	East Bloc	West Bloc
Demersals	450	236.4	119.6	69.4	33.4
Coastal Pelagics	100	174.4	113.6	92.1	10.0
Oceanic Pelagics	850	259.3	-0-	22.8	181.0
NEI (mixed)	250	98.3	36.4	10.8	30.5
Crustacea	5,000	152.5	45.8	-0-	78.5
Mollusca	2,000	<u>388.0</u>	<u>157.4</u>	<u>7.6</u>	<u>290.6</u>
		1,072.9	472.8	202.7	624.0

\*From Everett, et al. (1982).

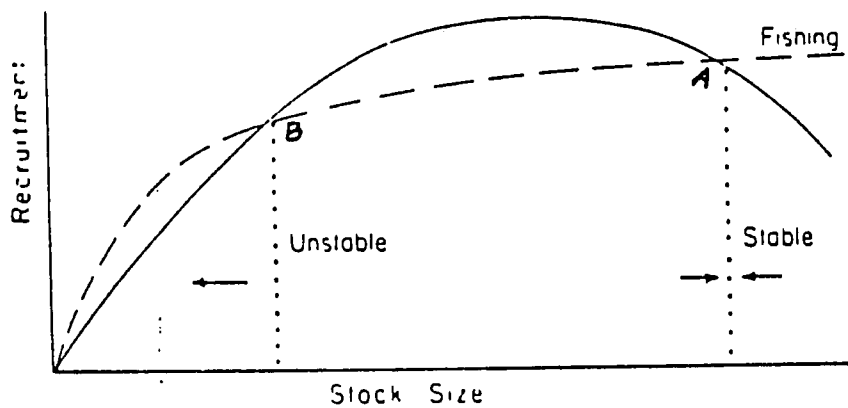
**APPENDIX C.**

**FIGURES**





1. A stock-recruit relation combined with a fishing mortality proportional to stock size gives a stable equilibrium yield. (After: Ocean Sciences Board 1980. Fisheries Ecology. National Academy of Sciences. Washington, D.C. 16pp.)



2. The recruitment curve combined with a fishing mortality relatively independent of stock size gives two possible yields. One stable and the other unstable. (Source: as in figure 1.)

**APPENDIX D**

**COUNTRY ANALYSIS**

The governmental infrastructures for fisheries, key people, and marine capabilities are presented on a country-by-country basis from Morocco to Angola. A statement is also included of the marine priorities of each coastal state. Much of this material is based upon: UNESCO 1981. Marine Science and Technology in Africa: present state and future development. UNESCO Reports in Marine Science 14, 142 pp. And, United Nations Environment Programme, Regional Seas Programme Activity Centres 1982. Marine Research Centres: Africa. FAO, Rome. 254 pp.

#### Morocco

Bensalem Smili, Minister  
Ministry of Ocean Fisheries and  
Merchant Marine  
63 Boulevard Moulay Youssef  
Rabat

Comments: A young, vigorous, but inexperienced Ministry with a dynamic staff. The Ministry is large, and its portfolio includes supervision of the merchant marine and maritime safety. The fisheries officials are generally bright, eager and multilingual. Several division heads have doctorates, but none have had formal training in fisheries. The Minister is eager, but because of his age this will probably be his last assignment in the government. The Ministry must get better cooperation from their Navy and Air Force in surveillance and enforcement. The Ministry has the further problems of better integrating the role of the Office National des Peches (ONP), and of limiting overall (foreign and domestic) fishing effort. The Ministry works well with its fisheries research institute, and uses their data. Catch statistics are reliable.

There has been an interest in marine science research for several decades, and several research institutions were established and staffed by French scientists during the French colonial government. However, in recent years, with the departure of most of the French scientists, the country has been experiencing an acute shortage of trained scientific manpower.

#### Training in marine sciences

At present, training in marine sciences is limited. At the Mohamed V (formerly Rabat) University, the Department of Earth Sciences of the University, in collaboration with the University of Bordeaux I in France, offers courses in sedimentology, geochemistry and physical oceanography with masters and doctoral programs available. The publications in these subjects have been produced by the staff since 1974. The Scientific Institute, with but two staff members, provides training at the masters level in biological oceanography, and has produced six publications since 1976. There are a few master's level courses offered in marine or fishery biology, through the Agronomic and Veterinary Institute Hassan II. AID has a training project which operates through the Ministry of Plan and Professional and Vocational Training, but is open to fishery students. Seven

such scholars have been sent to the United States for master's degrees over the past four years. A direct fisheries training project between AID and the Ministry of Ocean Fisheries and Merchant Marine is currently being negotiated. Moroccan students are well and easily trained, and prove to be excellent workers. However, with 2-3 years of experience they frequently transfer to the private sector where wages are higher.

#### Research in marine sciences

Research in marine sciences is at the Mohammed V University, at Hassan II, and in a few government ministries. The Department of Earth Sciences of the former and the Department of Geology of the Ministry of Energy and Mines carry out research on the geology and geochemistry of the continental shelf. The results are being issued mainly as detailed bathymetric charts. Together with the University of Bordeaux I, the University's Department of Earth Science, is also carrying out studies in the geochemistry and sedimentology of the coastal estuarine zone. The Sherifien Scientific Institute of the University carries out some research in marine biology and ecology. The Agronomic Institute collaborates with the National Advanced School for Agronomy (Rennes, France), the Agronomic Institute of Tunis, and the Marine Science Center of Oregon State University.

The Institut Scientifique des Peches Maritimes (Scientific Institute of Marine Fisheries) of the Ministry of Ocean Fisheries and Merchant Marine has reasonable facilities for research in biochemistry, fisheries biology, pollution, and fish processing, has produced 21 publications since 1968, and issues about 12 significant reports yearly. ISPM is under the Office National des Peches which guarantees it a budget, but makes its objectives and results somewhat distant from the planners. The ISPM has just hired its first staff economist. ISPM works closely with the university laboratories and regularly uses the Central Laboratory of Veterinary Research in Casablanca on chemical and biological problems. The Institute has a twinning agreement with the Southeast Fisheries Center of NMFS, but is hampered by a lack of funding.

There is a UNDP/FAO project on stock assessment and resource management with three experts (scheduled to phase out in 16 months), a well equipped research vessel and a computer.

#### Main activities of interest

The fishery resources of the country are only moderately developed, but the Government is making a great effort to improve the situation through manpower training, research, and port development. The ISPM is responsible for stock assessment and management. Technical training is carried out by the ISPM. There are small boat yards at Casablanca, Agadir and Safi and there is an on-going project for the construction of ports every 200 km.

Mauritania  
Mohammed Ould Sidy Ali  
Ministre  
Ministere de la Peche et  
de l' Economie Maritime  
Nouakchott

Comments: Although in a separate Ministry of Fisheries and Maritime Economy, reports indicate that fisheries is not well organized. The government claims to place "controllers" on all foreign fishing vessels, but poaching is serious, and largely unrestricted. It is reported independently that these observers stay in Dakar. According to reports, Mauritians in general are more attuned to the land, and so trained fisheries personnel are scarce. Catch statistics are reasonable, but subject to some political needs.

The population is small, consisting largely of nomads whose main occupation is livestock raising. There is no tradition of life at sea or of eating fish, and the artisanal fishery is very much underdeveloped. However, continuing Sahel droughts have decimated the livestock industry and it seems probable that gradually some Mauritians will have to turn to fishing for survival.

#### Training in marine sciences

The general standard of education is low and there are no institutions of higher education or professional training in the country; the small middle, and high level professional cadre is largely trained abroad (France, USSR and neighboring countries). There are plans to establish a training program in fisheries and marine sciences to be run by the National Centre of Oceanographic Research and Fisheries and the proposed "Ecole de Formation Maritime a Nouadhibou" (Maritime Training School at Nouadhibou), but these programs are for middle grade personnel and are slow to start.

#### Research in marine sciences

The only institution engaged in marine science research in the country at present is the "Centre National de Recherches Oceanographiques et des Peches" (CNROP)-(National Centre of Oceanographic Research and Fisheries) which was established in 1979 with assistance from the USSR. The Centre, which took over the research functions of the Fisheries Laboratory at Nouadhibou, is manned by 1 Mauritanian scientist, 2 Mauritanian technicians, 5 French scientists (working on catch), and 3 Russians. The present research programs of the Centre are believed to be in the areas of physical and chemical oceanography, survey and stock assessment of pelagic and demersal fisheries and marine pollution. It is hoped that future research programs will include mariculture.

The Centre is facing several problems arising from the lack of a clear fishery policy, lack of equipment, shortage of

suitably qualified local counterpart scientists, and the ambiguous presence of Russians. To increase its effectiveness they would need to add 1-2 biologists and 1-2 economists. The Mauritians have requested French support for CNROP which would have included funds to pay for the Russians' services. The French declined. 55 publications are listed by CNROP, mostly in the second half of the 1970's and none in the 80's.

#### Main activities of interest

The fishery resources of the country are very much underdeveloped, but overfished by foreign fleets. An on-going FAO project aimed at improving the artisanal fishery has run into several difficulties and after six years of operation has not met with much success. A Japanese-assisted project has also not been very successful. The Mamadou Toure Centre at Nouadhibou runs vocational training courses in several technical subjects (including diesel mechanics, fishing, refrigeration, electrical work, etc.) but there is a great shortage of manpower at all levels.

