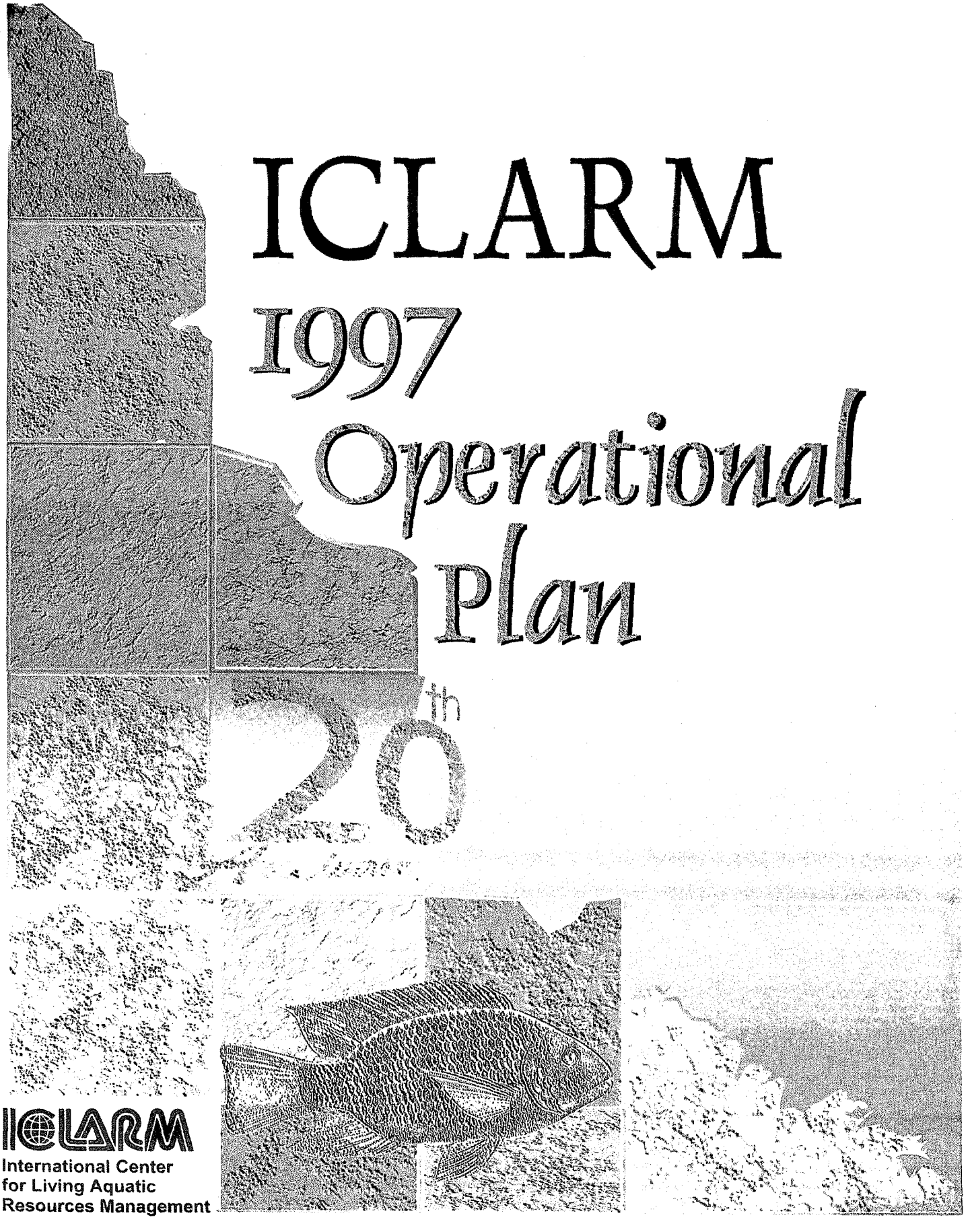
ICLARM

1997 *Operational Plan*



ICLARM
International Center
for Living Aquatic
Resources Management

ICLARM 1997 OPERATIONAL PLAN

International Center for Living Aquatic Resources Management

MCPO Box 2631, 0718 Makati City, Philippines
Telephones: 812-8641; 817-5255; 818-0466; 818-9283
Fax: (63-2) 816-3183; E-mail: ICLARM@cgnet.com
Visit our home page: *http://www.cgiar.org/iclarm/*

ICLARM 1997 OPERATIONAL PLAN

1997

Published by the International Center for Living
Aquatic Resources Management, MCPO Box 2631,
0718 Makati City, Philippines

Printed in Manila, Philippines

ICLARM. 1997. ICLARM 1997 operational plan. International
Center for Living Aquatic Resources Management,
Manila, Philippines. 150 p.

Editor: Peter R. Gardiner
Associate Editor: Joanna Kane-Potaka
Managing Editor: Marie Sol M. Sadorra
Copyediting: Danilo Abacahin and Rita Kapadia
Coordination: Dindo Satumba and Jessica Moya
Layout and typography: Ma. Graciela Balleras and Geraldine Gilera
Cover design: Alan Siegfrid Esquillon
Graphics: Roberto Cada and Albert Contemprate

ISBN 971-8709-03-7

ICLARM Contribution No. 1368

CONTENTS

ACTIVITIES AND SERVICES

FOREWORD

The year 1997 marks the 20th anniversary of the incorporation of the International Center for Living Aquatic Resources Management (ICLARM) in the Philippines. The Institute was first established in response to the need for an organization to facilitate and coordinate long-term research on fish and other living aquatic resources utilized by the poor fishers and consumers in developing countries. It began as a project developed by the Rockefeller Foundation in 1973 and implemented by the Research Corporation of the University of Hawaii in 1975. The international center concept was pioneered by the Rockefeller and Ford Foundations with the World Bank and other donors of the Consultative Group on International Agricultural Research (CGIAR). However, following its incorporation in the Philippines, ICLARM initially operated as an autonomous, nongovernmental, nonprofit international research center outside the CGIAR. Based on the research successes of ICLARM and the wider recognition of the role of aquatic and other natural resource systems management as a vital balancing component to agricultural and fisheries productivity in the long term, in 1992 ICLARM joined the CGIAR (along with other institutes concerned with irrigated water management and forestry).

This report is not specifically a celebration of 20 years of research but marks the third year that ICLARM has published an Operational Plan. It describes ICLARM's portfolio of scientific research and related activities as a record and a guide for ICLARM's research partners and those interested in the Institute. It lays out the current research projects within ICLARM's programmatic structure and details the work of the supporting management and administrative units. Readers will find that in addressing its broad mandate covering marine, coastal and freshwater aquatic resources, ICLARM has developed research projects on the management of natural resource systems; the evaluation and sustainable use of aquatic biodiversity; the improvement of the socioeconomic and policy environment governing the use of aquatic resources; and commodity-type improvement research for selected aquaculture species which benefit poor people.

ICLARM's current research activities stem from a Strategic Plan published in 1992. Its project activities are rated against a number of guiding principles which are listed in the text and explained on page xvii. These are used to guide program leaders and ICLARM management. As the nature of the immediate subject matter of the research varies (say, between the development of fisheries assessment software or determining the impact of improved fish germplasm in Asian farming systems), the weight of particular criteria and their ease of application also vary. Nevertheless, ICLARM's research remains geared to assist the poor of developing countries and to enhance the productivity and durability of the natural resource base on which such progress depends.

Major progress is anticipated during 1997 in the quantification of the productivity, economic and environmental benefits of improved tilapia germplasm in Asian aquaculture; the evaluation of markets for the products of enhanced aquaculture for coastal invertebrate species in the Pacific; and the continued improvement and broadening of electronic databases for the finfish and coral reefs of the world. New initiatives will include research on new methods for the evaluation of existing trawl data

in Asian coastal fisheries; the genetic improvement of carps; biodiversity research on African tilapia for aquaculture and coral reef species; and new initiatives in fisheries policy research, among others. In orienting itself to address the levelling off and even deficits in the world's fisheries catches, and in structuring itself as an institute of the CGIAR, ICLARM has not remained static. 1997 marks a step in the Institute's evolution captured by the Institute's substantial and influential publications and charted by the Institute's Medium-term Plan for the period 1998-2000. This year will also see the inauguration of ICLARM's research center for Africa and West Asia in Abbassa in Egypt. This will act as a hub for work on the African continent. Although much of the work to be conducted from the site is still in the planning and proposal writing stage, it can be expected to figure more prominently in the operational plans of future years. This year will be chiefly concerned with upgrading the existing facility and planning for its future operation.

In 1996, ICLARM completed its new management structure to assist the Director General, with the appointment of an International Relations Officer (who has presided over the extensive and increased activities of ICLARM's International Network for Genetics in Aquaculture [INGA] and other network activities) and appointments to two new Deputy Director General positions - for the Scientific Program and for the new initiative in Africa.

ICLARM takes pride in the range and effectiveness of its partnerships in conducting its scientific and development activities and lists collaborators, scientific staff and donor agencies who carry out or support the research described in this document. We take this opportunity to thank all those who work, or have worked, during ICLARM's two decades of facilitation and research, towards the effective conservation and use of the aquatic resources of developing countries.

MERYL J. WILLIAMS
Director General

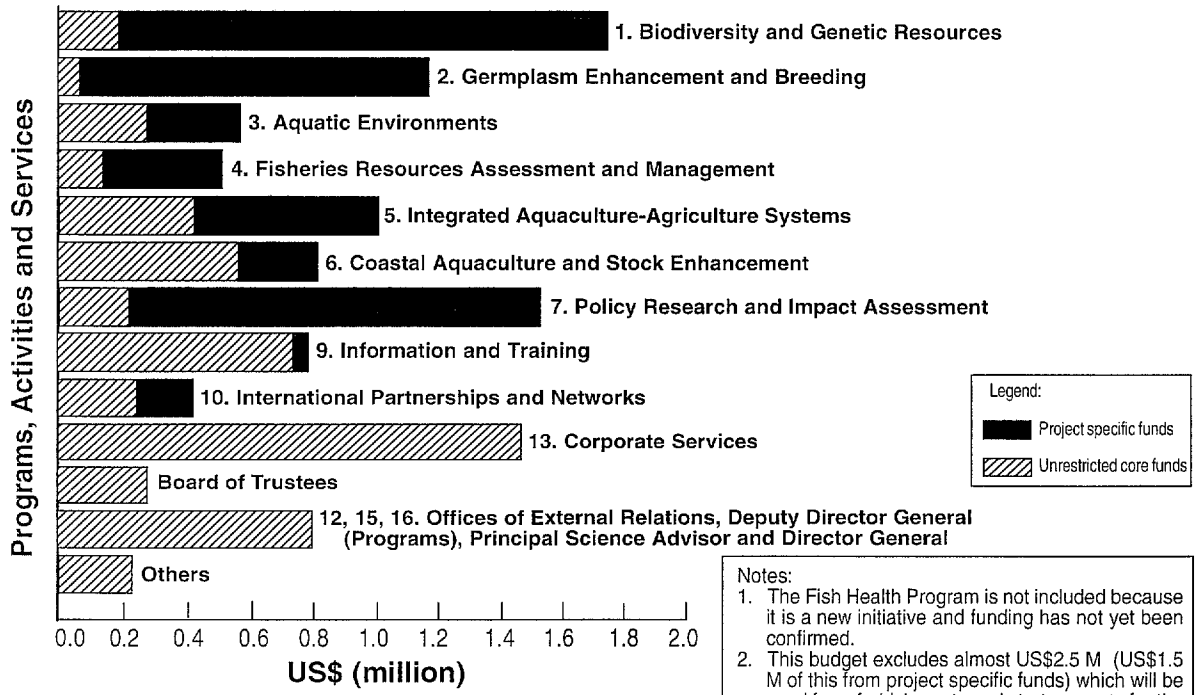
OVERVIEW

ICLARM's research covers both marine and fresh waters in important tropical ecosystems – coastal waters, coral reefs and freshwater waterbodies. The research is carried out through the following ten programs:

Program	Focus
1. Biodiversity and Genetic Resources	Conservation of aquatic life.
2. Germplasm Enhancement and Breeding	Ways of improving fish breeds.
3. Aquatic Environments	Conservation of aquatic habitats.
4. Fisheries Resources Assessment and Management	Methods to improve the way fisheries are managed.
5. Integrated Aquaculture-Agriculture Systems	Improving overall production on small farms.
6. Coastal Aquaculture and Stock Enhancement	Increasing marine harvests through fish farming and augmenting natural fish populations.
7. Policy Research and Impact Assessment	Analysis of aquatic resource issues to improve policy decisions, including investments in research.
8. Fish Health	Helping prevent and manage fish disease outbreaks, especially in Africa. *This program is under development.*
9. Information and Training	Assisting both scientific and public understanding of global fisheries problems; and helping in ICLARM's training activities.
10. International Partnerships and Networks	Strengthening connections and collaborations between fisheries organizations and individuals, especially in developing countries.

Activity or Service	Focus
11. System-wide Initiatives	Coordinating activities with groups of Centers within the Consultative Group on International Agricultural Research (CGIAR).
12. External Relations Office	Assisting the Director General in maintaining, developing and enhancing ICLARM's relationships with its major stakeholders.
13. Corporate Services Office	Providing the Center's management, staff and organizational units the needed support services to carry out programs and research activities.
14. Office of the Deputy Director General (Africa and West Asia)	Managing the refurbishment of the Abbassa aquaculture facility and overseeing its operations as ICLARM's research center for Africa and West Asia.
15. Office of the Deputy Director General (Programs)	Assisting the Director General in planning, implementing, monitoring and reporting ICLARM's research and related programs.
16. Office of the Director General	Managing the Center and ensuring proper implementation of Board-approved policies; acting as ICLARM's legal representative; and enhancing relationships with research organizations worldwide, and with current and potential donors.

Resource Allocation for 1997



Notes:
1. The Fish Health Program is not included because it is a new initiative and funding has not yet been confirmed.
2. This budget excludes almost US$2.5 M (US$1.5 M of this from project specific funds) which will be used for refurbishments and start-up costs for the Research Center for Africa and West Asia.

