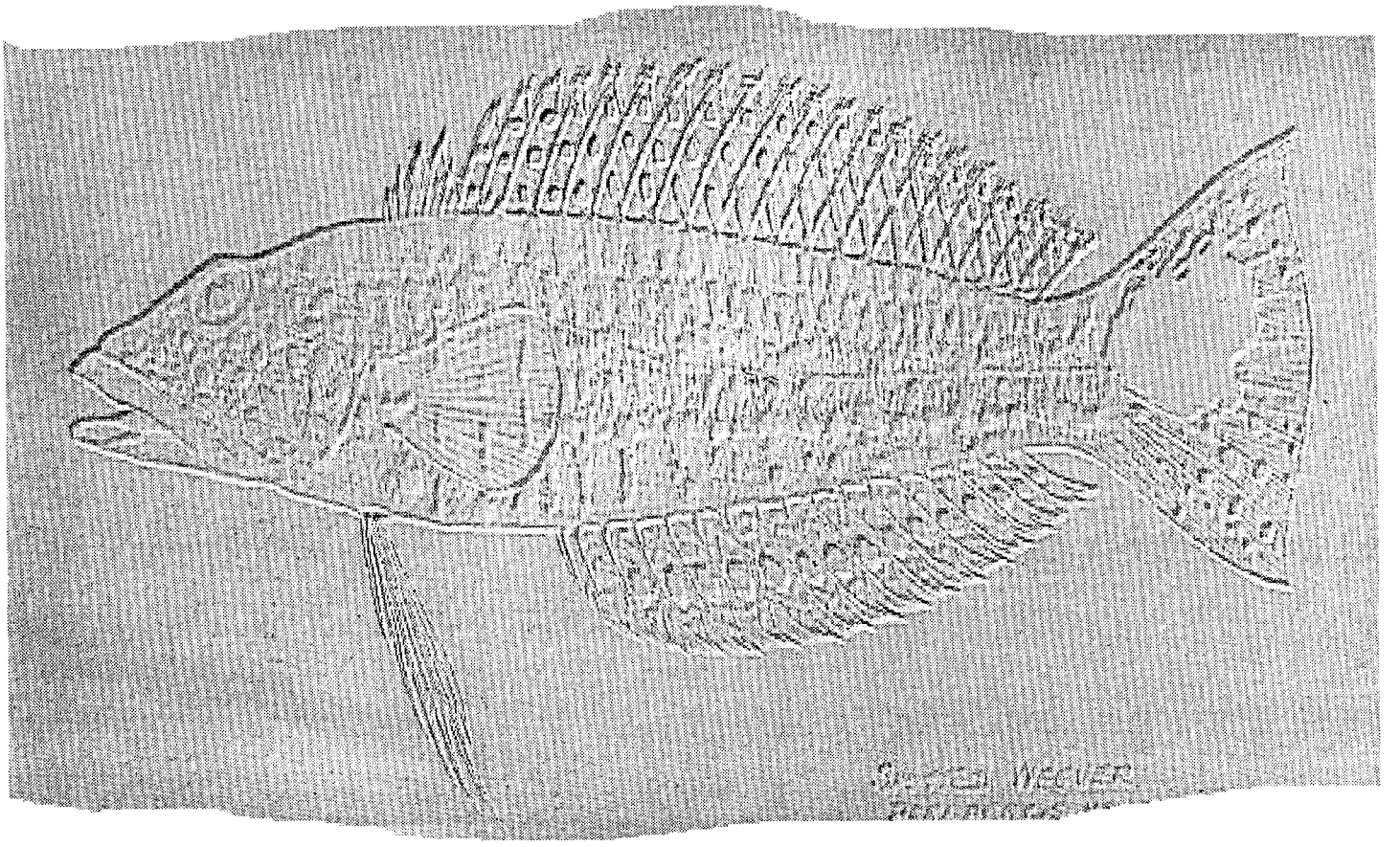
ICLARM

1996 Operational Plan



ICLARM

International Center for Living
Aquatic Resources Management

ICLARM 1996 OPERATIONAL PLAN

INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

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ICLARM ORGANIZATIONAL STATEMENT

"For those who use and depend on fish and other aquatic life in the developing world"

ICLARM's VISION

Our Goal: To enhance the well-being of present and future generations of poor people in the developing world through improved production, management and conservation of living aquatic resources.

Our Objectives: Through international research and related activities, and in partnership with national research government and nongovernment institutions, to:

1. Improve the biological, socioeconomic and institutional management mechanisms for sustainable use of aquatic resource systems.
2. Devise and improve production systems that will provide increasing yet sustainable yields.
3. Help develop the capacity of national partners to ensure sustainable development of aquatic resources.

The Functions of ICLARM are:

- multidisciplinary strategic research and policy analysis of an international public goods nature on all aspects of aquatic resource management, conservation and use;
- training and information activities;
- global knowledge bases for living aquatic resources;
- global reviews and assessments of the status of aquatic resources and their users;
- research publications;
- conferences, meetings and workshops to discuss aquatic resource issues and to formulate advice for users and other decision-makers;
- participation in the Consultative Group on International Agricultural Research (CGIAR) and in appropriate international intergovernmental activities.

The Guiding Principles for our Work Program are:

- Sustainability;
- Equity;
- Gender role in development;
- Participation;
- Systems approach;
- Anticipatory research.

Our Values:

In our work, we are committed to:

- excellence in achievement;
- relevance to our beneficiaries' needs;
- partnerships;
- center-wide team work;
- communication;
- efficiency and flexibility in program delivery;
- continual growth in our knowledge and understanding.

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FOREWORD

This report is ICLARM's second annual Operational Plan. The series began as an effort to provide partners, donors, decisionmakers and other interested stakeholders with a summary of the Center's planned activities for the coming year, together with an outline of progress made the previous year.

A new organizational structure for ICLARM took effect in January 1996. The aim is to spread the load of program development across more senior staff and to encourage greater interaction and participation in planning and review of work.

The Center moves this year from a two-program research structure to one of eight smaller programs. Two new offices - of External Relations and International Relations - support the programs. Details of the changes and their rationale are given in Annex I.

By midyear, ICLARM expects to welcome two new members to the senior management team. Recruitment began in January for a new position, Deputy Director General/Programs, and for a new Associate Director General/Corporate Services.

The decision by the participants in a meeting of ministers of agriculture from developed and developing countries and heads of aid agencies in Lucerne (February 1995) as well as by the Technical Advisory Committee of our parent system, the Consultative Group on International Agricultural Research, and other elements of that system to focus increased attention on aquatic resources, presents an opportunity for the Center to broaden its research agenda into significant areas that have been beyond our capacity to date. Among them are the projects in Africa and the broad West Asia–North Africa region identified for management out of the Abbassa facility, offered to ICLARM by the Government of Egypt.

MERYL J. WILLIAMS
DIRECTOR GENERAL

PROGRAM OVERVIEW

ICLARM's progress in 1995 and plans for 1996 are summarized here under the new program headings, i.e.:

- Biodiversity and Genetic Resources
- Germplasm Enhancement and Breeding
- Aquatic Environments
- Fisheries Resources Assessment and Management
- Integrated Aquaculture-Agriculture Systems
- Coastal Aquaculture and Stock Enhancement
- Policy Research and Impact Assessment
- Information and Training
- International Partnerships and Networks

Biodiversity and Genetic Resources. The major work in this field has been FishBase, a CD-ROM database of information on fish worldwide. To date it contains half a million records, for about 14 000 fish species in more than 1 000 data fields organized in 50 Tables. In 1996, it is expected that a project to distribute the database in 50 countries will begin; in addition to the database itself, hardware and training will also be given. A case study of conservation of fish genetic resources, using tilapias in Ghana, has identified genetic markers of the various species of tilapia and begun development of a field kit. The kit will be field-tested and a handbook for tilapia characterization will be published in 1996, when the project ends. A new collaborative thrust to develop methods for fish genetic resources research will begin in 1996. The project also seeks to assist other organizations concerned with these resources.

Germplasm Enhancement and Breeding. The genetic improvement of farmed tilapias (GIFT) project, which has shown that the process of documentation, evaluation and selective breeding can produce rapid genetic gain, continued selection work on growth and frequency of spawning in 1995.The activities also included expanded on-farm trials, training and an international workshop to develop strategies for future research and training. In 1996, further genotype-environment interaction trials will be made in various culture systems and the first generation of fish selected for both growth and spawning frequency will be bred. A comparison of GIFT strains and a popular Thai strain is currently being undertaken to determine the factors responsible for the GIFT fish's improved performance. By end of 1996, most of the results will be on hand.

Aquatic Environments. The backbone of this research area is the database ReefBase, of structured information on coral reefs and their resources. By end of 1995, some 5 700 reefs were included in a prototype CD-ROM. A beta-test version will be ready in early 1996 and when finalized, the database will be released and distributed through various fora. Designing for future versions will then begin. A project on coastal management training in the Philippine context ran successfully in 1995, in parallel with a more general cooperative project to develop standard management training packages in the country. In 1996, more training courses will be held, a Southeast Asian training

network will be established and a new curriculum, based on evaluation of the courses, will be provided. A new project in 1996 seeks to assess valuation techniques for coral reef systems, which should lead to a "valuation package" and training in its use in coastal management. A joint project to develop the "SIMCOAST" software for analysis of coastal transects was completed in November 1995. Transects summarizing issues, management interventions and sustainability indicators at previously studied ASEAN sites were also developed. A regional workshop to discuss the findings was held in Malaysia in September.

Fisheries Resources Assessment and Management. Several ICLARM software products were finalized during 1995 and others will be completed in 1996. The Center's new directions in this research area are evident in the publication in *Nature* (March 1995) on "Primary Production Required to Sustain Global Fisheries" and in plans to design research and training software on fish growth and population dynamics. The *Nature* article was based on the ECOPATH II program which will become a more dynamic model with enhanced predictive powers in 1996. A 5-year project to quantify the effect of a marine protected area on abundance of invertebrate resources in the Solomon Islands began its second year in October 1995. The chosen area was found through several surveys to be depleted and a robust sampling design for detecting future changes has been made. Surveys will continue in 1996 and beyond. Two new projects in this area begin in 1996 - a review of the status of Asian fish stocks that is expected to lead to a research program on their rehabilitation; and an expansion of work on marine protected areas in the Caribbean.

Integrated Aquaculture-Agriculture Systems. Work in this field has been continuous since 1991, with the aim of improving farm productivity through integration with fish farming and developing methods to assess sustainability of the systems. In 1995, field testing of the assessment procedures was completed; a beta version of the software used (RESTORE) was produced. The methods were discussed with farmers; cooperators were also helped to assess ways of integrating their resource types. In 1996 the main thrust is refinement of RESTORE and its application. In a related project, a number of sustainability indicators are being examined for their usefulness through simulation modeling. Models developed during 1995 will be refined in 1996. A specific model on rice-based agroecosystems has been developed during 1994-1995 and field data collected on four such agroecosystems. Further analyses using ECOPATH II remain to be done in 1996. A southern African research and development network is proposed to start in 1996. Meanwhile, on-farm and on-station research continued in Malaŵi on selection protocols for potential aquaculture species; on nutrient flow from ponds to gardens; on management of undrainable ponds; and on fish productivity.

A program of research and assistance in integrated farming in collaboration with national Bangladesh institutions has been in progress since 1993. In 1995, data for three crop years were consolidated and analyzed, while wide-ranging farmer-participatory studies in three rice ecosystems were made. Integrated rice-fish farms had higher rice yields as well as fish crops and used less fertilizers, pesticides and labor. Surveys showed that the practice is spreading and research on improving productivity of the fish is continuing. In 1996, specific guidelines for integration in the different ecoregions of Bangladesh will also be developed. A project to identify the most appropriate types of coalition between ICLARM and national agencies, using

Bangladesh as a case study, was completed in late 1995 and results will be available in 1996.

Coastal Aquaculture and Stock Enhancement. A three-year project began in 1995 with the aim of developing bioeconomic models of coastal aquaculture systems, especially of giant clam farming, to optimize farm design and marketing. Data on marketing and production will be forthcoming in 1996. The work complements ongoing biotechnical research, which in 1996 will publicize results to date to both researchers and farmers as well as continue solving remaining growout problems. Other ongoing projects related to the Indo-Pacific area are on development of rearing and farming methods of pearl oysters and sea cucumbers. During 1996, seed collecting operations for pearl oysters will be expanded, while spawning and rearing experiments on various sea cucumber species will be continued.

Policy Research and Impact Assesment. This is a relatively new area of endeavor for ICLARM. A global fisheries co-management project which seeks to provide internationally applicable co-management models, has held a number of workshops to develop co-management approaches, policies and training; undertaken analyses of management policies; developed a research framework for institutional analysis; and finalized a manual on rapid appraisal of management systems. In 1996, several case studies will be completed and pilot site co-management activities will commence. Work to strengthen socioeconomic aspects of aquaculture research in southern Vietnam was ongoing with several curriculum and training events held; four research projects are planned there in 1996. A new collaborative project in Bangladesh has been initiated, based on previous work - to develop a framework for equitable management and distribution of benefits, of that country's freshwater fisheries.

Evaluation of genetically improved tilapia is being carried out in four countries - Bangladesh, China, Thailand and Vietnam. Baseline profiles of tilapia farmers are being carried out as these countries prepare to introduce genetically improved tilapia. Post-adoption surveys are planned to evaluate the environmental and socioeconomic impact of the improved fish.

Information and Training. In the Information area, four monographs were published in addition to regular in-house publications. Much of the unit's time in 1995 was taken up in the preparation of material for meetings and for research papers. Staff held several communication workshops with those of related institutions around Manila; and one staff member completed her Ph.D. For 1996, an Information and Communication Strategy will be finalized and more attention will be given to public awareness as well as continued services to staff and interaction with other institutions. The role of the Program in training activities is yet to be decided upon.

The ICLARM library has maintained the pace of its growth. In addition to the databases already maintained, the Library began a long-term commitment to input abstracts to the Aquatic Sciences and Fisheries Abstracts database and released a prototype *Union Catalogue of Fisheries Serials in Asia* towards the end of 1995. The Library will make its databases and catalogues available to Internet users in 1996.

International Partnerships and Networks. In the Asian Fisheries Social Science Research Network, three new research projects were approved and reports of several previous projects were finalized. Three training courses were held during the year as well as a special session on social sciences during the Fourth Asian Fisheries Forum. Further training courses, workshops and project reports are scheduled in 1996.

The two information networks, of tropical fisheries and tropical aquaculture scientists, respectively, continued to attract new members and articles for publication in *Naga*. From 1996, both networks fall under new editorship as a result of the new organizational structure.

System-Wide Initiatives. The Consultative Group on International Agricultural Research (CGIAR) currently has two programs which include most of the Centers, including ICLARM: the System-Wide Genetic Resources Program and the System-Wide Information Network on Genetic Resources. A Coastal Environments Initiative, which would bring together the strengths of several CGIAR centers to bear on alleviating the effects of agricultural practices on coastal environments, has been proposed by ICLARM.

Corporate Services. Corporate Services intend to focus efforts in 1996 on continuing the development and implementation of management systems that would have a significant impact on the Center's efficiency, effectivity and accountability. Priorities for 1996 include the finalization of the implementing guidelines for project management, budget management, travel, purchasing and a revised salary administration system. The system improvements achieved in 1995 in the area of financial management and reporting have already begun to pay-off in terms of improved services and management control from the Finance and Management Information and Projects Administration Units. Further improvements in services, particularly to the Center's outreach offices, are expected as the various management system components fall into place and as the upgraded Platinum-based accounting system is made operational. Emphasis will also therefore be placed on integrating HQ management systems with those of the various outreach offices.

External Relations. This is a newly created office to help management and staff with fund-raising, CGIAR and donor relations. During 1996, a number of activities are planned which should ultimately improve ICLARM's participation in the CGIAR system and also relations with donors.

HOW DO WE SCORE AGAINST OUR GUIDING PRINCIPLES?

In an effort to show how each of our program activities measures against each of the guiding principles, the leader of each activity has given a rating, either H = high, M = medium, L = low or N/A = not applicable.

OUR INTERPRETATION OF EACH PRINCIPLE IS:

Sustainability: if successful, the result of the activity will lead to a more ecologically sustainable resource system and/or more economically sustainable system, taking a long-term perspective which respects the right of future generations.

Equity: the results of the activity will assist a more even distribution of benefits either through directly helping those who are presently disadvantaged or through allowing equal access to use of new results and technologies. Both producers and consumers are to be considered.

Gender: the extent to which the activity considers gender issues and seeks to ensure that women's and men's needs are met.

Participation: the extent to which eventual beneficiaries and our partners and their views and needs are included in priority setting, planning and implementation of the activities.

Systems approach: the extent to which the activity incorporates or takes into account the ecosystem, social and geopolitical context within which the activity is set.

Anticipatory research: the extent to which the activity is designed to anticipate the consequences of its outcomes, takes steps to alleviate or minimize potential negative consequences, and overcomes obstacles to the adoption of its results.

THE PROGRAMS

1. BIODIVERSITY AND GENETIC RESOURCES

1.1. DEVELOPMENT OF A BIOLOGICAL DATABASE ON FISH (FISHBASE)

ICLARM Staff	:	Dr. Rainer Froese (Project Leader), Dr. Maria Lourdes D. Palomares, Ms. Susan M. Luna (left in May 1995), Ms. Crispina B. Binohlan, Ms. Armi G. Torres, Ms. Liza Q. Agustin (left in Feb. 95), Ms. Pascualita T. Sa-a, Ms. Emily DC. Capuli, Mr. Rodolfo B. Reyes, Mr. Roberto N. Cada, Ms. Rachel Atanacio (part-time), Ms. Portia N. Bonilla, Ms. Cristina V. Garilao (replacement for Susan M. Luna), Ms. Christine V. Casal (part-time).
Collaborating Institutions	:	FAO; American Fisheries Society (AFS); International Game Fish Association; World Conservation Monitoring Center; Musée Royal de l'Afrique Centrale; Musée National d'Histoire Naturelle; Zoologisches Institut und Zoologisches Museum, Hamburg; Marine Resources Assessment Group (MRAG), London; EPOMEX, Universidad Autonoma de Campeche, Mexico; University of British Columbia, Canada; and several other institutions and individual researchers.
Donor	:	EU, ICLARM core funds
Duration	:	October 1988 to September 1995 (followed by permanent core support); EU-funded FishBase distribution project expected to start in early 1996.

Objective

- To facilitate the sustainable use and conservation of fish biodiversity by making scientific information readily accessible through a computerized encyclopedia of key information.

Background and Justification

FishBase contains key information on fish populations such as nomenclature, ecology, population dynamics, aquaculture, genetics, physiology and occurrence of fishes. It was conceived as a "tool" to assist fisheries researchers and managers to understand and manage better their natural resources.

FishBase was designed to provide information on a very wide range of topics pertaining to the fishes in a given country. These include the current scientific name and classification, the international (FAO, AFS, FishBase) common name, its global commercial importance, and key information on life history, population dynamics, physiology, etc. It contains more than 1 000 data fields organized in 50 tables with altogether half a million records. More than 200 procedures access this information and create a variety of outputs.

FishBase makes use of published literature (e.g., journal articles, technical reports, theses, etc.) and recent revisions of fish species or families.

The CD-ROM version of FishBase is distributed at nominal cost to fisheries institutions worldwide. Special emphasis is given to developing countries, some of which will be supported in purchasing the necessary hardware and receive training on how to use FishBase and related analytical tools.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	N/A
5.	Systems approach	M
6.	Anticipatory research	H

1995 Results

By the end of 1995, the FishBase team has incorporated about 14 000 species extracted from more than 9 000 references.

Several new routines increase the usefulness of FishBase:

- The **FishWatcher** routine creates a personal or institutional database on where, when, and how users have seen, caught, or acquired what fish. This is meant to turn FishBase from a *passive* information providing system into an *active* reporting tool for researchers, divers, anglers, aquarists, small museums, reserves, public aquaria, fisheries projects, etc. Basically users can enter, update, and print all information that is relevant to the collection of fish. They can also attach their own digitized pictures. At the same time all information that FishBase holds on these species—including maps and pictures—is only a mouse-click away.

- The **National Checklist** routine creates a national fish database for any country. This table is meant to enable fisheries and biodiversity managers to maintain their own database on habitats, abundance, uses, regulations, etc., for the fishes in their country. Again, complementary FishBase information is only a mouse-click away.

- Several new routines are aimed at taxonomists to assist them in checking scientific names and keeping track of nomenclatural changes.

A major event in 1995 was an FAO-ICLARM-MSI-NORAD workshop on the new FAO Field Guide for the Western Central Pacific, which exposed FishBase to peer review by more than 50 taxonomists. Overall, the experts gave FishBase very positive ratings and volunteered to help us to fill gaps and to get access to relevant publications.

The FishBase Team finalized the transition from DataEase to MS Access as underlying database software. Also, 130 copies of FishBase 1.0 were produced and distributed on CD-ROM in April 1995, and 1 000 copies of FishBase 1.2 in October 1995.

Expected Outputs in 1996

- In early 1996, a major EC-funded project is expected, which will distribute FishBase with hardware and training to about 50 countries in Africa, the Caribbean, and the Pacific Islands. The project will allow FishBase to expand to include all fishes of these countries, to assign them to ecosystems, and to improve FishBase's usefulness for biodiversity studies. It will assist the countries to create and maintain their own fish biodiversity databases.

- Together with IUCN a project to include all freshwater fishes in FishBase and to determine their status of threat, according to a new set of criteria that has been developed by IUCN, will begin.

- By the end of 1996 another update of FishBase will be produced for wide distribution to collaborators and other users.

1.2. Research on the Tilapia Genetic Resources of Ghana for Their Future Conservation and Management in Fisheries and Aquaculture

ICLARM Staff	:	Dr. Roger S.V. Pullin (Project Leader), Ms. Christine Marie V. Casal
Collaborating Institutions	:	The Institute of Aquatic Biology, Accra, Ghana; the Zoologisches Institut und Zoologisches Museum, Universität Hamburg (UH), Germany
Donor	:	BMZ/GTZ
Duration	:	1991 - June 1996

Objectives

- To determine the status of the tilapia genetic resources of Ghana with a view to future conservation of their biodiversity and their management

- To demonstrate the use of appropriate methods for such documentation in tropical developing countries

- To analyze and interpret all information gained so as to formulate guidelines for the management of fish genetic resources in Ghana and a national breeding program to develop inland aquaculture and to publish these in a form appropriate for use by policymakers, scientists and extension organizations

- To compile information on and to evaluate the biochemical and immunological markers of indigenous economically important tilapias obtained previously during the project

- To publish a biochemical key to the identification of tilapia species and populations in Ghana and possibly neighboring countries

- To develop an immunological test kit for tilapia species identification, comparable to the human ABO blood test group, but using monoclonal antibodies

- To strengthen the capabilities of IAB and Ghanaian scientists and administrators in fish genetic resources research and management

- To disseminate the results widely by means of workshops and publications.

Background and Justification

Many African countries are seeking to develop their fisheries and aquaculture to improve the livelihood of rural people and to provide their growing rural and urban populations with more animal protein. The genetic resources of African fish are of major importance in these efforts towards sustainable development. In this proposal, Ghana, with its fast-growing population, is taken as an example of this situation, from which lessons can be learned that are applicable in other African countries.

Ghana currently produces annually about 308 000 t of fish from all capture fisheries including about 55 000 t from the Volta Lake and 1 150 t from reservoirs. There may be some scope for growth in inland fisheries but the marine fisheries are judged to be already exploited at the maximum sustainable levels. Fish production from aquaculture in Ghana is currently only about 330 t/year. The extent of freshwater and brackishwater sites in Ghana (lakes, reservoirs, lagoons and farm ponds) suggests that inland aquaculture has considerable scope for growth. This is also indicated by land/water capability studies undertaken by FAO.

The tilapia (genera *Oreochromis, Sarotherodon* and *Tilapia*) are the most important fishes for future aquaculture development in Ghana and throughout Africa. Currently the tilapia stocks in Ghana are considered to be "pure" and of great importance to tilapia culture worldwide.

This project complements the activities of Ghanaian institutions in the ICLARM-coordinated International Network on Genetics in Aquaculture (INGA) of which Ghana is a founder member.