#### Senegal

Robert Sagna  
Secrtaire de l'Etat  
Secretariat a la Peche Maritime  
Ministry of Rural Development  
B.P. 4050,  
Dakar

Comments: The Department of Marine Fisheries, set within the Ministry of Rural Development, does an effective job although it has a major problem in fisheries enforcement. The Department has some inspectors, but the Navy refuses to use them. Department personnel have a strong desire to do a better job. As noted in Section 5, the Canadian Government is giving the Senegalese considerable assistance in surveillance and enforcement. Sogui Diouf, a Doctor of Veterinary Medicine but with training in selected marine topics, is Director of Oceanography and Marine Fisheries within the Secretariat. There is a School for Technical Agents of Oceanography and Marine Fishing attached to the Secretariat. The department works well with CRODT, uses data provided, and has 2 high-speed, Cherbourg-type boats and a standard patrol boat at its disposal. Catch statistics are now reliable.

The economy of the Republic of Senegal is based on agriculture (mainly groundnuts), industry and fisheries. The country derives much of its protein requirements and a considerable portion of its export earnings from its fishery resources. The excellent position of this country in fisheries is believed to be, in part, the result of their having used ORSTOM not only to generate knowledge, but also to train their people.

### Training in marine sciences

The University of Dakar does not at present offer full-scale degree studies in marine sciences, but a few, marine-oriented courses are given as parts of a major program in some departments, e.g., courses in marine ecology, and marine invertebrate and vertebrate systematics are offered to zoology students. Graduate students wanting to specialize in marine sciences have to go abroad. Technicians training is provided by the Ecole des Agents Techniques d' Oceanographie et des Peches Maritimes. Occasional training is provided by the Department de Biologie Marine, Institut Fondamental d' Afrique Noire (IFAN). CRODT offers no courses directly but works through the University of Dakar.

### Research in marine sciences

The principal marine science research institution is the "Centre de Recherches Oceanographiques de Dakar-Thiaroye" (CRODT). The Centre is under the Secretariat of Scientific and Technological Research and its research program is mostly oriented towards the development and exploitation of marine fisheries. The scientific staff of the Centre consists of 14 expatriate scientists (mostly French) and 11 qualified or in-training Senegalese scientists. The Centre has fairly well equipped laboratories and two small boats and an FAO research vessel on loan. Most of the staff scientists are marine biologists and the main research programs at present are stock assessment and management, and fishery biology. There are some pollution studies of the coastal environment. CRODT has received bioacoustic equipment totalling \$150,000 from AID. The institute issues about 65 publications, reports, etc. annually. Turnover in staff is slight; salaries and working conditions are excellent, and research is planned years in advance (monies roll over and budgets include amortizations, etc.) Staff are often recruited, hired, and then sent for training. IFAN conducts some marine biological research on marine mammals and the shrimp fishery, but the shortage of qualified scientists has seriously affected its research activities.

### Main activities of interest

Both artisanal and industrial fisheries are well developed, and there is good fishing capability among the local fishermen and the artisanal fishery. The industrial fishery is also largely operated by Senegalese whose fishing fleets go as far north as Mauritania and as far south as Angola.

Dakar is the main harbor of the country. A fishing port is to be established at St. Louis on the mouth of the Senegal River, and two new ports are to be constructed at Saloum and Casamance, south of Dakar. A major supertanker dockyard is being built in Dakar, and the Russians make heavy use of the port for their distant water fishing fleet.

Senegal has established three marine parks at "Lagune de Barbarie", "Ile de la Madeleine" and "Parc du Delta de Saloumi". These marine parks are an additional attraction for the long established tourist industry.

#### Cape Verde

Vicente Andrade Gomes, Acting Director  
Directorate of Fisheries  
Ministry of Economy and Finance  
Avenida Amilcar Cabral  
Praia

Comments: As of 1981, the Directorate of Fisheries had a Director, Deputy Director and a technician. The Director has had some in-service UNDP training, and has travelled annually to various fisheries conferences. Catch statistics are reliable.

The Republic of Cape Verde is composed of an archipelago consisting of ten islands - St. Antao, St. Vicente, St. Lucia, St. Nicolau, Sal, Boa Vista, Maio, St. Tiago, Fogo and Biava.

#### Training and research in marine sciences

There is a great shortage of trained manpower and there are no training or research institutions in marine sciences. However, some oceanographic studies have been carried out by scientists from the German Democratic Republic.

#### Main activities of interest

Both artisanal and industrial fisheries are well developed and fishery resources contribute 60-62% of the country's export earnings. There are freezing facilities at Mindelo and an old canning factory at Praia. Further development of the fishery industry is hampered by the lack of qualified personnel. There is a Nautical School at Mindelo for training mechanics and electricians, and it also serves Guinea Bissau. Mindelo is a major fishing port.

#### Gambia

Saihou S. Sabally  
Minister of Agriculture and  
Natural Resources  
Banjul

Comments: This small country and its marine resources are surrounded by Senegal, one of the four fishing powers of West Africa. The marine fisheries section is included in the Ministry of Agriculture and National Resources. Ms. Hannah King who, from 1978 to 1981, was Acting Director of Fisheries, has the equivalent of a master's degree in fisheries management, but she is now in London. She has traveled widely in both East and West.



### Training and research in marine sciences

There are no institutions of higher learning or professional training in marine sciences, and the country depends for most of its middle and high level manpower training on overseas institutions or those of neighboring countries. The very limited aquatic research is centered in the Department of Fisheries of the Ministry of Agriculture and Natural Resources, and these are mainly oriented towards the development of fresh and brackish water fisheries in the Gambia river. Some fish catch statistics have been pursued. 5 Gambians constitute the scientific staff. Their last annual report was published in 1979.

### Main activities of interest

The artisanal and industrial fisheries are fairly well developed and there is an elaborate administrative machinery for their operation and development, but they are mostly run by foreigners. There seems to be a conflict between foreign and national interests in the exploitation of the resources. The shortage of qualified manpower is compounded by the fact that fishing is an unpopular occupation among Gambians. There are plans to exploit several mineral resources from the continental shelf. Mostly, training occurs overseas or in neighboring countries, e.g., at the Ghana Nautical College, but occasionally it is done on the job. There is a small dockyard under the Gambia Port Authority equipped to service small ocean-going vessels and to build small trawlers, river barges and ferries.

#### Guinea-Bissau

Flavio Proenca

Secretario de Estado

Secretariado de Estado das Pescas

Bissau

Comments: The Secretary General reports directly to the Cabinet. The Secretariat has three subgroups: Finances, Fisheries and Captain of Ports.

### Training and research in marine sciences

There are as yet no institutions for advanced training or research in marine sciences, and professional scientists and technologists train abroad (Brazil, Portugal, USA, Cape Verde). This country, which is rich in shrimp stocks, is planning to establish some training and research institutions of its own. Some oceanographic observations, and fishery surveys and stock assessments have been made by foreign research vessels and by the "Centre de Recherches Oceanographiques de Dakar-Thiaroye" in Senegal. These studies have revealed a very rich fishery in the inshore and continental shelf zones.

### Main activities of interest

The rich marine resources of the country are not being fully exploited, but their development is one of the Government's priorities in its economic reconstruction effort. For the industrial fisheries, there are three fish processing companies, and a modern freezing plant is under construction. There is a Secretariat of Fisheries under the Prime Minister's Office which is reorganizing the fishing industry with assistance from Brazil. The School of Navigation in Cape Verde offers training places to trainees from Guinea Bissau and there are annual fellowships from Portugal for middle level training. A mechanical engineering school is to be established in the country. The harbour in Bissau is small and can handle only one ship at a time.

#### Guinea

Dian Bailo Diallo  
Directeur General de la Peche  
Ministere de l'Elevage et  
de la Peche  
B. P. 307,  
Conakry

Comments: Mr. Diallo has degrees in agriculture from Guinean universities, but has been in the Department of Fisheries since 1974. He has traveled approximately every two years.

### Training in marine sciences

The most important institution concerned with high level training of marine science personnel is the Institut Polytechnique Gamal Abdel-Nasser. The Biology Department of the Institute offers a 5-year program leading to an M.S degree in ichthyology, and graduates in mathematics and physics can opt for appropriate marine science courses (e.g. physical oceanography and fishery statistics) as a specialization. It is also expected that when fully operational, CROH (see below) will participate in the training of local marine scientists by introducing M.S. courses in oceanography for graduates from the University and the Polytechnic Institute.

In addition to these training facilities, a number of Guinean students are sent abroad annually (USSR, Poland, Cuba, Yugoslavia) to specialize in various marine science subjects.

There are as yet no strong research and training programs in marine sciences at the University of Conakry, but the Biology and Fisheries Departments of the University have been carrying out some joint surveys and mapping of fishing grounds.

### Research in marine sciences

Le Laboratoire de Biologie Marine de la Direction des Peches-  
(Marine Biology Laboratory of the Fisheries Service) of the Ministry of Rural Economy was established in 1974 to be

responsible for all research in marine fisheries. Because of the lack of qualified scientists, no substantial research work is being carried out by the laboratory at present. The laboratory has a reference collection of fish and crustacea found in Guinean waters.