1. Biodiversity and Genetic Resources. The Biodiversity and Genetic Resources Program (BGRP) pursues strategic research on fish biodiversity and genetic resources and the development of genetic resources research methods, in partnership with international, regional and national agencies and institutions, NGOs, scientists, farmers and fishers. The BGRP contributes to the meetings of the Convention on Biological Diversity (CBD), including the latter's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA). It collaborates with organizations concerned with the sustainable use and conservation of living aquatic resources, including FAO and IUCN. The BGRP provides ICLARM's contributions to the CGIAR's Systemwide Genetic Resources Program (SGRP) and Systemwide Information Network on Genetic Resources (SINGER).

The BGRP's largest activity is an EU-funded project which will focus on capacity building in fisheries and biodiversity management in the national programs of 55 African, Caribbean and Pacific (APC) countries. The project emphasizes training for establishing national fish biodiversity databases, based on the concepts implemented in FishBase, and the forging of regional and intraregional partnerships through electronic networking. Work on versions of FishBase in major languages other than English will also begin in 1997, commencing with French.

New research projects on documenting genetic resources for their sustainable use and conservation will start in 1997: case studies on a tilapia *(Sarotherodon melanotheron)* in the coastal lagoons and estuaries of West Africa and on an Asian carp, *Puntius gonionotus*, that is rapidly gaining popularity among resource-poor fish farmers in South and Southeast Asia.

2. Germplasm Enhancement and Breeding Program. This program aims to develop techniques for improving breeds of fish, disseminate these techniques, and train staff. The Genetically Improved Farmed Tilapia (GIFT) project, which began in 1988, is a major strategic research initiative in the applied genetics breeding and germplasm improvement of Nile tilapia (*Oreochromis niloticus*). In 1996, experiments were completed on the magnitude of genotype by season interaction and the estimation of response to selection for late and early spawning in females. The GIFT project is closely allied with the Dissemination of Genetically Improved Tilapia in Asia (DEGITA) project, which has examined the performance of the GIFT strain and its socioeconomic impact on fish farming households in selected countries in Asia. The project has shown that the improved GIFT tilapia continues to express enhanced growth and survival traits in various aquaculture environments. It has also proved that the farming of early maturing and more efficient strains of tilapia can result in lower prices for these species for the benefit of poor people. Work of the germplasm enhancement program has also contributed to ICLARM's INGA network activities, and to the development of new research proposals for the similar development of carp species in the future. As a means of ensuring the continued and increased availability of genetically improved strains, ICLARM and its partners are evaluating the formation of a nonprofit foundation to maintain both the distribution and genetic breeding research on tilapia in the Philippines.

3. Aquatic Environments. The ReefBase 1.0 CD-ROM and Manual were released at the International Coral Reef Symposium in Panama in June 1996. ReefBase was designated to be the official database of the Global Coral Reef Monitoring Network, an activity initiated as part of the International Coral Reef Initiative (ICRI) and which involves more than 80 countries. ReefBase 2.0, which will be released by June 1997, will contain a wide range of ecological and management information on over 7 000 coral reefs. A collaboration with the World Resources Institute will result in a global analysis of the threats to coral reefs by the end of the year. A manual is being finalized for the ReefBase Aquanaut System, which will enable sport divers, park rangers and others to gather standard data on the ecological status of coral reefs.

A study will be initiated of Population Interdependencies in the South China Sea Ecosystem (PISCES). This project will compare the genetic structures of selected coral reef species in six countries to obtain information on possible shared stocks that must be accounted for in ecosystem management policies. Work was completed in 1996 on the Lagonoy Gulf Project, a coastal zone management study, leading to specific recommendations for the future management of the area. This activity will be succeeded in mid-1997 by a regional project to study fisheries ecosystems and management in Southeast Asia. The coastal management training project will continue. It will focus on finalizing and testing training packages for local government officials in the Philippines to whom the primary responsibility for coastal zone governance has recently devolved. Numerous requests for these materials have been received from other countries, and possibilities for developing a regionally focused package are being explored.

4. Fisheries Resources Assessment and Management Program. This program seeks better tools and approaches to assess and manage tropical fish stocks, including developing methods for acquiring data for aquatic resources management. Included in this program is a scientific assessment of the role of marine reserves in fisheries management and the conservation of biodiversity.

In 1996 a Windows-based version of Ecopath (Ecopath 3.0), an ecosystem assessment software designed for fisheries, was released. Individual modules of this software were also improved and, in collaboration with scientists at the University of British Columbia in Canada and DIFRES in Denmark, a new package for dynamic systems modelling, termed Ecosim, has been developed. Other advances include the development of a multispecies analysis program, the development of a routine to determine yield per recruit for incorporation into ICLARM's FishBase CD-ROM, and a FiSAT reference manual to supplement the existing FiSAT users guide.

Work has continued in the Caribbean in finalizing project arrangements with the University of West Indies and the University of the Virgin Islands to conduct research on marine protected areas. Work consists of tagging and recapturing indicator fish species to provide evidence for the scientific placement and extent of marine protected areas and their probable effects on stock enhancement and adjacent fisheries.

A workshop in July 1996 on Asian coastal fisheries has developed into a proposal for using a prototype trawl analysis software for the effective utilization and interpretation of existing trawl data from several countries in Asia. This software will enable researchers to better analyze trends in fisheries catches in the region and to provide data for improved fisheries management. Two publications by the program provided synthesis of the work of ICLARM and its collaborators spanning more than a decade of research. The first is a CD-ROM, "The San Miguel Bay Story", which presents the compiled research and management reports on the aquatic resources of San Miguel Bay in the Philippines. The second is a major book on the fish resources of Western Indonesia jointly published by ICLARM and the German Agency for Technical Cooperation; it synthesizes an immense amount of information on the fisheries situation in the seas of Western Indonesia.

5. Integrated Aquaculture-Agriculture Systems. This program aims to improve the productivity of smallholder farms through integration of fish farming and development of methods to assess sustainability of integrated aquaculture-agriculture (IAA) systems.

RESTORE (consisting of farmer-participatory field procedures and software) is the analytical tool developed at ICLARM for this purpose. The beta-version was completed in 1996 and distributed to over 100 testers worldwide. Feedback will lead to a final version to be released in 1997. Data from previous projects in Ghana, Malawi and the Philippines (Cavite, Muñoz, Antique) are being analyzed. As part of this framework, the Spanish translation of a participatory diagnostic methods book was produced, as well as the proceedings of a workshop on the potential for smallholder aquaculture in Ghana.

A five-year study of the ecology and sustainability of Philippine rice-based farms (including rice-fish culture) was completed applying ECOPATH, a steady-state nutrient-flow modeling software, for the first time in a terrestrial environment. The results were presented in the form of a Ph.D. thesis at the University of Copenhagen. A Technical Report and peer-reviewed publications are forthcoming. In collaboration with the University of Kassel, Germany, a dynamic simulation model of the rice-fish farming system in the Philippines was completed.

As a new initiative, a small study on the potential for IAA in the context of rainforest borderzone management was begun in collaboration with a bilateral development aid project in the uplands of Quirino province in Luzon, Philippines.

In Malawi, activities are entirely core-funded and continue in the form of collaborative research on station with the Fisheries Department, strategic research on-farm and on-station, and the provision of training courses and of improved information services through an upgraded library. Points of focus were the study of adoption and impact of IAA on smallholder farms, partial harvest strategies for continuous fish supply (as opposed to bulk harvests after several months of culture) and on community management of seasonal small waterbodies (*thamandas*) for fish culture. Further highlights were the contribution to an expert consultation on smallholder aquaculture in Africa held at FAO in Rome, and a suite of publications on work performed by the project staff.

In Bangladesh, work continued on developing sustainable technology for smallholder aquaculture through studies of socioeconomics on rice-fish farms and on provision of training, particularly on hatchery and broodstock management to avoid inbreeding, to national research and extension institutions and to NGOs. Scheduled for 1997 is the start of a project to study the socioeconomic and technical aspects of community-managed deepwater rice-fish operations in Bangladesh and Vietnam, in collaboration with national partners and IRRI.

Among the new activities planned for 1997 are (1) the involvement in the System-Wide Initiative on Water Management (SWIM) in the fields of multiple use of irrigation water, watershed management, and water-use efficiency; and (2) the design of a study of the potential for improved management of small water bodies with a primary focus on subSaharan Africa.

6. Coastal Aquaculture and Stock Enhancement. The development of village farming systems for giant clams and blacklip pearl oysters, and the artificial propagation of sea cucumbers, continued throughout 1996 at the Coastal Aquaculture Centre in Solomon Islands.

The series of large-scale grow-out trials for giant clams at village farms was concluded in late 1996. These trials demonstrated that five species (*T. crocea, T. derasa, T. gigas, T. maxima* and *T. squamosa*) can be reared by village farmers for the aquarium trade at substantial profits. One species, *T. derasa*, had exceptionally high mean rates of growth and survival, and was the outstanding species for cultivation as food. Additional village farms were established to produce sufficient *T. derasa* to test and develop markets for clams of 150 mm shell length in the live seafood trade. In 1997, work on giant clams will focus on developing cost-effective ways to reestablish overfished stocks, enhancing the value of farmed giant clams, testing other markets for cultured clams and assessing the economic and social impact of giant clam farming.

Systems for farming of blacklip oysters in the "open" lagoon systems of the central-western Pacific were refined by identifying the types of sites where spat were most abundant, removing spat from collectors after three months and rearing them in panel nets, and by modifying the design of the spat collectors. In 1997, a pilot-scale pearl farm will be established and the feasibility of commercial operations, based on the collection of wild spat, will be assessed.

Two batches of the most commercially important sea cucumber, "sandfish", were produced in the hatchery at the Coastal Aquaculture Centre. The juveniles appeared to be suitable for mass-rearing in hatcheries as they grew rapidly, and had simple food requirements. In 1997, research will concentrate on developing larval rearing methods for other species of sea cucumbers of high value, and on refining methods for producing sandfish. Also, the early success in rearing sandfish, and their apparent suitability for stock enhancement, has brought forward the need for experiments to identify the best way to release the juveniles into the wild. As a prelude to these experiments, we will identify the nursery habitats of sandfish, determine what time of year they recruit, access how fast they grow, and establish the timing of migration from nursery to adult habitats.

7. Policy Research and Impact Assessment. This program became operational in 1996. A full-time Program Leader was appointed during the second half of the year. The program is building on the experiences of past and ongoing activities such as research on fisheries co-management; evaluation and assessment of aquaculture technologies; bio-economic analysis; and valuation of coastal resources.

The research on fisheries co-management, bio-economic analysis and valuation of coastal resources will now be carried out under a broader theme: *ecological economics for sustainable use of aquatic resources.*

Research to assess the results and evaluate impacts of aquatic resources will involve assessment of impact for major completed projects as well as development of internal mechanism to include *ex-ante* impact and built-in impact assessment for every major research initiative by ICLARM. Impact assessment projects will be categorized under the theme *impact of aquatic resources research: methods and assessment.*

Increasing emphasis will be given to examine a range of policy issues and measures by which governments might strive to increase the supply of fish for human consumption and the economic benefits which are available from the fisheries sector. These projects will fall under the theme *policy analysis of the contribution of fisheries to food security.* Substantial cooperation with IFPRI and other partners is foreseen on this.

8. Fish Health. This program is a recent initiative and a research plan is being developed.

9. Information and Training. In 1996 all units broadened their services. At the same time an in-depth analysis was undertaken of the role and operations of the whole area, and a new and progressive future focus designed.

Major changes are expected over 1997, including the wider integration of this program into ICLARM and its research projects so that the units under the program are viewed as information dissemination tools. A strategic approach will be taken to use these tools to develop information dissemination strategies as an interdisciplinary component to ICLARM's research projects and to develop new initiatives.

To achieve these goals, many developments will be needed, including new focuses, restructuring, more efficient operations of each unit, funding source, changed expectations, and planning for the further development of Public Awareness, Training and Translations Units. 1997 will see some major progress towards these.

10. International Partnerships and Networks. For better management of living aquatic resources worldwide, existing research partnerships are being strengthened and new partnerships are being developed with national and international institutions and NGOs, through research and information networks and collaborative research programs with and among developing countries. Through the International Network on Genetics in Aquaculture (INGA), national breeding programs have been developed, training programs in quantitative genetics and selective breeding have been conducted and INGA national chapters have been formed. GIFT germplasm has been provided for national breeding programs. New collaborative programs on carp and tilapia genetic improvement will be started in Asia and Africa, respectively, during 1997. The Asian

Fisheries Social Science Research Network (AFSSRN) has been transferred to the Asian Fisheries Society. In addition to the AFSSRN newsletter, the INGA newsletter has been incorporated in NAGA, the ICLARM quarterly.

Information networks: Network of Tropical Aquaculture Scientists (NTAS) and Network of Tropical Fisheries Scientists (NTFS) continue to attract new members and articles for publication in Aquabyte and Fishbyte sections of NAGA.

ICLARM Partnership Policy for Research and Related Activities has been approved by the Board of Trustees. ICLARM will continue to forge partnerships with NARS, ARIs, NGOs, GOs, private sector and development assistance agencies.

11. System-Wide Initiatives. The Consultative Group on International Agricultural Research (CGIAR) is currently mounting several programs on ecoregional or natural resource management subjects which include most of the Centers. Two of these to which ICLARM contributes are the System-Wide Genetic Resources Program and the System-Wide Information Network on Genetic Resources. The Coastal Environments Initiative has been proposed by ICLARM to be developed as Center-led research (rather than a system-wide initiative). ICLARM is also contributing to the development of the system-wide initiative on water management (SWIM) seeking methods to utilize irrigated water to support aquatic biota. SWIM involves many Centers, including ICLARM, in several projects with the aim of enhancing the productivity of water through agricultural use.

12. External Relations. The External Relations Office (ERO) was created in 1996 to help management and staff with fund-raising, CGIAR and donor relations. Its plans for 1997 include improved and more timely compliance with the CGIAR program planning documents; 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 to increase the flow of project-related funding to the Center; and better information of donors and agencies in support of fisheries and agricultural research in Africa and West Asia. The ERO is expected to improve ICLARM's participation in the CGIAR system and its relations with donors.

13. Corporate Services. The Corporate Services Division provides most of the operational support to the Center's research activities. It is organized into the following functional units: Finance and Management Information; Human Resources; Program and Administrative Services; and Computer Services Unit.