Scores Against Principles

1.	Sustainability	H
2.	Equity	N/A
3.	Gender	M
4.	Participation	L
5.	Systems approach	L
6.	Anticipatory research	H

1995 Results

Activities aimed at developing field serological techniques for identifying tilapia pure species and hybrids, were continued. Genetic markers for tilapia species (in Ghana) were identified using agglutination assays of erythrocytes, using lectins, allozyme electrophoresis of muscle proteins, polyacrylamide gel electrophoresis (PAGE) of general muscle proteins and parvalbumins and isoelectric focusing of proteins. These tests yielded genetic markers for groups of species and individual species.

Research work on monoclonal antibodies and the biochemical key for genetic characterization of Ghanaian tilapias, based on blood, hemoglobin, erythrocyte membranes and leucocytes were continued. Testing of the biochemical key and development of a field kit for tilapia characterization were also part of the research activities.

Work on a technical handbook for tilapia characterization for use by national researchers is underway. Procedures for morphological and biochemical characterization are being compiled and entered into a reference database (in Microsoft Access). Organization of the African regional workshop planned for 1996 was started.

Expected Outputs in 1996

- Continued work on monoclonal antibodies and a biochemical key for genetic characterization of Ghanaian tilapias, based on blood, hemoglobins, erythrocyte membranes and, subject to exploratory results, leucocytes.
- Commencement of testing of the biochemical key and development of a field kit for tilapia characterization.
- An African regional workshop and publication of its proceedings.
- Publication of a technical handbook for tilapia characterization for assisting national researchers.
- Proposals for support for further projects on tilapia biodiversity.

1.3. Conservation of Fish Genetic Resources and Aquatic Biodiversity through Sustainable Use

ICLARM Staff	:	Dr. Roger S.V. Pullin (Project Leader), Dr. John Munro, Dr. Rainer Froese, Ms. Christine Marie V. Casal; others to be determined.
Collaborating Institutions	:	To be determined; will probably include: other international institutions, especially IPGRI and CIFOR; IUCN; WCMC; the World Bank; Wetlands International; the ODA Genetics Program (UK); the University of Hamburg; national institutions and NGOs, especially those of INGA member countries.
Donor	:	Not yet funded (CGIAR/SGRI start-up funds anticipated for 1996).
Duration	:	To be determined

Objectives

- To pursue strategic research on fish genetic resources (FiGR) and the development of FiGR research methods (including those based on molecular genetics), in partnership with national, international and regional agencies and institutions, NGOs, farmers and fishers, through proposals to appropriate donors
- To contribute to the meetings and the still evolving mechanisms of the Convention on Biological Diversity (CBD) including its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) and Clearing House Mechanism (CHM)
- To assist the work of organizations concerned with the conservation and sustainable use of FiGR including the CBD/SBSTTA and CHM, FAO and IUCN
- To expand the services of ICLARM and its partners to the developing regions in the provision of information on FiGR for research, policymaking, natural resources management, education and public awareness through biological databases, such as FishBase, publications and responses to specific needs, and by contributing to inputs to the CGIAR's System-Wide Genetic Resources Program (SGRP) and System-Wide Information Network on Genetic Resources (SINGER)
- To assist the members of the networks of NARS that are coordinated by ICLARM, especially the INGA, on FiGR research, training, information and policy issues
- To develop, in partnership with national and other institutions, ICLARM's training activities in FiGR; concentrating on the research areas, methods and information technology for which the Center and its partners have a comparative advantage

- To manage the limited *ex-situ* collections of aquatic germplasm that are held in trust by ICLARM and its partners for research purposes and to develop policies and mechanisms for dissemination of such germplasm, in collaboration with research partners, other potential users and FAO, as the body that will be keeping under its auspices all designated germplasm held in CGIAR centers.

Background and Justification

ICLARM is the only center within the Consultative Group on International Agricultural Research (CGIAR) that works on living aquatic resources. ICLARM concentrates on systems research for natural resources management and regards fish genetic resources (FiGR) as vital for the sustainability of systems supplying human needs for food fish. The term 'fish genetic resources ' (FiGR), as used here, includes finfish, crustaceans, molluscs and other aquatic animals exploited by humans, but not aquatic plants.

ICLARM's current FiGR research, training and information activities contribute to the SGRP. These activities, like those of the entire SGRP, deal with the characterization, documentation, evaluation and conservation of genetic resources; but do not include breeding and genetic improvement activities.

For most of the CGIAR centers, SGRP activities comprise *ex situ* genebanks, germplasm distribution and related activities, including some research for *in situ* conservation (e.g., for wild relatives of crop plants). Most centers have organized these activities as Genetic Resources Divisions (GRDs). ICLARM and the CGIAR Center for International Forestry Research (CIFOR) - which, like ICLARM, pursues natural resources research - do not have GRDs. As recommended by the 1993 Stripe Study of Genetic Resources in the CGIAR, ICLARM will not develop large *ex-situ* fish genebanks or become a major distributor of fish germplasm. It will rather concentrate on strategic research, training and information for natural resources management. For FiGR this means principally sustainable use, minimizing adverse environmental and social impacts, and *in situ* conservation.

FiGR are of great importance for fisheries and aquaculture because they are themselves usually the sources of seed, harvested products, or both. The diversity of exploited aquatic organisms is high: of the 24 600 finfish species described, over 5 000 are used by humans. Other exploited aquatic animals total several hundred more species and many, perhaps thousands more, have potential uses. One constraint to using FiGR sustainably and to realizing the potential of new species is that, apart from finfish, the taxonomy of most aquatic animal groups is not precise and intraspecific genetic variation has been little studied for any aquatic groups, including finfish.

FiGR are being lost at an alarming rate. The recent rate of extinction of finfish is about one species per year and 764 species of finfish are currently regarded as threatened. Almost all are freshwater species. Freshwater species are particularly vulnerable because of their restricted habitats and limited opportunities for recolonization.

The World Conservation Union (IUCN), in recognition of ICLARM's work on FiGR, especially FishBase, has just invited the Center to become a major partner in its global assessment of the status of all freshwater fish species, to facilitate their conservation and sustainable use. IUCN and ICLARM, with multiple collaborators in developing and developed countries, will now develop a series of projects to accomplish this.

Marine species, such as those associated with coral reefs and mangroves, are less threatened with *species* extinction, but many of their local populations that are Evolutionarily Significant Units (ESUs) of biological species (i.e., *stable* and *distinct* populations that are substantially *reproductively isolated* from conspecific population units and that represent important components of the species' evolutionary legacy) have probably been lost and this is probably accelerating. Information is scarce, but conservation legislation, including the USA's Endangered Species Act, is increasingly designed to protect ESUs.

Fisheries and aquaculture can pose threats to FiGR. Fisheries usually overexploit stocks and often damage habitats through destructive fishing methods. Aquaculture can have large impacts on adjacent habitats: through water abstraction, effluents, spreading diseases, and clearance or fragmentation of habitats (e.g., mangroves). In addition to the purposeful releases of fish to enhance fisheries, farmed fish often escape from aquaculture installations. When they mix with wild stocks and disperse through natural habitats, the possible environmental consequences include: depletion or loss of wild fish stocks (e.g., by predation, competition for food or territory or diseases); changes in natural aquatic habitats (e.g., clearance of vegetation or increased turbidity); and genetic change by interbreeding.

Risks of such adverse impacts are generally higher with exotic than with indigenous species. At present, particularly in the developing countries where most aquaculture is practiced, introductions and transfers of aquatic organisms, especially by the private sector, are not effectively controlled and quarantine measures are inadequate.

For all exploited and exploitable aquatic animals, conservation of FiGR can be assisted by their sustainable use, recognizing the vulnerability of aquatic populations and habitats to overexploitation and to environmental damage. *In situ* FiGR conservation is of paramount importance. Freshwater, diadromous and coral reef species are particularly threatened. *In situ* FiGR conservation might be combined with conservation efforts for more charismatic species, such as large mammals in gameparks or trees in forest reserves, or with recreational activities in tourist-valued habitats, such as coral reefs and sports fisheries areas. Public awareness and education to explain the importance of such conservation are essential to protect these and other aquatic habitats.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	L

4. Participation H
5. Systems approach H
6. Anticipatory research H

1995 Results

ICLARM participated actively in the SGRP and its InterCenter Working Group on Genetic Resources (ICWG-GR) and in meetings related to its System-Wide Information Network on Genetic Resources (SINGER).

ICLARM staff contributed to meetings related to the Convention on Biological Diversity (CBD) including its Second Conference of the Parties, the first meeting of its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) and a special workshop on Marine and Coastal Biodiversity convened by the Swedish Biodiversity Committee.

ICLARM staff participated in a workshop in *In Situ* Conservation of Genetic Resources, convened by the Center for International Forestry Research (CIFOR). ICLARM also convened an International Consultation on Fish Genetic Resources in Rome.

Exploratory discussions on future collaboration were held with IUCN, and the World Bank's Asia-Wide Freshwater Biodiversity Assessment project, and work was initiated on an ICLARM policy document on aquatic germplasm.

Expected Outputs in 1996

- Establishment of Biodiversity and Genetic Resources Program for ICLARM comprising all the Center's SGRP contributions.
- Proposals and financial support for collaborative research and training on fish genetic resources and biodiversity.
- Contributions to the SGRP, ICWG-GR, CBD/SSBTA/CHM and related meetings.
- An ICLARM Policy Document on Aquatic Germplasm and Intellectual Property Rights, for Board appraisal.
- Expansion of database activities related to FiGR and biodiversity.
- Establishment of new collaborative partnerships.
- Effective management of ICLARM's limited *ex-situ* collections of aquatic germplasm and dissemination of information.
- Publication of the results of 1995 consultations and discussion on FiGR policy issues.

2. GERMPLASM ENHANCEMENT AND BREEDING

2.1. GENETIC IMPROVEMENT OF FARMED TILAPIAS (GIFT)-PHASE II

ICLARM Staff	:	Dr. Ambekar E. Eknath (Project Leader), Dr. Roger S.V. Pullin, Ms. Belen O. Acosta, Ms. Marietta P. de Vera, Ms. M. Dalusung, Ms. Ravelina R. Velasco, Ms. Carmela C. Janagap, Mr. Hernando L. Bolivar, Mr. Gaspar B. Bimbao, Ms. Ma. Josephine France D. Rius
Collaborating Institutions	:	The National Freshwater Fisheries Technology Research Center of the Philippine Bureau of Fisheries and Aquatic Resources (NFFTRC/BFAR); the Freshwater Aquaculture Center of the Central Luzon State University (FAC/CLSU); the Institute of Aquaculture Research of Norway (AKVAFORSK) through the Norwegian Center for International Agricultural Development (NORAGRIC/NORAD); and the International Center for Living Aquatic Resources Management (ICLARM)
Donor	:	United Nations Development Programme/Science, Technology and Private Sector Division (UNDP/ STAPS)
Duration	:	1993-1997

Objectives

- To develop improved breeds of tilapia and provide those fish breeds to national testing programs and thence to fish farmers
- To strengthen national institutions in aquaculture genetics research
- To establish a mechanism for international exchange and evaluation of improved breeds and research methods.

Background and Justification

The GIFT project which began in 1988, is a major strategic research initiative in applied genetics, breeding, and germplasm improvement in tropical aquaculture. The Nile tilapia *(Oreochromis niloticus)* has been chosen as a model species for the GIFT project because of its worldwide importance in aquaculture and short generation time. However, this work, by providing useful methodologies, is expected to have similar benefits for other finfish species, especially carps. The planned program of collaborative research, training and information dissemination will strengthen the capacity of national

institutions to carry out relevant research and to apply the findings in evolving self-sustainable national fish breeding programs.

The GIFT project has already demonstrated that documentation, evaluation and use in selective breeding programs of fish genetic resources can result in rapid genetic gain. This had not been previously demonstrated in tropical aquaculture to any significant extent.

The ICLARM-coordinated International Network on Genetics in Aquaculture (INGA) and its regional project "Dissemination and Evaluation of Genetically Improved Tilapia in Asia" (DEGITA) resulted largely from the research successes of the GIFT project.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

The project's fourth generation selection for growth (study 1) and an experiment to determine the frequency of spawning females (per family) and associated genetic parameters (study 2) were completed in February 1995. Heritability estimates for frequency of spawning females for sire component were 0.34 and 0.23, lower than the heritability estimates for dam component (0.55 and 0.64). Similar trends in heritability estimates were also observed in growth as a trait. This indicates significant maternal effects for each of the two traits. Higher genetic correlations (0.70 and 0.80) were observed in the sire component in two environments than in the dam component (0.43 and 0.37). A two-trait selection experiment for growth and frequency of spawning females is on-going.

A consultative workshop to develop "Strategies for Collaborative Research and Training in Application of Genetics to Increase Sustainable Aquaculture Production" was organized in June 1995 in Hyderabad, India. This included senior representatives from national institutions in Africa, Asia and the Pacific, resource experts from advanced scientific institutions; and senior representatives of UNDP, FAO, SIFR and ICLARM.

Expanded on-farm trials were undertaken in coordination with the DEGITA project. The documentation of on-farm trials and socioeconomic surveys, conducted under the auspices of GIFT in the Philippines, is for future publication in a book "Economics of Tilapia Farming in a Dynamic Environment: The Case of the Philippines".

One of the most significant accomplishments was the successful implementation of the intensive training program on the "Application of Quantitative Genetics to Aquaculture", held in Cavite, Philippines from 6 November to 2 December 1995. The

objective was to strengthen the capacity of GIFT core research staff and scientists from national institutions in the field of quantitative genetics and its application to increase sustainable aquaculture production. Thirty-two participants attended which included the GIFT core research staff and scientists from eleven member countries of INGA.

The Philippine National Tilapia Breeding Program (PNTBP) was assisted and is well on the way to becoming self-sustainable. The numerous consultations/meetings conducted in 1995 resulted in an emerging conceptual framework for the operations of the PNTBP through a foundation.

The Philippine Carabao Center, based in the Central Luzon State University, agreed to host and maintain a duplicate cryopreserved tilapia sperm bank at no additional cost to the GIFT Project.

Expected Outputs in 1996

- Selection for two-traits (growth and frequency of maturation in females) - first generation.
- Estimation of the magnitude of genotype (families) x season interaction (with the same sires and dams used in the previous generation.
- Estimation of the magnitude of genotype (families) x environment interaction in ponds, cages and rice-paddies.
- Evaluation of the performance of the GIFT strain in different culture systems (polyculture, stocking density, feed composition and fertilization methods).
- Further technical support to the Philippine National Tilapia Breeding Program.
- Organization of a follow-up training program for selected GIFT staff and INGA member countries.
- Publications: The GIFT Project has identified seven major publications for completion.

2.2. Comparison of the Nutritional Energetics of Two Nile Tilapia Strains: an Experimental GIFT Strain and the Widely Farmed Thai Chitlada Strain

ICLARM Staff	:	Dr. Roger S.V. Pullin; Dr. Ambekar E. Eknath
Collaborating Institutions	:	Asian Institute of Technology (AIT), Bangkok, Thailand
Donor	:	ODA [holdback funds]
Duration	:	April 1995-April 1997

Objectives

- To determine whether the phytoplankton filtration efficiency/digestibility of the GIFT strain is higher than for the Chitlada strain
- To determine whether the GIFT strain can absorb more nutrients from natural food and low quality farm-made feeds than the Chitlada strain, by enhanced digestive efficiency
- To determine whether the GIFT strain can tolerate low dissolved oxygen (DO) and recover more quickly from low DO stress than the Chitlada strain
- To determine whether the GIFT strain can grow well on low quality feeds, such as duckweed, in static and in recirculatory water systems
- To compare the growth of the GIFT and Chitlada strains in fertilized ponds with and without supplementary feeds
- To evaluate resource partitioning between the two strains when they are grown in polyculture with carp species that are commonly farmed in Asia.

Background and Justification

The Genetic Improvement of Farmed Tilapia (GIFT) project has developed an improved strain of Nile tilapia for low-cost sustainable aquaculture. It grows 60% faster and has 50% higher survival than some strains currently farmed in the Philippines. Additional trials have commenced.in other Asian countries. The development of a fast growing tilapia strain is encouraging. However, it is important to assess the nutritional, physiological or behavioral basis of its superiority over other strains. This project will evaluate the nutritional energetics of the GIFT strain of Nile tilapia in direct comparison with the Thai Chitlada strain.

There are several abiotic and biotic factors that affect growth and survival of fish. Provided that major abiotic factors such as temperature, pH, alkalinity and toxic concentrations of ammonia and nitrite are within optimal/tolerable ranges, acquisition of feed resources and the ability to tolerate (and to grow in) relatively low DO concentrations are important factors in small-scale aquaculture. The basis for the superior growth performance of the GIFT strain might derive from enhanced nutrient intake and/or low DO tolerance.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	L
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

GIFT Nile tilapia were transported and grown to maturity at AIT and their progeny raised in parallel with stocks of the Chitlada strain to produce fish with the same rearing history for use in comparative experiments. Parallel experiments were started to evaluate the digestibility of selected feedstuffs (phytoplankton, green fodder, low-quality farm-made pelleted feeds and high-quality commercial pelleted feeds).

Expected Outputs in 1996

- Analyses of results for the two strains grown under different DO concentrations over three months to evaluate the effects of DO on their feed intake and growth.

- Analyses of results for resource partitioning of the two strains of fish in monoculture and polyculture (with common carp, silver barb, rohu) pond systems.

3. AQUATIC ENVIRONMENTS

3.1. REEFBASE - A GLOBAL DATABASE OF CORAL REEF SYSTEMS AND THEIR RESOURCES

ICLARM Staff	:	Dr. John W. McManus (Project Leader), Dr. John L. Munro, Ms. Carmen C. Ablan, Mr. Benjamin M. Vallejo Jr., Mr. Lambert A. Meñez, Ms. Grace U. Coronado, Ms. Kathleen P.N. Kesner, Ms. Maharlina L.G. Gorospe, Ms. Cindy F. Cabote
Collaborating Institutions	:	World Conservation Monitoring Center (WCMC), numerous agencies providing, checking and using data
Donor	:	European Union, Netherlands Government, ICLARM core funds
Duration	:	October 1993 - September 2001

Objectives

- To design a relational database for structured information on coral reefs and their resources that will serve as a computerized encyclopedia for use in reef management, conservation and research
- To set up a network of coral reef researchers and managers that will contribute to the database
- To collaborate with other national, regional and international databases and GIS facilities relating to reefs, and provide a means of comparing and interpreting information at the global level
- To distribute analytical routines, and develop new ones, for the database that will make full use of the information and ensure appropriate interpretation and synthesis.

Background and Justification

Coral reefs are the most biodiverse ecosystems in the oceans and, at higher taxonomic levels, may be the most diverse in the world. They provide food and livelihood for many millions of coastal villagers throughout the developing world. In many areas, entry into a coral reef fishery requires very little capital investment, and reefs are often considered to be common property. This has led to a predominance of economically disadvantaged fishers entering the fisheries, who are then maintained at marginal levels of existence by competition from other entrants. The pool of such entrants tends to rise because of high population growth rates and inequitable resource distribution in general. This leads to a problem, identified as Malthusian overfishing, which involves the tendency for fishers to increasingly use fishing methods which are

destructive to the environment, and to themselves. In areas where villages are adjacent to fringing reefs and shoreline coral communities, organic pollution from sewage and siltation from onshore activities often cause a rapid decline in reef viability. Decreasing resource availability leads to greater desperation, which leads to increasing reef damage, and so on in a spiral of devastation.

Although it is now clear that there is a global problem, it is not possible to determine how great the problem is. There is no central repository of coral reef information, and no means by which coral reef data from around the world can be summarized, compared or evaluated for global trends.

The ReefBase system will serve national and international resource managers and national scientists primarily in three ways. First, by providing global and regional estimates of the status and utility of coral reefs, action will be initiated and prioritized to improve the management of critical areas. Second, the database will provide summaries of existing data on local reef systems (including resource maps and aerial images where available), and provide references for further investigation. Third, the database will facilitate the geographic comparison of coral reefs, from which generalizations about the natural states of reefs, their potential fishery productions and their responses to stresses can be made.

The International Coral Reef Initiative (ICRI) held its global workshop in May 1995 in the Philippines. ReefBase was designated the official ICRI Resource Center. Two of the three authors of the State of the Reefs background report were from ReefBase, and much of the material in the report came from ReefBase (3 000 copies have been printed and distributed). The ReefBase Project Leader presented the State of the Reefs Report as a keynote address, and served as a co-facilitator of the workshop. The Framework for Action, agreed to by delegates of more than 20 countries, includes information assimilation and dissemination (ReefBase activities) as a priority action for further strengthening. A major goal of each regional ICRI workshop (scheduled for mid-1995 through early 1996), is to develop regional mechanisms for data exchange to complement the ReefBase effort. ReefBase serves as an essential element of the ICRI, as well as playing key roles in planning for the Global Coral Reef Monitoring Program of the Intergovernmental Oceanographic Commission, the Land-Ocean Interface in the Coastal Zone component of the International Biogeophysical Program and the 1997 International Year of the Reef. It also directly addresses priority concerns of the draft UN Code of Conduct for Responsible Fisheries, Agenda 21, the UN Commission on Sustainable Development, the Convention on Biological Diversity, the Global Conference on Sustainable Development of Small Island Developing States, the UN Convention on the Law of the Sea and other relevant international programs.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	H
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

This initial project phase has resulted in a preliminary CD-ROM with selected information on 5 700 coral reefs. The information is available in a user-friendly software system on the management status of coral reef resource systems, their ecological zonation, fisheries and other uses by people. The data can be accessed using searches, queries, and/or an "active dot" geographical display system with zooming capabilities.

There are 30 maps covering all known coral reefs in 108 countries or island states, summarized in five regional maps and a world map, plus 24 detailed maps of selected coral reefs. Some 1 100 reports of natural and anthropogenic stresses to coral reefs are included.

Four hundred records of coral reef fisheries and mariculture production are provided and 2 000 records concerning the use of coral reefs by tourists, the most comprehensive collection of such information available.

Information on 400 marine protected areas is included. ReefBase can display these data geographically relative to other factors such as stresses, fisheries harvests and tourism uses to facilitate the selection and prioritization of new marine protected areas and other management strategies.

Expected Outputs in 1996

- The first version of ReefBase on CD-ROM will be ready for beta testing in early 1996. At this time, it will be sent out to twenty reviewers around the world. These reviewers will be principally those who were chosen to attend the first ReefBase design workshop, and include a variety of coral reef and database experts. The final product will be made available after its official presentation at the International Coral Reef Symposium in Panama in June.

- In July, work on a more comprehensive second version will begin with a planning meeting to determine new design goals given the availability of recent technology such as Windows 95 and higher resolution screens on laptop computers.

- A new program for training and certifying volunteer divers to produce data for ReefBase, the ReefBase Aquanaut Program, will be finalized and announced. Efforts will be made to involve major volunteer agencies concerned with diving in systematic efforts to produce uniform information on coral cover and related variables, making use of inexpensive Global Positioning Systems to locate sample sites. Efforts to expand this program internationally will continue through 1996.

3.2. RESOURCE AND ECOLOGICAL ASSESSMENT TRAINING FOR THE FISHERIES SECTOR PROGRAM OF THE PHILIPPINES

ICLARM Staff	:	Mr. Geronimo T. Silvestre (Project Leader), Mr. Len R. Garces (Asst. Project Leader), Ms. Rowena Andrea V. Santos, Mr. Quintin P. Sia, Mr. Danilo A. Bonga, Mr. Robert R. Pabiling, Mr. Leo R. Pura, Ms. Audrey Marie A. Banzon, Mr. Romelito P. Garcia, Ms. Zoraida N. Alojado, Ms. Miriam C. Balgos, Mr. Alvin Catalan, Ms. Annabelle C. Trinidad, Ms. Flordeliza L. Bravo, Ms. Maria Concesa C. Gayanilo
Collaborating Institutions	:	Department of Agriculture, Fisheries Sector Program; Philippine Bureau of Fisheries and Aquatic Resources
Donor	:	Philippine Department of Agriculture Fisheries Sector Program
Duration	:	April 1995 to August 1996

Objective

- To equip the "Regional Composite Teams" (RCTs) of the Department of Agriculture in Regions 3, 4 and 8 with the knowledge and skills needed to implement long-term monitoring of various bays in the Philippines, including provision of training manuals, and initialization of monitoring by means of a one-year supervised data-collection program.