Centre de Recherches Oceanographiques et Heliophysiques (CROH)  
(Centre for Oceanographic and Fisheries Research). This Centre, built through a technical cooperation agreement with the USSR, was completed in 1980 and formally dedicated in 1981. The agreement provides for technical and financial assistance from the USSR in running and managing the Institute for the first five years after its establishment (1981-1985) and for the training of Guinean counterpart scientists at CROH or in the Soviet Union. The research programs of the Centre deal with many topics but not stock assessment. Among the important equipment to be supplied to the Centre later are a research vessel and a computer.

Le Institute National de Recherche et de Documentation (INRD) (National Institute for Research and Documentation) does not carry out research. Its functions are to oversee and coordinate research and to harmonize research and development by organizing meetings of scientists and administrators at the national level. It also serves as a documentation center.

#### Main activities of interest

Both the artisanal and industrial fisheries are being reorganized to improve their efficiency and to coordinate their activities.

Conakry is the main harbor of the country and there are plans to expand it, and to build several fishing ports.

There are small boat yards capable of repairing small boats, and two floating docks in the Conakry harbor are at present carrying out dredging work.

Sierra Leone  
Ethan Golley-Morgan  
Chief Fisheries Officer  
Fisheries Division  
Ministry of Agriculture  
2 Pademba Road  
Private Mail Bag  
Freetown

Comments: A 1973 report of the Fisheries Division shows a full complement including fisheries officers, master fishermen, and other specialists for a total of forty-three professionals, and they have reorganized recently. At least one of their senior people, Ethan Golley-Morgan, has an excellent reputation among African fisheries specialists. It is reported that the division staff work somewhat with the university's experts, and there are

no scientists in the Fisheries Division. Reliability of catch statistics is unknown because of foreign fleets and inadequate review of artisanal fleet.

The Republic of Sierra Leone is a country rich in agricultural, mineral and fishery resources. It has a tradition as a marine coastal state. The British colonial government established the West African Fisheries Research Institute (WAFRI) in 1952 to serve the fishery interests of its former colonies of Sierra Leone, Gambia, Ghana and Nigeria. Through a series of transformations, WAFRI eventually gave rise to the Institute of Marine Biology and Oceanography (IMBO) of the Fourah Bay College, University of Sierra Leone in 1967. Since then, the country has maintained its lead among the West African coastal states in having well conceived training and research programs in marine science and technology. With the development of the University of Sierra Leone, these programs have been diversified and strengthened.

#### Training and research in marine sciences

Practically all activities concerned with research and training in marine sciences in the country are centered at the University of Sierra Leone with IMBO as the focal point. Apart from research in marine sciences, IMBO also conducts freshwater research. The main research carried out at the Institute is in fishery biology and ecology, fishery resource survey, algology and limnology. Future research programs include biological and chemical oceanography, stock assessment and population dynamics of economic species, marine pollution, egg and larval ecology, aquaculture, and biology and ecology of mangroves.

In its training activities, the institute contributes the oceanography component of the B. S. in Zoology and Oceanography in the Faculty of Science of the University, and offers a diploma course in Aquatic Biology and Fisheries. As a result of good working arrangements between IMBO and the Faculties of Science and Engineering of the University, many students in these departments now graduate with courses in marine sciences. Some members of the Faculty of Engineering and the Department of Geology also carry out research projects in such marine science related problems as coastal erosion, siltation and sediment transport.

The Institute (IMBO) has a staff of 11 including 7 scientists and 4 technical and administrative staff. The main constraints being experienced by the institute are shortages of staff and space. The Institute could also do with a good research boat, but it has access to the boats of the Fishery Division of the Ministry of Natural Resources. IMBO personnel have published 8 papers since 1966.

#### Main activities of interest

The artisanal fishery is well developed, well organized and staffed, with qualified national manpower. There are plans

to further develop the artisanal fishery through the improved training of fishermen and other marine technical staff at all levels, the provision of more modern fish-landing harbors, development and provision of modern fishing boats and fishing gear, and better organization of fishing cooperatives. The industrial fishery, which is also well developed, is to be further improved through the training of local manpower at all levels, and through the provision of on-shore facilities such as fishing harbors, cold storage, and fish handling and processing facilities.

Until recently, there were no specialized institutions for the training of technicians, but there were ad hoc vocational courses given by the Division of Fisheries, Ministry of Natural Resources, the University of Sierra Leone and the Sierra Leone Ports Authority, and on-the-job training by fishing companies. In 1980, the Sierra Fishing Company, with technical assistance from the USSR, established the Siaka Stevens Marine Training School in Freetown for the training of low-middle level marine technicians. It is hoped that this school will provide some of the technical manpower required at all levels.

The main harbor in Freetown is capable of handling large ocean-going vessels including container ships, and there are plans to construct several modern fishing harbours. Existing boat yards are to be improved so as to have the capability of building medium-sized boats, and two dockyards are to be constructed with slipways capable of handling small ocean-going vessels. There are long-term plans for further improvement and modernization of harbors and other on-shore facilities.

Coastal area erosion is becoming a serious problem in many places along the coast and there are also problems caused by sediment transport and deposition.

#### Liberia

Karnley Johnson  
Assistant Minister for Fisheries  
Bureau of Reg. Development  
Ministry of Agriculture  
Tubman Boulevard, Sinkor  
P.O. Box 9010,  
Monrovia

Comments: Effectiveness of the ministry is judged to be low. Accuracy of catch statistics is undetermined because of inadequate information on the activities of foreign fleets and the size of the artisanal fishery (which is quite important).

#### Training and research in marine sciences

There are practically no current research and training activities in marine sciences. The Biology Department of the Falkner College of Science and Technology, University of Liberia, carried out some observations in the past on marine

plankton and fishery biology, but owing to staff problems this modest effort stopped. There is a great need for cooperation between the University and government ministries to ensure that university activities are in harmony with manpower needs. In a reorganization of the Division of Fisheries, Ministry of Agriculture, a Research Institute was created which is responsible for all research related to fisheries development.

#### Main activities of interest

The artisanal fishery is not well developed and the industrial fishery is only moderately developed. However, steps have been taken to improve the situation, including the establishment of a Division of Marine Fisheries of the Central Agriculture Research Institute (CARI). There are plans for joint fishing ventures with the USSR and for an acoustic fisheries survey of the EEZ area through assistance from the French Government.

There is no organized training, and the "Mano River Union Marine Training Institute," established as a cooperative venture among Liberia, Guinea and Sierra Leona, is at or near collapse.

Monrovia is the main port of the country and there are plans to modernize and expand it. The other ports - Greenville, Harper and Buchanan - are also to be improved. The Masurado Fishing Company owns a boatyard for servicing small boats. There is a Maritime Affairs Commission responsible for regulating all maritime affairs including transport. Many shipping lines in the world use the Liberian "flag of convenience" by special agreement with the Liberian Government. There is some pollution arising from the iron industry and coastal erosion is a serious problem.

#### Ivory Coast

Luc Koffi  
Directeur General des  
Peches Maritime et Lagunaires  
Ministere de la Production Animale  
Rue des Pecheurs 19  
B.P.V. 19  
Abidjan

Comments: The ministry is effective and works well with the research establishment. Catch statistics are reliable. There are no reported foreign fleets, and much of the fishery is lagoonal.

#### Training in marine sciences

There are no specialized courses in marine sciences offered at the National University of the Ivory Coast and students are sent to foreign universities and other institutions, mostly in France. However, the Faculty of Science offers a course in

Hydrobiology as part of the program in Tropical Ecology whose main emphasis is freshwater biology.

### Research in marine sciences

The Government of Ivory Coast attaches high priority to the development of science and technology as a basis for economic advancement, and has set up an elaborate administrative machinery for the direction, execution and coordination of scientific research. There is a Ministry of Scientific Research with several research institutions under it.

The most important institution concerned with marine science research is the "Centre de Recherches Oceanographiques" (CRO) which was founded in 1959. The Centre is administered and managed through a cooperative arrangement with the "Office de la Recherche Scientifique et Technique d' Outre-Mer" (ORSTOM), which specializes in the development of scientific and technological research in developing countries. The French Government contributes financing to the research activities of the Centre, and there are 27 French scientists and 7 Ivorian scientists. Although, there is a concerted effort to train Ivory Coast scientists now, unlike in Senegal, ORSTOM has not trained native Ivorians. The research program is skewed towards fisheries development, but there is also some work in physical and biological oceanography. CRO participates in the training of local marine scientists by taking on postgraduate students from the national or overseas universities for the field work part of their research projects. In the 20 years prior to 1979, CRO staff published 392 papers.

The "Institut d'Ecologie Tropicale" (Institute of Tropical Ecology) in collaboration with the Faculty of Science of the University, carries out some limnological research.

There is also an Institute of Maritime Documentation, Research and Studies under the Ministry of Marine Affairs.

### Main activities of interest

The fishery resources of the country are not fully exploited. The government has an elaborate administrative machinery for the development of both artisanal and industrial fisheries. There is a Directorate of Marine and Lagoon Fisheries which is responsible for fishery statistics, fish handling, fishing technology, improvement of fishing boats and fishing gear, aquaculture and fishing cooperatives.

There is no training institution for higher level technicians and technologists, but proposals exist for the establishment of a Regional Academy of Marine Sciences and Technology in Abidjan to serve all the French-speaking West African countries.