Corporate Services intends to focus its efforts in 1997 to continued development and implementation of management systems that would have a significant impact on the Center's efficiency, effectivity and accountability. Priorities for 1997 include the finalization of a new accounting system (Platinum), the continued development of human resources policies and procedures, improved center-wide systems and telecommunications support and administrative operational enhancements. Support will continue to be expanded to the outreach sites with particular focus on assisting the new regional facility based in Egypt.

14. Deputy Director General (Africa and West Asia). This office was established early in 1997 to oversee the refurbishment and takeover of the aquaculture facility at Abbassa in Egypt as ICLARM's research center for Africa and West Asia. The office will be responsible for the infrastructural and staff development at the facility and, in collaboration with ICLARM's headquarters and other outreach staff, seek to develop a program of research appropriate for the region.

15. Deputy Director General (Programs). This office was established in mid-1996 to oversee the planning, implementation, impact assessment and reporting of ICLARM's scientific programs. In 1996-1997 the office helped coordinate the development of ICLARM's Medium-term Plan for the period 1998-2000 and will continue to assist in the formulation of scientific reviews, new project development (especially with respect to the new initiative in Egypt in conjunction with the Deputy Director General-Africa and West Asia and colleagues) and in the long-term development of ICLARM's strategic plan.

16. Director General. This office carries out the central executive management functions of ICLARM and is responsible for implementing Board policies and advising the Board on management and policy matters. With the new structure introduced in 1996 and the filling of new executive positions, the Director General now leads an executive team comprising also the Deputy Director General-Programs, Deputy Director General-Africa and West Asia (starting January 1997), Associate Director General-Corporate Services and Director of International Relations. External relations, including donor relations, are also included in the executive although a full-time Director of External Relations will not be appointed in 1997.

Major challenges in 1997 will be the successful selection of a new headquarters site for ICLARM and successful incorporation of the new Egyptian facilities and its African and West Asian research program into ICLARM. When the final version of ICLARM's Medium-term Plan (1998-2000) is approved, priority will be given to leading efforts to resource the Plan fully and overseeing the stronger development of research partnerships under it.

As ICLARM completes its 20th year as an international research center and its fifth year in the CGIAR, the Office of the Director General faces the opportunities and challenges of leading ICLARM into the next era of aquatic resources research with renewed enthusiasm.

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.

The rating of the criteria for each project has been interpreted by each program leader in relation to his/her projects' requirements. As the results of our studies on research impact emerge under the new Policy Research and Impact Assessment Program, we plan to be in a position to score activities in a more rigorous manner.

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. Strengthening Fisheries and Biodiversity Management in African, Caribbean and Pacific (ACP) Developing Countries, with Further Development of a Biological Database on Fish (FishBase)

ICLARM Staff	:	Dr. Rainer Froese (Project Leader), Dr. D. Pauly (Scientific Adviser), Dr. Jan Michael Vakily, Dr. Maria Lourdes D. Palomares, Ms. Crispina B. Binohlan, Ms. Armi G. Torres, Ms. Pascualita T. Sa-a, Ms. Emily DC. Capuli, Mr. Rodolfo B. Reyes, Ms. Rachel Atanacio, Ms. Portia N. Bonilla, Ms. Cristina V. Garilao, Ms. Christine Marie V. Casal
Collaborating Institutions	:	FAO; American Fisheries Society (AFS); International Game Fish Association; World Conservation Monitoring Center; Musée Royal de l'Afrique Centrale, Tervuren; Museum National d'Histoire Naturelle, Paris; Zoologisches Institut und Zoologisches Museum, Hamburg; Marine Resources Assessment Group (MRAG), Imperial College, London; EPOMEX, Universidad Autonoma de Campeche, Mexico; University of British Columbia, Vancouver, Canada; the national programs of 55 countries in the African Caribbean and Pacific (ACP) regions; other institutions and individual researchers
Donor	:	EU, ICLARM core funds
Duration	:	FishBase started in October 1988 and was supported up to August 1995 on EU funds; ICLARM core funds then supported FishBase up to October 1996; a new 4-year EU-funded project for Strengthening Fisheries and Biodiversity Management in ACP countries, through the use and further development of FishBase, started in December 1996.

Objectives

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

- To build up the aquatic resource management and scientific capacity of ACP country institutions by providing managers, researchers, teachers and students with reliable

and easy-to-use key information and with state-of-the-art management tools, and by training them in the use of these tools.

- To promote an enabling environment for research which is relevant and critical to sustainable aquatic resource management in developing countries, by promoting cooperation between researchers and managers in individual countries, and by actively fostering regional and global cooperation.

- To improve further the quality, completeness, and usefulness of FishBase, national biodiversity databases, and other management tools.

Background and Justification

Researchers and managers in ACP countries, as in other developing countries, are seeking to achieve sustainable management of their living aquatic resources and to increase awareness of the importance of conserving aquatic biodiversity. This requires resource management tools and broad-based training of NARS scientific and resource management staff. Accessibility of relevant information is the key to success.

FishBase is a large biological database developed by ICLARM in collaboration with FAO and many other partners. FishBase contains key information (nomenclature, morphology, trophic ecology, population dynamics, physiology, pictures, maps, etc.) for currently 16 500 of the estimated 25 000 recent species of finfish. It includes important databases developed by collaborators, such as FAO, the IUCN Red List Data, Eschmeyer's *Genera of Recent Fishes*, Myers' database of recruitment time series, Houde's LARVDYN database, and many others. FishBase will form the scientific backbone of ICLARM's EU-funded activities to strengthen fisheries and biodiversity management in the ACP countries, by facilitating the creation of up-to-date national biodiversity databases for finfish. Part of this task will be the repatriation of national biodiversity information currently held in the museums of developed countries. These data, once they are computerized, georeferenced, checked and completed with more recent data, will be used to analyze national biodiversity trends and patterns, and provide a scientific basis for national biodiversity policies in ACP and other countries.

Scores Against Principles

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

1996 Results

By the end of 1996, the FishBase team had incorporated in the database about 16 500 species, with information extracted from more than 10 000 references.

- The FishBase 96 CD-ROM was released at the 8th International Coral Reef Symposium in Panama City in June, together with the 179-page book *FishBase 96: Concepts, Design and Data Sources*, edited by R. Froese and D. Pauly, and containing contributions from FishBase Team members and collaborators. This CD-ROM release contains new species, new analytical graphs, and several thousand new pictures. By the end of 1996, FishBase had been distributed to more than 700 users in 90 countries and its collaborators numbered about 200 in 50 countries.

- At the 1996 IUCN Congress, held in Montreal, the Species Survival Commission of IUCN announced its intention to use FishBase as the repository database for information on the conservation status of the world's 10 000 freshwater species. To this end, ICLARM, IUCN, the World Conservation Monitoring Center (WCMC), and Fauna and Flora International (FFI) have developed a proposal, *"Fishes for the Future"*, to be presented to donors early in 1997.

- FishBase was invited in 1996 to be a founding member of Species 2000, an initiative to produce an authoritative checklist of the scientific names of all of the world's 1.75 million known species. In March, the FishBase Team hosted, at ICLARM HQ, the Species 2000 Inaugural Workshop with senior representatives from leading taxonomic centers. ICLARM was given the task to develop a prototype for the CD-ROM version of the global checklist.

- In 1996, a number of scientific papers that drew exclusively on FishBase data and software were submitted for publication: evidence that FishBase had crossed the threshold from being a source of information on fishes to become a research tool and a resource upon which research can be done.

- In December 1996, the FishBase ACP-EU Training Project began its four years of work, designed to bring such database approaches to 55 developing countries in ACP.

Expected Outputs in 1997

- Two regional training nodes (Pacific and Caribbean) will be established and training of national scientists, from ACP countries, will be carried out.

- FishBase will complete an in-depth coverage of the fishes of the Pacific Islands and the Caribbean. This information will be available in stand-alone databases, for use by the Fisheries Departments of collaborating countries.

- The FishBase 97 CD-ROM and book will be launched in October 1997 at the International Indo-Pacific Fish Conference in Noumea, where the FishBase Team will organize a workshop on databases on fish and fisheries. Highlights of FishBase 97 will be more analytical graphs, yield-per-recruit analysis for more than 1 000 stocks and more high-quality pictures.

- FishBase will be converted to MS Access 97 database software, which will allow full access through the Internet.

- Several major museum collection databases will be incorporated into FishBase and these will support biodiversity maps.

1.2. Fish Biodiversity in the Coastal Zone: a Case Study on the Genetic Diversity (Process of Speciation), Conservation and Sustainable Use in Aquaculture and Fisheries of the Black-chinned Tilapia *(Sarotherodon melanotheron)* in West African Coastal Lagoons and Watercourses

ICLARM Staff	:	Dr. Roger S.V. Pullin (Project Leader), Ms. Christine Marie V. Casal
Collaborating Institutions	:	The Institute of Aquatic Biology, Acrra, Ghana; the Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany
Donor	:	BMZ/GTZ
Duration	:	January 1997 - December 1999

Objectives

Overall objective:

To assist in the conservation and sustainable use in aquaculture and fisheries of a brackishwater tilapia *(Sarotherodon melanotheron)* that is widely exploited in the coastal zone of West Africa, thereby improving fish supply, providing livelihood opportunities for fishers and farmers, and demonstrating approaches that can be used in other regions and with other exploited and exploitable fishes.

Specific objectives:

- To gather comprehensive information, including indigenous knowledge, on the biology, ecology and use of *S. melanotheron* in West Africa.

- To determine the conservation status and potential for sustainable use of *S. melanotheron.*

- To identify at least two localities in Ghana with potential for community-based sustainable aquaculture and/or fisheries development, using *S. melanotheron.*

- To initiate a practical aquaculture development program for *S. melanotheron* at a locality in Ghana.

Background and Justification

The black-chinned tilapia *(Sarotherodon melanotheron)* is a coastal zone species inhabiting brackishwater and freshwater lagoons and watercourses in West Africa. It ranges from Sénégal to Zaïre. It is widely exploited by poor fishers using a variety of fishing gear and traditional methods of fisheries enhancement: the so-called "brushparks". It is also a promising candidate species for aquaculture in brackish- and freshwater and its development for this purpose would help to obviate the need for importation of exotic species for aquaculture, which has attendant possibilities of adverse environmental impacts.

S. melanotheron is a highly appropriate species for a case study on how to combine the conservation of the genetic resources of an exploited species with its sustainable and equitable use by humans. This is a question that needs to be answered for many exploited fishes in the developing regions. *S. melanotheron* has the following attributes that justify its choice for such a case study, the results of which are expected to have regional and global importance:

- It is used by poor coastal dwellers for food and livelihood in capture fisheries and enhanced fisheries and has potential for aquaculture. Its sustainable use in all of these, including breeding programs for aquaculture, will depend largely upon the characterization, evaluation and conservation of its genetic resources.

- Its populations have a high level of intraspecific variation in that five subspecies are recognized *(S. m. melanotheron, S.m. heudelotii, S.m. leonensis, S.m. paludinosus* and *S.m. nigripinnis)*. It is therefore a good subject for further development of different methods, especially new biochemical techniques applicable in developing country institutions, to characterize and evaluate fish genetic resources.

- Its populations are threatened by all of the human pressures that are responsible for the loss of fish genetic resources worldwide: overfishing, habitat degradation, pollution, impacts of exotic species, etc.

- The local indigenous knowledge and the traditional management practice that were established to conserve its populations for sustainable use are breaking down as populations increase and natural resources and habitats are degraded.

Scores Against Principles

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

Expected Outputs in 1997

This project is expected to start in January or February 1997. The work for the year will comprise mainly reconnaissance and collection visits to sites in West African lagoons and basins and commencement of genetic characterization of specimens collected.

1.3. Genetic Diversity of the Silver Barb, *Puntius gonionotus* (Bleeker), in Southeast Asia

ICLARM Staff	:	Dr. Roger S.V. Pullin (Project Leader), Ms. Christine Marie V. Casal
Collaborating Institution	:	The University of Wales, Swansea, UK
Donor	:	ODA
Duration	:	Three years, commencing in October 1997

Objectives

Overall objective:

To identify the center(s) of genetic diversity of *Puntius gonionotus* across its natural range and to make recommendations for the management of these genetic resources.

Specific objectives:

- To survey existing information, including indigenous knowledge on the distribution, transfer and introductions of this species in order to identify key sites where samples would be likely to represent important populations of the species.
- To gain experience in and to develop methods for genetic diversity research that could be applied to other species.

Background and Justification

Puntius gonionotus (Bleeker), the silver barb, is an Asian carp that is popular as a food fish. It is particularly suitable for low-input pond aquaculture in poor communities in South and Southeast Asia. It is reportedly native to Indonesia and the Mekong Basin (Cambodia, Laos, Thailand and Vietnam) although recent evidence indicates that it may have been originally introduced to the Mekong from Indonesia. The species has now been introduced throughout much of tropical and subtropical Asia, e.g., Bangladesh, China, India, and Malaysia.

Knowledge of the genetic diversity and population structure of this species is vital to the future management of farmed and wild populations. A recent preliminary study on the selection of *P. gonionotus* stocks in Bangladesh has indicated growth differences between farmed strains of different origins. As the commercial importance of a species grows, so does the value of its genetic diversity. Wild populations act as reservoirs of genetic variation available for exploitation. It is thus essential that the most important wild populations (i.e., those having the highest levels and most unique genetic variation) must be identified and given priority in terms of conservation. They can then be used for further domestication of the species, in breeding programs. There is very little information available on the population genetics of *P. gonionotus*, a knowledge gap which this project will help fill.

Scores Against Principles

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

Expected Outputs in 1997

- Survey of existing information and collection of first samples from Indonesia.
- Planning for further collections and analyses in 1998 and beyond.

2. GERMPLASM ENHANCEMENT AND BREEDING

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

ICLARM Staff	:	Dr. Ambekar E. Eknath (Project/Program Leader), Ms. Belen O. Acosta, Ms. Marietta de Vera, Ms. Ravelina Velasco, Ms. Carmela Janagap[1], Mr. Hernando Bolivar, Ms. Ma. Josephine France Rius, Ms. Perla Virly, Mr. Cirilo Federigan, Mr. Norberto Cabrera, Ms. Florian Lopez
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 Program/Sustainable Energy and Environment Division (UNDP/SEED)
Duration	:	1993 - 1997

Objectives

- To develop improved breeds of tilapia and provide these breeds to national testing programs and hence to fish farmers.
- To strengthen national institutions in aquaculture genetic 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 is expected to have similar benefits for other finfish species especially carps, for it provides useful methodologies. The planned program of collaborative research, training and information dissemination will strengthen the

[1]Resigned from ICLARM effective May 1996.

capacity of national institutions to carry out relevant research and to apply the findings in evolving 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 has 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 success of the GIFT Project.