Background and Justification

ICLARM has previously completed resource and ecological assessments (REA) in several localities in the Philippines, leading to an awareness of the need for continuous monitoring. The project will supply the requisite skills to implement such work.

Scores Against Principles

1. Sustainability	H
2. Equity	N/A
3. Gender	N/A
4. Participation	H
5. Systems approach	H
6. Anticipatory research	H

1995 Results

Resource and ecological monitoring involves five interrelated tasks in which training was given. These are: (1) capture fisheries assessment; (2) coastal habitat

assessment; (3) water quality assessment; (4) socioeconomic studies; and (5) database management. The project activities are implemented in two phases, the formal training and the field training phase, covering the skills development of the RCTs on the five tasks. Training development activities including needs analysis, course design, module development and evaluation planning preceded the formal training phase.

Formal training was held on 16 - 27 July 1995 in VISCA, Baybay, Leyte for the RCTs in Region 8 (Carigara Bay) and on 14 - 23 August 1995 in ISMED, Diliman, Quezon City for the RCTs in Regions 3 and 4 (Manila Bay). Simultaneous sessions for all five tasks were held covering informational and skills development modules. Evaluation and preparations for field training and setting up the database capped this training phase.

The project staff together with the RCTs started primary data gathering in July 1995 in Carigara Bay and in September 1995 in Manila Bay. Sites previously used in the REA studies of both bays served as reference points during actual field sampling. Bounce dives and ocular surveys were conducted for coral reefs, seagrasses, algal beds and mangrove areas. Initial monitoring of water quality parameters was done. Fish landing areas were visited and socioeconomic surveys were organized. A monitoring system to assess on a quarterly basis, the performance of the RCTs on the job has been developed.

Expected Outputs in 1996

- A training package on fish stock, coastal habitat, and water quality assessments, socioeconomic impact studies, and database management for use in resource and ecological assessment studies.
- Technical reports from one-year monitoring of Carigara Bay and Manila Bay covering capture fisheries assessment, coastal habitat assessment, water quality assessment, and socioeconomic studies.
- A database where the acquired data are stored and analyzed.

3.3. Valuation of Coral Reef Systems

ICLARM Staff	:	Ms. Annabelle Cruz-Trinidad, Mr. Len R. Garces; others to be identified
Collaborating Institutions	:	University of the Philippines Marine Science Institute, Silliman University, Palawan National Agricultural College
Donor	:	ICLARM core funds
Duration	:	January 1996-March 1997

Objectives

- To assess appropriate valuation techniques for coral reef systems with different use patterns
- To characterize use and non-use values of coral reef systems under varying degrees of exploitation
- To develop a data collection package (survey forms and related informational tools such as visual aids) and an applications manual
- To apply these to reef areas characterized by varying degrees of exploitation, i.e., Anilao (heavily exploited), Bolinao (medium exploitation), El Nido (minimal exploitation).

Background and Justification

Coral reefs are highly stressed ecosystems because of the varied marketable goods and services derived from them. The reef system provides shelter and nutrition for food fish and aquarium fish thus significantly affecting incomes and nutrition of marginal fishers. Paradoxically, human activities are the primary cause of coral reef degradation. Resource and ecological economics attribute this, and prevailing patterns of resource exploitation, to the failure of estimating extra-market benefits and services.

"Total Economic Value" framework is to be employed to estimate the use and non-use values of coral reef systems. Use value is referred to costs and benefits of a resource for which a market exists; it can be direct use (*in situ*) or indirect.

Non-use value applies to the value individuals place on resources, regardless of their present/future or consumptive/non-consumptive use.

Three types of reef systems according to the level of use and exploitation are included: Bolinao, with a strong municipal and aquarium fishery, medium exploitation; Anilao, with its dive tourism, heavy exploitation; and El Nido in Palawan, with managed tourism and fishery, minimal exploitation.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

Expected Outputs in 1996

- Journal article and technical report on use and non-use values of coral reefs.

- "Valuation package" for future use by collaborators.
- Training/workshop on the use of the valuation package.

3.4. COASTAL AREAS MANAGEMENT TRAINING

ICLARM Staff	:	Ms. Miriam C. Balgos, Ms. Audrey Marie A. Banzon
Collaborating Institutions	:	Haribon Foundation, Philippines; Philippine Council for Aquatic and Marine Research and Development, Philippines; Department of Environment and Natural Resources, Philippines, Department of Agriculture-Bureau of Fisheries and Aquatic Resources, Philippines; International Institute of Rural Reconstruction, Philippines; University of Rhode Island Coastal Resources Center, USA
Donor	:	Rockefeller Brothers Fund
Duration	:	January 1995-December 1996

Objective

- To develop a pool of coastal management practitioners in the Philippines from government organizations, academe and NGOs both at the national and local levels, who will work together in the formulation and implementation of an integrated coastal management plan for each region in the Philippines.

Background and Justification

This project was initiated because of the need throughout the Philippines for adequate trained manpower in coastal management. In addition, common national goals and standards in the formulation and conduct of coastal management programs are required.

The program design and curriculum will be developed incorporating recent approaches to coastal management such as combination of regulatory and non-regulatory techniques, use of national and local approaches in varying scales, and participatory planning and implementation. The broad-based nature of the training courses should allow room for various options, scenarios, case studies, problems, approaches and special focus.

1995 Results

A preliminary training needs analysis of coastal management practitioners indicated the need for a group-based validated training material, considering such factors as stability of topic content, number of individuals to be trained, desired trainee

performance standards, scarcity of qualified resource persons, and need for implementation in various locations.

A workshop of some 35 participants from the academe, NGOs, and various sectors of the government working on coastal management at IIRR, Silang, Cavite on 7-9 June 1995 produced a preliminary coastal management framework and a course design based on the results of the training needs analysis and workshop outputs.

An initial roster of local training collaborators was identified from the workshop participants. A training bulletin designed to serve local training information needs and to facilitate the formation of a local training network was started.

Collaboration with the UN TRAIN-SEA-COAST Programme and familiarization with the TRAIN-X training development guidelines was made, through participation in a course developers' workshop and application of the guidelines in the project's curriculum development.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

Expected Outputs in 1996

- A validated standardized training package on broad-based coastal management.
- Seven training courses conducted involving participants from 14 regions of the Philippines.
- A training-workshop on course development and delivery for local trainers.
- A Southeast Asia training network operating by the end of 1995 (which is the particular responsibility of ICLARM).
- A report on impact evaluation of trainees by the end of the year.

A curriculum for a follow-up training course based on the impact evaluation results.

3.5 COMPARATIVE ANALYSIS OF COASTAL TRANSECTS

ICLARM Staff	:	Mr. Geronimo T. Silvestre (Project Leader), Dr. Daniel Pauly, Dr. Hal McArthur (Affiliate Scientist from the University of Hawaii at Manoa), Ms. Annabelle Cruz-Trinidad, Mr. Len R. Garces, Mr. Felimon C. Gayanilo, Jr.
Collaborating Institutions	:	University of Warwick, UK; Philippine Council for Aquatic and Marine Research and Development, Philippines; Department of Fisheries, Brunei; National University of Singapore, Singapore; Department of Fisheries, Malaysia; Department of Fisheries, Thailand; Human Geography Research Center, Hanoi, Vietnam; Environmental Research Center, Bogor Agricultural University, Bogor, Indonesia.
Donor	:	European Commission
Duration	:	January 1994 to November 1995

Objectives

- To elaborate generic coastal system types, processes and development trajectories
- To develop selected methodologies in support of integrated management of coastal systems
- To create generic problem/opportunity structures and management actions/ guidelines
- To develop interactive software (SIMCOAST) to provide cross-sections and transect analysis
- To package these results and transfer them effectively to users/beneficiaries.

Background and Justification

In many developing countries, especially in ASEAN, coastal areas are suffering considerable levels of stress due to increased demand for and conflicting uses of natural resources plus downstream effects of land-based sectors. These have led to economic losses, increased conflicts, and a significant decrease in biodiversity and the abundance of most renewable resources.

The Strategy on International Fisheries Research (SIFR) and Agenda 21 of UNCED placed high priority on integrated coastal zone management to reverse the worldwide trend of increased coastal degradation and overexploitation. While previous research on coastal management problems tackled specific resources and disciplinary

areas, it is now seen as imperative to apply an integrated framework, because of the vast ecological and socioeconomic linkages created by the use of coastal resources.

A novel approach to structuring coastal management problems and solutions is being developed by this project, which is a cooperative undertaking involving ICLARM, the Ecosystems Analysis and Management Group (EAMG) of the University of Warwick, UK, and individual scientists identified by the ASEAN Subcommittee on Marine Sciences.

Scores Against Principles

1.	Sustainability	H
2.	Equity	M
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

The conceptual framework relevant to the application of spatial transects in coastal environments was established with pertinent documentation contained in the final project report.

Mr. Geronimo T. Silvestre, ICLARM Project Leader, visited the Ecosystems Analysis and Management Group of the University of Warwick in January to discuss project developments and in November to complete final project report.

Several in-house meetings involving ICLARM Project Staff as well as staff seconded from the DA-FSP Project on Training and Monitoring resulted in the final format of the transect. This form was used to cull out and synthesize information found in all USAID-ASEAN Coastal Profiles as well as management plans. Transects summarizing issues, management interventions and sustainability indicators were also developed by the project team. Lastly, icons representing coastal zone activities and issues were developed as input to the SIMCOAST software being developed by the main project executor, University of Warwick.

The initial transect outputs were sent to all ASEAN collaborators for comments. From July - August, Ms. Abbie Cruz-Trinidad and Mr. Len Garces visited the ASEAN collaborators to discuss the project and to prepare for the Final Workshop. The Final Workshop was held on 12-15 September 1995 in Penang, Malaysia. Future thrusts of the project were discussed and approved by the ASEAN collaborators. Initial discussions have been made with the Vietnamese team for a transect to be developed for Halong Bay.

In December 1995, Ms. Abbie Cruz-Trinidad discussed the potential role of RRA/PRA techniques relevant to the coastal transect approach at the ICLARM Research Methods Workshop.

1996 Plans

ICLARM Project Staff will visit Vietnam to help the team develop the transect for Halong Bay. The future role of ICLARM in the next phase of the project is being discussed. Cooperation of ASEAN collaborators is assured, specifically with regard to their inputs to the SIMCOAST software. The software is expected to be completed early in 1996 for distribution to all collaborators.

4. FISHERIES RESOURCES ASSESSMENT AND MANAGEMENT

4.1. TROPICAL FISH STOCK ASSESSMENT

ICLARM Staff	:	Dr. Daniel Pauly (Project Leader), Mr. Felimon C. Gayanilo Jr., Dr. Villy Christensen, Mr. Geronimo Silvestre, Dr. Rainer Froese, Dr. Maria Lourdes D. Palomares, Mr. Nathan S. Quirit, Mr. Eliseo H. Garnace
Collaborating Institutions	:	FAO, with informal linkages with other research institutions
Donor	:	ICLARM core funds
Duration	:	Indefinite

Objectives

- To increase our understanding of the dynamics of exploited tropical/subtropical fish communities
- To develop stock assessment methods which are straightforward and readily applicable to tropical and subtropical stocks
- To implement and disseminate these methods in the form of widely usable software for research and training.

Background and Justification

Stock assessment methods used in the temperate north were traditionally based on age structured information. These data are not only difficult to obtain, but have also proven to be costly. ICLARM has been instrumental in making length-frequency-based methods available to tropical developing nations. ICLARM's role in stock assessment of tropical fisheries is based on collaboration with fisheries scientists, dating back to 1978, working on length frequencies for stock assessment.

Since its inception, this project has continued to supply national institutions with conceptual and methodological advances to understand and manage fisheries resource systems. New approaches and techniques developed were distributed through computer program routines, now widely used by fisheries researchers in developing countries and increasingly in developed countries as well. One such product is the ELEFAN software, now in use throughout the world.

In late 1989, it was agreed that a single software program be developed that merges the routines in the Compleat ELEFAN software and the Length-Frequency Stock Assessment (LFSA) package which would become the basic training tool for

future FAO and ICLARM courses in stock assessment. The new product was named FiSAT (FAO-ICLARM Stock Assessment Tools). The package has been submitted to FAO which will undertake its publication and dissemination in 1996. ICLARM has agreed to maintain and expand the capabilities of the software.

ICLARM is also seeking new models appropriate to tropical situations. For example, for cases where length-weight data pairs are lacking to estimate the relationship between length and weight of fishes, a new model was developed to estimate the coefficients (a, b) of the length-weight relationship from length frequencies and sample weights only. This is incorporated in the software product ABee.

To further encourage and facilitate working with the different software applications and databases developed at ICLARM, an interface will be developed which will integrate these different products and the corresponding files, and guide the user's interpretation of the outputs. An important component of this product will be the management and detailed analysis of files resulting from scientific trawl survey data, which tend to be underutilized, although they are extremely costly to obtain.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

The bulk of the work was the final debugging of FiSAT and the completion of the user's guide. ABee, for the estimation of coefficients of length-weight relationships published in refereed journals, was completed. The beta versions of ETAL II, which fits variants of the standard von Bertalanffy growth function (2-stage growth, seasonal growth, etc.) to size-at-age data and MAXIMS, software which estimates food consumption from the variations in the diel stomach content of fish, are currently being tested and debugged.

Drs. D. Pauly and V. Christensen's article on *Primary production required to sustain global fisheries* came out in a March 1995 issue of *Nature*. This paper had a major scientific and public impact, with its conclusions being disseminated worldwide through newspaper articles and radio interviews. One of its indirect effects was the nomination of Dr. Pauly to a newly formed Committee of the (US) National Research Council, which is devoted to ecosystem management for sustainable marine fisheries. Dr. Pauly also participated in a number of conferences and meetings where he presented papers and established contacts with potential collaborators.

Expected Outputs in 1996

The year 1996 will largely cover the continuation of some of the planned publication of several software packages:

- Finalization of the version of the MAXIMS.
- Introduction of the new software, ABee.
- Publication of the bioeconomic model based on the Thompson and Bell model, also incorporated in FiSAT.
- Development of an interface which will integrate several ICLARM software packages.
- Completion of MicroDP, software updating and implementing a 1984 publication of Dr. Pauly titled "Fish population dynamics in tropical waters: a manual for use with programmable calculators".
- Design of a new software for research and teaching purposes linking, functionally and through graphics, the anabolic processes manifested in growth curves with their underlying physiological (food and oxygen consumption) and anatomical (gill area) constraints.

4.2. MODELING OF MULTISPECIES FISHERIES

ICLARM Staff	:	Dr. Villy Christensen (Project Leader), Dr. Daniel Pauly, Ms. Ma. Rosandra A. Gayosa, Mr. Eliseo H. Garnace, Mr. Nathan S. Quirit, Mr. Felimon C. Gayanilo, Jr.
Collaborating Institutions	:	Fisheries Centre, University of British Columbia, Canada; Danish Institute of Fisheries Research, Denmark; Russian Federal Research Institute of Fisheries and Oceanography, Russia; Greenland Fisheries Research Institute, Greenland; Lake Tanganyika Research Project, Finland; Central Marine Fisheries Research Institute, Mangalore, India.
Donor	:	DANIDA, ICLARM core funds.
Duration	:	February 1990 - January 1998

Objectives

- To develop modeling approaches for ecosystem analysis and for management of multispecies fisheries incorporating biological interaction

- To make the methods available and develop them further in cooperation with scientists in national institutions.

Background and Justification

A method for ecosystem analysis has been developed at ICLARM based on an approach originally conceived by a US scientist, Dr. J.J. Polovina. This has led to the ECOPATH II software system which by now is widely distributed (more than 400 registered users in 74 countries) and has been used for description of more than 50 ecosystems, for regular course work at universities, theses work, etc.

Recently a methodology for management of multispecies fisheries has been added to the system based on an approach developed for fisheries management of Northwest Atlantic ecosystems, while a dynamic simulation model is to be developed in cooperation with the Fisheries Centre.

There are no other comparable methodologies for ecosystem analysis and biological management of multispecies fisheries accessible for scientists working with tropical fisheries.

Scores Against Principles

1.	Sustainability	H
2.	Equity	N/A
3.	Gender	N/A
4.	Participation	M
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Drs. Daniel Pauly and Villy Christensen published (in *Nature*) an analysis of the primary production required to sustain global fisheries. Other project activities were published in *Ecological Modelling*, *Ecological Engineering*, *Dana*, and *Naga*.

A test version of the new methodology for biological management of multispecies fisheries was developed, described, and presented at the ICES Annual Science Conference.

Studies on potential competition between marine mammals and fisheries was presented at the Asian and Pacific University Presidents Conference, and at the NAFO/ICES Symposium on "The role of marine mammals in the ecosystem".

A new Windows-based version of ECOPATH II was released after testing on a workshop at the University of British Columbia on the trophic dynamics of the Northeast Pacific ecosystem (where it served as the structural element for the workshop).

Expected Outputs in 1996

- Application of the methodologies for management of multispecies fisheries to one or more ecosystems in cooperation with the collaborators.
- Further development and dissemination of the new ECOPATH II version.

4.3. Sustainable Exploitation of Coastal Fish Stocks in Asia

ICLARM Staff	:	Dr. Daniel Pauly, Dr. Rainer Froese, Mr. Geronimo T. Silvestre, Mr. Felimon C. Gayanilo, Jr., Mr. Len R. Garces, Ms. Rowena Andrea V. Santos, Mr. Francisco S.B. Torres, Jr., Mr. Leo R. Pura, Ms. Flordeliza L. Bravo
Collaborating Institutions	:	Various Developing Member Countries (DMCs) of ADB
Donor	:	ADB, ICLARM core funds
Duration	:	March to August 1996

Objectives

- To assist selected DMCs in reviewing the status of their fish stocks and develop guidelines for fisheries resource databases that meet their resource management needs
- To prepare agenda for developing appropriate strategies, action plans and options for management and rehabilitation of degraded fish stocks in the region.

Background and Justification

Coastal fish stocks in Asia have declined drastically, principally as a result of overfishing. Collaborative research on the sustainable exploitation of coastal fish is required in order to conserve these valuable resources and promote sustainable exploitation.

Scores Against Principles

1.	Sustainability	H
2.	Equity	M
3.	Gender	N/A
4.	Participation	H
5.	Systems approach	M
6.	Anticipatory research	H

Expected Outputs in 1996

- A review of previous fish stock surveys and an examination of the current status of fish stocks in the selected DMCs and the Asian region.
- Draft guidelines for the establishment of appropriate fisheries resource databases for DMCs.
- Organization of a regional workshop to identify constraints and gaps of fisheries resource information for fish stock assessment and resource management and to propose follow-up action plan and support activities for continuing regional collaboration in coastal fisheries resource management.
- Workshop proceedings.
- Development of a project proposal for collaborative regional research on the rehabilitation of coastal fish stocks in the Asian region and an agenda for developing strategies and action plans to rehabilitate coastal fisheries resources of DMCs.

4.4. Testing the Use of Marine Protected Areas to Manage Fisheries for Tropical Coral Reef Invertebrates - Arnavon Islands

ICLARM Staff	:	Dr. Johann Bell (Project Leader), Mr. M. Lincoln-Smith (Consultant), Mr. N. Kile (Solomon Islands Ministry of Agriculture and Fisheries), Mr. Mark Gervis, Mr. Idris Lane
Collaborating Institutions	:	Great Barrier Reef Marine Park Authority (GBRMPA), Solomon Islands Ministry of Agriculture and Fisheries, Solomon Islands Ministry of Forests, Environment and Conservation, The Nature Conservancy (TNC)
Donor	:	ACIAR
Duration	:	4.5 years, October 1994 - February 1999

Objective

- To test the hypothesis that abundance of commercial tropical invertebrates will increase on coral reefs closed to fishing, and that the average sizes of individuals in reserves will be greater than those in fished areas.

Background and Justification

This study is being done in conjunction with the Marine Conservation Area (MCA) of 83 km^2 at the Arnavon Islands, Solomon Islands. TNC has negotiated a three-year closure to fishing with the traditional users of the area for trochus, sea cucumbers, giant clams and spiny lobsters. GBRMPA has provided assistance with the statistical design of a monitoring program to assess the effect of the closure. This monitoring program is based on a "Before vs After, Impact vs Control" design.

ICLARM regularly attends meetings of the Management Committee established by TNC to oversee the establishment and surveillance of the MCA. A major impact of ICLARM's initiative to monitor the effects of the MCA has been the raised awareness, both by traditional users of the area and the Ministry of Agriculture and Fisheries, of the potential value of marine protected areas in the management of coral reef fisheries.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	N/A
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Three surveys of populations of commercial invertebrates inside the MCA, and at the three "control" areas, were completed in January, May and August 1995, prior to declaration of the MCA. A preliminary report on the variability of populations of commercial invertebrates at the study sites was submitted to ACIAR. The report outlines that, despite the remote location of the MCA, populations of most species had been fished down to some of the lowest levels recorded for the Pacific.

The report also demonstrates that the sampling design for this project has a high probability of detecting small (10-20%), but significant, changes in population sizes of trochus and sea cucumbers following declaration of the MCA.

An important outcome of the project in 1995 was the fact that staff from the Ministry of Agriculture and Fisheries, and Conservation Officers appointed by TNC to work for the MCA, were trained to identify the target species and quantify their abundances. These staff are now capable of collecting the scientific data for the project.

Expected Outputs in 1996

- A full report on the area, and at three control sites, prior to variability in abundance of target in the MCA declaration of the reserve.

- A paper on the concept of the project, the sampling design and the nature of the variability in invertebrate populations prior to the declaration of the MCA will be presented at the 8th International Coral Reef Symposium.

- An interim survey of invertebrate populations at all study sites will be made in August, 12 months after the declaration of the MCA.

- Staff from ICLARM will attend meetings of the Management Committee for the MCA to provide an update on the status of invertebrate populations.

4.5. The Role of Marine Protected Areas in Fisheries Management and Biodiversity Conservation in Coral Reef Ecosystems

ICLARM Staff	:	Dr. John L. Munro (Project Leader); others to be appointed
Collaborating Institutions	:	University of the West Indies, Jamaica; Department of Conservation and Fisheries, Tortola, British Virgin Islands (not yet confirmed)
Donors	:	Inter-American Development Bank (Jamaica component), ODA (not yet confirmed)
Duration	:	Four years

Objective

- To develop scientifically validated criteria for the establishment of marine protected areas and to establish methods for identifying optimal locations for marine protected areas and for the implementation of management strategies based on sound social, economic and ecological evaluations.

Background and Justification

Marine protected areas (MPAs) have been established in many countries, usually for the express purpose of marine conservation. In the tropics, such areas very often encompass coral reefs.

It has been clearly established that increases in average individual size, stock abundances and the diversity of marine organisms occur as a result of the creation of MPAs and such areas are therefore a source of increased production of eggs and larvae. Additionally, MPAs serve as reservoirs of genetic diversity, which can be diminished in heavily exploited fish stocks. However, in some cases unfavorable currents might entrain the eggs and larvae and sweep them into the deep sea where no suitable habitats are available and the MPA might, consequently, be ineffective in enhancing recruitment to stocks in adjacent exploited areas.

Outmigrations from MPAs also enhance fisheries in adjacent areas but such migrations depend, to a degree, on the size and location of the MPA. In some cases the target organisms might be highly sedentary and unwilling or unable to physically move out of the MPA. Other species might be so highly mobile that they are mere transients in the MPA.

MPAs can have a role in ecotourism, particularly in relation to scuba diving, and thus have alternate economic benefits. Conversely, fishing area is lost by closure and protection of fishing grounds. Consequently, the economic and social benefits of MPAs are difficult to evaluate, particularly in multispecies, multigear tropical fisheries, and must be evaluated on the basis of a knowledge of existing fisheries, of potential gains from outmigrations and from increased recruitment or from ecotourism.

The major variable is recruitment, in that an MPA with poor recruitment will take many years to become effective. Areas with good recruitment will be good MPAs, but also good fishing areas. Poorly situated MPAs will have no effect on fish harvests because larvae are lost. Stocks in MPAs which receive all of their recruits from intensively fished areas will eventually dwindle, despite protection.

The current project encompasses a limited range of investigations designed to provide baseline data at a few carefully selected sites.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	H
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

Expected Outputs in 1996

- A mark-and-recapture program will be developed in which fish are captured using Antillean fish traps at fixed trapping stations. Activities will focus on a few selected MPAs, including one or more in the British Virgin Islands (BVI) reef systems and at Discovery Bay, Jamaica.