The Port of Abidjan is one of the busiest and most efficient in West Africa and there are plans for its further

modernization and expansion. The country has two modern and competent shipping companies - the state-owned "Societe Ivoirienne de Transports Maritimes" (SITRAM) and the privately owned "Societe Ivoirienne de Navigation Maritime" (SINM), which handles about 40% of the country's shipping business. The Directorate of Hydrocarbons is responsible for the protection of the offshore oil fields and of the environment generally, but some of its duties have been transferred to the National Commission for the Environment.

#### Ghana

Victor N. Dowuona, Director  
Fisheries Department  
Ministry of Agriculture  
P.O. Box 630  
Accra

Comments: The Ministry is an unknown quantity especially during the current unstable conditions. There is no evidence of the ministry working with the laboratory experts. Statistics are adequate, although much of the catch is landed in Togo for hard currency. Ghanaian artisanal fishermen of the Fanti tribe are excellent fishermen and, when allowed, migrate to other countries.

#### Training in marine sciences

Although plans to establish an institute of marine science and oceanography at the University of Ghana in Accra or Cape Coast have not materialized, the University has been offering postgraduate studies in aquatic biology since 1974. There are no university programs in the areas of physical oceanography or marine geology and, consequently, there is a shortage of scientists with these specialties in the country.

#### Research in marine sciences

The principal institution engaged in marine science research in Ghana is the Research and Utilization Branch (RUB) (now possibly separated from the Fishery Department, Ministry of Agriculture). Research is fishery-oriented, although there have been some observations in physical and chemical oceanography and marine geology. RUB has good laboratory facilities at the port of Tema, and owns a modern, well-equipped research vessel - R.V. KAKADIAMA (180 tons, 29.2m), and two smaller vessels. The research sections of RUB have a staff of 32 including 5 scientists (all Ghanaians). Current research is in biological oceanography, hydrography, planktonology, stock assessment, fishery statistics and population dynamics.

Because of current economic and political problems, some of the cadre of good, British-trained scientists are leaving, and the work at Tema is deteriorating. The Institute of Aquatic Biology under the Council for Scientific and Industrial Research is mainly concerned with research in limnology but also carries out some marine science research.



There have also been some studies, sponsored by UNEP, on marine pollution and coastal erosion.

#### Main activities of interest

Both the artisanal and industrial fisheries are well developed. There is an infrastructure for the efficient exploitation of marine fishery resources, i.e., efficient and experienced fishermen, good fishing boats, factory ships and gear, large and efficient local fishing companies, a good fishing port (Tema), and onshore facilities for fish-handling and processing. Nearly all these activities are owned, operated, and managed by Ghanaians. The Ghana Nautical College provides practically all the training required at this level. There are no formal fishery or maritime schools for middle level personnel, but the Fisheries Department (Ministry of Agriculture) organizes vocational courses for its personnel.

There are several companies with boat yards and a large well equipped dry dock at Tema capable of handling large ocean-going vessels and claiming to be the best in West Africa. A deep-sea fishing harbor is to be constructed at Elmina and a smaller fishing port for the artisanal fishery at Mumford. There is an Environmental Protection Council.

#### Togo

Djelema Tchadre  
Directeur General  
Service des Peches  
Ministere de l'Amenagement Rural  
B.P. 1095  
Lome

Comments: In 1976, the Fisheries Service was structured as shown in the attached table of organization, and had a full time staff of fifty-nine.

#### Training and research in marine sciences

There are at present no institutions concerned with research or training in marine sciences in the country, but an oceanographic laboratory is under construction at Agbodrafo. The French are providing some help.

#### Main activities of interest

The fishery industry is underdeveloped and there is a shortage of manpower at all levels. There are no training institutions for technical personnel. A Department of Planning and Fisheries Protection under the Ministry of Rural Planning, and a Division of Marine Fisheries under the Ministry of Rural Development, are responsible for the development and administration of the country's fishery resources. Coastal erosion is a serious problem and there is some pollution in Lome

harbor arising from domestic sewage, oil spills and the phosphate industry.

Benin

Laurent Fagbohoun, Directeur  
Service des Peches  
Ministere des Fermes, de l'Elevage  
et de la Peches  
B.P. 457  
Cotonou

Comments: The fisheries service is not very effective, and scientific input is limited. Their lagoon fishery has the highest productivity in the world, and the catch statistics are reliable. Their shrimp fishery is presumably based on Nigerian stocks.

Training and research in marine sciences

There is a shortage of scientific manpower and there are no activities on training and research in marine sciences at present. However, with adequate staffing and equipment there are several institutions potentially capable of performing this role, including: The University of Benin; The Ministry of Higher Education and Scientific Research; The Ministry of Cattle Breeding, State Farms and Fisheries; and The Directorate of Fisheries.

Main activities of interest

The fishing industry is underdeveloped and there is an acute shortage of manpower. Nevertheless, Benin has the highest productivity in the world in lagoonal fisheries. There is a National Commission for the Environment one of whose responsibilities is to look into the very serious problem of coastal erosion. A Hydrographic Commission has been created to coordinate all activities concerned with the extension of the Cotonou port.

Nigeria

Director  
Federal Department of Fisheries  
Federal Ministry of Agriculture  
Victoria Island  
P.M.B. 12529  
Lagos

Comments: The Federal Department of Fisheries is reported to be professional, and well organized. (B.F.Dada was the director, but has recently joined FAO Fisheries as director of the latter's Planning Division.) The department is reported to have succumbed to political pressure in at least the reporting of catch statistics. The argument is presented that as a consequence of this event, there has been little demand for

scientific input, and, for this and other reasons, the productivity of NIOMR has declined sharply. Catch statistics are generally believed to be overstated by 200-300%.

### Training and research in marine sciences

There are several institutions carrying out training and research in marine sciences.

Nigerian Institute for Oceanography and Marine Research (NIOMR) is well planned and is housed in a complex of new and modern buildings providing ample office, laboratory and service space. The laboratories are well equipped for research work in fishery biology, chemical oceanography and marine pollution. Some of the facilities are incomplete. The Institute had a generous budget and the scientific staff establishment seemed adequate, but several vacancies went unfilled, some personnel were on study leave abroad, and now there is a severe budget crunch now. The best areas are biological oceanography, fisheries, and chemical oceanography. NIOMR supervises two training institutions:

-The Federal School of Fisheries situated next door to the Institute, which runs diploma courses in fisheries and fish technology, and orientation courses for fishermen.

-The African Regional Centre for Aquaculture at Port Harcourt has 40 students, and was opened in June 1980. It offers a one-year Diploma course in Aquaculture to marine scientists who would, after qualifying, return to their countries and organize teaching and research projects in aquaculture. The Centre also carries out research and field work to support its training program. The scientific staff includes 3 Nigerians and 4 expatriate FAO experts. NIOMR has three research/fishing boats, 21 meters, 15 meters, and 36 meters long. It has a library with holdings of 1,713 books, 5,244 periodicals, and 5,834 reprints. As noted elsewhere, the publication rate of the staff has decreased substantially and the research effort is beginning to stall.

Several universities in Nigeria have research and teaching programs in marine sciences:

-The University of Lagos offers a course in marine biology and fisheries as a component of the B.S. program in Biology. The University (Department of Biological Sciences) has a well equipped marine research unit, whose facilities are not being fully utilized due to a shortage of qualified staff. There are facilities for M.S. and Ph.D. research. Research focuses on bacterial and heavy metal pollution in the Lagos lagoon, and aquaculture.

-The University of Calabar has an Institute of Aquatic Sciences with 15 native scientists. It offers a course in fishery biology as a component of the B.Sc. in Fisheries Biology. There are also M.S. & Ph.D. programs in aquatic

sciences. Besides an impressive equipment list, the Institute staff has 4 publications in the last 4 years.

-The University of Port Harcourt runs an M.Sc. program in Hydrobiology and Fisheries.

#### Main activities of interest

The government is making great efforts to develop and modernize the fishing industry. The artisanal fishery is to be greatly expanded through the training of higher and middle level technical personnel, the strengthening of fishing research, the development of fishery cooperatives, and the provision of on-shore facilities for fish landing, handling and processing. Nigerian participation in industrial fisheries exploitation (at present largely in the hands of foreign companies) is to be increased through the encouragement of local private fishing companies and formation of state fishing enterprises. The establishment of aquaculture in the lagoon zone is also being emphasized. Training at the Federal Marine Training School, state fishery schools and the Nigerian Nautical college are to be expanded and their capacities greatly increased so as to satisfy the country's need for such manpower.

All the main ports of the country - Lagos, Calabar, Warri and Port Harcourt - are being expanded and modernized, and several new, small harbors for fishing and other industries are being established. It is planned to establish a big ocean terminal complex capable of handling large container ships. Plans exist to expand and improve the boatyard facilities of the country which will include the manufacture of fishing equipment. Three large dry docks, capable of handling large ocean-going vessels, are to be established at Lagos, Buruti and Port Harcourt.

There is a Directorate of Environmental Planning and Protection which looks after all environmental matters. The government has made it mandatory for all future development projects to include an environmental protection component in their investment plans.

#### Cameroon

Godlieb Mbome Moukia  
Directeur des Peches  
Ministere de l'Elevage et des  
Industries Animales  
Yaounde

Comments: The ministry works well with its scientific sources, and catch statistics are reasonably accurate.