Scores Against Principles

1. Sustainability	H
2. Equity	H
3. Gender	M
4. Participation	H
5. System Approach	H
6. Anticipatory Research	H

1996 Results

The first generation selection experiment for two traits (growth and frequency of spawning females) and the associated experiments (to estimate the magnitude of genotype [families] x season interaction and to estimate the response to selection for late and early spawning in females) have been completed. Analyses of data from these experiments are still ongoing.

The GIFT Project has continued to provide technical assistance to the genetic evaluation component of on-farm trials. The first phase of on-farm trials conducted by the DEGITA Project has been completed; the second phase is in progress. Results of on-farm trial conducted under the auspices of GIFT in 1991-94 have also been analyzed.

The national tilapia-breeding program in the Philippines has now evolved into a nonprofit foundation known as the GIFT Foundation International Inc. Strategies to operationalize the Foundation, a program which will continue the GIFT activities after its completion in 1997, have been initiated. The incorporation papers were signed by the initial members during formal ceremonies held on October 9 in the presence of the Philippine Secretary of Agriculture.

The Project has provided substantial contributions to the International Network on Genetics in Aquaculture. The Project gave significant technical and logistical support to the organization of the Third Steering Committee meeting in Cairo held on 8-11 July 1996. The Project Leader also assisted in the preparations for formal presentation of INGA during the SIFR/UNDP-convened International Fisheries Development Donors Consultation meeting in Paris in October 1996. At the request of national programs,

tilapia genetic materials (all representative families from latest generation of selection) were transferred to Governments of Bangladesh and Vietnam to initiate their formal breeding programs in these countries. With funding support from NORAGRIC and through the help of AKVAFORSK research partners, breeding plans for GIFT, tilapia mrigal (one of the popular Indian major carps in Vietnam) and Silver barb, have been established in close consultation with Vietnam scientists based in the Research Institute for Aquaculture (RIA) No. 1 and RIA No. 2.

The Project Leader (as primary author) coordinated the preparation of a proposal for collaborative research and training in Genetic Improvement of Carps in Asia for funding by the Asian Development Bank. A special session to discuss the status of this proposal with leaders of the national programs was held, in conjunction with the INGA Steering Committee meeting in July 1996, in Cairo, Egypt. As recommended by the participants, the participating countries will start identifying the scientists/institutions to be involved so that an initial planning workshop can be effectively organized in 1997.

Preliminary guiding principles for research on genetics of tolerance to saltwater were developed during a special session held in conjunction with the Third INGA Steering Committee meeting. These guidelines would help ICLARM and the participating INGA member countries in arriving at common goals and approaches to the problem of brackishwater utilization so a proposal could be formulated.

Preparation of major publications from the GIFT Project is ongoing. Substantial progress on analyses of the project's major strategic experiments (Generations 3 to 8) was made during the Program Leader's visit to AKVAFORSK (Norway). Draft manuscripts from the project's four complementary experiments (Growth performance testing methodology, Genetics of carcass composition, Sex ratios in diallel cross experiment, and Response to selection for frequency of early maturing females) have been completed and are being reviewed by all partners. Initial drafts of the book *Aquaculture Genetic Research Initiatives, GIFT Manual of Procedures* (Volume 1) based on TRAIN-X methodology, and *GIFTStat Manual* have been prepared.

Expected Outputs in 1997

- Continuation of selection for two traits (growth and frequency of maturation in females).

- Support to full operationalization of GIFT Foundation in the Philippines and development of national fish-breeding programs in Bangladesh, Indonesia and Vietnam.

- Publication of scientific papers based on seven major experiments and various complementary experiments and the book *Aquaculture Genetic Research Initiatives in Asia, Africa and the Pacific.*

- A validated standardized training package on GIFT procedures.

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. Ambekar E. Eknath (Project Leader), Dr. Roger S.V. Pullin
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 tolerance to low DO.

Scores Against Principles

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

1996 Results

An experiment to compare the growth of GIFT and Thai Chitlada strains during nursing and grow-out stages was conducted. All male GIFT and Chitlada strains produced by treating with methyl testosterone and normal populations (non-hormone-treated) of both strains were reared in hapas during the nursing stage and in twelve 200m^2 earthen ponds during the grow-out stage. Results showed a large variation in final body weight of all four groups of fish during the nursing stage. However, the proportion of larger fish was higher for GIFT strain than Chitlada strain. The average final weight of sex-reversed GIFT fish was 16% higher than the sex-reversed Chitlada strain. During grow-out trial, the net yield of sex-reversed GIFT fish was 28% higher than the yield of sex-reversed Chitlada strain. The non-sex-reversed GIFT fish, on the other hand, was 24% higher than the Chitlada strain. The final mean body weight of sex-reversed GIFT fish was 15g higher than sex-reversed Chitlada strain.

Experiments were conducted: (1) to determine the effects of dissolved oxygen levels (2 mg/l, 4 mg/l, 6 mg/l) on sex-reversed GIFT and Chitlada strains in an outdoor circular concrete tank system installed with automated aeration control devices; and (2) to evaluate the growth, survival and yield of GIFT and Chitlada strains (sex-reversed) at different feeding levels (control, 25% of satiation, 50% and 100% of satiation) in fertilized earthen ponds. Analyses of data from these two experiments are in progress.

Expected Outputs in 1997

- Analyses of data from dissolved oxygen tolerance experiment and response to varying feeding rate experiments, and submission of the manuscripts to a peer-reviewed journal.

- Initiation of experiment on filtration/digestibility.

2.3. PRIORITIZATION OF CARP GENETIC RESEARCH

ICLARM Staff	:	Dr. Madan M. Dey (Project Leader), Dr. Modadugu V. Gupta, Mr. Gaspar Bimbao, Quantitative Geneticist (to be appointed), Ms. Maricon C. Gayanilo
Collaborating Institutions	:	Bangladesh, China, India, Indonesia, Thailand, Vietnam (specific institutions to be identified)
Donor	:	ADB, UCore
Duration	:	1997 - 1999

Objectives

- To conduct baseline surveys to understand the existing farming practices, marketing and consumption patterns.

- To identify constraints to carp productivity improvement in different ecological and socioeconomic environment.

- To prioritize researchable topics for
  - ◊ selection of species;
  - ◊ choice of farming system; and
  - ◊ selection of traits.

Background and Justification

Prioritization of carp genetic research in Asia is very important. Diverse species, farming systems and socioeconomic scenarios prevail in various major Asian carp-producing countries. About 20 carp species are extensively cultured under diverse farming systems; all are natural inhabitants of Asian waters. And there are a number of potential commercial traits that might be improved for each species, depending on the users' perspective. Carp genetic research will therefore begin by choosing species, farming systems, and breeding goals with highest potential payoff (efficiency) and in consideration of equity, sustainability and environmental issues.

The study will be implemented in Bangladesh, the People's Republic of China, India, Indonesia, Thailand and Vietnam. These countries contribute to more than 90% of the world production of carps. In these countries, carps constitute about 50% of the total aquaculture production.

In prioritizing carp genetic research, we shall consider both demand for and supply of research. In analyzing demand for carp genetic research, we will consider the following aspects: (a) assessment of how and to what extent existing carp species/strains are valued by different groups of the society (farmers, consumers, agents, etc.); (b) estimation of future demand for various carp species by income

groups; (c) analysis of present and future importance of various carp-based farming systems, including problems and opportunities for increasing production in these environments; (d) assessment of relative economic importance of various traits (for example, growth, disease resistance, resistance to abiotic stresses such as low dissolved oxygen, adverse soil and water conditions, etc.). The analysis will be based on field surveys for carp producers, consumers and traders, and also based on secondary information available in different participating countries. This demand-side analysis will provide information on research problem areas. The research problem areas would include activities to (1) increase biological efficiency (productivity), (2) reduce production cost, and (3) improve quality.

On the supply side, we will consider: (a) alternative research techniques/tools to solve research problems; (b) probability of research success for different research techniques; and (c) time and resource required to solve various research problems through alternative research tools. The analysis of the supply side of research will be based on surveys of experienced research scientists.

Scores Against Principles

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

Expected Outputs in 1997

- Completion of baseline survey on farming practices, marketing and consumption patterns.

- *Ex-ante* assessment of potential impact of carp genetics research.

3. AQUATIC ENVIRONMENTS

3.1. ASSESSING AND LIMITING CORAL REEF DEGRADATION

3.1.1. REEFBASE: A GLOBAL DATABASE ON CORAL REEFS AND THEIR RESOURCES

ICLARM Staff	:	Dr. John W. McManus (Project Leader), Ms. Ma. Carmen A. Ablan, Ms. Cindy F. Cabote, Ms. Grace U. Coronado, Ms. Maharlina G. Gorospe, Ms. Kathleen P.N. Kesner, Mr. Lambert Anthony B. Meñez, Ms. Sheila G. Vergara, Ms. Irene Uy
Collaborating Institutions	:	World Conservation Monitoring Center (WCMC) and many other institutions and individuals who contribute to the database
Donor	:	ReefBase funding consortium (USAID; SIDA; ICLARM core funds; others)
Duration	:	October 1996 - September 2000

Objectives

ReefBase is an effort to gather the available knowledge about coral reefs into one information repository. This database was created for resource managers in government and private institutions, students, scientists, academicians, divers, and other coral reef enthusiasts. The information in ReefBase is intended to arrive at assessments and summaries about coral reefs worldwide and to facilitate informed decisions regarding coral reef use and management.

- 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 network with coral reef researchers and managers who will contribute to the information in ReefBase.

- To collaborate with other national, regional and international database and geographical information system (GIS) facilities relating to reefs and provide a means of comparing and interpreting information at the global level.

- To develop and distribute analytical routines for ReefBase that will make full use of the information and ensure appropriate interpretation and synthesis.

Background and Justification

A great part of the coral reef resources in the world is in danger of destruction due to overexploitation, degradation of the habitat and possibly changes in the global climate conditions. A survey by the International Union for the Conservation of Nature concluded that coral reefs in 93 countries have been seriously degraded. On a global scale, the loss in fisheries income may exceed a billion dollars a year and affect as many as 10 million people.

Several initiatives are underway to monitor the status of and threats to reefs at global, regional and national levels, but little progress has been made in developing database systems that will ensure broad dissemination of data and interpretation and comparison of results. The need for such a tool is becoming increasingly urgent if appropriate management is to be introduced worldwide to halt decline in health and productivity of reef systems.

The ReefBase project addresses this need. More than just a compact source of information, ReefBase is an essential element of a global movement to manage coral reefs by facilitating communication between scientists and providing global summaries and assessments on the status of coral reefs. Even in its preliminary stage, ReefBase served as a major source of information for the "State of the Reefs Report", which served as the primary background document for the International Coral Reef Initiative (ICRI) workshop. The workshop produced a "Framework for Action", which was agreed to by 95 delegates from 39 countries and several international funding and conservation organizations.

Aside from the ICRI, ReefBase is also endorsed by the Global Coral Reef Monitoring Network (GCRMN) and officially designated to be the primary central database and means of information dissemination for this recently instituted program. The GCRMN is an activity of the International Oceanographic Commission, United Nations Environment Program and International Union for the Conservation of Nature, which will involve countries throughout the tropics gathering data on the status of coral reefs using standard procedures. Both ReefBase and the GCRMN directly address priority actions of the Framework for Action of the ICRI, which has now been endorsed by representatives of 75 countries. ReefBase is also affiliated with the International Year of the Reef (IYOR).

Scores Against Principles

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

Project Components and Expected Outputs

The main components within the ReefBase project include: (1) database structuring and entry; (2) presentation packaging; (3) establishing information exchanges; (4) developing analytical tools to facilitate summarization and assessments; and (5) developing an integrated approach to determining global coral reef ecosystem health including sampling, data analysis, integration and reporting.

Database Structuring and Entry for the main ReefBase tables as well as added features (RAMP, ECOPATH Aquanaut Surveys)

- Systematically gather information and maps from the published literature, technical reports, popular articles and surveys to enter into major tables in ReefBase. The information is:

  ◊ collected from libraries and other information repositories;
  ◊ purchased (as in the case of books, journals and maps);
  ◊ solicited from collaborators; or
  ◊ gathered from questionnaires and other survey forms designed and distributed by the ReefBase team.

Improved strategies are to be designed by the team in 1997. Priorities regarding the data to gather will be set since the coverage of ReefBase tables is necessarily very broad.

- Continue adjusting the data entry and retrieval system according to the nature of the available information as well as the needs of the intended audience. During the past years of the project, a basic structure for the database and information tables was established and data for over 7 000 reefs. In 1997 intensive data entry input will require further refinements to the structure design.

- ICLARM's ECOPATH 3.0 ecosystem modeling package has been integrated into ReefBase. Additional user-friendly features will be added and integrated in 1997 to choose parameters as well as access existing models which may be referred to as examples.

- The RAMP subdatabase, designed and tested on the first phase of the project, was developed in collaboration with the University of Rhode Island. Upon completion of ReefBase Phase I the RAMP structure and guidelines for data entry have been established. During the past year, the actual RAMP tables and forms for data entry were constructed and sample data were added into the main ReefBase CD-ROM. In 1997, efforts will be concentrated on adding data and modifying the table structures according to the available information.

- Begin promoting the Aquanaut Survey Method for volunteer divers to gather information on coral reefs. The release of the preliminary manual as well as the initial training of Aquanauts will be carried out in February 1997.

Presentation Package

- Continue designing forms in such a way that information may be accessed in a user-friendly and attractive manner anticipating the needs of the intended audience. We will continue to actively solicit feedback from users in 1997.

- Design means to present as much information within ReefBase as possible through the Internet. At the moment a large portion of ReefBase together with search engines for some features are already available through the Internet. Information gathered through the Aquanaut surveys will also be made available to the general public through the Internet.

- Release the second version, ReefBase 2.0, in June 1997. This will also require a revision of the accompanying ReefBase User's Guide to reflect the changes added or modified from the first version.