- Collection of socioeconomic data will be initiated. The principal focus will be in Jamaica, building on previous work, plus sites in the BVI and, possibly, in St. Vincent.

- A reef fish settlement and recruitment monitoring program will be initiated, using light-traps and pound nets for post-settlement fishes, and visual census and small-meshed fish traps for older juveniles, both in Jamaica and the BVI.

- Appropriate databases will be developed for collating the catch records.

5. INTEGRATED AQUACULTURE-AGRICULTURE SYSTEMS

5.1. REVIEWS ON INLAND AQUATIC RESOURCE SYSTEMS

ICLARM Staff	:	To be determined
Collaborating Institutions	:	-
Donors	:	To be identified
Duration	:	Continuous from 1995

Objective

- To define strategic research agendas (and ICLARM's possible future contributions to these) for aquaculture and fisheries development in inland aquatic resource systems other than that chosen for the 1994-98 Medium-Term Plan period: ponds and rice floodwaters. The systems to be reviewed include reservoirs, small lakes, floodplains and wastewaters.

Background and Justification

Given its limited budget, ICLARM chose, for the 1994-98 MTP period, to focus the work of its Inland Aquatic Resource Systems Program on the resource system for which the most pressing needs and opportunities could be seen with respect to resource-poor farmers: i.e., ponds and rice floodwaters. This was based upon the priority setting done in ICLARM's strategic planning. However, other inland aquatic resource systems (reservoirs, small lakes, floodplains and wastewaters) have potential for fish production and livelihood, and strategic research agendas are needed for this, with ICLARM's possible roles clarified for future research periods. This can be done through commissioned reviews.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	L
4.	Participation	L
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Discussions were held with a number of potential donors and contributors.

Expected Outputs in 1996

- Proposals for donors to fund commissioned reviews on one of the additional aquatic resource systems listed above; reservoirs will be the priority.

5.2. INTEGRATED RESOURCES MANAGEMENT (IRM) GROUP AND DEVELOPMENT OF RESTORE SOFTWARE

ICLARM Staff	:	Dr. Mark Prein (Project Leader), Mr. Jens Peter Tang Dalsgaard, Ms. Mary Ann P. Bimbao, Ms. Teresita S. Lopez, Mr. Farlyz Villanueva, Ms. Emma Luisa A. Orencia, Mr. Roberto T. Oficial
Collaborating Institutions	:	International Institute of Rural Reconstruction (IIRR), Cavite, Philippines; ICLARM outreach teams and national collaborators in Bangladesh, Malawi, Vietnam and other countries.
Donors	:	ICLARM core funds, DANIDA
Duration	:	1991 - ongoing

Objectives

- To improve the way farmers manage their land and water resources through integration of aquaculture and agriculture
- To develop participatory research procedures for farmers to integrate aquaculture into their farming systems
- To develop participatory research methods for enhancing farmers' natural resources management skills
- To develop an analytical framework, including customized software, for monitoring the impact of integration on households, assessing the sustainability of integrated farming systems and providing direct feedback to farmers.

Background and Justification

Development of integrated agriculture-aquaculture (IAA) farming systems has progressed over the past decade. Much has been learned and development imperatives have changed. The pursuit of maximum commodity yields has now given way to exploring sustainable management of natural resources. The concentration on systems developed at research stations has given way to farmer participation in technology development.

Resource-poor farmers are the target and very few of them culture fish. Ways are needed to integrate fish farming on resource-poor farms, not solely to produce more fish, but as part of a strategy to develop sustainable farming systems.

A farmer participatory-research protocol that brings farmers and scientists together to transform existing farming systems of resource-poor farmers into IAA farming systems is the aim of ICLARM's integrated resources management (IRM) approach. This transformation process is guided by a set of 'sustainability indicators' to ensure that the farming systems developed are ecologically and economically sustainable and that many resource-poor farmers can adopt them.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Three years of field testing of a set of participatory research, monitoring and evaluation procedures was completed in Cavite, Philippines. This collaborative work with IIRR and a group of 14 farmers involved the use of participatory techniques to develop village resource maps, farm transects and bioresource flow diagrams. The work culminated with two impact workshops during which farmers were provided with and assessed a set of data summaries for their farming operations, including bioresource flow diagrams, kite diagrams (indicating farm performance against four sustainability indicators) and a set of bar graphs illustrating gross operating costs and gross and net returns. During the workshops, the participating farmers ranked each of the processes in terms of its relevance and usefulness to them. This information was presented at a research seminar hosted by IIRR. Twelve months of intensive monitoring of on-farm activities of an additional four rice farms, including systems with and without aquaculture components were also completed in Cavite. Data were consolidated and prepared for steady-state agroecological modeling with ECOPATH II, for comparative analysis of productivity, efficiency and farm ecological performance.

The beta version of RESTORE (Research Tool for Natural Resource Management, Monitoring and Evaluation) was completed with accompanying user's manual and field guide. Initial presentations of the software were demonstrated to potential user groups, including the EU-funded Western Samar Agricultural Resource Development Program (WESAMAR), IIRR, and at a Participatory Rapid Appraisal Workshop co-sponsored by the German Development Foundation and the Farming Systems and Soil Research Institute at the University of the Philippines, Los Baños. Additional inputs were provided to the development of the latest version of ECOPATH II version 3.0 software, making the tool more suitable for modeling terrestrial based agroecological scenarios.

Farmers were introduced to the concept of a natural resource type (NRT) during the development of their farm transects and bioresource flow diagrams. While they clearly knew what their different crops contributed to household food and income, the opportunity to assess returns to labor and capital on an NRT (upland, midland, lowland, homestead, fishpond) basis was, for them, a new way of looking at their farms in terms of a set of integrated resource types. They were able to see which NRTs were the most productive and where they were likely to gain the greatest return through increasing the total number of different cultivars and/or the amount of recycling between NRTs. They were also able to compare different farms, not only in terms of productivity, but also in terms of the presence and relative location of different NRTs.

Expected Outputs in 1996

- Evaluation of RESTORE by distribution of beta-test versions to a range of potential user groups, including national research systems, NGOs, national and regional donor-funded development projects. The objective of this evaluation is not only to seek user feedback on the software, but to also determine whether RESTORE is likely to have its greatest impact as a research or farm management tool and who are likely to be its main users.

- Based on the above analysis, the project will release a RESTORE version 1.0, along with a revised User Manual and Field Guide, following a feedback workshop.

- The IRM project also plans to establish working relationships with on-going projects, such as the FAO Farming Systems Programme, to further test and evaluate the RESTORE process and software.

- Publications on the potential applications of RESTORE and a printed information brochure on RESTORE.

- A 10-12 minute video illustrating the application of participatory aspects of RESTORE in different environmental settings.

5.3. Development of Sustainability Indicators for Integrated Agriculture-Aquaculture Farming Systems

ICLARM Staff	:	Dr. Mark Prein (Project Leader), others to be determined
Collaborating Institutions	:	University of Kassel (GHK), Germany; national institutions in the Philippines and Vietnam; ICLARM outreach teams and national collaborators.
Donor	:	BMZ/GTZ
Duration	:	October 1994-September 1996

Objectives

- To develop and test a set of sustainability indicators for evaluating the performance of integrated agriculture-aquaculture (IAA) on small farms
- To formulate a range of simulation models of IAA systems at different levels of integration
- To disseminate results through a workshop, ICLARM publications and peer-reviewed journals
- To train national and project staff at appropriate ICLARM work sites in the application of tools for participatory monitoring and evaluation (PME) of system integration.

Background and Justification

Farm activities can be integrated, in that some enterprises can provide nutrient inputs to or 'ecological services' for others. Such integration has shown potential to improve income and nutrition of small farm households and to counteract the effects of environmental degradation. However, data on the economic, ecological and nutritional benefits of IAA are still scarce. Moreover, for determination of sustainability, clear definitions, criteria and quantitative indicators are lacking. If IAA systems are to be successfully developed and adopted in the future, tools for measurement of their sustainability must exist to enable control of the development process.

In collaboration with scientists from the University of Kassel, indicators of sustainability on IAA-smallholder farms are being formulated and evaluated. Multivariate statistical analyses of farm datasets and indicators will identify key relationships and governing variables. Dynamic simulation models of representative farms will enable testing and characterization of the indicators in terms of sensitivity and precision.

Scores Against Principles

1.	Sustainability	H
2.	Equity	M
3.	Gender	L
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

- Existing information on sustainability indicators was compiled from a range of sources, including grey literature and e-mail conferences. This body of knowledge is being explored for indicators suitable for IAA-smallholder farms.

- Compilation of datasets from IAA farming systems in Malawi, Ghana and the Philippines was continued. The acquisition of additional datasets was delayed and this also delayed related RESTORE training. New collaborators have been identified and plans are being negotiated for data acquisition and analysis.

- Basic model designs of IAA farms were formulated. These are being developed in the STELLA modeling environment. More refined, site-specific models will be developed.

- The project framework and RESTORE concept will be presented at the Conference on Systems Approaches to Agricultural Development at IRRI in December.

Expected Outputs in 1996

- RESTORE training workshops will be conducted.

- Data from secondary sources are to be processed.

- Multivariate analyses will be performed allowing refinement of models and procedures.

- Preliminary characterization of indicators will be made.

- An extension of the project will be proposed to allow further testing.

5.4. A Modeling Approach to the Determination of Ecological Sustainability in Integrated Agriculture-Aquaculture Farming Systems

ICLARM Staff	:	Mr. Jens Peter Tang Dalsgaard (Project Leader), Dr. Mark Prein, Mr. Roberto T. Oficial
Collaborating Institutions	:	Royal Veterinary and Agricultural University, Denmark; University of the Philippines at Los Baños, Laguna, Philippines; the International Institute of Rural Reconstruction, Cavite, Philippines
Donor	:	DANIDA
Duration	:	1994-1995 (extended to May 1996)

Objective

- To analyze and to model the characteristics of rice-based agroecosystems in order to identify chief system properties that may serve as quantifiable indicators of the ecological state and ecological sustainability of the systems.

Background and Justification

ICLARM's focus is on ponds and rice floodwaters for strategic research on integrated resources management and sustainability for its first 5-year period (1994-98). IRRI and ICLARM are also discussing how to collaborate more on rice-fish systems research. ICLARM's work stresses the ecological basis of sustainability and the ecology of rice-based farming systems that could incorporate aquaculture. This project aims to produce ecological models of these systems to indicate their prospects, including sustainability, based on mainstream ecological rather than conventional agricultural descriptors.

Scores Against Principles

1.	Sustainability	H
2.	Equity	L
3.	Gender	L
4.	Participation	M
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Data were collected from four Philippine rice-based smallholder agroecosystems, covering one full annual cycle from 1994 to 1995, to construct steady-state balanced network models. These will be analyzed using the ECOPATH II modeling software. ECOPATH II calculates and quantifies a range of system properties which can be used in the assessment and comparison of the ecological states of the systems.

Expected Outputs in 1996

- Further adaptation of the ECOPATH II software for agroecosystems analysis and the incorporation of this additional facility into future versions of ECOPATH.
- Publications on ECOPATH-based comparative steady-state modeling and evaluation of productivity, efficiency and ecological performance of agroecosystems.

5.5. Research for Development of Sustainable Aquaculture Practices

ICLARM Staff	:	Dr. Modadugu V. Gupta, others to be determined
Collaborating Institutions	:	Fisheries Research Institute, Mymensingh; various NGOs
Donor	:	USAID
Duration	:	June 1993-May 1995. Extension proposed

Objective

- Working in collaboration with national research institutions, to develop sustainable, low-external input integrated agriculture-aquaculture practices that fit into farming systems of Bangladesh.

Background and Justification

Fish is an important source of animal protein for the people of Bangladesh but is in short and diminishing supply. The country has vast water resources some of which are presently under- or unutilized. Available capital intensive aquaculture technologies are not suitable for adoption by resource-poor farmers. Hence, the project has been assisting the national research and development institutions and a number of NGOs in developing low-external input, low-cost, integrated agriculture-aquaculture (IAA) practices that could be sustained by the rural poor, using mostly on-farm resources.

This requires on-station research; farmer participatory research; dissemination of the technologies developed through training government and NGO extension workers; training of scientists in IAA research; assisting in preparation of trainers' training manuals; and conducting impact studies for feedback to research.

Dissemination of results is done in collaboration with NGOs, which provide feedback from different agroecological regions. The project also addresses gender issues through the involvement of women in pond aquaculture, through which they contribute to household income, resulting in their empowerment. This work is expected to benefit not only resource-poor rural households but also to contribute to increasing the availability of affordable fish in urban areas and indeed throughout the country.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	H
4.	Participation	H
5.	Systems approach	M
6.	Anticipatory research	H

1995 Results

Data collected over the last three years, through farmer participatory activities, were consolidated, analyzed and reports prepared. Additional farmer participatory studies were also undertaken for integrating aquaculture with agriculture, in three rice-ecosystems: fish culture concurrently with rice farming in medium highlands and lowlands and alternating with rice in deeply flooded lowlands. Studies undertaken in 256 farms in medium highlands during rainfed and irrigated seasons indicated average fish productions of 230 and 212 kg/ha during irrigated and rainfed seasons, respectively. Farmers who stocked at higher densities (> 6 000 fingerlings/ha), obtained higher

production: averages of 577 and 458 kg/ha during the irrigated and rainfed seasons, respectively. Seventy-one per cent of the integrated farms had higher rice yields (average of 10.8%) than farms with only rice.

Integrated farms used less fertilizers, pesticides and labor, resulting in lower rice cultivation costs by 8.7 and 10.7% during the irrigated and rainfed seasons, respectively. Slightly lower costs combined with higher rice yields in integrated farms resulted in increasing net benefit from rice cultivation alone to over 20%, as compared to rice farms only. Net benefit from integrated farms (from fish and rice) as compared to farms with only rice averaged higher by 64.4% during the irrigated season and 98.2% during the rainfed season.

Studies have indicated the feasibility of utilizing roadside ditches and canals as nurseries for raising fingerlings at the beginning of rainy season, followed by rearing a crop of short-cycle species, such as Nile tilapia *(Oreochromis niloticus)* and/or silver barb *(Puntius gonionotus)* in combination with silver carp *(Hypophthalmichthys molitrix)* and common carp *(Cyprinus carpio)*.

Surveys to assess the impact on farm households of research undertaken for integrating aquaculture into the farming systems in a flood-prone ecosystem showed that fish production from ponds (average size 770 m^2) in the area increased from 23.4 kg per annum (304 kg/ha) before research intervention to 148 kg (2,574 kg/ha) subsequent to research intervention. Household consumption of fish from homestead ponds increased from 15.2 kg to 62 kg after research intervention. Household incomes increased by 12.9% after incorporation of aquaculture into their farming systems. Per caput availability of fish for consumption for households (average 6.7 members per household) increased to 9.25 kg/year (excluding contribution of purchased fish), which is higher than the national per caput consumption of 7.9 kg.

Studies initiated earlier for genetic improvement of silver barb *(Puntius gonionotus)* through selective breeding and line crossing techniques were continued. F_2 generations from Thailand, Indonesian and Bangladesh stocks were produced and their growth performance is being studied.

Studies were initiated for assessing the feasibility of culturing small, indigenous fish, in polyculture with carps.

Twenty training programs were organized during the year, through which 25 scientists were trained in research methods and management, plus 214 extension workers and 408 farmers in different aspects of integrated agriculture-aquaculture farming systems.

Expected Outputs in 1996

- Studies for development of ecoregion-specific integrated agriculture-aquaculture in four ecoregions of the country, viz., (i) flood-free, high rainfall, medium highlands; (ii) low-rainfall, droughtprone medium-highlands; (iii) floodprone lowlands; and (iv) coastal lands.

- Studies for integrating aquaculture with agriculture in medium lowlands and deeply flooded lowlands.
- Studies to assess feasibility of culturing small, indigenous fish species either in monoculture or in polyculture with carps.
- Genetic improvement of silver barb through selective breeding and line crossing techniques.
- Institutional linkages between government institutions and NGOs.

5.6. AN AQUACULTURE RESEARCH AND DEVELOPMENT NETWORK FOR SMALLHOLDER FARMS IN SOUTHERN AFRICA

ICLARM Staff	:	Dr. Randall Brummett (Project Leader), Mr. Fredson Chikafumbwa, others to be determined.
Collaborating Institutions	:	Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR), FAO, Malawi Fisheries Department, Malawi Ministry of Agriculture and Livestock Development, University of Malawi, Malawi-German Fisheries and Aquaculture Development Project (MAGFAD), Aquaculture for Local Community Development (ALCOM/FAO), Swedish Agency for Research Cooperation with Developing Countries, Zambian Department of Fisheries, Zimbabwean Department of National Parks and Wildlife Management (ZDNP).
Donor	:	to be identified (supported in 1995 from ICLARM core funds)
Duration	:	1996 - 2000 (proposed)

Objectives

- Using existing farm resources, to develop technologies to optimize efficient use of water and nutrients on small farms
- To strengthen national capacity to study and develop new integrated agriculture-aquaculture (IAA) farming systems
- To develop farmer-participatory methods for integrating aquaculture into existing smallholder farming systems
- To define and measure economic and ecological sustainability of integrated aquaculture
- To identify why farmers adopt, continue or discontinue

- To provide more precise estimates of potential impact of IAA.

Background and Justification

Policies being adopted in Africa and much of the rest of the world aim at creating more economically and environmentally sustainable food production. The environmental costs (of soil erosion, water pollution and bioaccumulation of pesticides, among others) and direct financial costs (in the form of subsidies) of industrialized agriculture continue to be enormous. Current smallholder farming practices in subSaharan Africa will not be able to support the continent's population. However, building up their productive capacity rather than replicating the unsustainable farming systems of industrialized agriculture, might create an environment from which more sustainable agricultural practices and rural economic security can evolve.

Rural development-oriented R & D programs and institutions have been working on the component technologies for such a strategy. Integrated pest management, integrated nutrient management and agroforestry are examples of this work. Integrated Resources Management (IRM) offers potential for reducing dependence upon external farm inputs, improving farm function and productivity, restoring degraded environments and enhancing household nutrition making it a logical component of a more sustainable approach to farming.

The proposal for this work was approved by SACCAR and the Southern African Development Community (SADC) Council of Ministers, for submission to donors.

The project proposes to work in a strategic, cross-sectoral, collaborative and farmer-participatory mode to provide the answers to long-standing questions about how smallhold farms function and evolve. It will also build capability within SADC institutions to conduct strategic and applied research in IRM and will directly complement and strengthen the applied research, development and extension activities of existing national and regional programs (e.g., ALCOM, SADC/ICRAF and the FAO Farming Systems Programme). It aims to generate new IAA farming systems for direct use by smallholders.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

On-farm and on-station research was continued towards the development of protocols for the selection of indigenous species for integrated farming systems; the characterization of tropical aquatic ecosystems for use in species selection, improved

pond management strategies, and trophic system modeling. Nine species of haplochromine cichlids were chosen on the basis of a literature review. Stomach contents are presently being analyzed. Once complete, these data will be compared with information collected in the pond characterization studies to make a match between fish diet and pond ecology.

Research was continued on the flows of nutrients applied to different forms to integrated fishponds and subsequently to garden plots: 16 ponds were harvested in early October and the data are now being analyzed in preparation for the gardening phase of the study.

A study was made on determining how smallholders could best manage small undrainable ponds for integrated aquaculture. The preliminary finding is that the selective harvesting of intermediate-sized tilapias has a greater positive impact on pond output than does the removal of large individuals. Final data analysis is underway.

A study was started on production of catfish *(Clarias gariepinus)* in backyard tanks, with the stocking of 50 catfish in each of four 1-m^3 experimental units located in the gardens of participating farmers. Kitchen wastes are fed to the fish. Growth has been slow due to the small amount of kitchen wastes generated by Malawian families. Stocking rates have been reduced and the study will continue.

Development of the farmer-scientist partnership protocols for IRM research in a variety of farming systems, included the refinement of the PondSim simulation program for setting control conditions on-station.

The ICLARM/Malawi library, as part of its new regional agenda, extended the range of its NARS partnership services to include the dissemination of research findings and the provision of referencing and literature location services to subSaharan African scientists, handled 15 local and 3 international requests for information per month.

ICLARM/Malawi's Research Bulletin Series, which is mailed to 40 organizations in the SADC region, produced seven new issues.

Project staff participated in 18 national, regional and international workshops, with 13 papers presented, and the project produced 15 scientific publications.

Final approval from the SACCAR Board of Directors was received in February for a new networking project proposal but funds have not yet been secured.

Expected Outputs in 1996

- Relocation of ICLARM/Malawi project offices from the National Aquaculture Centre, Domasi, to the University of Malawi Administrative complex in Zomba. This will improve accessibility to both national and regional collaborators for networking activities.

- Completion of on-station and on-farm research started in 1995.

- Initiation of new research projects with the Malawi Fisheries Department and the Universities of Malawi and Zimbabwe.

- Start-up of the SADC networking project, subject to available funding.

- Improved linkages with the information and documentation center in Lilongwe, the Chancellor College Library in Zomba and the Bunda College of Agriculture Library in Lilongwe, to enhance information acquisition and dissemination, plus increased information flow from ICLARM HQ to Africa.

6. COASTAL AQUACULTURE AND STOCK ENHANCEMENT

6.1. BIOTECHNICAL SYSTEMS FOR CULTIVATION OF GIANT CLAMS

ICLARM Staff	:	Dr. Johann D. Bell (Project Leader), Mr. Mark Gervis, Mr. Idris Lane, Mr. Anthony Hart, Mr. Cletus Oengpepa, Mr. Hugo Tafea, Mr. Ferral Lasi, Mr. Patrick Timmy, Ms. Angela Grice
Collaborating Institutions	:	Solomon Islands Ministry of Agriculture and Fisheries, James Cook University
Donors	:	ACIAR, EU, FAO South Pacific Aquaculture Development Programme
Duration	:	Operational since 1987. This phase mid-1995 to December 1999

Objectives

- To identify optimum growing conditions and husbandry methods for five species of giant clams in coastal villages
- To obtain robust estimates of growth and survival of five species of giant clams from a wide range of coastal village farming sites
- To train village farmers and key regional fisheries personnel in the efficient and profitable culture of giant clams
- To develop markets for giant clams in the live seafood trade and aquarium industry
- To maintain genetically diverse F_1 broodstock of each species of giant clam as the basis for future hatcheries throughout the Asia-Pacific
- To supply giant clam larvae, and training in the rearing of giant clams, to countries in the Asia-Pacific region where giant clams have been overfished or extinguished.

Background and Justification

Coastal communities adjacent to coral reefs in developing countries have few opportunities to develop low-cost industries capable of generating income and food on a sustainable basis. Giant clam farming is one option. Past research by the Micronesian Mariculture Development Center, James Cook University, the University of the Philippines and ICLARM's Coastal Aquaculture Centre (CAC) in Solomon Islands, resulted in development of reliable methods for the spawning and land-based larval rearing of giant clams. The ultimate goal of this research - to develop viable giant clam

farming industries for coastal villages - was, however, never realized. The CAC is completing the international research effort by developing methods to grow five species of giant clams in villages. Over the next 3-4 years, the CAC will run large-scale grow-out experiments for each species at 12 villages to identify variability in growth and survival among sites, and to identify the most reliable husbandry methods.

This project will provide a firm basis for a sustainable increase in the productivity of coral reefs through the farming of giant clams. It will also yield robust information on the commercial viability of small-scale farms for giant clams in villages. At the conclusion of the project, ICLARM will be in a position to provide advice to national agencies on the costs and benefits associated with farming of giant clams. The maintenance of adequate broodstock, and the delivery of larvae and grow-out technology to a variety of countries, will facilitate the continuation and expansion of giant clam farming throughout the Asia-Pacific.

Giant clam farming is particularly suitable to villagers living on coral reefs because: there is virtually no impact on the coral reef environment; the procedures tend to enhance rather than diminish genetic diversity; the farms can be designed to be economically viable at the village level; the farms have been shown to be particularly successful when run by family units; and there are a variety of markets, including sale for food, aquaria and shellcraft.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Production from the CAC's nursery resulted in the distribution of 118 000 giant clam "seed" to coastal villages in 1995. In addition, a Solomon Islander produced an additional 23 500 seed clams for distribution to villages from larvae supplied to him from the CAC. The species distributed to giant clam farmers were *Tridacna crocea*, *T. derasa*, *T. gigas*, *T. maxima* and *Hippopus hippopus*.