#### Training and research in marine sciences

There are at present no activities concerned with high level training or research in marine sciences. However, the

Faculty of Science of the University of Cameroon, with the cooperation of the University of Bordeaux I and a few other French institutions, has established an institute of marine sciences at Limbe.

#### Main activities of interest

There is an acute shortage of manpower, and the marine resources of the country are not well developed. The fishery resources make an insignificant contribution to the country's economy. These resources are believed to be larger than those stated in the literature, the coastal biotope resembling that off Mississippi.

#### Equatorial Guinea

Pedro Bayeme  
Deputy Director for  
Livestock and Fisheries  
Ministry of Agriculture  
Malabo

Comments: Fisheries is under the Technical Directorate of this ministry, and consequently suffers some neglect. Data collection, marketing assistance, and financial assistance are deficient.

The artisanal fishery is underdeveloped and not well organized, but steps are being taken to reorganize and improve its performance with the assistance of the EEC and the French Government. There was a joint venture with the USSR for the management and running of the industrial fishery, but this arrangement came to an end in 1979. There are two small harbors (Malabo and Bata), and there are plans to double their present capacities.

#### Sao Tome et Principe

Arlindo Braganca Gomez, Minister  
Ministry of Agriculture and  
Fishing  
Sao Tome

Comments: None

#### Training and Research in marine sciences

There are no activities in marine science training or research in the country.

#### Main activities of interest

Both the artisanal and industrial fisheries are underdeveloped and their exploitation is said to be far below the potential. The artisanal fishery uses mostly primitive fishing methods and the industrial fishery consists of three boats, using hook and line.

## Gabon

Mathieu Ndong  
Directeur des Peches  
Ministere des Eaux et Forets  
B.P. 1128,  
Libreville

Comments: The Office of Fisheries issues licenses, promulgates regulations, and irregularly publishes an annual report. The office does not have scientific backup, and its main concern, probably ineffective at that, is tuna. Gabon is the tuna center for West Africa. Tuna statistics are excellent, but other statistics are poor.

### Training and research in marine sciences

Although there are not as yet any concrete programs concerning training and research in marine sciences, the country is conscious of the importance of science and technology in economic development and has set up the necessary machinery to look after the development of scientific research and training in the way of:

- a national university - the Omar Bongo University,
- a National Anti-Pollution Centre, and
- a Directorate for Scientific Research and Environmental Protection

### Main activities of interest

The artisanal fishery is mostly being run by outsiders with little participation of the local people. There is an industrial fishery with modern fishing vessels exploiting the rich fishery resources of the country but there is much room for improvement.

## Congo

Baptême-François Ndounga  
Directeur General de la Peche  
Maritime  
Ministere de l'Industrie et de la Peche  
B.P. 2117  
Brazzaville

Comments: There is little interest in marine fisheries, but the statistics are excellent.

### Training and research in marine sciences

There are no training institutions for marine scientists in the country and the only institution which carries out marine science research is the "Centre ORSTOM de Pointe Noire." The Centre is run by 8 French scientists with two Congolese on the scientific staff, and research includes circulation, hydroclimate, plankton ecology and population dynamics.

### Main activities of interest

The exploitation of marine fisheries is carried out by foreign fishing companies under license, some in partnership with the government. Due to the short coastline, most of these companies fish in the waters of neighboring countries (Angola and Gabon). The artisanal fishery, which is not well organized, is based on the freshwater fisheries of the Congo River. Most of the information about marine fisheries (including data) is kept at the Oceanographic Research Station, ORSTOM at Pointe Noire.

There is a Directorate of Environment under the Ministry of Public Works, supposedly by responsible for all matters pertaining to environmental protection, including marine pollution. There is currently little or no organized activity. Here too one finds a serious shortage of trained manpower.

#### Zaire

State Commissioner Kamitatu Massamba  
Department of Agriculture, Rural Development  
and Environment  
B.P. 8722  
Kinshasa

Comments: Little can be reported, but most of their efforts are in inland fisheries. Catch statistics are reliable.

### Training and research in marine sciences

At present there are no important research or training activities in marine sciences. There is a great shortage of trained manpower. A very short coastline and abundant other resources - minerals and agriculture products - contribute to a disinterest in marine resources. There is a Belgian-owned fishing fleet whose operations are centered mainly on the rich fisheries of Angola.

#### Angola

Emílio Jose Guerra de Carvalho  
Minister of Fisheries  
Luande

Comments: The Ministry of Fisheries has a large, sophisticated structure, which seems to operate well, and utilizes the data provided by their scientific establishment. The catch statistics are reliable.

#### Training and research in marine sciences

The Department of Biology of the Faculty of Science of the University of Angola offers a one-year curriculum in Aquatic Ecology which incorporates some courses in marine sciences. The main research orientation of the faculty is plankton ecology.

The Centro de Investigações Pesqueiras has been revived and carries out research in fisheries and oceanography. Under a SIDA assistance project, the research vessel of the Centro, GOA (36m), is being recommissioned and short and long-term consultants have been provided to assist in research execution and planning.

#### Main activities of interest

The fishing industry is not well developed; the rich resources are at present being exploited by foreign fishing fleets. With the assistances of SIDA, a school of fisheries is to be established at Cacuaco near Luanda. The SIDA project includes the construction of ferrocement fishing boats.

The main harbors of the country are Cabinda, Lobito, Laauanda and Mocamedes. There have been some marine pollution studies and Angola is included in the UNEP Action Plan for the West African Region.



**APPENDIX E**

**SPECIAL CONTACTS**

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**APPENDIX F**

**ELEMENTARY ECONOMICS OF FISHERIES  
MANAGEMENT AND DEVELOPMENT**

Fisheries development and fisheries management share the same basic goal: to increase the benefits derived from exploiting fishery resources. What constitutes benefits varies from region to region, country to country, and fishery to fishery. In West Africa, benefits are often stated in terms of additions to production and food supplies, foreign exchange earned or saved, and increases in employment and incomes.

Fisheries development and fisheries management differ in the means by which each attempts to increase benefits, and in the nature and extent of benefits each produces. For example, fisheries development projects often infuse new technology to increase "fishing power" (the ability to harvest a stock of a given size) and thereby increase production. In contrast, fisheries management programs often constrain technology (e.g., by prohibiting or limiting the use of certain gear) to "protect" a stock, and thereby assure continued and, possibly, increased production.

Are fisheries development and fisheries management incompatible? Under what conditions is development (management) appropriate? Why introduce new technology if it must be constrained? The answers to these, and related questions, are in the following, oversimplified analysis.

Some elementary economic concepts. The analysis of production and markets draws heavily on the concepts of supply and demand. In Figure 1, we have drawn the commonly used scissors diagram where OS is the supply curve of an unspecified commodity (soya, wheat or sorghum), and DE is the demand curve. The quantity produced and the price at which the commodity is exchanged in this hypothetical case is where the supply curve intersects the demand curve (at A in Figure 1). That is, OQ is the quantity produced and exchanged, and OP is the price per unit.

Under certain conditions we can measure economic benefits by the area ODA. The lower portion of this area, OPA, represents the benefits to producers (say, farmers) and the upper portion represents the benefits to consumers and other down-stream users (e.g., processors, wholesalers and retailers).

In this situation, the effects of a development project can be represented by shifting the demand curve (DE) up, or the supply curve (OS) down, or both. The result is a larger area representing benefits (not shown), with greater economic benefits accruing to all groups (producers, consumers and other downstream users).

Elementary fisheries economics. The scissors diagram (Figure 1) must be modified in order to apply the concepts of supply and demand to fisheries production and markets. The principal modification must be made on the supply side. For the fishery, we distinguish between short-run and long-run supply schedules. Short-run supply schedules exist for given fish

stock sizes. For example, in Figure 2 the short-run supply curve, MSS, is drawn for a larger stock size than is the short-run supply curve, NSS'. This illustrates the commonsense idea that, at a given price, more fish will be caught with a greater stock abundance.

Since fish are a replenishable (or renewable) resource, not all production rates for a given stock size (and a given short-run supply curve) can be sustained for each stock size. The long-run supply curve, RS, in Figure 2, connects the sustainable points on all of the short-run supply curves. Points on the upper portions of RS, the long-run supply curve, correspond to small stock sizes, and points on the lower portions to large stock sizes. The maximum sustainable yield (MSY) is that catch rate where the long-run supply curve begins to bend backwards.

Let us now look at measures of economic benefits accruing from exploiting a fishery. In Figure 3, we have added a demand curve, DE. The market and the resource system will come into equilibrium where the demand curve intersects the long-run supply curve. That is, the short-run supply curve will adjust to where it also cuts RS at A. In this simple context, economic benefits are measured by the area DAM, with the area PAM representing the benefits to fishermen, and the area DAP representing the benefits to consumers and other downstream users of the catch. Price and quantity caught are given by OP and OQ, respectively.

With a higher demand for fish, such as that represented by D'E' in Figure 3, equilibrium is reached at point B with a small stock size, high price, low catch rate, and, as drawn here, a low level of economic benefits (area D'BN).

The equilibrium solutions, A and B, (Figure 3) occur under open access, i.e., without an effective management program. (The lack of an effective management program does not always result in the open access solution, but that is a refinement that need not enter our present discussion.) Open access means that all who are willing and able to harvest the resource may do so; and effective management programs constrain fishing operations in various ways in order to attain a greater stock size than would otherwise result under open access.