- Participate in workshops and symposia to disseminate information about ReefBase. ReefBase is a main participant in IYOR 1997. The activities should both encourage awareness and involvement of coral reef-related institutions in the various sectors. The Aquanaut Survey is one of the activities initiated in line with the IYOR.

- Produce information material in the form of flyers, slide shows, demonstration packages and news articles to promote ReefBase as the opportunity arises. ReefBase shall continue to send prompt replies to inquiries, comments, suggestions and technical difficulties received by mail, fax or e-mail in 1997.

Summaries and Assessments

Arrive at a means to summarize the information through a search or query system installed within the CD-ROM package. A simple but powerful system has been included as a primary analysis tool in ReefBase 1.0. More efforts in this area are expected in 1997 as the volume of the encoded information increases.

Collaboration

- Continue to seek to collaborate with individuals, institutions, national, regional and international databases and GIS facilities relating to reefs. Expected inputs from Dr. J. Kleypas from the National Center for Atmospheric Research (NCAR), GCRMN and the ICRI will be incorporated.

- Actively solicit materials from individuals and institutions in the Caribbean and African region in 1997.

- Facilitate systematic gathering of coral reef health data through involvement in the Global Coral Reef Monitoring Program and through the dissemination of the ReefBase Aquanaut Survey Method designed for volunteer divers. Research will continue on refining both coral reef assessments and the methodology to make such assessments.

3.1.2. Population Interdependencies in the South China Sea Ecosystems (PISCES)

ICLARM Staff	:	Dr. John W. McManus (Project Leader), Ms. Ma. Carmen A. Ablan
Collaborating Institutions	:	Coastal Aquaculture Center (Solomon Islands); University of Malaya (Sabah, Malaysia); Institute of Zoology Academica Sinica (Nankang, Taipei); Department of Marine Living Resources; Institute of Oceanography (Nhatrang, Vietnam); Environmental Study Center of Pattimura University (Ambon, Indonesia)
Donor	:	John D. and Catherine T. MacArthur Foundation, World Environment and Resources Program
Duration	:	January 1997 - June 1999

Objectives

- To conduct an initial study on the nature and degree of interdependencies of populations of selected reef species from six sites in the South China Sea and adjacent areas.
- To initiate a scientific study involving representatives from various institutions from the South China Sea and adjacent areas.
- To promote appreciation of the interconnected nature of resources in the South China Sea in arriving at management strategies for resources.

Background and Justification

The South China Sea provides food, livelihood and other services to millions of coastal dwellers. The Sea is part of the center of marine biodiversity for the world's oceans, supporting tens of thousands of species. Intense fishing pressure on the resources of this area has led to a condition known as Malthusian overfishing, wherein the competition for resources causes villagers to adopt fishing methods such as blasting and poisoning, which are detrimental both to the environment and the users. This condition is compounded by coastal pollution and other forms of massive habitat destruction.

Various initiatives to manage the resources in the area are being implemented, usually at the country level. However, the concept of reef biotic interconnectedness within the region of the South China Sea has not been generally considered in the conceptualization and implementation of these management initiatives.

The concept of interconnectivity between reefs is important in management. The adults in a harvested population are either progeny of the local adult organisms or transported from other populations. Source populations may be a few meters to hundreds of kilometers away. A study of regional currents and the times spent by various reef fish species in pelagic stages revealed that many areas, such as the Spratly Islands, may be a source of recruits for populations in the adjacent areas. There is, therefore, a need to study the nature and degree of interdependencies between populations of organisms in the area.

The best evidence for marine population interdependencies in the South China Sea would come from a combination of genetic studies, current pattern analyses, life history studies and observation of the transport of pelagic stages of selected organisms in the currents of the region. Of these, the greatest return for minimal funding would be the genetic studies. Such studies would result in initial guidelines for implementing coordinated management measures for exploited stocks and for unexploited species which are locally threatened.

Scores Against Principles

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

Project Components and Expected Outputs

The project is expected to run for two and a half years. These should involve four phases: (1) start-up; (2) initial screening; (3) data gathering and analysis; and (4) integration and training.

- *Start-up*

  The *Start-up* phase will include a consultation meeting. This meeting will involve many institutions from various countries; therefore, it should begin with an initial discussion among fisheries experts who are familiar with the biological and practical considerations of their country's reef fishery. Representatives from each institution will convene for three days at the ICLARM headquarters to discuss the species; they will study the sampling strategy, sampling size and expected outputs. The fish will be given priority in the first year of the study since the methods for studying fish are straightforward. Runs for the invertebrate species will follow.

- *Initial screening*

  Mature individuals of each species in the potential list will be sent to the laboratory for initial screening. By doing so, we can evaluate the potential of registering variation among populations of the species. We are looking for loci that will discriminate populations. The main choices will include the species that register highest variation.

- *Main data gathering*

  Allozyme electrophoresis will be carried out systematically by species. That is, all runs for a species will be completed before we start on a new species. Gels will be analyzed on the same day they are run.

  Data analysis

  Data analysis will similarly be conducted by species. As the runs are completed for each species, the data will be encoded and analyzed. Population genetic parameters will be calculated initially using the Biosys 1 software. Other clustering routines in SAS previously applied to genetic data will be used. When applicable, relative contributions to the different stocks will be estimated.

- *Integration and training*

  Towards the end of the project period, participants from the institutions will gather again for the project integration and workshop. A short training course on the use of allozyme electrophoresis techniques will also be conducted. At this workshop, results from the studies will be presented to the group and the participants will collectively draft recommendations based on the results of the study. A two-day hands-on training course on the techniques developed during the study will also be organized.

By the end of the project, we hope to achieve the set objectives in the context of studies on LMEs (Large Marine Ecosystems) and biodiversity. The current project is expected to leverage future complementary studies in these areas.

3.2. FACILITATING DECISION-MAKING IN THE COASTAL ZONE

3.2.1. TRAINING PROGRAM IN INTEGRATED COASTAL MANAGEMENT FOR LOCAL GOVERNMENTS

ICLARM Staff	:	Ms. Miriam C. Balgos, Ms. Sheila Vergara, Ms. Audrey Marie Banzon
Collaborating Institutions	:	Local Government Academy (LGA); Philippine Council for Aquatic and Marine Research and Development (PCAMRD)
Donor	:	Rockefeller Brothers Fund; LGA; PCAMRD; ICLARM
Duration	:	January 1996 - December 1998

Objectives

- To develop a pool of coastal management practitioners in local government units from government organizations, academe, nongovernment organizations (NGOs), private sector and people's organizations (POs).

- To bring together major stakeholders who will work together in the formulation and implementation of an integrated coastal management plan for each coastal municipality or city in the Philippines.

Background and Justification

Local government units (LGUs) have management jurisdiction over coastal waters. However, they lack staff trained in resource management. There is a growing number of LGUs with trained staff in coastal management because of their involvement in the DA Fisheries Sector Program and the DENR Coastal Environmental Program implementation, and in resource management projects of NGOs and other organizations. Additionally, in 1992, PCAMRD conducted five municipal coastal resources management training-workshops which provided a venue for the major stakeholders to get together to identify and discuss municipal coastal management issues and how to manage them in an integrated approach.

A National Training Program on Integrated Coastal Management (NTPICM), assisted by the Rockefeller Brothers Fund and jointly implemented by Haribon, DA, DENR, PCAMRD, ICLARM and IIRR, developed and is implementing a National Course on Integrated Coastal Management (NCICM). The course provides a comprehensive view on the basic tasks of a coastal manager and an opportunity to enhance competencies in particular management functions such as issue identification and evaluation, strategy and action plan formulation, and institutional arrangements, for mid-level staff of DA, DENR, LGUs, NGOs, academe and the Philippine Coast Guard.

The LGA is responsible for training local government officials and developing human resources of the local government sector under the Department of Interior and Local Government. Its mission involves the development and implementation of training and equivalent programs through a network of local training institutions. With no experience in training in coastal management, LGA needs assistance in carrying out its mandate in this area. This project envisions (1) adapting of the NCICM into a training course which fits local government units' needs and (2) equipping the LGA in implementing the course.

Scores Against Principles

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

Project Components

Pre-project phase

To prepare LGA staff in packaging and implementing the proposed project, a number of them will be invited to participate in the NCICM (ongoing) and in the NTPICM's Trainers' Training (scheduled in 1997). Participation in these activities will facilitate discussion on the scope of the training project and the requirements of its implementation.

Phase 1. Development and implementation of the course.

This phase includes the following:

1. TNA
2. Design and development of the course
3. Production of materials
4. Validation and revision
5. Implementation

The NCICM curriculum will be adapted to fit local government needs. To ensure that the adapted course meets the requirements for training local coastal managers, a training needs analysis (TNA) will be conducted covering representative municipalities and prospective clientele. The training course will consequently be designed and developed based on the TNA results. This project's TNA will build on the data gathered in the NTPICM's TNA.

The adapted course will develop among the participants the skills and knowledge of a coastal manager, at the level appropriate to an LGU setting:

1. to understand the key elements of an integrated coastal management program;
2. to conduct stakeholder analysis in the coastal zone;

3. to identify, evaluate and prioritize the issues in a given coastal zone;
4. to formulate objectives and evaluation criteria of a coastal management program;
5. to formulate strategies and action plans to address prioritized issues;
6. to illustrate the nature, features and process of selecting site-specific management instruments;
7. to demonstrate the process of designing institutional arrangements and adopting integrated coastal management programs;
8. to identify the traits and practice the skills and roles of a coastal manager; and
9. to share insights from past experiences on integrated coastal management implementation.

The adapted curriculum will be piloted in a number of municipalities for validation and promotion. These municipalities will serve as areas for cross-visits so that other municipalities will know of the training course and include the training in their annual program activities and budgets. Municipal coastal management plans implemented with the assistance and leadership of individuals trained through this project will help promote the training course.

The TNA will give an idea of the nature and number of the target clientele. Based on these data, implementing strategies will be formulated and implemented. Because of their mandates and substantial network of contacts and facilities, PCAMRD and LGA will be the main collaborators in Phase 1. The project can benefit from PCAMRD's experiences in conducting CRM municipal training workshops in 1991 and being the lead agency in the implementation of the NCICM. A training of trainers from LGA's regional offices will be the main strategy for widespread implementation. Potential trainers identified from among the participants of the NCICM will be involved in the project.

The other project partners will be actively involved in providing technical inputs and guidance in the above activities as members of the project's steering committee. The committee will initially be composed of representatives of the main collaborators and other partners who assisted in developing and implementing the NCICM.

Phase 2. Institutionalization of the course.

This phase will include:

1. Training of trainers
2. Post-implementation evaluation
3. Marketing and promotion of the course
4. Linkaging with ongoing development programs

Activities covering this phase will be detailed in the Phase 2 workplan.

Expected Outputs in 1997

- Suitable training package for LGUs
- Trained manpower to plan and implement municipal coastal management plans
- Trainers and training centers in integrated coastal management for LGUs
- Maximized use of the NCICM

4. FISHERIES RESOURCES ASSESSMENT AND MANAGEMENT

4.1. Caribbean Marine Protected Areas Project: The Role of Marine Protected Areas in Fisheries Management and Biodiversity Conservation in Coral Reef Ecosystems

ICLARM Staff	:	Dr. John L. Munro (Project Leader) and others to be appointed
Collaborating Institutions	:	Center for Marine Sciences, University of the West Indies (UWI), Kingston, Jamaica; Conservation and Fisheries Department, Tortola, British Virgin Islands (BVI)
Donors	:	Inter-American Development Bank (Jamaica component); United Kingdom Overseas Development Administration (BVI component)
Duration	:	January 1996 - December 1999

Objective

To develop scientifically validated criteria for the establishment of marine protected areas and, specifically, 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) or marine fishery reserves (MFRs) have been established in many countries, usually for marine conservation and, in some cases, specifically to conserve stocks of exploited fish and invertebrates. 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; 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. The MPA might, consequently, be ineffective in enhancing recruitment to stocks in adjacent exploited areas.

Outmigrations from MPAs will also enhance fisheries in adjacent areas but such migrations depend 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. Thus, the likelihood of an MPA being effective in enhancing fisheries is probably dependent upon the life history and biological attributes of the target organisms and will vary from species to species and between genera, families and taxa.

MPAs can have a role in ecotourism, particularly in relation to scuba diving. Thus they 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. These must be evaluated based on a knowledge of existing fisheries, of potential gains from outmigrations and from increased recruitment or from ecotourism.

The major variable is recruitment: an MPA with poor recruitment will take many years to become effective. There is a body of evidence that suggests that many larvae are retained in the area in which they were spawned, particularly in topographically complex areas. If there was no retention of larvae, isolated islands would have no fish stocks. However, the relative importance of locally generated recruitment is unknown.

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 might never become abundant, 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.	Systems approach	H
3.	Gender	H
4.	Equity	H
5.	Participation	H
6.	Anticipatory approach	H

1996 Results

The Jamaican component of the project commenced in June, following release of the funds and the signature of a contract with the University of the West Indies. Staff were recruited (employed by UWI), equipment purchased or constructed and a sampling program designed and tested. Fishing in the Discovery Bay Fisheries Reserve by local trap fishers ceased in November, although the reserve does not yet have legal status and spear fishers still exploit the area occasionally.

By the end of the year a monitoring schedule for juvenile reef fish was well established, based on monitoring catches in small-meshed fish traps and subsequent release of the catch. Additionally, a light trap has been designed and components are being assembled.

Tagging trials were made on a large number of species, leading to the development of a range of tagging and handling techniques, suited to individual species, which minimize trauma and hence tagging mortality. Fish are captured using Antillean fish traps at fixed trapping stations. First releases of marked fish took place in the second half of December and the first recoveries were taken within two days.

A relational database has been developed for storing and analyzing data on catch compositions, catch per unit effort, trap type and mesh sizes, tagged fishes, fishes recovered and fishers operating in the area.

The ten-year Host Country Agreement with the BVI was finally completed on 29 November, enabling work on this component of the project to proceed. Preliminary arrangements were made for the acquisition of various items of equipment and recruitment of project staff and organizational details completed.

Expected Outputs in 1997

In Jamaica, 1997 is expected to provide a full year of routine recruitment monitoring using small meshed fish traps. Additionally, trap catches will be compared with data gathered by underwater visual census techniques. The trapping techniques for juvenile fish developed in Jamaica will be replicated in the BVI.