A village grow-out trial completed in 1995 yielded data on variation in growth and survival of *Tridacna squamosa* over a large spatial scale. These data indicated that this species can be grown profitably for the aquarium trade and have aided village farmers in choosing optimum sites for grow-out of *T. squamosa*.

In 1995, 27 000 clams were sold on behalf of the 26 farmers, at a gross value of US$77 000. This represents an average net income of about US$1 350 per annum. ICLARM's methods for growing giant clams not only deliver benefits to village growers,

they are sustainable. There is no longer any reason to harvest wild clams from coral reefs to supply the aquarium trade.

The large-scale nature of this project and quality of the data on growth and survival of cultured giant clams at coastal villages also resulted in continued funding from donors. ACIAR have funded an Australian Volunteer Abroad, Mr. A. Hart, between July 1995 and July 1997 to publish the robust estimates of growth and survival of giant clams resulting from this project. Also, the European Union has provided funds to increase the number of village clam farms.

A staff member from the Fisheries Division, Ministry of Agriculture and Fisheries, was seconded to the giant clam project until the early part of 1995, completing an eight-year collaboration. The staff member was integrally involved in all aspects of the development of village farming methods, and in scaling-up the village farming trials. In addition, a member of the fisheries department of Malaysia visited the CAC for training in propagation and village-based farming of giant clams.

The giant clam project also benefited from the input of a PhD student from James Cook University. Ms. Angela Grice conducted a comprehensive experiment on the process of fertilizing the zooxanthellae of giant clams. She assessed the effects of stocking density, shell size and nutrient concentration and found that the standard practice of applying a 20 μM solution of ammonium sulfate inhibited the growth of clams < 10/mm, and limited growth when clams attained 20/mm. Her findings have enabled the CAC to reduce the duration of the land-based nursery phase.

In 1995, papers on the cultivation of giant clams were presented at the World Aquaculture Society meeting, the Pacific Congress on Marine Science and Technology International (PACON) meeting on Sustainable Aquaculture, the Forum Fisheries Committee, and the FAO/JICA Workshop on Aquaculture in the Pacific.

A proposal was also submitted to FAO to investigate the potential of giant clams as *sashimi* in the Asian market.

Expected Outputs in 1996

- Publications documenting: i) the methods used by ICLARM to propagate and grow-out giant clams; ii) the variability in survival and growth of *T. derasa* and *T. crocea* at 12 village farms; and iii) the effects of nutrient concentration on growth during the land-based nursery phase.

- Presentation of papers/posters on growth and survival of giant clams at village farms at the 2nd World Fisheries Congress.

- Field experiments to solve grow-out problems with *T. crocea*.

- A workshop to update giant clam farmers on improvements to grow-out methods for giant clams, and developments in the market place.

- Provision of training for fisheries staff from Fiji.
- Sales of giant clams to local seafood outlets in the Pacific.
- Establishment of a computerized database for giant clam broodstock.

6.2. DEVELOPMENT OF SMALL-SCALE VILLAGE FARMS FOR BLACKLIP PEARL OYSTERS IN SOLOMON ISLANDS USING WILD SPAT

ICLARM Staff	:	Dr. Johann D. Bell (Project Leader), Mr. Kim Friedman, Mr. Mark Gervis, Mr. Idris Lane, Mr. Gideon Tiroba (Solomon Islands Ministry of Agriculture and Fisheries)
Collaborating Institutions	:	Solomon Islands Ministry of Agriculture and Fisheries; James Cook University, Australia; Cook Islands Ministry of Marine Resources
Donor	:	ACIAR
Duration	:	November 1995 - November 1997

Objectives

- To work with local villagers to scale-up the collection of blacklip pearl oyster spat
- To continue experimentation to identify the optimum system for collecting spat of the blacklip pearl oyster
- To develop methods for maximizing the survival of oysters in the juvenile grow-out phase
- To assist villagers to establish small-scale pearl farms based on oysters derived from wild spat
- To produce the biological data needed to make a thorough economic analysis of potential returns to village farmers from farming black pearls in Solomon Islands.

Background and Justification

The culture of pearls from blacklip pearl oysters has brought substantial economic benefits to native coastal communities in French Polynesia and Cook Islands. Despite intensive fishing of the species throughout the Pacific earlier this century, these countries managed to establish pearl farming industries due to the nature of their "closed" coral atoll lagoons - spat from the remnant populations were trapped within the lagoons and therefore easy to collect.

The blacklip pearl oyster also occurs throughout much of the more open coral reef habitats of Solomon Islands. This project builds on the results of an initial study funded by ACIAR from November 1993 to November 1995 entitled "A Collaborative Investigation of Options for Spat Collection and Hatchery Production of Pearl Oysters in the Central Western Pacific". During that project, spat collectors were deployed at 24 sites spread across Solomon Islands. Spatfall occurred mainly during early summer, and was great enough at two sites to provide a strong indication that village-based collection of wild spat could be sufficient to sustain commercial operations there. ACIAR has agreed to extend the work for another two years to initiate the mass collection of spat, to test alternative materials for collecting spat and to develop methods for the grow-out of spat in villages to the size where they can be sold to pearl farmers. Predation of spat by *Cymatium* gastropods was a problem during the first study. Special attention will be given to this problem when developing the village-based grow-out methods.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	H
5.	Systems approach	M
6.	Anticipatory research	H

1995 Results

The main results of the initial project were: i) spatfall of blacklip pearl oysters was consistently greater at two sites in the Western Province of Solomon Islands than at other readily accessible areas across the country; ii) spatfall was greatest on collectors deployed between October and January; iii) shademesh collected more spat than black plastic sheeting; and iv) protective bags placed around spat collectors did not reduce mortality of spat: in some cases mortality was greater inside the protective bags because they "trapped" larval *Cymatium* gastropods and predatory crabs that settled from the plankton.

The project has heightened the awareness of the value of blacklip oysters on the part of coastal villagers across much of Solomon Islands. This has had three outcomes: i) villagers now understand the reasons for the national ban on export of pearlshell and conform to it; ii) villagers safeguard wild broodstock; and iii) some villagers have started their own spat collection trials.

The project has been done in close collaboration with scientific staff and provincial fisheries officers from the Fisheries Division, Ministry of Agriculture and Fisheries. These staff are now in a strong position to provide training in the design and installation of spat collectors, the grow-out of wild spat and the maintenance of wild broodstock.

Expected Outputs in 1996

- Establishment of large-scale spat collecting operations at two village sites.
- Assessment of the feasibility of large-scale collection of spat to support commercial operations.
- Publication(s) on improved methods for collecting spat from the wild.
- Development of methods to achieve high survival of spat during grow-out at village sites.

6.3. Development of Methods for the Mass-Rearing of Tropical Sea Cucumbers for the Purpose of Enhancing Wild Stocks

ICLARM Staff	:	Dr. Johann D. Bell (Project Leader), Dr. Stephen Battaglene, Ms. Jane Seymour, Mr. Mark Gervis, Mr. Christian Ramofafia
Collaborating Institutions	:	Solomon Islands Ministry of Agriculture and Fisheries, Advisory Panel from Advanced Scientific Institutions in Australia coordinated by ACIAR
Donor	:	ACIAR
Duration	:	Operational since 1993. This phase January 1995 to December 1999

Objectives

- To develop reliable methods for inducing tropical species of sea cucumbers to spawn
- To identify tropical algae suitable for the nutrition of larval sea cucumbers
- To develop repeatable, cost-effective methods for rearing the larvae and juveniles of tropical sea cucumbers to the stage where they are robust enough for release into coral reef habitats.

Background and Justification

Processed sea cucumbers are a valuable source of income for communities in remote areas of Asia-Pacific because they can be processed (boiled and dried) on site, have a long shelf-life without refrigeration and fetch a high price in Asian markets. There is a strong demand for sea cucumbers from China. This demand has pushed up the price of the favored species, and created a market for a wider variety of species.

There is now widespread concern that recent levels of catch throughout tropical Asia-Pacific may not be sustainable.

The ability to sustain or increase the yield of sea cucumbers by stock enhancement would be a valuable tool for managers. Stock enhancement involves liberating sufficient juveniles (raised in hatcheries, or caught from the wild as spat and reared to a more robust size) into the wild to ensure that there is a fairly large and constant supply of animals for capture each year. This form of management is particularly attractive where recruitment of juveniles is highly variable. Liberation of cultured juveniles could also be used to restore fisheries where the stock has been overexploited to the point where adequate recruitment is jeopardized.

There are several reasons why sea cucumbers appear to be well-suited to enhancement: i) most species are restricted to particular inshore habitats; ii) sea cucumbers are low on the food chain, so availability of food is unlikely to be a limiting factor; and iii) they are conspicuous and slow-moving and therefore easy to harvest. However, there have been few successful attempts to rear the larvae of commercially valuable species of tropical sea cucumbers. Therefore, the potential of enhancement for managing stocks of sea cucumbers in the tropical Asia-Pacific cannot be assessed until cost-effective methods of producing larvae *en masse* have been developed.

Scores Against Principles

1.	Sustainability	H
2.	Equity	M
3.	Gender	M
4.	Participation	H
5.	Systems approach	M
6.	Anticipatory research	H

1995 Results

In 1995, a pilot study on cultivation of tropical sea cucumbers funded by the Australia and Pacific Science Foundation identified that: i) wild juveniles of the surf redfish (*Actinopyga mauritiana*) can be reared in captivity at growth rates substantially better than those reported from the wild; ii) the white teatfish (*Holothuria fuscogilva*) has a restricted spawning season (July-December with a peak in August) in tropical waters and production of larvae will be restricted to these times unless methods can be developed for maturation in captivity; and iii) the larvae of *A. mauritiana* and *Holothuria atra* could not be reared past Day 30 on formulated diets; rather, successful larval rearing is likely to depend on the availability of a wide range of nutritious tropical algae.

Additional accommodation and offices, along with an enlarged hatchery, algal culture facility and wet laboratory, were constructed at the Coastal Aquaculture Centre during 1995 for the project. An Aquaculture Scientist (larval rearing methods) and Research Associate (algal production) were also recruited for the project in 1995.

Expected Outputs in 1996

- The Aquaculture Scientist will inspect laboratories in Indonesia, India, China and Japan involved with the culture of sea cucumbers.

- Broodstock of several different species of sea cucumber will be collected and induced to spawn.

- The algal production unit will be commissioned and produce sufficient high quality algae for a series of large-scale larval rearing experiments.

- The enlarged hatchery will be set up for rearing of sea cucumbers and impediments to completing their life cycles will be identified.

7. POLICY RESEARCH AND IMPACT ASSESSMENT

7.1. FISHERIES CO-MANAGEMENT PROJECT

ICLARM Staff	:	Dr. Robert S. Pomeroy (Project Leader), Mr. Michael D. Pido, Mr. Melvin B. Carlos, Mr. Canesio D. Predo, Ms. Anjanette C. Trinidad, Ms. Josella M. Mayordomo, Ms. Maricel C. Gamo
Collaborating Institutions	:	**Denmark** - North Sea Centre (NSC), Hirtshals; **Vietnam** - Ministry of Fisheries; National Center for Social Sciences; Cantho University; **Thailand** - Department of Fisheries; Kasetsart University; Prince of Songkla University; **Malaysia** - Universiti Pertanian Malaysia; **Indonesia** - Research Institute for Marine Fisheries; Directorate General of Fisheries; Indonesian Fisheries Socioeconomic Research Network; **Philippines** - Southeast Asian Fisheries Development Center-Aquaculture Department; University of the Philippines-College of Public Administration; Department of Environment and Natural Resources; Southeast Asian Ministers of Education Organization-Regional Center for Graduate Study and Research in Agriculture (SEARCA); Tambuyog Development Foundation; University of the Philippines in the Visayas; **Mozambique** - Institute for Development of Small-Scale Fisheries; **Zimbabwe** - Center for Applied Social Sciences, University of Zimbabwe; Lake Kariba Fisheries Research Institute; **Malawi** - Fisheries Department; Chancellor College; **West Africa** - Programme for Integrated Development of Artisanal Fisheries; **Zambia** - Department of Fisheries; **South Africa** - University of Cape Town, Sea Fisheries Research Institute; **Caribbean** - CARICOM Fisheries Resource Assessment and Management Program
Donor	:	Danish International Development Assistance
Duration	:	April 1994-April 1999

Objectives

- To provide a set of globally or regionally applicable fisheries co-management models developed and applied in selected aquatic resource systems in selected countries and pilot sites in Asia, Africa and the Pacific, towards the goal of sustainable and equitable management of fisheries in developing countries to meet the nutritive and economic needs of poor people.

Background and Justification

There is a need for rapid and substantial evolution of existing fisheries management strategies to support sustainable resource use. There must evolve a more dynamic partnership using the capacities and interest of the local community and resource users, complemented by the ability of the national government to provide enabling legislation and administrative assistance. This partnership can be called co-management, where the national government and the community share authority and responsibility for fisheries management. Community-based management is a central element of co-management. The amount of authority that the national government and the community have will differ and depend upon country and site-specific conditions.

The Fisheries Co-Management Research Project will conduct research in coastal, coral reef, lake and river/floodplain aquatic resource systems in countries in several regions of the world including Asia, Africa and the Pacific.

The project will systematically and comparatively document and assess models and processes of fisheries co-management implementation at national government and community/fisher organization level and their results and impacts. General principles and propositions which facilitate successful implementation of fisheries co-management strategies will be identified. The research activities will be conducted through three components: comparative case studies of fisheries co-management strategies; country research; and information exchange.

The research project will utilize a comparative analytical approach, relying on a common research strategy and an institutional analysis research framework for use in each partner-country and resource system, in order to integrate and improve the understanding and implementation of fisheries co-management strategies.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	M
4.	Participation	M
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

A major project event was the international "Fisheries Co-Management Research Workshop" held at the North Sea Centre in Hirtshals, Denmark, 29-31 May 1995 with a total of 54 participants from Benin, Cambodia, Canada, Denmark, FAO, Indonesia, Malawi, Malaysia, Mozambique, Norway, Philippines, Sweden, Thailand, UK, USA, Vietnam, Zambia, Zimbabwe. The workshop was the first occasion for all project partners to meet and share experiences in community-based fisheries management and co-management and to discuss future collaboration. Among the recommendations from the workshop was the organizing of a regional (training) workshop in the southern Africa

region in late 1995. This workshop, which focused on the research framework and methodology, future collaboration in fisheries co-management research, and the establishment of an informal regional research network, was held on 20-22 November in Kariba, Zimbabwe with some 40 participants from Malawi, Mozambique, Zambia, Zimbabwe, and South Africa and ICLARM/IFM project core staff.

The other highlights of the project to date include:

- Identification of NARS partners and research projects in Philippines, Indonesia, Vietnam, Thailand, Malaysia, Benin, Côte d'Ivore, Zambia, Zimbabwe, Malawi, Mozambique, and South Africa. The research projects in partner countries are either ongoing or in the final planning stage.

- Comparative analysis of fisheries management policies and approaches to co-management at national/international levels initiated. Comparative analysis of enforcement and compliance ongoing.

- Research framework for institutional analysis revised and indicators on key contextual variables and decisionmaking arrangements identified.

- Manual on Rapid Appraisal of Fisheries Management Systems, RAFMS, completed and methodology field tested in Philippines and Indonesia.

- Computerized database on fisheries co-management literature established. Literature review under completion.

- Establishment of an informal regional fisheries co-management research network in Southern Africa with Center for Applied Social Science, CASS, University of Zimbabwe, as focal point.

- Project presentation made at international conferences. Articles on project issues accepted for publication in scientific journals.

- Fisheries co-management policy brief as well as fisheries co-management research newsletters published and widely distributed.

- Database on community-based coastal resources management projects in the Philippines established and draft project review report prepared.

- Case study of community-based coastal resources management arrangement in Bali, Indonesia completed.

- Case study of beach seine fisheries co-management arrangement in Inhassoro, Mozambique completed.

- National project workshops held in the Philippines and Vietnam.

Expected Outputs in 1996

- Publication and dissemination of fisheries co-management literature review.

- Completion of co-management case studies in partner countries and publication of studies including comparative analysis.
- Completion and publication of comparative fisheries management policy analysis and comparative analysis on enforcement and compliance.
- Completion of research projects initiated in 1994/95 with partners in the Philippines, Vietnam and Malaysia.
- Literature review and other project documentation presented at international conferences and workshops.
- Identification and initiation of fisheries co-management pilot site activities with NARS/NGO partners in the Philippines, Mozambique, Malawi and possibly Togo.
- Regional fisheries co-management workshop in southern Africa in November 1996.
- Impact and performance evaluation of community-based coastal resource management projects in the Philippines.
- National workshop on community-based coastal resource management in Indonesia.
- Pilot site coastal resource co-management: Palawan, Philippines.

7.2. Socioeconomic Component of the Project Support to Strengthening the Institutional Capacity for Sustainable Aquaculture Development in the Southern Part of Vietnam

ICLARM Staff	:	Dr. Robert S. Pomeroy, Ms. Arlene L. Garces
Collaborating Institutions	:	Cantho University, Vietnam; The Fish Culture Research Institute, Szarvas, Hungary
Donor	:	Netherlands Government
Duration	:	1 September 1994-31 December 1997

Objectives

- To strengthen and upgrade the educational, adaptive research and extension capacity and capability in aquaculture in the southern part of Vietnam
- To improve access to current knowledge and experience in aquaculture development
- To increase institutional cooperation between national partners and international development organizations involved in aquaculture.

Background and Justification

The focus of the project is on the improvement and development of integrated freshwater aquaculture systems in the southern part of Vietnam, specifically the Mekong Delta region. The WES project will focus on the upgrading of the staff and facilities of the Faculty of Fisheries of the Cantho University (CTU). In order to expedite a multidisciplinary approach towards fish farming systems and a constructive cooperation, project activities will be implemented with Faculty of Economics at CTU, the Faculty of Fisheries at the University of Agriculture and Forestry, and the Farming Systems Research and Development Centre of CTU. The project will be implemented in three phases with a total period of 3-4 years. These phases are: Phase I: Upgrading of Staff and Facilities; Phase II: Interdisciplinary Approach Towards Farming Systems Analysis, Assessment of Needs; and Phase III: Transfer of Information. The target areas of the project are Cantho and Vinh Long Provinces.

The Socioeconomic Component consists of four activities: (1) Curriculum Development, (2) Training, (3) Research and (4) Coordination. These activities would be carried out by members of the Asian Fisheries Social Science Research Network (AFSSRN).

1995 Results

The Curriculum Development activities consisted of both review of existing courses and development of new courses for the Faculty of Fisheries and Economics of CTU. These courses include farm management, aquaculture and fisheries economics, natural resource economics, socioeconomic analysis of farming systems, and social science research methods.

The training consisted of five courses including social science research methods, socioeconomic analysis of integrated farming systems, aquacultural marketing, farm management and production economics, and natural resource economics.

The curriculum development and training activities were undertaken by AFSSRN members during the period of 26 May to 25 September 1995.

Technical assistance and funding was provided to Mr. Le Xuan Sinh who has completed his Master of Science degree at the Asian Institute of Technology in Bangkok, Thailand. The title of his thesis is "The Effects of Aquaculture on Farm Household Economy: A Case Study of Omon District, Cantho Province, Vietnam."

Expected Outputs in 1996

- Four planned research activities: (1) socioeconomic analysis of fish farming households; (2) economic analysis of fish farming systems; (3) bioeconomic production of fish farming systems; and (4) marketing analysis of fish farming systems. The research activities will be implemented with the Faculty of Fisheries of Cantho University.

7.3. A REVIEW AND EVALUATION OF COMMUNITY-BASED COASTAL RESOURCE MANAGEMENT PROJECTS IN THE PHILIPPINES, 1984-1994

ICLARM Staff	:	Dr. Robert S. Pomeroy (Project Leader), Mr. Canesio D. Predo
Collaborating Institutions	:	-
Donor	:	USAID
Duration	:	25 August 1995-25 April 1996

Objective

- To provide a critical assessment of the implementation, impact and performance of completed CB-CRM projects to serve as a basis for improved implementation of the new USAID Coastal Resources Management (CRM) Project and other CB-CRM initiatives in the Philippines.

Background and Justification

To lay the groundwork for further community-based coastal resource management (CB-CRM) development activities in the Philippines, a review and evaluation of community-based resources management in the Philippines will be undertaken. Through this study, a systematic review of CB-CRM projects in fisheries will allow for the: (1) identification of the successful and non-successful previous approaches; (2) assessment of the causes for project success or failure; (3) determination of the major intervention activities, impacts and sustainability of interventions; and (4) determination of the approaches and processes that work best in different environments and conditions that could be replicated to other locations in the country. By undertaking this review and evaluation, recommendations for the improvement and refinement of similar and future projects can be made.

1995 Results

Six sites were selected for the study based on the criteria and suggestions presented in the project proposal. The six sites are: (1) Calagcalag, Ayungon, Negros Oriental; (2) Tiguib, Ayungon, Negros Oriental; (3) Ulugan Bay, Palawan; (4) Honda Bay, Palawan, (5) Zaragosa, Badian, Cebu; and (6) Ronda, Cebu.

A project evaluation methodology, "Evaluating Factors Contributing to the Success of Community-Based Coastal Resource Management Projects: A Baseline Independent Method" was developed. The interview schedule for the household survey of fishers was prepared. Field data collection was undertaken at the first site, Calagcalag, Ayungon, Negros Oriental and at the second site, Tiguib, Ayungon, Negros Oriental.

Expected Outputs in 1996

- Completion of field data collection at four remaining sites.
- Completion of data encoding and statistical analysis.
- Final report preparation.

7.4. Policy Research on User-based Management. The Case of Inland Openwater Fisheries of Bangladesh

ICLARM Staff	:	To be determined
Collaborating Institutions	:	Bangladesh - Department of Fisheries and Fisheries Resource Instititute
Donor	:	The Ford Foundation
Duration	:	1996 - 1998 (proposed)

Objectives

General

- To develop a framework for user-based fisheries management that would promote equitable distribution of benefits to those who are vulnerable in the community and ecologically sustainable use of Bangladesh's openwater and floodplain fisheries.

Specific

- To develop an integrated systems view of human community-fisheries resources relationships
- To understand the role of local institutions, traditional practices and ecological knowledge in regulating access to, and patterns of exploitation of, the fisheries
- To test alternative models of GO-NGO-fishers collaboration in fisheries management and examine the extent to which the models contribute to encouraging community participation, reducing pressure on the fisheries, and building locally sustainable institutions
- To generate and disseminate policy-relevant information to foster informed debate and necessary policy change.

Background and Justification

Beset with increasing poverty and inequality, many developing countries have been experiencing intense pressure to manage their fisheries and other natural

resources for improved and sustained productivity as well as to ensure an equitable distribution of benefits amongst the diverse populace.

Since the 1970s, the Department of Fisheries (DOF) of Bangladesh has argued for managing the country's natural waterbodies with the objectives of increasing and sustaining fish production and promoting the welfare of fishing communities. In 1986, the government decided to pursue a New Fisheries Management Policy (NFMP) for the management of openwater fisheries along the lines suggested by DOF. Following this new initiative, about 300 waterbodies were placed under the administration of DOF.

The Ford Foundation supported DOF to work creatively with organized fisher-groups to develop innovative and mutually agreed plans for management and sustainable exploitation of inland openwater fisheries. Subsequently, a new project entitled Improved Management of Openwater Fisheries (IMOF) focused on strengthening the licensing management by DOF through active participation of the four leading NGOs (BRAC, CARITAS and Proshika MUK) with technical assistance from ICLARM.

An external evaluation of the IMOF Project noted that the Bangladesh experience with GO-NGO-fisher relationship would prove valuable and be applicable to co-management systems in many coastal and estuarine areas. The report suggested that it is considered desirable to increase the participation of local fishers in resource management.

ICLARM in the past has provided technical and scientific inputs to the innovative ideas of transfer of technologies and design of management approaches, to benefit the poorer communities in Bangladesh. Recently, ICLARM embarked on a global research project on fisheries co-management. The fisheries co-management models will be developed in Asia, Africa and the Pacific. This new project in Bangladesh and the ongoing fisheries co-management project will be mutually strengthened through collaboration and networking.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	H
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

Expected Outputs

The research will generate a substantial body of knowledge for institutional design of future user-based resource management policies. The body of knowledge will include:

- research frameworks relevant to fisheries resource management and the attainment of sustainable food security in low-income, high-population density countries;
- reviewed and organized information on local views, fishers' priorities, traditional ecological knowledge, etc.; and,
- technical and scientific publications, policy briefs, newsletters and results of workshops, seminars and meetings with government planners and policymakers, NGOs and community.