#### Economics of fisheries management.

It can be shown that restraining fishing activity and thereby maintaining a larger-than-otherwise stock size will yield greater economic benefits than will an unrestrained open access fishery. The management trick is to cut back on catch rates (at least temporarily) to allow the fish stock to grow larger, and then keep catch rates consistent with the desired larger stock size. These results are illustrated in Figure 4, where the open access equilibrium solution is initially at A with catch rate Q and economic benefits DAN. Through a management program we assume a large stock size is maintained, shifting the short-run supply curve from NSS' to MSS. If

successful, the management program would keep catch rates at  $Q'$  (the new sustainable rate), generating benefits measured by the larger area DBCM. While admittedly oversimplified, this is one way by which fisheries management can bring about increased benefits to users of the resource.

The basic nature of the enforcement problem can be seen in Figure 4. Market forces tend to push the fishery to produce in the short-run out where the short-run supply schedule intersects the demand schedule, i.e., at point  $B'$ . If fishing is not controlled and kept at  $Q'$ , the stock will decline and, if left uncontrolled, the system will revert to point A. It should be clear that the greater the stock size the management program attempts to maintain, the further apart are points analogous to C and  $B'$ , and the greater the incentive for fishing firms to harvest above the prescribed catch rates. In this sense, we can say that more ambitious fisheries management programs require greater levels of enforcement and surveillance effort in order to achieve their objectives.

Economics of fisheries development. As with the general commodity case discussed above, we can represent the effects of development by shifting only the demand schedule up.

Before proceeding further, let us designate levels of exploitation in a fishery. A lightly exploited fishery is one which is at some point along the longer portion of the long-run supply schedule (i.e., at a relatively large stock size). A fully exploited fishery is in the neighborhood of MSY (where the long-run supply schedule begins to bend backwards). An overexploited fishery is at some point on the upper portion of the long-run supply schedule (i.e., at a relatively small stock size).

We begin the analysis of fisheries development with a lightly exploited fishery. In Figure 5, equilibrium is initially at A and benefits are given by the area DAM. To represent development we shift demand from DE to  $DE'$ . If the fish stock is slow to adjust, a short-run equilibrium emerges at C, yielding short-run benefits given by the area  $D'CM$ . Since catch rates at C cannot be sustained, the short-run supply schedule shifts up as the size of the fish stock declines, ultimately restoring long-run equilibrium at point B. The new level of benefits is given by the area  $D'BN$ . Under plausible conditions in the lightly exploited fishery represented here, level of economic benefits ex post development is greater than the ex ante level. Unlike the heavily exploited fishery (discussed next), the lightly exploited fishery requires no management program to preserve the benefits accruing from development. However, even in this lightly exploited fishery, effective management alone, or in conjunction with development, can increase benefits. That is management is not necessary for beneficial development, but is desirable to further enhance the benefits of development.

We consider next the case of a heavily exploited fishery,



represented in Figure 6. Initial equilibrium is at point A, and benefits are given by area D'E'. Development is represented by a shift in the demand schedule from DE to D'E'. If the fish stock adjusts slowly, temporary short-term benefits equal area D'CM. After the stocks fully adjust, the new short-run supply schedule is NSS', long-run equilibrium is at point B, and long-run benefits are given by area D'BN. Under plausible conditions in the overexploited fishery represented here, the level of benefits ex post development is less than the level of ex ante benefits. Without an effective management program, development is not desirable on economic grounds alone. In order to be economically desirable, development in an overexploited fishery must be combined with an effective management program. It can be shown that a small amount of management (i.e., restraint on production) may not be sufficient to prevent the erosion of the potential benefits from development. In this case, an effective management program of suitable size is required in order to realize development benefits. Development alone in an overexploited fishery is not desirable in the long run; the added benefits generated are only temporary and cannot be sustained without management controls.

Several caveats are in order for the results presented immediately above. First, the framework used here is strictly applicable to a fishery comprised solely of fishermen, intermediaries and consumers from a single country. In West Africa, many fisheries are exploited by fleets from several nations and the fish produced is traded in both domestic and international markets. While modifying the present framework would surely provide additional useful insights, the general tenor of the results, viz. development and management, should remain unchanged.

Second, no distinction is drawn between artisanal and industrial fishing operations, where significant conflicts are known to exist in the region. Again, similar results, viz. development and management, should apply when these details are accounted for.

Third, there are numerous other characteristics that should properly be considered. Among these are: transboundary stocks, migratory stocks, and biological interdependencies in multispecies fisheries.

Fourth, distributional effects of fisheries development and management have been ignored here. Both development and management can bring increased economic benefits to some and economic losses to others. Therefore, an overall assessment of development and management must properly consider the economic impacts on the various users of the fishery resource. Increasing overall benefits likely would not be desirable or acceptable if the benefits accrue to a few individuals and losses are imposed on several others in society.