Light traps will be constructed and deployed to test their effectiveness in capturing presettlement juveniles of important species in the Jamaican and BVI fisheries and, in particular, to compare the catch compositions and recruitment rates with the fisheries.

A major fish-tagging effort will be mounted in Jamaica in the first half of the year with the objective of tagging 6 000 fishes of all species. Decisions on whether or not to continue the tagging program will depend on the rate at which marked fish are returned by fishers or recaptured by the project's own traps.

A social scientist will be employed on a short-term basis to study the economic and social factors operating in the BVI and Jamaican (north coast) fisheries.

A review of the status of marine protected areas in the Caribbean will be prepared based on published literature, correspondence and visits to some sites.

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

ICLARM Staff:	:	Dr. J. Bell (Project Leader), Mr. M. Lincoln-Smith (Consultant), Mr. N. Kile (Solomon Islands Ministry of Agriculture and Fisheries), Mr. R. Pitt, Mr. I. 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)
Donors	:	Australian Center for International Agricultural Research (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 on the Arnavon Islands, Solomon Islands. TNC has negotiated a three-year closure to fishing in the MCA for trochus, sea cucumbers, giant clams and spiny lobsters with the traditional users. GBRMPA has helped 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. In this particular case, abundances of all species are estimated from six transects at each of four sites on two islands within three "control" areas, and within the MCA. Such estimates were made three times prior to dedication of the MCA in August 1995, and will be repeated once in 1996 and 1997, and on three occasions between late 1998 and early 1999.

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 Fisheries Division, of the potential value of marine protected areas in the management of coral reef fisheries.

Scores Against Principles

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

1996 Results

In 1996, the first of the postdeclaration surveys of abundance of invertebrates was made. The aims of the survey, which was done 12 months after declaration of the MCA, were:

- to identify any recovery (i.e., increase) in abundance of exploited invertebrates in the MCA in relation to control areas in which fishing practices have not changed as a result of the MCA, and

- to maintain the interest of the local communities in the project.

After 12 months, there was little indication of increasing numbers of commercially exploited invertebrates in the MCA. The exception was trochus, which increased in abundance at five of the eight sites within the MCA relative to sites in control areas. Numbers of invertebrates continued to vary greatly among sites within the MCA, indicating that if the MCA does produce a significant increase in abundance, it may be highly site-dependent.

Expected Outputs in 1997

- An interim survey of invertebrate populations at all study sites will be made in September, 24 months after the declaration of the MCA.

- Meetings with the Management Committee for the MCA to provide an update on the status of invertebrate populations.

4.3. Tropical Fish Stock Assessment

ICLARM Staff	:	Dr. Daniel Pauly (Project Leader), Mr. Felimon C. Gayanilo, Jr., Dr. Villy Christensen, Mr. Geronimo Silvestre
Collaborating Institutions	:	Predominantly in-house studies with informal linkages with various 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 prominent role in stock assessment of tropical fisheries is based on collaborations with fisheries scientists, dating back to 1978, working on length frequencies for stock assessment.

Since its inception, this project has continued to supply NARS 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 widely used throughout the world.

In late 1989, it was agreed that a single software be developed that merges the routines in the ELEFAN 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 for publication and dissemination in 1995. ICLARM has agreed to maintain and expand the capabilities of the software.

Corollary to the efforts to improve FiSAT, ICLARM is 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, i.e., crosslink, 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.	System approach	H
3.	Gender	M
4.	Equity	H
5.	Participation	H
6.	Anticipatory approach	H

1996 Results

The FiSAT project was completed. The package has been widely distributed by our collaborators in FAO and is in daily use in many laboratories. FiSAT incorporates models and methods commonly used or developed by ICLARM and FAO for tropical fish stock assessment. The package comes with three disks and a 126-page user's guide. A reference manual, which will contain the theoretical foundations of the models used by the software will soon be published.

A CD-ROM was prepared. Entitled "The San Miguel Bay Story", this contains all ICLARM publications (including the pictures and tables) concerning San Miguel Bay in the Philippines. The studies were completed between the early 1980s and 1992, and all data used in the studies are included. An interactive multimedia interface, developed by ICLARM programmers, was used for the software.

Work continued on various software packages. These include MAXIMS, which is used to estimate food consumption from the diel stomach contents of fishes, and ABee, which is used to estimate coefficients of length-weight relationships.

Expected Outputs in 1997

Work will continue on various programs including finalization of a Yield/Recruit program and Auximetric Grid analysis (AUXIM). Additionally, interfaces will be developed for two CD-ROMs entitled "Materials for the Study of Tropical Fisheries and Aquaculture". Volume 1 will incorporate five software packages (FiSAT, ECOPATH 3.0, Sunlight, B:RUN and ABee), various databases collected by ICLARM, and the bibliographic collections of ICLARM professional staff and of the ICLARM library (totaling over 100 000 records). Volume 2 contains the publications of Dr. D. Pauly.

4.4. Modeling of Multispecies Fisheries

ICLARM Staff	:	Dr. Villy Christensen (Project Leader), Dr. Daniel Pauly, Ms. Sandra Gayosa, Mr. Eliseo Garnace (rehired), Advanced Programmer (vacant), Mr. Felimon Gayanilo, Jr.
Collaborating Institutions	:	Informal cooperation with numerous institutions worldwide
Donor	:	Danish International Development Assistance, ICLARM core funds
Duration	:	February 1990 - January 1998

Objectives

- To develop modeling approaches for ecosystem management 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 over the last years been developed at ICLARM based on an approach originally conceived by a US scientist, Dr. J.J. Polovina. This has led to the ECOPATH software system which by now is widely distributed (500+ 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. Interest is now growing for its potential for ecosystem management.

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. In addition a new methodology, EcoSim, for describing ecosystem dynamics has been developed by Prof. Carl Walters, University of British Columbia, Vancouver, for inclusion in the ECOPATH software. EcoSim makes it possible to simulate the impact of perturbations on ecosystems.

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

1996 Results

Both of the project's Advanced Programmers resigned during the year, causing some delays. Nevertheless, a new Windows-based version of ECOPATH was formally released after several years of development. The new version was distributed widely on request. In addition, ECOPATH is included on the FishBase and ReefBase CD-ROMs. A draft version of a 100-page User's Guide was prepared.

A number of project-related publications appeared in the primary literature and elsewhere. ECOPATH for Windows was presented, by invitation, at a number of international fora. These included the Annual Science Meeting of PISCES held in Canada; an international workshop on ecosystem management arranged by the National Science Foundation, USA; an international workshop on ecosystem development held in Germany; a SPACC Modeling Workshop of GLOBEC in Italy; and the 3rd Regional Dialogue of the ACP/EU Fisheries Research Initiative in Belize.

A 60-hour course/workshop on ECOPATH for Windows was given by Drs. Pauly and Christensen at the IPN, La Paz, Mexico, with 40 participants. The course resulted in 15 draft models to be published in early 1997.

Preparation of manuscripts on "ECOPATH for Windows, A User's Guide" and on "Comparisons of Upwelling Ecosystems" (by A. Jarre-Teichmann and V. Christensen) is in an advanced stage.

Expected Output in 1997

The new ECOPATH version will be further developed and disseminated. It will incorporate the EcoSim module and several known bugs will be eliminated. A manual entitled "ECOPATH for Windows, A User's Guide" will also be finalized and published.

Several courses on the use of ECOPATH will be conducted, including one at the University of Chile, in Santiago, and two ECOPATH workshops, funded by the European Commission (one in the Caribbean and one in West Africa or Europe).

4.5. Sustainable Exploitation of Coastal Fish Stocks in Asia

ICLARM Staff	:	Dr. Daniel Pauly (Project Leader), Mr. G. Silvestre
Collaborating Institutions	:	Various Developing Member Countries (DMCs)
Donor	:	Asian Development Bank (ADB)
Duration	:	February - June 1996

Objectives

- To assist selected DMCs in reviewing the status of their fish stocks and developing 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.	Systems approach	M
3.	Gender	N/A
4.	Equity	M
5.	Participation	H
6.	Anticipatory approach	H

1996 Results

An international workshop on "The Sustainable Exploitation of Tropical Coastal Fish Stocks in Asia" was held in Manila, in July, funded by ADB. Country representatives from Bangladesh, Indonesia, Sri Lanka, Thailand, Malaysia, Vietnam and the Philippines participated, together with representatives of other fisheries institutions in the region. The workshop led, as planned, to the submission, in November, of a major proposal to ADB for a project entitled "Rehabilitation Strategies and Action Plans for Coastal Fish Stocks in Tropical Asia." The primary focus is on the trawl fisheries in near-shore waters in Asia and on the creation of a database, TrawlBase, which would include all existing trawl survey records in the region.

Expected Output in 1997

This project has been completed, and led to Project 4.6.

4.6. Regional Technical Assistance Toward Strategies and Action Plans for Sustainable Utilization of Coastal Fish Stocks in Tropical Asia

ICLARM Staff	:	Mr. Geronimo T. Silvestre (Project Leader), Dr. John W. McManus, Dr. Daniel Pauly, Mr. Felimon Gayanilo, Jr., Mr. Len R. Garces
Collaborating Institutions	:	Various Developing Member Countries (DMCs)
Donor	:	Asian Development Bank (ADB)
Duration	:	3 years (1997 - 2000)

Objectives

The main objective of the Regional Technical Assistance (RETA) is to assist selected DMCs, in a catalytic mode, in improving the management and sustainable utilization of their coastal fisheries. Specifically, the proposed RETA aims to:

- develop resource databases and enhance management information in order to meet the resource management needs of selected DMCs;
- develop appropriate strategies and action plans to assist selected DMCs in rehabilitating their coastal stocks and sustaining the resulting improved benefits; and
- strengthen the capabilities of selected DMC institutions in coastal fisheries assessment and management.

Background and Justification

The results of ADB RETA No. 5651 (Sustainable Exploitation of Tropical Coastal Fish Stocks in Asia) acknowledge that the multiplicity of issues impacting coastal fisheries in the region requires action on a broad front. Success in reversing or mitigating these issues will be highly premised on institutional capabilities and resources mobilization in the DMCs, which face considerable technical, manpower and financial constraints in responding to the host of issues. In this regard, RETA No. 5651 has successfully identified key elements for an expanded regional collaboration. The consensus achieved is that these elements (duly incorporated and for implementation in this project) can catalytically assist the DMCs in identifying, prioritizing and orchestrating the interventions to many of the issues at hand.

The Project supports the objectives of ICLARM and ADB as it would address environmental and natural resources management. The regional cooperation is cost-effective in addressing common issues in the management of coastal fish stocks in the participating DMCs. The Project will have an impact on the management and protection of fisheries resources in South and Southeast Asia. It will contribute to scientific advancement in stock assessment and development of fisheries resource databases which could be applied extensively in developing countries for improved management and sustainable utilization of coastal fisheries resources.

Scores Against Principles

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

Project Components and Expected Outputs

Target outputs for the proposed RETA will be generated via the implementation of two interrelated components. The Research, Information and Training Component consists of three main tasks: (1) database development; (2) the conduct of regional and national trainings for DMC scientists in the required fields of expertise for successful RETA implementation; and (3) analyses of the compiled data and related information at the national and regional levels. The Management Policy and Planning Component consists of three main tasks: (1) the conduct of national and regional workshops; (2) elaboration of national strategies and action plans for participating DMCs; and (3) development of strategies and action plans at the regional level.

The main outputs expected after completion of the RETA activities are: (1) TRAWLBASE - a consolidated regional resource database and related documentation; (2) a regional training/workshop proceedings detailing the results of the data analyses and reviews conducted at the national/regional levels (including resource/management trends and opportunities); (3) reports detailing the national strategies and action plans for each of the participating DMCs; and (4) a report detailing regional strategies and action plans for rehabilitation of coastal stocks/fisheries.

Expected Outputs in 1997

The main outputs expected in 1997 are the completion of start-up activities and the elaboration of trawlbase from the initial prototype developed under RETA No. 5651. The start-up activities will include work programming, team formation (at ICLARM and participating DMCs) and submission of the inception report. The trawlbase programming and revision should be largely completed by year-end, preparatory to the host of training activities and the start of data inputting and the national level during 1998.

4.7. Network of Tropical Fisheries Scientists (NTFS)

Please note that coordination of NTFS has been transferred to the International Relations Office since April 1996. Please consult Section 10.1.

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	:	1997

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 approach	H

1996 Results

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

Expected Outputs in 1997

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), Dr. Harold McArthur, Jr., 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	:	ongoing since 1991

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 approach	H

1996 Results

Data from three years of collaboration with a group of 14 farmers in Cavite, Philippines, were further consolidated and analyzed with RESTORE (Research Tool for Natural Resource Management, Monitoring and Evaluation). A final technical report and publications are in preparation.

The beta version of RESTORE was completed with accompanying user's manual and field guide and released to 72 voluntary collaborators. Initial presentations of the software were demonstrated to potential user groups, including the conference of the Association of Farming Systems Research and Extension (AFSRE) in Colombo, the FAO-FARM network in Asia, and the IBSRAM-PACIFICLAND network. Additionally, presentations on RESTORE were given at: (1) a GTZ Workshop on Sustainable Natural Resource Management held at CIAT in Cali, Colombia; (2) a regional workshop on aquaculture research convened by the International Foundation for Science at Can Tho University in Vietnam; and (3) a workshop on Biodiversity and Sustainable Agriculture arranged by the Swedish Scientific Council on Biological Diversity in Ekenas, Sweden. These presentations all helped identify potential users and interested beta testers.

Expected Outputs in 1997

- Evaluation results of RESTORE beta-test by user group, 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 also to 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.

- The IRM project also plans to further establish working relationships with ongoing projects, to further test and evaluate the RESTORE process and software.

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

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
Donors	:	BMZ/GTZ
Duration	:	October 1994-September 1996 (to be extended)

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 approach	H

1996 Results

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

- A first dynamic simulation model of a Philippine rice-fish farming system was completed within the STELLA modeling environment, and will undergo testing.

Expected Outputs in 1997

- RESTORE training workshops will be conducted.
- Data from secondary sources are to be processed.
- Further models of IAA systems will be constructed.
- Multivariate analyses will be performed allowing refinement of models and procedures.
- Preliminary characterization of indicators will be made.

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
Donors	:	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 five-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.

The project was completed in the form of a Ph.D. thesis to Copenhagen University, three manuscripts submitted to peer-reviewed journals, several newsletter articles and a technical report on the field methods applied.