7.5. DISSEMINATION AND EVALUATION OF GENETICALLY IMPROVED TILAPIA SPECIES IN ASIA (DEGITA)

ICLARM Staff	:	Dr. Madan M. Dey (Project Leader), Dr. Durvasula V. Seshu (up to July 1995), Dr. Roger S.V. Pullin, Mr. Gaspar B. Bimbao
Collaborating Institutions	:	**Bangladesh** - Fisheries Research Institute; **China** - Shanghai Fisheries University; **Philippines** - Bureau of Fisheries and Aquatic Resources; **Thailand** - National Aquaculture Genetics Research Institute; **Vietnam** - Research Institute for Aquaculture No. 1, Research Institute for Aquaculture No. 2.
Donor	:	ADB
Duration	:	June 1994 - December 1996

Objectives

- To carry out detailed evaluation of the genetic and socioeconomic performance and environmental impacts of improved Nile tilapia in Bangladesh, China, the Philippines, Thailand and Vietnam
- To disseminate promising tilapia strains among small-scale fisherfolk in these five countries for increasing their incomes and improving the nutrition of poor fish producers and consumers
- To transfer scientific knowledge and technology on tilapia genetics in order to assist the participating countries in planning national tilapia breeding programs.

Background and Justification

Nile tilapia *(Oreochromis niloticus)* is one of the most popular farmed fish species in East and Southeast Asia. It is the second most important freshwater farmed fish in China, the Philippines and Thailand - second to carps in China to milkfish in the

Philippines and to catfish in Thailand. Nile tilapia is also proving to be a suitable cultured species in other parts of Asia, particularly in Bangladesh and Vietnam.

ICLARM, in collaboration with national aquaculture research institutes of the Philippines and the Institute of Aquaculture (AKVAFORSK) of Norway, has developed an improved Nile tilapia *(Oreochromis niloticus)* strain through selective breeding that has, on average, 50% better survival rate and 60% faster growth rate than the present farmed breeds in the Philippines. Bangladesh, China, Thailand and Vietnam have shown keen interest to disseminate this improved strain of Nile tilapia in their respective countries. Before disseminating the strain for commercial production, there is a need to assess its performance, economic viability, social acceptability and environmental compatibility under varied biophysical and socioeconomic environments.

The project is being implemented as an integral part of the International Network on Genetics in Aquaculture (INGA). It is targeted to make the tilapia production system more sustainable and equitable by conducting anticipatory system-based research, in partnership with the national aquaculture research institutes of five developing countries of Asia.

To ensure sustainability, the project aims to generate location-specific Nile tilapia technology with proper consideration of the sustainable limits of natural resource systems, the resource base of tilapia farmers, and perspectives of different stakeholder groups (fish producer, consumer, agents, landless laborers, etc.). Socioeconomic analysis is being carried out to ensure that the technology would benefit the disadvantaged section of society, particularly the poor and women. The project is considering both the supply and demand sides of the tilapia industry, specifically future demand for tilapia, technical constraints faced by fish farmers, and comparative advantage of different ecosystems/resource bases in culturing Nile tilapia.

Scores Against Principles

1.	Sustainability	M
2.	Equity	H
3.	Gender	H
4.	Participation	H
5.	Systems approach	M
6.	Anticipatory research	H

1995 Results

All five participating countries initiated baseline surveys of tilapia producers, consumers and traders. Each country is collecting baseline information on 15 to 25 aquaculture farmers per site to characterize the farm households and their farming systems from socioeconomic and ecological perspectives. Information on consumption and trade aspects is being collected through multiple visits (3 to 4 times a year) from 8 to 10 fish consumers and to more or less equal numbers of fish traders per site.

Bangladesh, China, Thailand and Vietnam initiated on-station trials, and Vietnam completed the first cycle of on-station trials. Results so far indicate superiority of the GIFT strain over the controls used.

Plans for on-farm activities in all participating countries were finalized and include: analysis of agroecological and socioeconomic environments of project sites; baseline surveys of fish producers, consumers, and traders; on-farm monitoring of GIFT and local strains; and post-adoption surveys. Sites representing a range of agroecosystems and aquaculture systems were selected. All the participating countries initiated collection of information on agroecological and socioeconomic environments. On-farm monitoring of GIFT and local strains was initiated in 80 ponds in Bangladesh, 90 ponds/cages in the Philippines, and 120 ponds in Vietnam.

Information on the environmental impact of tilapia species and culture systems is not generally available. However, anecdotal information suggests that, though the Mosambique tilapia *(O. mossambicus)* created some environmental problems, the same has not been experienced so far with Nile tilapia.

The progress of DEGITA activities was presented and discussed during the second steering committee meeting of the International Network on Genetics in Aquaculture (INGA) held on 20-23 June 1995 in Hyderabad, India. Encouraged by the progress of DEGITA, six carp-producing Asian members of INGA - Bangladesh, China, India, Indonesia, Thailand and Vietnam - expressed interest in similar collaboration on carps.

Expected Outputs in 1996

- Results of comparative on-station and on-farm trials.
- Implementation of an adoption survey.
- Organization of a training program on "Impact Assessment of Improved Tilapia Strains in Asia" for national team members.
- Preparation of a policy framework for developing self-sustaining national tilapia breeding programs.
- Organization of training programs on broodstock management for local fish breeding technicians and fish farmers.
- Organization of a final workshop.
- Final project report and publications.
- Organization of a training workshop on Genetic and Ecological Data Analysis.

8. INFORMATION AND TRAINING

8.1. PUBLICATIONS AND DISSEMINATION

ICLARM Staff	:	Dr. Leticia B. Dizon, Ms. Marie Sol M. Sadorra, Ms. Casilda I. Guevara, Mr. Christopher M. Bunao (until February 1996), Mr. Albert B. Contemprate, Ms. Ma. Graciela R. Balleras, Ms. Alma G. Canuto and Mr. Rodelio L. Resurreccion
Collaborating Institutions	:	In addition to ICLARM authors, various external authors on commission (Studies and Reviews) or providing articles (Conference Proceedings and *Naga*)
Donor	:	ICLARM core funds
Duration	:	Continuous

Objective

- Prepare and disseminate ICLARM publications as efficiently as possible.

Background and Justification

ICLARM has always published findings from its research to ensure that they are available to the widest audience, especially in developing countries.

Scores Against Principles

1. Sustainability	N/A
2. Equity	H
3. Gender	N/A
4. Participation	M
5. Systems approach	N/A
6. Anticipatory research	N/A

1995 Progress

The 1994 Annual Report was published in October 1995. The issues for *Naga, the ICLARM Quarterly* for January, April, and July were published in February, June, October, respectively. Other publications during the period included one Conference Proceedings, three Technical Reports, three issues of the *ICLARM Newsbriefs*, two issues of the *Fisheries Co-Management News*, one fish poster, one brochure, ten issues of the *ICLARM Newsplash,* and the *ICLARM 1995 Operational Plan.* The Publications Unit also produced a technical report (of 37 papers) ready for compact disc format. Four

486DX4-100 computers were acquired by the Unit during the middle of the year for use in graphics/layout and editing.

Delays in production of the Annual Report and *Naga* were incurred due to staff reduction -- one of two typesetters in early 1995 and one of three artists in mid-1995. It was decided not to replace them immediately but to use contract staff as recommended in the external review of December 1994.

The Publications Unit also did the graphics and layout of two issues of the *Asian Fisheries Science*, the journal of the Asian Fisheries Society. Materials for meetings (slides/overhead transparencies, programs, identification cards for participants, posters, etc.) are constantly being prepared. The Unit also prepares various illustrations, figures and artwork for different projects and presentations that are not published, as well as calling cards. The editors of the Unit also copyedited many ICLARM contributions for submission to international refereed journals, as well as fifteen papers for a terminal report for submission to a national fisheries agency. Bibliographies were also prepared on (1) the impact of ICLARM publications; (2) ICLARM contributions on biodiversity; and (3) ICLARM contributions in Africa and West Asia.

From sales, library exchange, and free issue, the total number of books that have been distributed in ICLARM's seven technical series since the first publication in 1980 is over 165 000. The total Naga recipients as of December 1995 are 4 800. ICLARM books were exhibited at the Western Central Pacific Living Marine Resources Identification Guide Workshop, 1-10 October 1995, at the University of the Philippines Marine Science Institute, Diliman, Quezon City.

A paper on ICLARM scientific productivity was presented by L. Dizon during the International Conference of the International Federation of Science Editors with the theme "Science, Culture and Communication for the 21st Century" in Barcelona, Spain on 9-13 July 1995. Another paper on the citation impact of ICLARM publications was presented by L. Dizon during the Fourth Asian Fisheries Forum in Beijing on 16-20 October 1995.

An impact study on the quarterly magazine, *Naga*, was conducted among local recipients on 3 October 1995. The sixteen participants overwhelmingly felt that the present format of *Naga* should not be changed. They were equally divided as to whether its scope should stay the same or be increased.

Publications staff have also met with the Communications Groups of the International Rice Research Institute (IRRI) and the International Institute for Rural Reconstruction (IIRR) to exchange experiences regarding production, publishing, and distribution during workshops in May and August 1995.

Expected Outputs in 1996

- The Publications Unit intends to produce an annual report and operational plan, two Studies and Reviews, six Conference Proceedings, three Technical Reports, four issues of *Naga*, about four issues of the *ICLARM Newsbriefs*, and twelve issues of

the *ICLARM Newsplash* as well as two to three issues of the *Asian Fisheries Science*.

- The Unit will continue to do typesetting and drafting of figures for other Center staff needs, as well as posters and overheads for presentations at meetings. Books and other publications will continue to be distributed to recipients in free and exchange lists and subscribers. Distribution staff will also handle sales through the mail and over the counter as well as take care of the Center's photography needs. *Asian Fisheries Science* will continue to be produced by the Unit.

- The Unit will also continue to conduct a readership survey of the *Naga* to look at areas where the magazine may be improved.

8.2. TRANSLATION SERVICES/UNIT

ICLARM Staff	:	Catherine Lhomme-Binudin
Donors	:	ICLARM core funds
Duration	:	Continuous since 1988

Objective

- To coordinate translation activities in the languages of the countries in which ICLARM is or may be involved, to expand this capability into a structured unit in the future and to work towards the establishment of a system-wide language policy.

Background and Justification

Translations activities started in 1980 with the ICLARM translation series and were strengthened as far as French translations are concerned from 1988, when the French government started to fund ICLARM's project of Transfer of Aquaculture Technologies from Asia to Africa. At this point and in view of language barriers present in Francophone Africa, it was deemed appropriate to give ICLARM a translation capability and to expand it in the future.

NonEnglish speaking scientists, particularly in Francophone Africa, Latin America and Asia suffer from a recurring lack of material written/translated in their own language that can help them catch up and cope with the scientific developments originating mostly from scientists trained and published in the North. Scientists and other key operators of the developing countries of the South are experiencing big gaps in their scientific and technical knowledge and thus are systematically lagging behind; this partly due to their problem of accessing literature in their own language.

Against this background, a CGIAR system-wide language policy needs to be formulated and implemented, and appropriate resources sought.

Scores Against Principles

1.	Sustainability	H
2.	Equity	H
3.	Gender	N/A
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Work continued on translating both English and French manuscripts of the Third International Symposium on Tilapias in Aquaculture (ISTA III). Additional staff were hired on a temporary basis. Delays have been caused by slow responses from editors and the illness of ICLARM's translator.

Machine translation software was used extensively in 1995 and is proving very useful for technical translations. A database of specific aquatic-resource terminologies continues to be built up and is now used in association with the translation software, which has made the latter much more efficient.

Other functions of the Unit during the year included translation of other technical articles for publication and letters of enquiry and responses as well as liaison with French agencies on behalf of the Center. Contacts are maintained with translators and translation units of other institutions, particularly of the CGIAR.

Expected Outputs in 1996

- The translation unit will continue its activities, including the translation into French of the possibly revised version of the book *A Hatchery Manual for the Common Chinese and Indian Major Carps by* V.G. Jhingran and R.S.V. Pullin. Translations of several short articles for publication, including Spanish as well as French, will be made.

- The proceedings of ISTA III will be distributed in early 1996 to the conference participants and other users in Africa, Asia and Latin America as well as in Europe and the USA.

- The Translation Unit will continue to enrich its terminology database and to use its translation software for maximum efficiency. The Unit also plans to increase contacts through e-mail with the Translation Divisions of other CG Centers to consider possible ways to optimize the translation "mission" of the centers. The Unit will expand its language capability by establishing a list of translators available on a freelance basis. Finally, the Unit will work towards (and cooperate in) the establishment of a CGIAR system-wide language policy.

8.3. LIBRARY AND INFORMATION SERVICES

ICLARM Staff	:	Ms. Rosalinda M. Temprosa (Chief Librarian), Ms. Norma I. Jhocson, Ms. Erlinda B. Gonzalez, Ms. Adelina P. Mendoza, Ms. Isabel D. Redulla, Ms. Rosario T. Yabut, Mr. Rey A. Damalerio
Collaborating Institutions	:	-
Donor	:	ICLARM core funds
Duration	:	Continuous

Objective

- To identify, collect, process, store, analyze and disseminate information relevant to the needs of the Center's management and staff and, likewise, meet the information needs of fisheries and other aquatic researchers in the tropics.

Background and Justification

In September 1978, the ICLARM library (renamed the *Ian R. Smith Memorial Library and Documentation Center* in May 1990) was set up as a nucleus of information resources to help and implement the Center's goal in providing the technical information required to strengthen research on tropical aquatic resources for the benefit of economically developing countries.

To date, it has grown rapidly in pace with the proliferation of fisheries and aquatic literature not only from the tropical developing countries served by ICLARM, but also from the developed countries where much of the relevant literature is published/printed. Its growth enables the Center to provide more specialized information services.

Scores Against Principles

1. Sustainability	N/A
2. Equity	H
3. Gender	N/A
4. Participation	H
5. Systems approach	N/A
6. Anticipatory research	N/A

1995 Progress

The collection of books and monographs now totals 14 221 volumes. A total of 805 volumes of new materials was added. The serials collection consists of 1 277 titles. The reprints collection has now a total of 6 594 titles and 373 nonbook materials.

Since the computerization of library holdings in early 1987, the maintenance and updating of the library's four bibliographic databases have become routine. These databases and their total number of entries are as follows:

LIBRI	9 950 bibliographic records
NAGA	13 875
RED	453
SERIE	1 277

From LIBRI database, six Acquisitions Lists (with 1 150 bibliographic entries) were produced and issued to headquarters and overseas project research staff and to other local and foreign libraries.

Aside from the abovementioned databases, the library also continued to monitor, check and index all incoming materials for Citation Analysis Database (CAD). The IRSMLDC Book Catalogue for 1994 (930 entries) compiled by Norma Jhocson was also made available for all library users.

On information services, 330 enquiries were received from January to December 1995. Queries received came from 62 countries/territories worldwide. The top subjects of enquiry were Finfish Culture Systems, General Fisheries and Resource Management. The library also received 1 877 visitors.

A total of 7 839 computer-retrieved titles, photocopies of 476 requested articles (8 002 pages), 198 copies of various ICLARM publications/contribution series, including brochures and several library duplicates were provided to enquirers.

The most frequently used serials in the library were: *Aquaculture, Hydrobiologia, Philippine Journal of Science, Journal of Fish Biology, Environmental Biology of Fishes, Canadian Journal of Fisheries and Aquatic Sciences,* and *Aquaculture and Fisheries Management.*

Instructional services on the use of ASFA CD-ROM, Current Contents on Diskette, AGRIS Fisheries CD-ROM and library databases to 471 users were also provided.

A current awareness service for ICLARM projects in Bangladesh and Malawi is being maintained by sending photocopies of table of contents of (their) selected journals monthly. As of end December 1995, a total of 530 pages of table of contents from 272 volumes/issues of different journals were sent since January 1995.

The upgrading of some library computers enabled the staff to keep up to date with current information systems and technology. E-mail was heavily used to communicate with publishers, libraries, etc., for book orders and reprints requests.

An initial input to the Aquatic Sciences and Fisheries Information System (ASFIS) was submitted in November 1995.

The library continued to explore sources of information materials, especially those hard to find and available only through exchange. For this year, exchange of publications agreements was made with eight new institutions.

As an institutional member of the IAMSLIC (International Association of Aquatic and Marine Science Libraries and Information Centers), the library continued to participate actively in their Duplicate Exchange Program. A member-library should send a list of duplicates to other participating libraries/institutions at least once a year. This program has become very useful to our collection development. We were able to replace lost books/journals and fill gaps in our serials collection. In July 1995, we sent a list of our duplicates to 81 members from which we responded to 16 requests. In return, we received 7 volumes of books and 12 serial titles (16 issues).

During the year, the library continued to provide library and information services to the Regional Co-operation in Scientific Information Exchange in the Western Indian Ocean Region (RECOSCIX-WIO) project of the International Oceanographic Commission of UNESCO. The project is based in Mombasa, Kenya.

An an INFOTERRA Special Sectoral Source in the area of living aquatic resources management, the library continued the provision of information services to their users.

Work experience and practical training in fisheries librarianship and computerized system were provided to a Cambodian librarian on 10 May - 2 June 1995; SEAFDEC Training Dept. Staff (2) on 4-9 December 1995; and Technical Staff of the Philippines-Australia Pilot Provincial Agricultural Extension Project, 5-15 December 1995. Advice on the setting up of the library of the Subic Bay Metropolitan Authority (SBMA), Olongapo, Philippines, was provided to two SBMA technical staff on 4 July.

Expected Outputs in 1996

- The library will continue providing Selective Fisheries Information Service (SFIS) to enquirers worldwide. It will also continue to adopt and use current information systems and technology in the efficient delivery of information services.
- More inputs of ICLARM publications to ASFIS will be submitted.
- The merging of three (3) library databases, i.e., Libri, Naga and Red into one large database using the ASFISIS system.

8.4. Union Catalog of Fisheries Serial Holdings in Asia

ICLARM Staff	:	Ms. Rosalinda M. Temprosa (Project Leader), Ms. Norma I. Jhocson
Collaborating Institutions	:	Libraries/institutions in the Asian region
Donor	:	Study on International Fisheries Research (1993); ICLARM core funds
Duration	:	Continuous since September 1993

Objective

- To disseminate a database of serial holdings in the Asian region which would facilitate easy and quick access to serial sources available in the Asian region; and promote resource sharing and active interlibrary loans.

Background and Justification

This project is a part of the regional survey conducted by ICLARM on behalf of SIFR. ICLARM was asked to do a comprehensive study of nonstatistical information programs and services. ICLARM is to compare serial holdings from the major sources within the region to identify gaps in the collections.

Scores Against Principles

1.	Sustainability	N/A
2.	Equity	H
3.	Gender	N/A
4.	Participation	H
5.	Systems approach	N/A
6.	Anticipatory research	H

1995 Progress

During the year, data were sorted, selected and transferred from DataEase to the software Access. A prototype catalogue on disc was distributed to the inputting institutions in December for their comments.

Expected Outputs in 1996

- ICLARM will finalize and make the Union Catalog widely available on diskette.

8.5. Asian Fisheries Bibliography

ICLARM Staff	:	Ms. Rosalinda M. Temprosa (Project Leader), Mr. Jay L. Maclean
Collaborating Institutions	:	Libraries in the Asian region
Donor	:	To be identified
Duration	:	12 months

Objective

- To improve access to aquatic resource research information by creating an ongoing bibliography of aquatic resource literature in the Asian region which would, a) be available virtually free to all; b) link with ASFA (Aquatic Sciences and Fisheries Abstracts).

Background and Justification

The major bibliographic tools for aquatic resource literature are being very expensive and thus poorly used in developing countries. They have patchy coverage of Asian literature.

This project would bring together the computerized monographic holdings of libraries around the Indo-Pacific onto a single database which would be updated regularly and disseminated. It would also assist and encourage other libraries to organize or computerize their monographic holdings (as the Union Catalog project is doing for serial holdings).

Scores Against Principles

1.	Sustainability	H/M
2.	Equity	H
3.	Gender	N/A
4.	Participation	H
5.	Systems approach	N/A
6.	Anticipatory research	L

Expected Outputs in 1996

- If funded in 1996, some two months programming would be done to enable duplicate records to be handled (using CDS ISIS). A routine for regular input and dissemination would be developed.

- By end 1996, the system would be operational. Some training for new inputting centers could be also arranged.

8.6. COMPUTER SERVICES UNIT

ICLARM Staff	:	Mr. Wilfredo C. Fontano, Mr. Romy P. Oite, assistant LAN administrator to be appointed
Collaborating Institutions	:	-
Donor	:	ICLARM core funds
Duration	:	Continuous

Objectives

- To provide organized computer maintenance for the growing number of computer users in the Center
- To implement an internal network (LAN)
- To provide advice on the information technology requirements of the Center.

Background and Justification

The Unit was formed in response to the growing number of computer users and the lack of an organized source of assistance. The Center was overly dependent on external suppliers and technicians. There are presently two national staff; the Unit being headed by the FishBase project leader Dr. Froese, and placed for administrative purposes in the Information section. Strictly the LAN administrator should focus on the LAN, but general computer problems take much of his time.

1995 Progress

Apart from maintenance of computers, advice on new purchases, and administering the LAN, the Unit took on responsibility for the Integrated Voice and Data Network connection, and has consulted with personnel of IRRI and the CGNET. The necessary documentation has been done and the hardware purchased. Connection to the IVDN begun in December 1995.

The Center now has 120 microcomputers, most of which need attention at some time during the year; 80 computers are connected to the LAN.

1996 Expected Outputs

- Advisory and maintenance functions will continue.
- A third staff person will be sought to take care of minor software and hardware problems.
- The IVDN will be fully connected.
- New servers including a CD-ROM server, will be installed for the network.
- A program of scheduled replacement of aging computers will be continued.

9. INTERNATIONAL PARTNERSHIPS AND NETWORKS

9.1. NETWORK OF TROPICAL FISHERIES SCIENTISTS (NTFS)

ICLARM Staff	:	Dr. Daniel Pauly (Coordinator), Ms. Ma. Rosandra A. Gayosa
Collaborating Institutions	:	FAO/DANIDA Training Course in Tropical Fish Stock Assessment
Donor	:	FAO, ICLARM core funds
Duration	:	Continuous from April 1982

Objectives

- To enhance communication between fisheries scientists working on the assessment, conservation and management of tropical stocks
- To enhance the output of these scientists by improving access to literature, providing free database searches, distributing manuals and other literature and publishing a regular newsletter.

Background and Justification

Progress in stock assessment work on tropical fisheries has been slow and there are very few, if any, fisheries which are rationally managed. The reasons are obvious: the biology of fishes, the nature of the fisheries and the institutions that manage them, as well as the limited educational opportunities available to scientists.

A great constraint is the fact that scientific personnel attached to fisheries institutions are often not well-versed in the quantitative aspects of stock assessment. This is partly an effect of the lack of relevant educational support systems. Only recently has fisheries stock assessment, and fisheries science for that matter, been given due consideration in universities in tropical developing countries. Furthermore, the avenues for information exchange are not many or are not fully utilized.

1995 Results

Total individual membership by the end of September 1995 was 1,363 representing 130 countries with all members receiving *Naga, the ICLARM Quarterly. Fishbyte,* as a section of *Naga* totaled 47 pages, and included 15 contributions by 18 authors in 11 countries, and continued its role as a tool for dissemination and discussion of methods developed at the center and/or other tools for tropical fish stock assessment. Also, through *Fishbyte* in the form of a contribution by V. Christensen and D. Pauly in the July 1995 issue, an informal research network devoted to the construction and

comparison of ECOPATH II models of marine ecosystems (see. p. 34-40) was initiated, and which should include as many NTFS members as possible.

Scores Against Principles

1.	Sustainability	N/A
2.	Equity	H
3.	Gender	H
4.	Participation	M
5.	Systems approach	N/A
6.	Anticipatory research	N/A

Expected Outputs in 1996

- Four issues of Fishbyte in *Naga.*
- An update on the membership through a survey questionnaire.