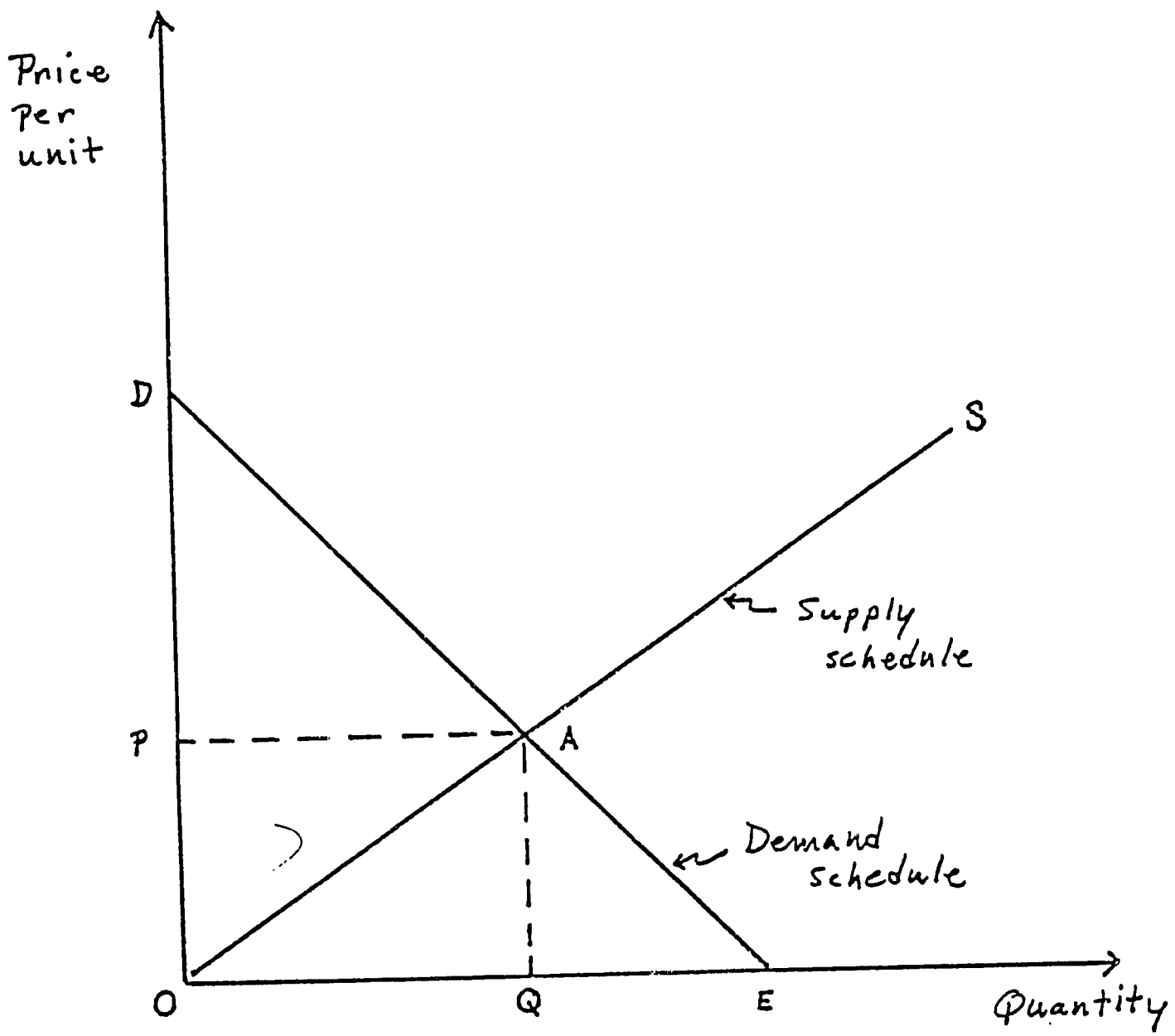


Figure 1

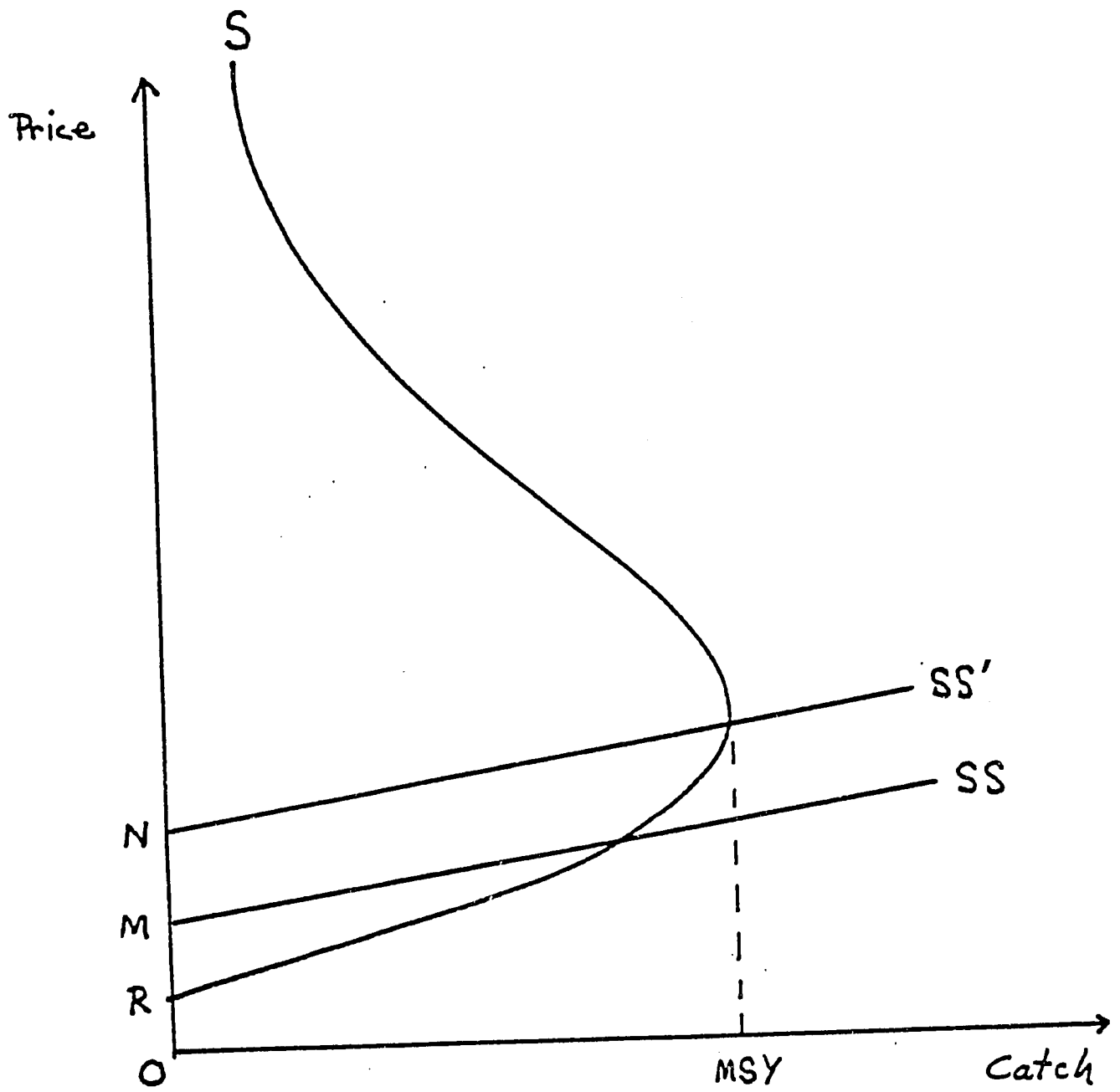


Figure 2

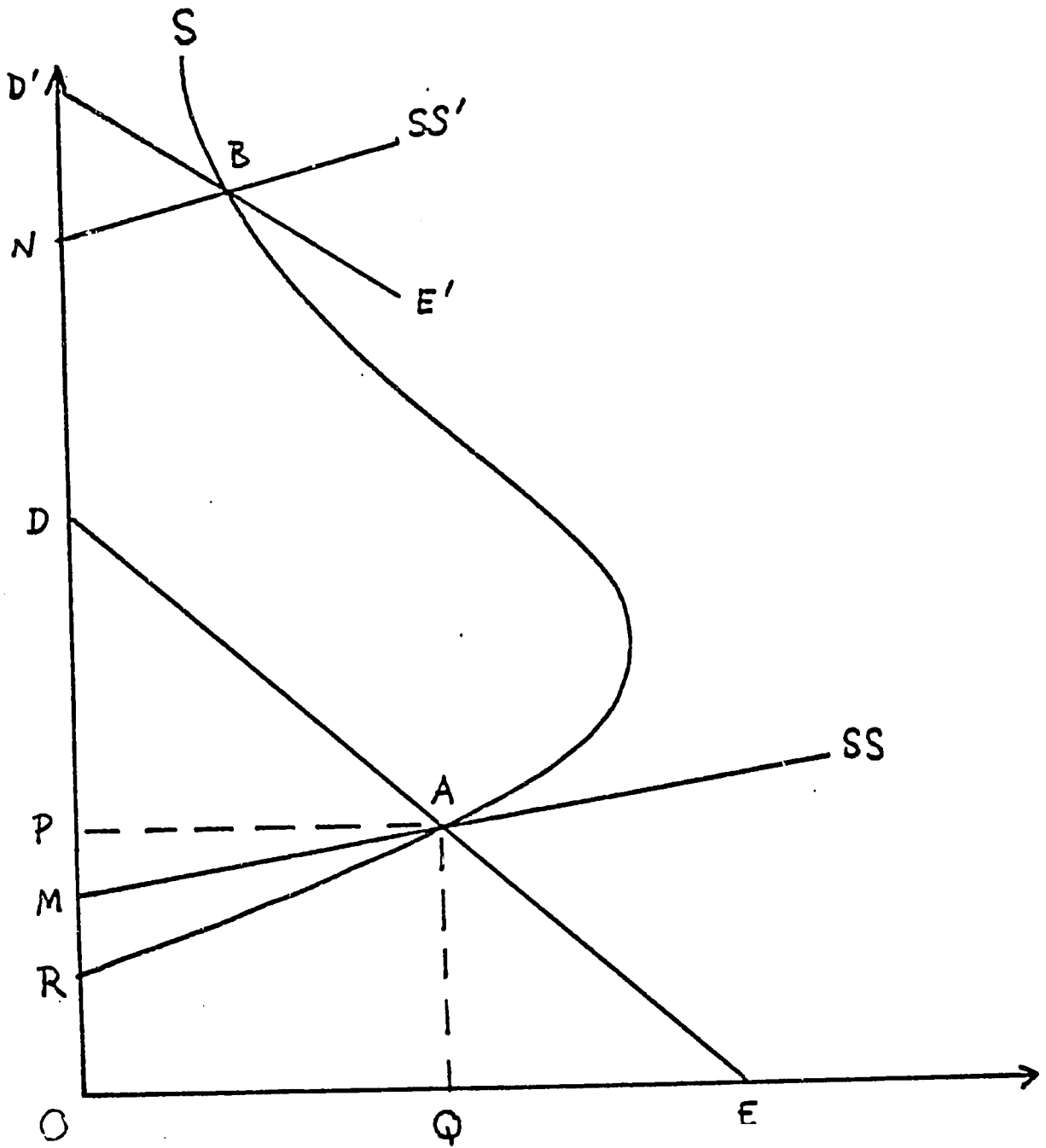


Figure 3.