Additionally, presentations were made at a conference at the Asian Vegetable Research and Development Center in Taiwan, and at the Conference of AFSRE in Colombo.

5.5. Research for Development of Sustainable Aquaculture Practices

ICLARM Staff	:	Dr. Satyendra D. Tripathi and Dr. Modadugu V. Gupta (until April 1996)
Collaborating Institutions	:	Fisheries Research Institute, Mymensingh; various NGOs
Donors	:	USAID
Duration	:	June 1993-December 1998

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 approach	H

1996 Results

To develop the aquaculture technologies useful for different eco-regions, four major eco-regions were identified and research centers established at Rajshahi, Mymensingh, Khulna and Sylhet.

On-farm research and development of low-cost sustainable aquaculture practices, where grass carp was the main component, have shown excellent results. Expenses on feed and fertilizers were obviated through feeding grass carp alone on aquatic/terrestrial weeds.

Utilization of seasonal and perennial ponds and rice fields for aquaculture incorporating high-value small indigenous species and prawn has indicated that the farmers' income could be increased four to six times, compared with only two times with carp culture.

With a view to increasing mineral and vitamin intake by farmers, a small indigenous fish *Cirrhinus reba* was bred and its seed reared and distributed for culture in ponds and rice fields.

As rampant inbreeding and hybridization were causing large-scale mortality in hatcheries, training workshops on "Quality Fish Seed Production" were organized for Hatchery and Nursery operators to impress on them the need for avoiding inbreeding and employing unrelated broodstock for seed production.

Study tours of scientists, policy makers and administrators were organized as part of human resource development program besides, training programs conducted for farmers and extension workers.

Expected Outputs in 1997

- Studies for development of ecoregion-specific integrated agriculture-aquaculture in four ecoregions of the country: (1) flood-free, high rainfall, medium highlands; (2) low-rainfall, drought-prone medium-highlands; (3) flood-prone lowlands; and (4) 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 Center 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)
Donors	:	to be identified (supported since 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 smallholder 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 approach	H

1996 Results

Dr. Randy Brummett participated in the SACCAR Annual Board Meeting held in South Africa and presented a progress report of ICLARM activities in Malawi. He also convened the first project steering committee meeting in Lilongwe with participants from the Malawi Fisheries Department and the University of Malawi.

At the Domasi Station, experiments on intermediate harvesting strategies and fertilization regimes were completed. Data are being analyzed and publications prepared.

Periodicity of phytoplankton and zooplankton population cycles in small ponds stocked with *Tilapia rendalli* has been documented over 12 months in ponds fed with isonitrogenous and isophosphoric inputs of either organic or inorganic origin. These data will be combined with stomach content data from 11 indigenous fish species which were previously identified through literature review. Preliminary results indicate that production of *T. rendalli*, a popular food species in Southern Africa, is as well, and possibly better, undertaken in integrated ponds fed with plant material and residues such as grasses than in fertilizer-driven systems. Both Chancellor and Bunda campuses of the University of Malawi are major collaborators in this research, with four B.Sc. students presently engaged.

Eight species of fish were collected from Malawian waters. These were reared and observed under small-scale fish farming conditions at the NAC. Two species, *Brycinus imberi* and *Labeo mesops*, have been selected for further work based on their survival, growth and sexual maturation in small ponds. Follow-on research is being led by the University of Malawi, which is collecting additional broodstock for purposes of establishing induced breeding procedures and, then, replicated pond production trials to evaluate the potential of these new indigenous fish species for aquaculture.

Field experiments on 12 smallholder farms with rainfed seasonal ponds were completed and the results analyzed. In culture periods ranging from 86 to 189 days *Tilapia rendalli* attained average weights of 54 g resulting in production values ranging from 99 to 1 371 kg/ha. Fish survival was generally low, ranging from 32 to 64%, with only two farmers over 70%. Pond inputs in form of maize bran and plant residues were low, with only two farmers adding more than 35 g dry matter/m^2/week. Fish were partly marketed to neighbors, partly given away to relatives and friends and partly used for home consumption.

Clarias gariepinus in backyard tanks: A study on the production of the catfish *Clarias gariepinus* in backyard fish tanks was initiated by T. M'hango (Malawi Fisheries Department) in March 1995 with the stocking of 50 catfish in each of four 1 m^3 experimental units located in the gardens of participating farmers. Participating families are feeding kitchen wastes to the fish and recording inputs and growth. Recent evaluations have shown very little growth due to the small amount of kitchen wastes generated by Malawian families. So far, densities of 50 and 25 fish per 0.5 m^3 tank have been tested.

For smallholders: Two 10-month studies of the interaction between stocking size and partial harvesting methods have been completed. A third trial with larger fingerlings will begin in November. When stocking 12.6 g fingerlings, partial removal of intermediate individuals with hook-and-line improves production. When stocking 6 g fingerlings, removal of larger fish seems to best. The next trial will involve 25 g fingerlings. Results will be compared with a multiple regression model.

SADC-ICLARM has this year finalized a long-term relationship with SAREC to investigate certain environmental parameters as proximate or predictive cues for sexual maturation in tilapias. Rainfall, and hence flushing rate, could be important in this regard. While not yet completely analyzed, it appears that fish in ponds with less flushing, grow faster and mature earlier than do ponds with higher water replacement rates.

The information center at the Malawi National Aquaculture Center has been restaffed, reorganized and re-equipped to better serve the information needs of the region's aquaculture scientists. A librarian has been hired by SADC-ICLARM on a fixed two-year contract to establish an information exchange network and to train an apprentice designated by the Malawi Fisheries Department. The library's collection has been reorganized to facilitate its exploitation.

New and improved relationships with other institutions have so far been established with the ALCOM library in Harare, the SADC/IFSTCU library in Lilongwe, the Bunda College library in Lilongwe, the Chancellor College library in Zomba, the Fisheries Training College library in M'pwepwe, the Fisheries Library at Monkey Bay, the FAO library in Lilongwe, the Ministry of Research and Environmental Affairs library in Lilongwe, the Malawi National Commission for UNESCO and the Malawi National Library Service. Efforts are underway to formally link these resource centers with other regional and extraregional information centers.

Preliminary trials with villages to utilize temporary rainpools (*thamandas*) for enhanced fish production through stocking and nutrient input were conducted. Village communities showed ability to organize themselves and agree on protective measures and management arrangements. Trials are to be expanded in 1997.

Expected Outputs in 1997

- Completion of on-station and on-farm research started in 1996.
- Initiation of new research projects with the Malawi Fisheries Department and the Universities of Malawi and Zimbabwe.
- Formal training courses for NARS staff at the Malawi National Aquaculture Center.

5.7. Upland Integrated Aquaculture-Agriculture Systems in Forest Borderzone Management

ICLARM Staff	:	Dr. Mark Prein (Project Leader), Mr. Roberto Oficial
Collaborating Institutions	:	Community Forestry Project Quirino (CFPQ); Department of Environment and Natural Resources (DENR); People's Organizations (POs) of Baguio Village and Don Mariano
Donors	:	Republic of the Philippines/Germany CFPQ; BMZ/GTZ
Duration	:	July 1996 - June 1997

Objective

To conduct a rigorous assessment of the usefulness of farm ponds for aquaculture and the potential for integration of ponds and ricefields into existing farming systems within the forest borderzone management efforts of CFPQ.

Background and Justification

The Philippine-German Community Forestry Project Quirino, based in Diffun, Quirino, is a development project of bilateral cooperation between the Philippines and Germany, executed by GTZ and KfW in collaboration with the Provincial Government of Quirino and the Department of Environment and Natural Resources (DENR). Its aims are to contribute to the sustainable management of the natural resources (forest, land and water) within the project areas through community organization and self-help in order to conserve the watershed function of the areas and to safeguard the livelihood of the upland population. The project operates under the premise that small communities are able to independently conserve and manage their local resources and benefit from them. The project operates in five barangays in the municipalities of Diffun, Maddel and Nagtipunan. The project area covers 23 700 hectares, of which 19 300 are still thickly forested, with a population of 3 500 persons in 660 households.

In 1993 CFPQ promoted the establishment of small farm reservoirs above terraced ricefields, which was widely adopted. These reservoirs range in size from 50 to 2000 m^2 and provide opportunities for aquaculture. Initial attempts at tilapia cultivation have been made and some households have established a reliance on this source of fish for their home consumption, with give-aways to neighbors. Few nutrients are added to ponds, and only in the form of direct feed to the fish and of leaves or rice hulls.

Based on observations and suggestions by CFPQ staff and an initial visit of an ICLARM team to the CFPQ areas in Baguio Village and Don Mariano Perez in May 1996, it was concluded that greater potential exists for aquaculture as an added element of farm diversification in the areas. Existing operations can be improved for enhanced production from existing farm ponds (mini reservoirs), i.e., through better management and enhanced input of on-farm residues as nutrients. Additionally, considerable potential exists for rice-fish culture, as numerous irrigated rice terraces have been established, permitting two crops per year without the use of fertilizers or pesticides.

ICLARM will provide appropriate IAA technology to farmers and apply the RESTORE approach to establish measures and indicators of the economic and ecological benefit.

Scores Against Principles

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

1996 Results

- Several sitios in two barangays were assessed on their potential for IAA adoption which was found very favorable.
- The RESTORE approach was implemented and maps transects, calendars and bioresource-flow diagrams produced.
- Training workshops on IAA and follow-up visits were conducted with individuals and groups of farmers. Fingerlings of Nile tilapia, catfish and carp were delivered to farmers through CFPQ based on farmer requests.
- RESTORE data collection is ongoing.

Expected Outputs in 1997

- Analyses of IAA impact after the first eight months of IAA trials presented to farmers and CFPQ staff in workshop in May.
- Report to CFPQ and newsletter articles.
- Decision whether or not to embark on greater involvement with a larger activity.

6. COASTAL AQUACULTURE AND STOCK ENHANCEMENT

6.1. Aquaculture and Stock Enhancement for Coral Reefs

6.1.1. Biotechnical Systems for Cultivation of Giant Clams

ICLARM Staff	:	Dr. J. Bell (Project Leader), Mr. R. Pitt, Mr. I. Lane, Mr. A. Hart, Mr. C. Oengpepa, Mr. H. Tafea, Mr. F. Lasi, Mr. P. Timmy, Ms. A. Grice, Ms. J. Battaglene
Collaborating Institutions	:	Solomon Islands Ministry of Agriculture and Fisheries, James Cook University
Donors	:	Australian Center for International Agricultural Research (ACIAR), European Union (EU), FAO South Pacific Aquaculture Development Program, Economic and Social Commission for Asia-Pacific
Duration	:	Operational since 1987; this phase from 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 seafood trade and aquarium industry.
- To maintain genetically diverse F_1 broodstock of five 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 Center (CAC) on 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, identifying variability in growth and survival among sites.

This project will provide a firm basis for a sustainable increase in the productivity of coral reefs through the farming and restocking 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 nature of markets for giant clams, and the costs and benefits associated with farming and restocking. 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, and reestablishment of wild stocks, throughout the Asia-Pacific.

Giant clam farming is particularly suitable to villagers living near 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.	Systems approach	H
3.	Gender	M
4.	Equity	H
5.	Participation	H
6.	Anticipatory approach	H

1996 Results

Production from the CAC's nursery resulted in the distribution of 129 000 giant clam "seed" to coastal villages in 1996. In addition, a Solomon Islander produced an additional 47 000 seed clams for distribution to villages from larvae supplied to him from the CAC and received a grant from the Pacific Development and Conservation Trust to construct his own hatchery. The species distributed to giant clam farmers in 1996 were *Tridacna crocea*, *T. derasa* and *T. maxima*.

A village grow-out trial completed in 1996 yielded data on variation in growth and survival of *T. derasa* over a large spatial scale. Across 12 sites, *T. derasa* grew to an average size of 149.7 mm ± 19.8 SD shell length (SL) in 24 months, with an average survival of 85.9% ± 19.6 SD. These data indicate that this species can be grown profitably for the aquarium trade, and that it is the outstanding candidate for cultivation for the live seafood market. Accordingly, in March 1996, we established an additional 26-village clam farms for the sole purpose of producing sufficient *T. derasa* to test and develop markets for clams of 150 mm SL in live seafood markets in Asia. Each farmer was provided with 3 000 seed clams and sufficient materials to construct grow-out cages. The grow-out trial will enable us to supply one tonne of live clams per week for a period of 12 months, commencing mid-1997.

Together with the Government of the Solomon Islands, ICLARM arranged for the Economic and Social Commission for Asia and the Pacific (ESCAP) to employ a consultant to study food markets for live giant clams in Taiwan and Hong Kong. Mr Mike Riepen, formerly an economist with the Forum Fisheries Agency, has been selected for this role, and will begin the consultancy in January 1997.

In support of our efforts to test seafood markets for giant clams by supplying one tonne of live product per week, the FAO South Pacific Aquaculture Development Program has agreed to provide funding for a person to coordinate the collection of clams from village farmers, and then dispatch them to buyers in Asia identified by the ESCAP consultant.

In 1996, 20 000 clams were sold to the marine aquarium trade on behalf of village farmers on Solomon Islands. This represented a 16% decline in sales over 1995. The main reason for the decline was increased competition from other Pacific islands, indicating that farming of giant clams is now being implemented more widely in the region.

The giant clam project also benefited from the continued input of a Ph.D. student from James Cook University. Ms Angela Grice conducted comprehensive experiments to identify how the process of fertilizing zooxanthellae with ammonium sulfate reduces the time needed to produce seed clams. She also demonstrated that clams receiving additional nitrogen two times per week grew as well as those fertilized more frequently. This knowledge has helped reduce fouling by algae and the labor involved in cleaning tanks.

In 1996, papers on the cultivation of giant clams were presented at the Second World Fisheries Congress, the Regional Technical Meeting on Fisheries of the South Pacific Commission, and the conference on Marketing and Shipping Live Aquatic Products '96.

Expected Outputs in 1997

- Publications documenting: (1) the methods used by ICLARM to propagate and grow-out giant clams; (2) the variability in survival and growth of *T. derasa*, *T. crocea* and

T. maxima at village farms; and (3) methods for optimizing growth of seed clams during the land-based nursery phase by the addition of ammonium sulfate.

- Presentation of keynote address on the status of efforts for restock of giant clams worldwide at the First International Symposium on Stock Enhancement and Sea Ranching.