9.2. Network of Tropical Aquaculture Scientists (NTAS)

ICLARM Staff	:	Dr. Modadugu V. Gupta (Coordinator)
Collaborating Institutions	:	-
Donors	:	ICLARM core funds
Duration	:	Continuous from July 1987

Objectives

- To enhance communication among aquaculture scientists working in the tropics, especially in genetics, integrated agriculture-aquaculture farming systems and coastal aquaculture
- To facilitate increased output by these scientists by assisting them in information and database searches, research and methods, data analysis and interpretation, and by publishing some of the research findings of members in the *Aquabyte* section of *Naga, the ICLARM Quarterly.*

Background and Justification

Aquaculture scientists in tropical developing countries often lack critical information for their research activities. They tend to work in isolation using outdated research methods and approaches. They are not well informed on the status of aquaculture development, ongoing research by fellow scientists, and recent publications and results. This lack of awareness reflects the high costs of communication and

information, particularly books and technical reports. Tropical aquaculture scientists therefore need a mechanism to exchange information, results and ideas: a need that can be served by a network.

Scores Against Principles

1.	Sustainability	N/A
2.	Equity	H
3.	Gender	H
4.	Participation	M
5.	Systems approach	N/A
6.	Anticipatory approach	N/A

1995 Results

Aquabyte, the NTAS newsletter, is incorporated in *Naga*, the ICLARM Quarterly. In 1995, *Aquabyte* retained all its regular features and an additional section was included: recent thesis abstracts of NTAS members.

NTAS membership continued to expand to 583 scientists in 90 countries. Most are from Asia (44%) and Africa (22%). From 1992 to 1995, 61 articles were submitted to *Aquabyte* and of these, 41 were published, of which 25% were from ICLARM authors. Of the 21 article submissions that were not accepted, nine were restyled and published as news items. An average of three main articles was published in *Aquabyte* per *Naga* issue.

Expected Outputs in 1996

- Four issues of the *Aquabyte* section of *Naga, the ICLARM Quarterly*, with articles, news items, letters, photoessays, and thesis abstracts sent in by members.

- Free computerized literature searches, supply of published material unobtainable from reprint requests, and providing communication links among research scientists.

- A new edition of the NTAS Directory for distribution on diskette.

- A survey of NTAS members' views on the desirability of forming working groups with special interests.

9.3. ASIAN FISHERIES SOCIAL SCIENCE RESEARCH NETWORK (PHASE IV)

ICLARM Staff	:	Dr. Robert S. Pomeroy (Coordinator), Ms. Anjanette C. Trinidad
Collaborating Institutions	:	**Indonesia** - Faculty of Economics, Universitas Diponegoro (UNDIP); Central Research Institute for Fisheries (CRIFI); Research Institute for Marine Fisheries (RIMF); **Malaysia** - Faculty of Economics and Administration, Universiti Malaya (UM); Natural Resource Economics Department, Universiti Pertanian Malaysia (UPM); **Philippines** - Bureau of Fisheries and Aquatic Resources (BFAR); Freshwater Aquaculture Center, Central Luzon State University (CLSU); Economics Section, Research Division, Aquaculture Department, Southeast Asian Development Center (SEAFDEC-AQD); Department of Agricultural Economics, College of Economics and Management, University of the Philippines at Los Baños (UPLB); Faculty of Arts and Sciences in the Visayas (UPV); **Thailand** - Fisheries Economics Research Subdivision, Department of Fisheries (DOF); Department of Agricultural and Resource Economics, Faculty of Economics and Business Administration, Kasetsart University (KU); Coastal Resources Institute, Prince of Songkla University (PSU); **Vietnam** - Ministry of Fisheries; Cantho University
Donor	:	IDRC
Duration	:	April 1994 to March 1996

Objectives

- To encourage and develop networking within and among Network institutions and countries
- To enhance the professional capacities of the Network members through training, advanced study, and collaboration with individuals and institutions with special skills useful to the research and teaching programs
- To support collaborative research programs in the social sciences that will generate results of value in the formulation of fisheries resource management and aquaculture systems development and policies
- To promote the use of research results through more effective dissemination

- To identify and encourage membership of additional institutions both within current Network member-countries and in other countries.

Background and Justification

The Asian Fisheries Social Science Research Network (AFSSRN) was established in 1983 to address the need to enhance domestic social science research capabilities relative to capture fisheries, coastal resource management and aquaculture in Asia. The aims of the Network are even more relevant today due to the increasing recognition of social and political factors in achieving sustainable aquatic resources development.

The AFSSRN is currently composed of 13 research teams, totaling more than 80 researchers, at universities, research institutions and government fisheries agencies in Indonesia, Malaysia, Thailand and the Philippines. In addition, two research teams have recently been formed in Vietnam. These AFSSRN member institutions have a strong commitment to social science research relative to capture fisheries, coastal resource management and aquaculture.

The scope and methods of the Network programs are taken up under five general categories related to the objectives stated above. These are: (1) Networking, (2) Education and Training, (3) Research, (4) Dissemination of Results and (5) New Members.

A more coordinated, well-defined and strategic research program has been established with Phase IV. The focus is on major themes in order to coordinate research, training and networking activities. The priority research areas are: (1) community-based management/integrated coastal fisheries management; (2) integrated agriculture-aquaculture systems; (3) policy analysis; (4) new methodologies; and (5) sociology/anthropology.

Scores Against Principles

1.	Sustainability	M
2.	Equity	M
3.	Gender	M
4.	Participation	H
5.	Systems approach	H
6.	Anticipatory research	H

1995 Results

Three AFSSRN research projects were approved during the year:

a) identification, evaluation and determination of appropriate organization of fish auction based on local characteristics - Universiti Diponegoro, Indonesia;

b) an economic and environmental analysis for sustainable use of southern Thailand's coastal resources: a case study of shrimp farming in Trang province - Kasetsart University, Thailand;

c) transaction costs and fisheries co-management - Universiti Pertanian Malaysia

Two Phase III research reports were finalized:

a) A bioeconomic model of the East Johore prawn fishery - Universiti Pertanian Malaysia;
b) Financial profitability of rice-fish farming system: a case study of the concurrent pond refuge system: a Philippine example - Central Luzon State University.

A special session on Asian Fisheries Social Science was held during the 4th Asian Fisheries Forum, Beijing, China, 16-20 October;

A project proposal was prepared on "Capacity Building in Ecological Economics for Sustainable Aquatic, Marine and Coastal Resources Management in the Mekong Sub-region of Asia" for submission to the Asian Development Bank;

A team leaders' meeting was held in Beijing, China, 17 October.

Four issues of *AFSSRNews* were prepared for *Naga.*

There were three training activities for members:

- regional training on "Transforming Research Into Policy" at Los Baños, Laguna, Philippines, 16-20 January;

- training workshop in Cambodia on Social Science Research Methods in Fisheries and Natural Resources Management, Phnom Penh, 6-10 February;

- training course on Social Science Research Methods (Part II), Phnom Penh, Cambodia, 11-22 September; 15 participants from Agriculture Ministry, Department of Fisheries, Siem Reap Agricultural Service, Ministry of Environment, PADEK, AIT, Prek Leap Agricultural College;

Expected Outputs in 1996

- Publication of additional Phase III and Phase IV research reports.

- Regional workshop on "Assessing the Effectiveness of Environmental Policies," with Dr. Richard Tobin of EPAT in March.

- National workshops in the Philippines, Thailand, Malaysia, Indonesia.

- Support for additional Phase IV research projects.

- Publication of AFSSRNews in *Naga.*

9.4. INTERNATIONAL NETWORK ON GENETICS IN AQUACULTURE (INGA)

ICLARM Staff	:	Dr. Durvasula V. Seshu, Research (Coordinator until August 1995), Dr. Modadugu Gupta (Coordinator from April 1996)
Collaborating Institutions	:	**Bangladesh** - Fisheries Research Institute, Mymensingh; - **China** - Department of Aquaculture, Shanghai; **Côte d'Ivoire** - Fish Research Center, Bouaké; **Egypt** - National Aquaculture Center, Sharkia, Fish Research Center, Ismailia; **Ghana** - Fishery Division, Achimota; **India** - Central Institute of Freshwater Aquaculture, Orissa, Central Institute of Fisheries Education, Versova, Bombay; **Indonesia** - Central Research Institute for Freshwater Fisheries, Sukamandi; **Malawi** - University of Malawi, Zomba, Fisheries Department, Lilongwe; **Philippines** - Bureau of Fisheries and Aquatic Resources, Quezon City, Freshwater Aquaculture Center, Nueva Ecija; **Thailand** - National Aquaculture Genetics Research Institute, Bangkok; **Vietnam** - Research Institute for Aquaculture, Ha Bac
Donor	:	ICLARM core funds; United Nations Development Programme
Duration	:	Ongoing, initiated August 1993

Objectives

- To promote cooperation and interaction among fish genetic improvement scientists
- To serve as a center for information on all aspects of fish genetics
- To strengthen national capabilities for genetic enhancement of farmed fish.

Background and Justification

The aquaculture sector, where increased production is needed, has made only modest gains from genetic research to date, particularly in tropical developing countries. Recent studies in different parts of the world have clearly demonstrated the potential for achieving substantial gains in aquaculture production through application of genetics and breeding.

Networking is a well-tested and proven mechanism to foster international cooperation in seeking solutions to problems of common interest that cut across political boundaries. The inherent advantages of the networks are that they accelerate exchange of information, experience, methods and materials; boost research efficiency; reduce

research costs; and combat scientific isolation. This approach has been chosen for genetic improvement of inland cultured fish, targeted to the aquaculture systems in developing countries.

Strategy

- Exchange of methodologies and materials
- Research planning meetings and workshops
- Training
- Joint site visits
- Information dissemination
- Involvement of national systems in planning and governance.

Scores Against Principles

1.	Sustainability	M
2.	Equity	H
3.	Gender	M
4.	Participations	H
5.	Systems approach	M
6.	Anticipatory approach	H

1995 Results

The Second Steering Committee Meeting and two concurrent special sessions on fish biodiversity and aquaculture genetics were held in Hyderabad, India in June 1995. Thirty-eight scientists (biologists and social scientists) from eleven INGA member countries, eight nonmember countries and four organizations participated in these meetings.

Comparative evaluation studies were carried out in Bangladesh, China, Indonesia, the Philippines, Thailand and Vietnam using the GIFT and local strains of Nile tilapia. Overall, GIFT emerged as a superior strain.

Two unrelated stocks of *Puntius gonionotus* from Indonesia and Thailand along with the local stock were used in Bangladesh to establish two lines.

Selective breeding program of bream in China resulted in their increased growth rate by at least 5% per year.

In India, hybrids of rohu (*Labeo rohita*) x catla (*Catla catla*) and catla x mrigal (*Cirrhinus mrigala*) have manifested useful traits of more flesh and less bones. Triploids of common carp (*Cyprinus carpio*) have exhibited 60-100% faster growth as compared to the normal diploids.

Promising selections of common carp from fifth generation of selective breeding have been identified in Vietnam. Improved common carp were supplied from Vietnam to

Bangladesh, India, the Philippines and Thailand. Selective breeding of silver carp (*Hypophthalmichthys molitrix*) is in progress.

In Ghana, comparative evaluation of four approaches to genetic characterization indicated that Polyacrylamide Gel Electrophoresis (PAGE) of parvalbumins and starch Gel Electrophoresis (GEL) of general muscle proteins could be adopted as routine approaches for genetic characterization of closely related fish.

Further improvements were made to the drafts on research methodologies and fish transfer protocols. Proposals for country-specific special projects relating to genetic improvement of preferred species were submitted to the Strategy for International Fisheries Research (SIFR) for obtaining donor support.

Fiji and Malaysia joined the network bringing the membership to a total of 13 countries.

Expected Outputs in 1996

- Further exchange of genetic material as per plans formulated at the second Steering Committee Meeting.
- Publication of revised versions of research methodologies and transfer protocols.
- Distribution of field books and collection and analysis of data on growth performance of test material (carps and tilapia) in Asian countries.
- Preparation and distribution of reports to different member countries on the results of genetic evaluation studies in different countries.
- Organization of the third INGA Steering Committee meeting in Egypt in July 1996.
- Initiation of collaborative research and training programs for genetic improvement of carps in Bangladesh, China, India, Indonesia, Thailand and Vietnam.

SYSTEM-WIDE INITIATIVES

ICLARM is becoming involved in activities with groups of Centers within the Consultative Group on International Agricultural Research (CGIAR). These System-wide activities include:

1. GENETIC RESOURCES PROGRAM (SGRP)

Most Centers contribute to this Program through *ex situ* genebanks, germplasm distribution and research on *in situ* conservation, for which ICLARM has been assigned a lead role for database activities. ICLARM's role in aquatic resources is to concentrate on strategic research, training and information towards natural resource management.

This program also enhances access to genetic resources data held by CGIAR through a System-wide Information Network on Genetic Resources (SINGER) to which ICLARM contributes data. By 1997, the majority of all the genetic resources data held by the various centers should be available for searching through a common user-interface.

2. COASTAL ENVIRONMENTS

A proposal to develop this initiative was submitted by ICLARM, as lead Center, to the CGIAR's Technical Advisory Committee in November 1995. The goal of the initiative is to enhance and preserve the quality of life of coastal zone dwellers, through new methods in coastal zone management and planning; new policy insights towards improved management of the zone; assessment of environmental impact of key stresses and of management interventions; and software to facilitate integrated management of coastal systems.

EXTERNAL RELATIONS OFFICE

ICLARM Staff	:	Ms. Marian Fuchs-Carsch, Ms. Angelina A. Agulto
Donors	:	ICLARM core funds
Duration	:	Continuous from 1996

Objective

- To assist the Director General in maintaining, developing and enhancing the Center's relationships with its major stakeholders, including donors and the CGIAR, its TAC and their respective Secretariats.

Background and Justification

The time spent by ICLARM staff and management in raising funds and complying with CGIAR requests is growing. At the discussion of the Center's restructuring, the need for a central office to relieve this burden was expressed. The External Relations Office was created to help management and staff with all activities related to fund-raising and CGIAR relations.

Expected Outputs in 1996

- Improved and more timely compliance with the CGIAR program planning documents - specifically the 1997 Program and Budget paper, the new project portfolio and the 1998 - 2000 Medium Term Plan [for submission in early 1997.

- Development of project development guidelines to streamline and standardize project approaches and negotiations with donors.

- Development of a donor strategy to guide the Center in maintaining, and where possible, increasing its quantum of unrestricted funds.

- Assistance to staff with project development and donor negotiations, thus increasing the flow of project-related funding to the Center.

CORPORATE SERVICES

The Management Services Division (MSD) plays a critical role in the operations of the entire Center. Much of the Center's success in attaining its objectives and fulfilling its mission depends on the Division's ability to provide the Center's management, staff and organizational units the support services they require to carry out their own work programs.

In general, the Division's responsibilities include:

- Delivering high quality and timely services to Center management, individual staff, organizational units and other stakeholders (trustees, donors, etc.)
- Developing, implementing and maintaining systems for the effective and efficient management of Center resources
- Establishing systems for effective communications within the Center.

The Division is organized into the following key functional units:

1. *Finance and Management Information:* This unit is responsible for managing the Center's financial resources for the purpose of ensuring that these resources are available for the Center's operations. The Unit is also responsible for generating the financial information required by Center management staff to manage their resources. The reporting function of the Unit has made it the focal point for the development of management-related information systems.

2. *Projects Administration:* This unit is primarily responsible for providing Project Leaders and Program Directors with the management support required for them to accomplish their work programs.

3. *Human Resources Management:* This unit is responsible for providing ICLARM Management and managers with the systems and services required to manage the center's human resources.

4. *Administrative Services:* This unit is responsible for the delivery of services required for the day-to-day operations of the Center.

Although each unit within the division is aware of its operating responsibilities, Division management has given a high priority on continuing to address the findings and recommendations of the 1995 Mid-Term External Review Panel. The concerns of the panel which have been given priority by the Division include the following:

1. *Cash Flow Management:* Central to addressing this issue is the establishment of financial information systems to assist Project Leaders and Unit Managers more effectively control and manage their budgets. Improved information flows between the research activities and Center administration will also contribute significantly not

only to the management of cash but also to the management of the Center's other resources.

2. *Administrative Systems:* Although much was accomplished in 1995, the Division's continuing priority will be the establishment and documentation of Center policies and implementing guidelines across a number of areas such as human resources management, budget management and project management. Effort and resources will also be devoted to integrating ICLARM outreach offices with the headquarters administrative system.

3. *Staff Development:* The Human Resources Unit will be the focal point for staff development programs which will include staff training in the use of the various systems developed by the Division.

4. *Communication:* The Division remains committed to the continuous improvement of communication across the entire Center. Particular attention will be paid to communication between the Division and other Center units.

1. FINANCE AND MANAGEMENT INFORMATION

1.1. Finance and Accounting Systems

ICLARM Staff : Finance and Management Information Staff

Duration : Ongoing

Objective

- To operationalize the modified finance and accounting systems.

Background and Justification

Prudent and responsible management necessitates that decisions are based on accurate, relevant and timely information. To date, a number of changes have been happening in the Center's operating environment. The uncertainties brought about by these changes may be contained by the availability of up to date and accurate information. Unfortunately, the capability of our existing finance and accounting systems to meet these changing information needs is fairly limited.

Presently, the accounting and financial data generated by the systems cannot be used readily by management and research groups. Simply put, the current systems are not transparent to the intended users. In a way, this situation has prevented the speedy turn-over of the project management functions to the project leaders. Thus, in 1995, management decided to invest on upgrading/enhancing our finance and accounting systems.

The modified systems are based on *Platinum* accounting software and feature multi-user applications operating in an integrated networked environment. They are expected to:

a) Preclude duplication in data entry by sharing of common files
b) Hasten transaction processing and update of account balances
c) Enhance transaction review and authorization control
d) Fix responsibility for data entry
e) Support funds management and budgetary functions
f) Provide on-line authorized data inquiry
g) Facilitate generation of appropriate financial and management reports.

1995 Progress

On 15 June 1995, the Center engaged the Price Waterhouse Information Technology Division to manage the upgrading/modification of the finance and accounting systems. For smooth and effective implementation, a project team was formed comprising of two full-time programmers of Price Waterhouse and two ICLARM programmers. A work plan and timetable were prepared and agreed upon for the development and implementation of the general ledger, purchasing/inventory, disbursement/liquidation, bank book, overhead/allocation, payroll and fixed assets modules.

Platinum was chosen over six other software packages. Training of programmers and users in the primary *Platinum* modules was completed.

Expected Outputs in 1996

- By July 1996, all the modified systems should be operational in the Headquarters. Debugging will continue until year-end. To the extent possible, parallel runs will not be carried out. Direct implementation shall be the central goal.

- By end 1996, the operation of the modified systems should have been stabilized. The Financial Report Extender and budgetary control systems of *Platinum* should likewise be in place and utilized fully.

1.2. Financial Management Policies

ICLARM Staff : Finance and Management Information Staff

Duration : Ongoing

Objectives

- To disseminate and explain to concerned ICLARM staff the financial management policies approved by the Board of Trustees

- To monitor compliance with approved policies.

Background and Justification

Policies serve as guideposts to employees in the general conduct of specific function/areas of operations. To be effective and enforceable, these policies must be:

a) consistent with established goals and approved strategies of the Center;
b) workable and allow sufficient flexibility in implementation;
c) kept current and updated as the need arises;
d) disseminated widely and understood by concerned staff; and
e) approved for implementation by the Board of Trustees.

In the absence of uniform reference and understanding of the Center's financial management policies, implementation in 1995 was carried out on a best effort and fragmented basis. Whenever exceptions arose, relevant policies were cited. Since dissemination was relatively limited and only a few policies have been formalized, implementation became a long-drawn out exercise.

Management recognizes that the foundation of an effective financial management system is a set of well-defined policies that steer the conduct of the Center's financial and accounting affairs. Thus, high priority was given to formulation of financial management policies. On 30 June 1995, the Center commissioned the Price Waterhouse Management Consulting Division to assist the Finance and Management Information Unit in drawing up a manual.

1995 Progress

The financial management policies manual was completed on 30 September 1995 and will be presented to the Board of Trustees for their approval.

On a continuing basis, applicable policies were invoked whenever necessary. Rationale for the policies was explained to concerned staff.

As part of our policy information campaign, a workshop on the Center policy on indirect cost recovery was held on 16 August. The workshop, which was attended by project leaders and their research staff, was aimed at establishing a clear understanding of Board policies on the recognition, recovery and reporting of indirect costs.

Expected Output in 1996

- Widespread dissemination of the approved policies will be the primary goal of Finance and Management Information Unit. This will be achieved by conducting appropriate workshops to be attended by ICLARM staff after distributing copies of the manual. Whenever necessary, clarificatory memos will be issued for proper staff guidance.

1.3. Investments

ICLARM Staff : Finance Staff

Duration : Ongoing

Objective

- To maximize earnings from investment of surplus cash.

Background and Justification

Funds management in 1995 was geared towards stabilizing the funds position of the Center through:

a) rigid follow-up of receivables collection;
b) strict implementation of budget and related policies; and
c) proper matching of receipts and disbursements timing.

While in general the Center maintained a healthy cash position during most part of 1995, its cash flow can still be described as uneven. There were notable surges in the cash inflows; however, surplus was not invested in view of the uneven requests for project funding. Thus, in 1995, a huge amount of surplus cash was kept in order to service immediately the fund requirements of the different projects. This situation precluded the Center from earning interest that could offset partially the effects of inflation.

1995 Progress

The cash position of the Center has been fairly stable since the third quarter. Close coordination was maintained with Project Leaders and Project Assistants. Cash planning was carried out continuously.

Expected Output in 1996

- Investment of surplus cash will be optimized while maintaining a balance in liquidity. Other investment facilities within approved policies of the Board of Trustees shall be considered, based on risk/return trade-offs.

1.4. Integration of Field Office Finance/Accounting and Reporting

ICLARM Staff : Finance and Accounting Staff, Field Office Staff

Duration : Ongoing

Objectives

- To develop uniform finance and accounting systems in Headquarters and outreach offices for easy consideration of results

- To ensure proper monitoring of accountability for Center resources at field offices.

Background and Justification

To date, a complete accounting of financial transactions undertaken by field offices has not been achieved. Currently, the only linkage of the Unit with field offices is through the project operating fund mechanism. As established, based on approved annual budgets, monthly remittances are sent to field offices to finance their operating requirements. The field offices submit monthly statements of liquidation showing the nature of expenses incurred.

Management recognizes the limitations of the project operating fund mechanism. Accounting for expenses is entirely dependent upon the submission of liquidation reports. Thus, more often than not, there is a lag time in the recording of expenses. Also, this mechanism covers only expenses paid out of remittances from Headquarters. Direct remittances by donors to the field offices are difficult to establish unless reported explicitly. Further, timely recording and control over capital expenditures cannot be done. Thus, Headquarters staff are not apprised fully on the financial position of the field offices.

The Center is now focusing on expanding its research activities outside of Headquarters. This move will entail a huge amount of resources. To ensure optimum usage of resources vis-à-vis approved research strategies, appropriate finance and accounting systems should be set up at the field offices. Likewise, to facilitate consolidation of results and implementation of control procedures, Headquarters and field office systems should be compatible.

1995 Progress

In 1995, topmost priority was given to the implementation of an ad-hoc system that will enable Headquarters to:

a) monitor the cash balances of field offices;
b) determine the extent of direct remittances from donors;
c) account for expenses incurred thereat; and
d) verify the reasonableness of the amount of monthly remittances requested by field offices.

On 28 April 1995, a memo was issued to all field offices requesting them to submit bi-monthly cash position reports and monthly statements of project operating fund liquidation. This new system was carried out religiously effective 1 September.

To date, the Unit has been able to anticipate the funds requirements of the field offices resulting in constant and timely monthly remittances.

1996 Expected Outputs

- By third quarter of 1996, the Unit will replicate (to the extent applicable) the Headquarters finance and accounting systems at the CAC field office. Prior to installation, financial transactions shall be reviewed to establish the correct initial balances, of the financial accounts.

1.5. Donor Reporting

ICLARM Staff : Accounting Staff

Duration : Ongoing

Objective

- To prepare monthly donor reports for selected projects.