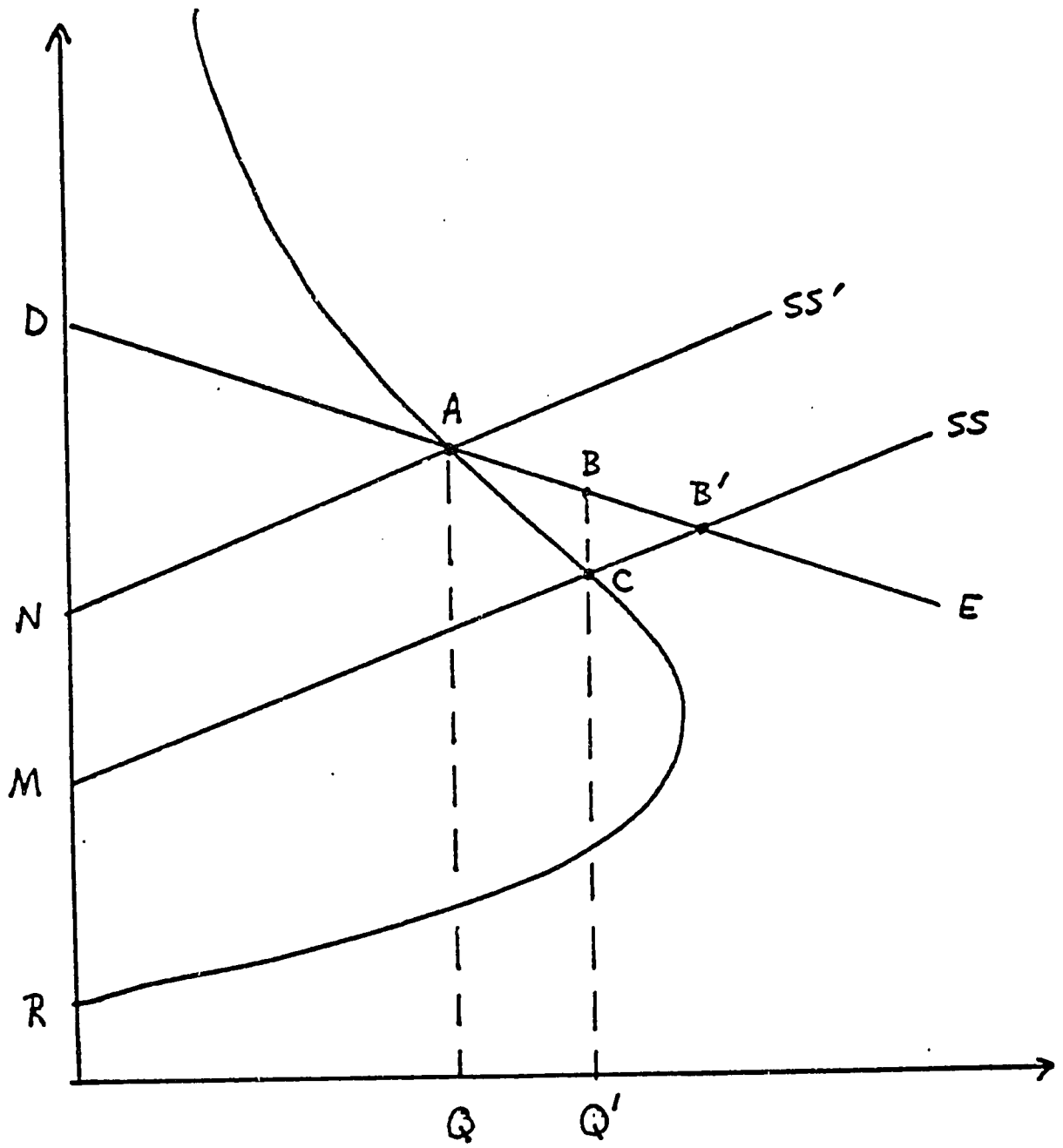


Figure 4

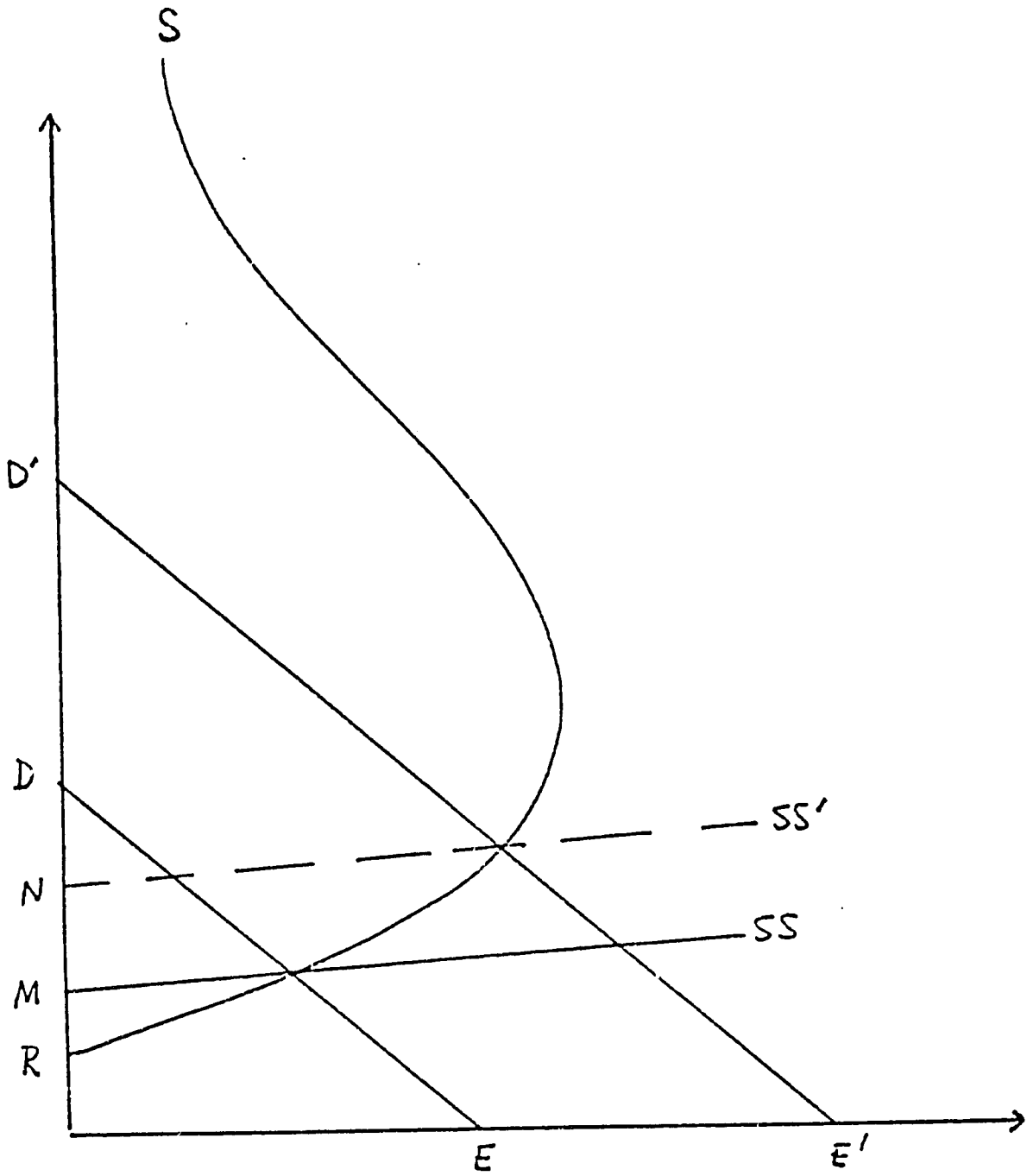


Figure 5

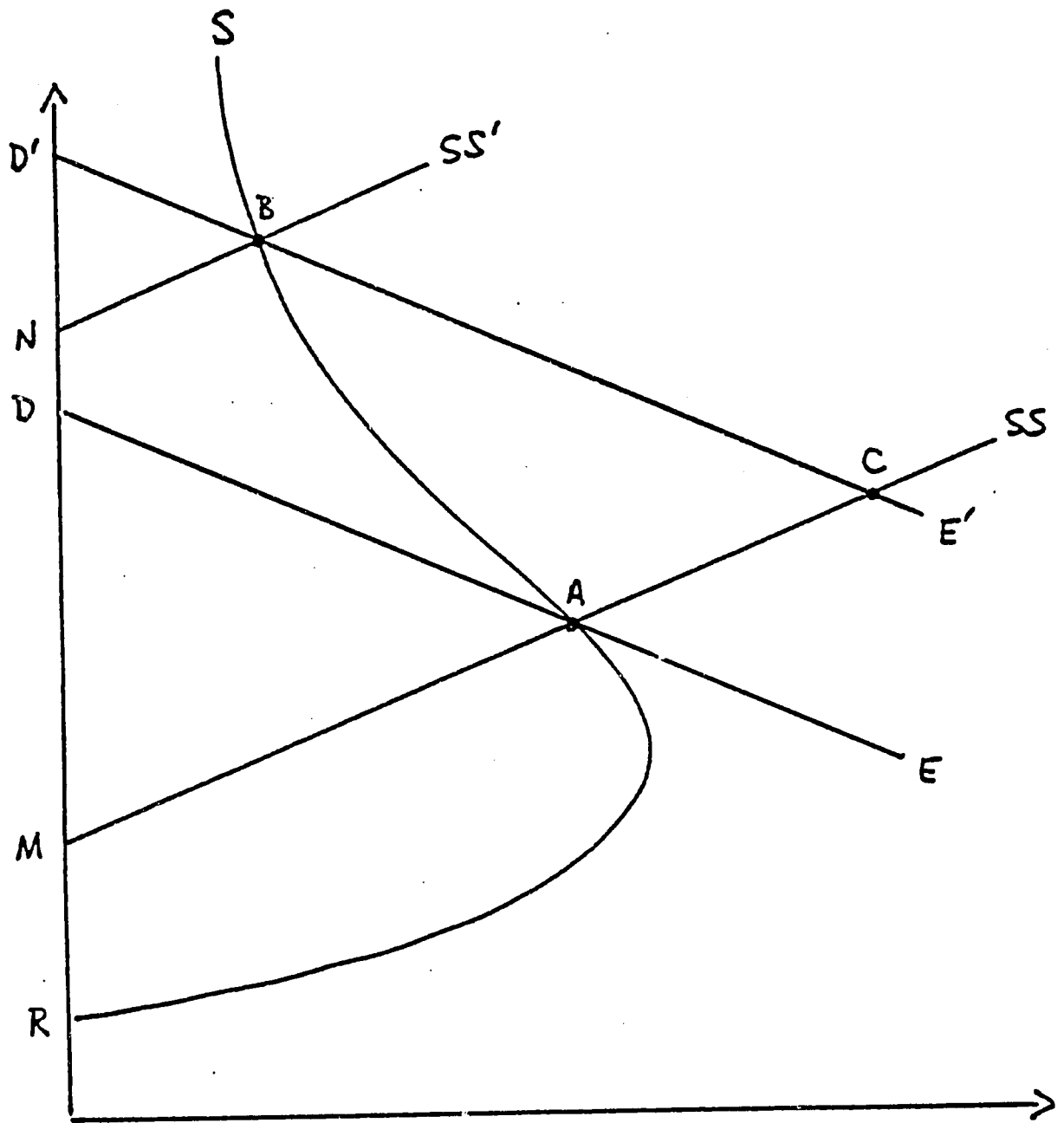


Figure 6