Background and Justification

The prompt submission of donor reports is prerequisite to an effective collection program. To a large extent, the Center's cash inflows are dependent upon compliance with donors reporting requirements. At all times, their required reporting standards and formats are adopted.

Presently, the Center has about 40 active projects and 25 donors. Each donor has its own report format. Consequently, when preparing the donor reports when they fall due, a considerable amount of time is spent in recasting the accounting data to conform with the prescribed format. This is aggravated by the relatively "long period" of time covered by the reporting period since recasting is only done when the reports are due for submission.

1995 Progress

In general, donor reports were submitted on time. No qualifications were made by the donors. The donors' favorable response was manifested in the steady cash inflows of the Center during the year. A staff member was assigned to prepare the donor reports for selected projects on a monthly basis.

Expected Output in 1996

- Monthly donor reports for selected project will be submitted to and discussed with project leaders. Reports will be submitted to donors as they fall due.

2. PROJECTS ADMINISTRATION

2.1. Finalization and Implementation of the Project Procedures Manual

ICLARM Staff : Projects Administration Staff

Duration : Fully operated by end of 2nd quarter

Objectives

- To establish and operationalize a formal and uniform system for project planning and management within the Center
- To assist in the information dissemination and implementation of the manual in 1996 in order to communicate effectively the responsibilities of project managers.

Background and Justification

The need for a project-based management system has already been acknowledged by various review committees both within ICLARM and outside. Answering this need, a Project Procedures Manual has been developed to serve as a guideline in standardizing and institutionalizing project planning and management in ICLARM. This however will be useless unless properly implemented and operationalized through a series of discussions, trainings, etc.

Expected Outputs in 1996

- Systematic planning and management of projects in ICLARM.
- Well-established management procedures that ensure efficient allocation and use of resources.
- Training on the operationalization of the Project Procedures Manual.

2.2. Budget Management Systems

ICLARM Staff : Projects Administration Staff, other MSD units

Duration : 6 months

Objectives

- To develop policies for the management of budgets

- To establish clear authorities for the approval of budget-related decisions
- To orient project leaders and unit managers on new budget management procedures.

Background and Justification

Although budget status reporting improved in 1995, the current systems for making and tracking budget-related decisions are inadequate. Very often, staff are confused as to who is authorized to make changes in budgets and the manner in which recommendations for budget adjustments will be considered by management. Decisions to revise the budgets are also not communicated effectively enough.

Expected Outputs in 1996

- Budget management policies for Board approval.
- Budget management implementing guidelines.
- Budget tracking and information systems.

2.3. Project Management Training

ICLARM Staff : Projects Administration Staff, Project Leaders, Research Staff and Program Directors

Duration : Ongoing

Objective

- To upgrade the management skills of all project leaders and other staff with project management responsibilities.

Background and Justification

Benefits to be derived from establishing a project-based management system (as promoted by the Manual) hinge on the management skills of all staff concerned. It is therefore of extreme importance that project managers have the necessary skills and training to plan and manage projects effectively and efficiently. This can be ensured by providing venues for relevant project planning and management training. Training on proposal preparation is also a perceived need.

Expected Outputs in 1996

- Training courses on project planning and management, as well as proposal preparation, to be conducted by consultants and attended by all concerned staff.

2.4. Project Management Information

ICLARM Staff : Projects Administration Staff, other MSD units

Duration : 12 months

Objective

- To ensure that project information is readily available to all who require such information.

Background and Justification

The initial phase of the development work focused on organizing basic information on each project (title, start/end date, donor, objectives, reporting requirements, staff involved, etc.) into data that would be made available on a Center-wide LAN. Databases on projects, donors, proposals, etc., should be put in a system that would allow for cross referencing.

To achieve the above, a programmer should be assigned to the Projects Administration Unit to set-up the system. If no programmer is available, a new programmer will be hired for three months for this purpose.

Expected Outputs in 1996

- For implementation in 1996

2.5. Preparation of Workshop Guidelines

ICLARM Staff : Projects Administration Staff

Duration : 3 months

Objective

- To develop a set of guidelines on the procedures for organizing workshops/ conferences/training within ICLARM.

Background and Justification

Training, workshops and seminars are integral parts of ICLARM Projects. Through these, ICLARM not only provides relevant venues for scientific exchanges of ideas. ICLARM's image as an international research center of high caliber could also be projected. Thus, it is important to make sure that all training, workshops and seminars conducted by ICLARM are well organized and executed according to ICLARM standards.

Expected Outputs in 1996

- A manual setting out guidelines for organizing training, workshops and seminars should be drafted by end of the first quarter of 1996.

2.6. Regular Services

ICLARM Staff : Projects Administration Unit

Duration : 12 months

Objective

- To provide general staff support to Program Directors/Project Leaders on matters pertaining to finance, logistics, human resources and projects administration.

Background and Justification

As menticned, the implementations of the project-based management system is critical to ICLARM's general performance.

Expected Outputs in 1996

- Coordination with other MSD Units and Research Staff on resources required by projects/grants, like personnel, cash, equipment, travel, etc. requirements.
- Preparation and monitoring of MOUs and MOAs with collaborators.
- Center-wide budget preparation.
- Budget preparation and monitoring of grant/project proposals.
- Assistance in the preparation of workshops/training/seminars/conferences.

3. HUMAN RESOURCES MANAGEMENT (HRM)

3.1. Performance Management Systems

ICLARM Staff : HRM Unit Staff

Duration : Continuous

Objectives

- To continue the smooth implementation of the ICLARM Performance Management System
- To continue to support management efforts to achieve maximum staff ownership and improvement of the system.

Background and Justification

Toward the end of 1995, the ICLARM Performance Management System was fully implemented for the first time. Hopefully, this will mark the beginning of effectively and objectively measuring staff performance. The focus in 1996 will be to continue what has been started and to assess further the system and identify areas of improvement to maximize its effectivity for the Center.

Expected Outputs in 1996

- All new hires will be given the appropriate training in the implementation of the system.
- Annual 1996 Performance Agreements should be prepared by all staff and agreed to by their respective supervisors.
- Interim performance reviews should be conducted by supervisors by July 1996.

3.2. Personnel Policies Implementation

ICLARM Staff : HR Manager, MSD Director, NRS Advisory Committee

Duration : Continuous

Objectives

- To communicate to ICLARM staff how personnel policies are to be implemented within the Center by developing implementing guidelines as required/requested by staff or as anticipated as necessary by ICLARM management
- To keep the IRS and NRS Policy Manuals updated.

Background and Justification

Although Board-approved personnel policy manuals have been very helpful in establishing a greater awareness and understanding among staff of how the Center is being managed, recent experience indicates that many of the policies will benefit from being spelled out in greater detail through implementing guidelines issued by management. In addition, ICLARM management, in the process of implementing these

policies has identified the need to bring forward to the Board policy changes it felt were necessary.

The NRS Advisory Committee has also been very useful in the identification of areas requiring the articulation of such implementing guidelines and policies in need of change. In 1995, management drafted the following policies: Staff Compensation and Benefits, Recruitment, Appointment and Tenure, Promotions and Transfers, and Staff Development. Upon approval of these policies, guidelines will be drafted for clearer and more uniform implementation of these policies.

1996 Expected Outputs

- The HR Unit should be able to release and implement all the above policies with the corresponding implementing guidelines.

- Recommendations for changes to the IRS and NRS Personnel Policy Manuals will include the new policies.

3.3. Staff Development Programs

ICLARM Staff : HR Staff, MSD Director, All ICLARM Staff

Duration : Continuous

Objective

- To identify and develop a comprehensive listing of all training needs for all positions within the Center and a corresponding set of training and development activities for a formal staff development program.

Background and Justification

- In the past, ICLARM has been content with hiring staff on fixed-term contracts with the requisite skills to perform the required task for a given activity or function. As the organization has become more complex and ICLARM's clients more demanding, ICLARM needs to be in a position to make better and more efficient use of its human resources.

- While a formal staff development program complements other management initiatives in performance planning and management, it also will greatly assist the Center's staff members in coming to terms with their own career expectations and in managing their own careers.

Expected Outputs in 1996

- An inventory of minimum and desired skills for each position in the Center as well as methods, if any, available to establish levels of skills.

- Available training and staff development activities which will provide these skills.
- A system for supervisors to assess the skill level and prioritize staff training and development activities for staff during the performance planning/assessment process.
- A staff training and development budget for 1997.

3.4. Human Resources Management Information

ICLARM Staff : HR Unit Staff, MSD Director

Duration : 12 months

Objectives

- To establish and maintain a database of information on all ICLARM staff. To be able to generate, from this database, regular reports and answers to inquiries.

Background and Justification

In 1993, the HR Unit (called Personnel Services at that time) purchased a software package called "Rapid 201". Staff data were entered and simple reports have since then been generated. Unfortunately, the software could not generate the kind of information required by ICLARM managers without undergoing special customization that would have cost ICLARM both time and money. In the meantime, new software packages have been developed and are now being sold in the market.

Expected Outputs in 1996

Basic specifications for the information system and software it requires. Such specifications will include definitions of fields it would like to see included and queries and reports that the system should be able to handle. These specifications should be ready by March 1996.

- On the basis of the specifications established for the system, a new software package should be purchased and installed no later than June 1996.
- All ICLARM staff data should be entered into the system by September 1995.
- HR reports should be generated by the system no later than October 1996.
- The system should be accessible by LAN toward the end of 1996.

3.5. Personnel Services

ICLARM Staff : HR Unit Staff

Duration : Continuous

Objectives

- To ensure that the basic services provided by ICLARM to each staff are clearly understood and effectively delivered
- To ensure that these services are updated and comparable with general practices.

Background and Justification

One focus of the HRM Unit is streamlining the delivery of services to individual ICLARM staff. In 1995, the Unit achieved the following:

i) the processing and delivery of SSS and Pag-Ibig benefits for NRS were expanded and improved;

ii) contact with AIARC for IRS benefits was established and the ability of the HRM unit to respond to IRS requests was improved;

iii) a dentist was put on retainer and provided ICLARM staff with dental services at preferred rates;

iv) bottlenecks in the processing of hospital insurance claims of NRS were identified and resolved; and

v) a staff picnic was organized.

Expected Outputs in 1996

- A recommended course of action for Medical Insurance and Dental Benefits by January 1996.
- Review of all the other benefits due to ICLARM staff and recommendations made by June 1996.

3.6. Compensation Planning and Salary Structure

ICLARM Staff : HR Manager, MSD Director, Director General

Duration : 12 months

Objectives

- To evaluate the existing salary structure and compensation package of individual ICLARM employees and determine their competitiveness in the general market

- To evaluate the existing job grades of individual positions in the ICLARM organization and determine whether realignments are necessary.

Background and Justification

In early 1995, a salary structure was designed and corresponding movements were implemented. There are, however, still positions that are being recommended for realignment. To ensure that all similar concerns are addressed, a Center-wide position evaluation program is recommended.

Expected Outputs in 1996

- Terms of reference for all ICLARM HQ positions should be formally updated by March 1996.

- A Center-wide job evaluation program for all NRS positions to be completed by the end of 1996 with a proposal for an appropriate job grading system and salary structure.

OFFICE OF THE DIRECTOR GENERAL

ICLARM Staff	:	Dr. Meryl J. Williams, Ms. Josephine Z. Hernandez, Ms. Milagros D. Inquig, Ms. Anabelle M. Ramirez
Donors	:	ICLARM core funds
Duration	:	Continuous

Objective

- To manage the Center and assure that ICLARM's programs are properly developed and carried out
- To act as ICLARM's legal representative and, within the limits established by ICLARM's Board, to take whatever actions are necessary to attain ICLARM's purposes
- To manage the staff of ICLARM, observing the policies approved by the Board of Trustees
- To be responsible for the Center's external relationships with research and development organizations worldwide and with potential and current donors.

Background and Justification

The decision by the CGIAR system to put increasing emphasis on living aquatic resources offers special challenges to the Director General in 1996. As the only IARC concerned with fishery research, ICLARM expects to benefit from increased funding that will enable the Center to expand its research agenda and, possibly, establish a major research facility at Abbassa in Egypt to facilitate outreach on the African continent. The development of collaborative partnerships in Africa and elsewhere, which is a major goal for 1996, will require a significant commitment of time on the part of the Director General. The staff of the Office of the DG support the Director General in carrying out her objectives on a day to day basis. They need to be, and have proved to be, flexible in being available to meet a complex and changeable schedule in a pressured atmosphere.

Expected Outputs in 1996

Lead the Center in the production of:

- Initial work on the 1998-2000 Medium Term Plan (by mid-1996).
- Implemented plan for assessing the impacts of ICLARM's research and related activities.

- Revised research plan incorporating the Abbassa-based program and revised program structure (by March 1996).
- Project management manual and appropriate staff training.
- Establishment of a central registry system (by June 1996).
- Recruitment and orientation of two new senior staff (by July 1996).
- Full implementation of the Performance Management System, with all performance agreements evaluated for 1995 and renegotiated for 1996 (by end of February 1996) and with mid-cycle reviews (by end September 1996).
- Design and commencement of establishments review/job evaluation/competency model development, especially for NRS staff (by November 1994).
- Final ICLARM mission statement, set of core values and a staff code of conduct (by September 1996).
- Development of a CGIAR Coastal Area Environment Initiative.
- Plan for the next ICLARM External (CGIAR) Program and Management Review including a rolling plan of internationally commissioned reviews.
- Achievement of a successful outcome for ICLARM and the CGIAR through the incorporation of a well structured work program based at the Egyptian facilities.
- Successful selection and planning for a new ICLARM headquarters site in the Philippines.

GLOSSARY

ABee	-	Software on length-weight relationship
ACIAR	-	Australian Centre for International Agricultural Research
ADB	-	Asian Development Bank
AFS	-	American Fisheries Society
AFSSRN	-	Asian Fisheries Social Science Research Network
AIARC	-	Association of International Agricultural Research Centers
AIT	-	Asian Institute of Technology
AKVAFORSK	-	Institute of Aquaculture Research of Norway
ALCOM	-	Agriculture for Local Community Development Program
ASEAN	-	Association of Southeast Asian Nations
BMZ/GTZ	-	Bundesministerium für Wirstchaftliche Zusammenarbeit/ Deutsche Gesellschaft für Technische Zusammenarbeit, GmbH
BRAC	-	Bangladesh Rural Advancement Committee
BVI	-	British Virgin Islands
CARITAS	-	An international charitable organization working in various public sectors
CBD	-	Convention on Biological Diversity
CHM	-	Clearing House Mechanism
CIFOR	-	Center for International Forestry Research
CTU	-	Cantho University
DANIDA	-	Danish International Development Agency
DMCs	-	Developing Member Countries of ADB
DO	-	Dissolved oxygen
DOF	-	Department of Fisheries
EAMG	-	Ecosystems Analysis and Management Group
EPAT	-	Environmental and Natural Resources Policy and Training Project
EPOMEX	-	Program of Ecology, Fisheries and Oceanography of the Gulf of Mexico
ESU	-	Evolutionarily Significant Units
EU	-	European Union
FAO	-	Food and Agriculture Organization of the United Nations
FAC/CLSU	-	Freshwater Aquaculture Center of the Central Luzon State University
FiGR	-	Fish Genetic Resources
GBRMPA	-	Great Barrier Reef Marine Park Authority
GIFT	-	Genetic Improvement of Farmed Tilapias
GRD	-	Genetic Resources Division
HR	-	Human Resources
IAA	-	Integrated Agriculture-Aquaculture
IAMSLIC	-	International Association of Aquatic Marine Science Libraries and Information Centers
ICES	-	International Council for the Exploration of the Sea
ICRAF	-	International Center for Research on Agroforestry
ICRI	-	International Coral Reef Initiative
ICWG-GR	-	InterCenter Working Group on Genetic Resources

IDRC	-	International Development Research Centre
IIRR	-	International Institute for Rural Reconstruction
IRM	-	Integrated Resource Management
IRRI	-	International Rice Research Institute
IRS	-	Internationally Recruited Staff
IRSMLDC	-	Ian R. Smith Memorial Library and Documentation Center
ISMED	-	Institute for Science and Mathematics Education Development
IUCN	-	World Conservation Union
JICA	-	Japan International Cooperation Agency
LAN	-	Local Area Network
MAGFAD	-	Malawi-German Fisheries and Aquaculture Development Project
MAXIMS	-	Software for the estimation of food consumption of fishes from diel stomach contents data and population parameters
MCA	-	Marine Conservation Area
MicroDP	-	Software for fish population dynamics
MOU	-	Memorandum of Understanding
MOA	-	Memorandum of Agreement
MPA	-	Marine Protected Area
MSD	-	Management Services Division
MSI	-	Marine Science Institute
MUK	-	Manobik Unnayan Kendra
NAFO	-	Northwest Atlantic Fisheries Organization
NARS	-	National aquatic research systems
NFFTRC/BFAR	-	National Freshwater Fisheries Technology Research Center of the Philippine Bureau of Fisheries and Aquatic Resources
NFMP	-	New Fisheries Management Policy
NGOs	-	Nongovernmental organizations
NORAGRIC/ NORAD	-	Norwegian Center for International Agricultural Development
NRS	-	Nationally Recruited Staff
NRT	-	Natural Resource Type
ODA	-	Overseas Development Administration
PADEK	-	Partnership for Development in Kampuchea
PME	-	Participatory Monitoring and Evaluation
PNTBP	-	Philippine National Tilapia Breeding Program
RCTs	-	Regional Composite Teams
REA	-	Resource and Ecological Assessments
RRA/PRA	-	Rapid Rural Appraisal/Participatory Rapid Appraisal
SACCAR	-	Southern African Centre for Cooperation in Agricultural Research and Training
SADC	-	Southern African Development Community
SBSTTA	-	Subsidiary Body on Scientific, Technical and Technological Advice
SGRP	-	System-wide Genetic Resources Program
SIFR	-	Strategy on International Fisheries Research
SIMCOAST	-	Software to show relationships between different coastal sectors (fisheries, agriculture, etc.)
SSS	-	Social Security System
TNC	-	The Nature Conservancy

UNDP/STAPS	-	United Nations Development Program/Science, Technology and Private Sector Division
USAID	-	United States Agency for International Development
VISCA	-	Visayas State College of Agriculture
WESAMAR	-	Western Samar Agricultural Resource Development Program
WCMC	-	World Conservation Monitoring Center

Annex I

ICLARM's ORGANIZATIONAL STRUCTURE

The attached chart describes the organizational structure of ICLARM as of 1 January 1996. The structure was developed following extensive staff discussion on how to capitalize on ICLARM's strengths in the light of substantial changes in the context within which the Center works. It will not be fully implemented until mid-1996 when all senior staff position will be filled.

ICLARM was established in 1976 and admitted to the system supported by the Consultative Group on International Agricultural Research (CGIAR) in 1992. During these early years, the Center had carried out a distinguished research program with a relatively small staff, but a program more restricted in scope than is now the case. In fact, ICLARM's budget has grown by some 15% over the past year alone, and it is expected to increase by an even larger percentage in the years immediately ahead. Among other factors, the coming growth is the outcome of a possible extensive new research program planned for Africa and West Asia as well as of the call by participants in the CGIAR Renewal Meeting at Lucerne to address issues of aquatic resources more forcefully. With growth, there will also be change in some aspects of the research focus. More attention will be paid in the coming years to biodiversity and genetic resources, for example, and there will be a growing emphasis on integration of the social sciences in the research program – with a focus on food security issue involving aquatic resources

In addition, the welcome invitation to membership in the prestigious CGIAR System has offered opportunities to the Center and imposed obligations upon it to which the structure in place could not respond effectively. Inter-center collaboration places more demands on management time than was previously the case, as does the decision of the System to develop stronger partnerships both with national agricultural research systems (NARS) in client countries and with advanced research institutes (ASIs) in the industrialized world.

The new structure was developed with due consideration to ICLARM's core business as defined in its mandate and approved Strategic, Medium-Term and Operational Plans, and key support functions. The Center's core business is composed of:

- strategic research,
- the strengthening of national systems through training and partnership research,
- information, including the dissemination of research results,
- global reviews of the status of aquatic resources,
- the development of global knowledge bases, and
- policy analysis.

Key support functions include such traditional corporate services as:

- finance,
- human resources management,
- information technology,
- facilities management, and
- general administration.

However, they also include activities related to public awareness, the management of external relations with partners, donors, and other CGIAR System participants, and research monitoring and impact assessment.

The new structure also takes into account the value placed on the relative autonomy of projects, the research freedom that keeps motivation high and fosters leadership in science, the importance of integrating the information function with the research activities it serves, and clarity in reporting lines and the accountability system. The disadvantages that might accompany the decentralization of research decisions--the possibility that the project-driven nature of operations will inhibit interactions between projects and programs and curtail disciplinary exchange--are addressed in the plan for coordination and communication described below. The structure reduces the current overload on the Director General and other senior management staff, promotes greater delegation of decisionmaking, and clearly assigns such functions as donor and partner relations which have no current home.

With reference to the organization chart, specifically:

The Director General will be assisted by a general office staff (the Office of the DG) and by a Director/External Relations. The latter position will provide support to the DG in interacting with donors, the Technical Advisory Committee (TAC), the CGIAR, and the Board of Trustees and will be responsible for the management of external visitors, for assistance with the drafting of project proposals, and for the preparation of information for general public awareness/public relations purposes. In addition, an Internal Auditor will report to the DG.

A Deputy Director General/Programs will be responsible for oversight of the global program for research, information, and training and of relations with NARS. This DDG will be assisted in the latter assignment by a Director/International Relations, whose tasks will include the promotion of partnership research with both NARS and ASIs, the assessment of NARS training needs, and coordination of most networks.

A second Deputy Director General/Africa-WANA is anticipated once the size of the Africa program requires such a position.

Research, information, and training in the following areas will be managed by Program Leaders, reporting to the DDG/Programs:

- Biodiversity and Genetic Resources
- Germplasm Enhancement and Breeding

- Aquatic Environments
- Fisheries Resources Assessment and Management
- Integrated Aquaculture-Agriculture Systems
- Coastal Aquaculture and Stock Enhancement
- Policy Research and Impact Assessment
- Information and Training

A ninth program, International Partnerships and Networks, will be headed by the International Relations Officer.

The Officers-in-Charge/Scientists at outpost sites will be responsible for project research, the management of local facilities and staff, and relations with the local NARS. They will report to the DDG/Programs or DDG/Africa-WANA, respectively, for administrative and policy purposes and with respect to NARS relations, and to the appropriate Program Leader with respect to research. Personal assessments will be prepared in the first instance by the respective Program Leader.

The Associate Director General/Corporate Services will oversee the assignments of the following staff:

- Manager/Finance and Management Information
- Manager/Project Administration (responsible for ensuring adherence to project budgets, reporting requirements, etc., in close collaboration with the respective project leaders)
- Manager/Human Resources
- Manager/Administrative Services

In addition, the position of Manager, Headquarters Site Development, reporting to the ADG, will be established on an interim basis to oversee construction of the ICLARM Headquarters and to manage the property and its facilities until Center operations have been transferred to the site.

The following formal mechanisms for communication, planning, and coordination, most of which currently exist, will be in place:

Program and Management Committee	Chaired by DG; composed of two DDGs, ADG, Director/External Relations and the Director/International Relations; meeting weekly; joined at one meeting per month by the eight Program Leaders.
Program/Unit Meetings	Chaired by Program Leaders or other unit heads; meeting weekly.
Internal Program Review	Annual reporting/planning session attended by all scientific staff and representatives of the Board of Trustees' Program Committee; chaired by DG.

Internally-Managed External Reviews	Periodic reviews of specific research management areas carried out by external consultant specialists.
NRS Advisory Committees	At HQ, chaired by DG; in Africa, chaired by DDG/Africa-WANA; composed of appointed members of the nationally recruited staff (NRS); meeting approximately quarterly. In addition, representatives of NRS at other outreach sites will be invited to HQ once in a year to meet with DG.
Publications Committee	Chaired by Program Leader/Information and Training; composed of appointed scientific staff; meeting as needed.
Standards Committee	Chaired by DG; composed of appointed staff; meeting as needed to ensure equity in the Performance Management System and in other personnel-related decisions.

In addition, a monthly publication, *NewSplash*, carries staff and other Center news to the entire staff, while the weekly Management Committee Notes reports on key decisions or other items of information stemming from the Committee and the monthly Research Group Notes reports on milestones and other performance indicators from the programs.

ICLARM ORGANIZATION