- 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 Micronesia.

- Establishment of restocking experiments in collaboration with local villages at several sites on Solomon Islands.

- Sales of live giant clams to seafood markets in Asia and local restaurants.

- Establishment of the first independent giant clam hatchery on Solomon Islands based on technology developed by ICLARM.

- Analyses of the profitability of village-based giant clam farming for the aquarium trade.

6.1.2. Development of Small-Scale Village Farms for Blacklip Pearl Oysters on Solomon Islands Using Wild Spat

ICLARM Staff	:	Dr. J. Bell (Project Leader), Mr. K. Friedman, Mr. I. Lane, Mr. D. Anderson, Mr. G. Tiroba (Solomon Islands Ministry of Agriculture and Fisheries)
Collaborating Institutions	:	Solomon Islands Ministry of Agriculture and Fisheries, James Cook University, Australia (JCU), Cook Islands Ministry of Marine Resources, US Peace Corps
Donors	:	Australian Center for International Agricultural Research (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 establish a small-scale pearl farm using 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 a few sites to provide a strong indication that village-based collection of wild spat could sustain commercial operations. ACIAR 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.

Scores Against Principles

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

1996 Results

In 1996, average yields of 3-4 spat per collector were harvested from two regions, with the best collections occurring at or near the end of the year. It is widely accepted that such catch rates could support the development of village-based pearl farms.

Four other significant findings concerning the collection of spat were also made in 1996. First, survival of spat was jeopardized when they were left on collectors for six months: greater numbers of oysters were obtained by removing spat from collectors after 3, 4 or 5 months, and keeping them in intermediate grow-out systems, than by leaving them on collectors. Second, spat collectors constructed of shade-mesh yielded significantly greater numbers of live spat than collectors made of the rope used for the collection of spat in Cook Islands. Third, the size (and therefore cost) of shade-mesh collectors was reduced by 50% without significantly affecting catch rates of spat. Fourth, spat were grown successfully in four different systems (panel nets, lantern nets, trays and chaplets) with survival of >80% during the first three months of grow-out.

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 two outcomes: (1) villagers now understand the reasons for the national ban on export of pearlshell, and conform to it; and (2) villagers now safeguard wild broodstock.

Expected Outputs in 1997

- Further refinements to methods for collecting spat.
- Continuation of large-scale spat collections in two regions.
- Assessment of the feasibility of large-scale collection of spat to support commercial operations.
- Refinement of methods to achieve high survival of spat during grow-out at village sites.
- Publication(s) on spatial and temporal variation in abundance of spat.
- Establishment of a pilot-scale pearl farm using oysters collected as spat.
- Seeding of oysters to culture pearls on the pilot-scale farm.

6.1.3. Development of Methods for the Mass-Rearing of Tropical Sea Cucumbers to Enhance Wild Stocks

ICLARM Staff	:	Dr. J. Bell (Project Leader), Dr. S. Battaglene, Ms. E. Seymour, Senior Research Associate (to be appointed), Mr. C. Ramofafia
Collaborating Institutions	:	Solomon Islands Ministry of Agriculture and Fisheries, Advisory Panel from Advanced Scientific Institutions in Australia coordinated by ACIAR
Donors	:	Australian Center for International Agricultural Research (ACIAR)
Duration	:	Operational since 1993; this phase from January 1995 to December 1999

Objectives

- To develop reliable methods for inducing tropical species of sea cucumbers to spawn.

- 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

Beche-de-mer (processed sea cucumbers) is a valuable source of income for communities in remote areas of the Asia-Pacific because it can be processed (boiled and dried) on site, it has a long shelf-life without refrigeration and it fetches a high price in Asian markets. There is a strong demand for beche-de-mer 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 stock enhancement: (1) most species are restricted to particular inshore habitats; (2) sea cucumbers are low on the food chain, so availability of food and impact on other species are unlikely to be major limiting factors; and (3) sea cucumbers are conspicuous and slow-moving and therefore easy to harvest.

The potential of stock enhancement for managing sea cucumber fisheries in the Asia-Pacific cannot be assessed until three discrete pieces of research have been completed. These are: (1) development of cost-effective methods for producing larvae *en masse*; (2) identification of strategies for maximizing the survival of juveniles released in the wild; and (3) evaluation of the profitability of large-scale releases of juveniles to existing fisheries. ACIAR has provided funding until December 1999 to tackle the first of these research tasks.

Scores Against Principles

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

1996 Results

Research on development of methods for the mass-rearing of tropical sea cucumbers to enhance wild stocks began in earnest in early 1996, with the appointment of Dr Battaglene to undertake spawning and larval rearing trials and Ms Seymour to produce live algal food for the larvae.

During 1996, the reproductive cycles of three species were monitored and a total of 107 *Holothuria scabra*, 64 *Actinopyga mauritiana* and 49 *Holothuria fuscogilva* broodstock were collected from the wild for spawning at the Coastal Aquaculture Center. Successful spawning was induced by elevating seawater temperature by 3 to 5°C. Spawning occurred for 16% of *H. scabra* and 33% of *A. mauritiana,* but only for 2% of *H. fuscogilva.*

As a result of the first induced spawning of *H. scabra*, one million auricularia larvae were produced. The larvae were reared in 750-liter fiberglass tanks at around 2 larvae/ml. Water was exchanged by sieving out the larvae every second day until they metamorphosed to the doliolaria stage on Day 10. The majority of *H. scabra* larvae were at the pentacula stage by Day 14.

From Day 40, the juveniles were reared in 4 000-liter concrete tanks. At Day 60, the juveniles held at the lowest density averaged 23.8 ± 4.7 mm in total length (n = 50). Settlement and juvenile rearing on fiberglass plates conditioned with diatoms in the 750-liter tanks produced smaller animals 8.4 ± 3.4 mm (n = 50). Reduced growth of these animals appeared to be related to a copepod infestation. A second batch of *H. scabra* larvae was also reared using the methods described above. Some of the 10 000 individuals resulting from the second batch were used in grow-out experiments, which indicated that this species grows quickly and can be reared on algae and bacteria colonizing concrete and fiberglass tanks, with minimal addition of artificial diets. Maximum growth occurred in unshaded tanks with sand substrates. Individuals reared under these conditions attained a mean weight of 18.6 g (n = 30) at 4.5 months of age. As a result of the two initial trials on *H. scabra*, 20 000 juveniles suitable for release into the wild were produced.

The early success in rearing *H. scabra*, and their rapid rate of growth, has brought forward the need for experiments to identify the best way to release the juveniles into the wild. As a prelude to these experiments, ICLARM will apply in 1997 for funding to study the ecology of wild juveniles. In particular, we need to identify their

nursery habitats, determine what time of year they recruit, assess how fast they grow, and establish the timing of migration from nursery to adult habitats.

Expected Outputs in 1997

- Methods for larval rearing of white teatfish and surf redfish.
- Documentation of reproductive cycles in wild broodstock.
- Optimized methods for production of juvenile sandfish.
- Life history information for juvenile sandfish in the wild.
- Publications on larval rearing of sandfish and reproduction of white teatfish in the wild.
- Presentation of a paper on the attributes of sandfish for stock enhancement at the First International Symposium on Stock Enhancement and Sea Ranching.

7. POLICY RESEARCH AND IMPACT ASSESSMENT

7.1. Ecological Economics for Sustainable Use of Aquatic Resources

7.1.1. Fisheries Co-Management Project

ICLARM staff : Dr. Robert S. Pomeroy (Project Leader), Ms. Brenda M. Katon, Mr. Emmanuel L. Genio, Ms. Anjanette C. Trinidad, Ms. Josella M. Mayordomo, Ms. Maricel C. Gamo

Collaborating Institutions : Denmark - North Sea Center (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 - Program 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 - March 1999

Objective

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 and Africa, 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 and Africa.

The project will systematically and comparatively document and assess models and processes of fisheries co-management implementation at national government and community/fisher organization levels 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, 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

1996 Results

The major outputs of the project include the:

- completion of research report "Enforcement and Compliance with Fisheries Regulations in Malaysia, Indonesia and the Philippines" led by Dr. K. Kuperan Viswanathan, Malaysia;

- completion of global literature review and comparative analysis of fisheries co-management; and
- completion of case study of co-management arrangements in the Zambian and Zimbabwean Inshore Fisheries of Lake Kariba.

Initial work on pilot site activities in Honda Bay area, Puerto Princesa City, Palawan, Philippines, with research consortium of SEAFDEC-AQD, SEARCA and Tambuyog Development Center, was undertaken. Fisheries co-management case studies are underway in the Philippines and Bangladesh.

Other highlights of the project were the arrival of the following staff:

- Dr. Magnus Torell, Sweden, on 1 October on a two-year secondment from the Swedish International Development Assistance, to work on national law and policy research.
- Ms. Ingvild Harkes, the Netherlands, on 1 November as a two-year Associate Expert, to work on sustainability and resilience of co-management in the Philippines and Indonesia.
- Ms. Camilla Foltz, the United States, in September on a nine-month Rotary Foundation Fellowship, to work on co-management case study in the Philippines.

Expected Outputs in 1997

- Asia: Seven case studies will be conducted in the Philippines. These studies will examine existing collaborative arrangements between government and fishing communities. Performance indicators of co-management will be assessed in terms of sustainability, efficiency and equity. Additional case studies will be done in Bangladesh, Indonesia, Malaysia, Thailand and Vietnam.

- Africa: Case studies will be completed in Malawi, Mozambique, South Africa, West Africa, Zambia and Zimbabwe.

- An international workshop in Africa will be conducted to discuss the results of the case studies. Proceedings will be published.

7.1.2. Valuation of Reef Systems

ICLARM Staff	:	Dr. Mahfuzuddin Ahmed (Project Leader), Ms. Rowena Andrea V. Santos, 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 1997 - December 1998

Objectives

- To assess appropriate valuation techniques for coral reef systems with different 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 extramarket 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 consumption/nonconsumptive 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 approach	H

1996 Results

No activities were carried out during 1996 because of lack of operational funds. It will be taken up in 1997 provided fund is available.

Expected Outputs in 1997

- 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 valuation package.

7.1.3. Policy Research on User-Based Management: The Case of Inland Openwater Fisheries of Bangladesh

ICLARM Staff	:	Dr. Paul Thompson (Project Leader), Nurul Islam, Manjur Kabir, Dr. Mahfuzuddin Ahmed, Dr. Robert S. Pomeroy
Collaborating Institutions	:	Department of Fisheries, Bangladesh; Caritas; Proshika; BRAC; Banchte Shekha; BAZI; CRED
Donor	:	Ford Foundation
Duration	:	July 1995 - June 1998

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 relationship.
- 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-fisher collaboration and examine the extent to which the models contribute towards 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 changes.

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 among 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 four leading NGOs (BRAC, CARITAS, Proshika MUK, and FIVDB) with technical assistance from ICLARM.

An external evaluation of the IMOF Project noted that the Bangladesh experience with GO-NGO-fisher relationships would prove valuable and be applicable to co-management systems in many other fisheries. 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 approach	H

1996 Results

The project became operational with 16 waterbodies during 1996. These include parts of 10 flowing rivers; five beels (lakes), some of which are mostly seasonal; and one dead river. These sites are spread through most of the regions of Bangladesh, and give a cross-section of inland water types, regions and different approaches by NGOs. The partner NGOs have formed groups of participant fishers who are users of each of these waterbodies, and have ongoing programs of group/community development, training, and credit for fishing gear and other income-generating activities.

In 1997 it is expected that BRAC will start activities in several waterbodies (possibly eight) upon the approval by the Ministry of Land for waterbodies to be transferred to DOF for the project. In January 1997 some of the waterbodies proposed for BRAC were approved by the Ministry of Land.

Baseline socioeconomic surveys have been completed by the research team (DOF and ICLARM staff) in all 16 waterbodies and their communities. These in general comprise a sample of 60 NGO participant households, and 60 fishing households from the same villages, for each waterbody. Analysis of this large volume of data is ongoing, but does indicate that the NGOs have successfully targeted poorer fishers who are more dependent on the project waterbodies for their income. It also shows that fishing incomes during the monsoon (rainy season) are low in some sites (alternate income generation in this lean season is one of the aims of the NGO programs), and that there are access problems in some of the fisheries. The surveys form a basis for periodic comparison of socioeconomic condition (mainly assets and income), fishing involvement, and fishery access and involvement in management. The baseline surveys are being followed up by quarterly surveys of fishing activity in the same households, and annual impact monitoring.

Monitoring of fish catches and fish markets will be extended to all 16 waterbodies throughout the year. Monitoring of fish consumption and subsistence fishing will be started in four or possibly five waterbodies from January onwards for 12 months. Further rounds of monitoring of fishing activity by sample households and impact monitoring will also be undertaken.

Routine monitoring has already started in 12 waterbodies, covering fishing effort, catches and fish markets. DOF Field Assistants are stationed for each waterbody. They are responsible for documenting local coordination and management issues and conflicts. The monitoring system is relatively detailed for research purposes, but practical uses are being developed through regular feedback meetings with the community and co-management organizations.

Analysis of baseline data will be completed with reports on waterbodies and comparative results compiled during the first half of the year. PRA orientation and training will be held for project staff, followed by PRAs carried out during 1997 for all the 16 waterbodies. This is expected to aid in the development of community fishery management plans, and to provide an understanding of traditional fishery knowledge and management. Another input will be quarterly meetings at each waterbody to review

monitoring results with the fishing community. These activities are expected to start in February.

Expected Outputs in 1997

- Addition of more waterbodies to the project.
- Improved means of developing co-management in the flowing rivers by working with those communities and NGOs.
- A national workshop for the project, linked to a joint workshop with DANIDA on inland openwater fishery management issues, will be held in late March. This will be a venue to present the initial findings of the project and thereby influence policy formulation. Another internal workshop is expected in September 1997; each team working at the project waterbodies will present its progress with reference to the workplan.
- A program of training and study visits for DOF and NGO staff, including outside Bangladesh, is expected to start during the year.

7.1.4. Legal and Institutional Analysis of Coastal Resources Co-Management

ICLARM staff	:	Dr. Magnus Torell (Project Leader), Dr. Robert S. Pomeroy
Collaborating Institutions	:	To be identified
Donor	:	SIDA
Duration	:	1 October 1996 - 30 September 1998

Objective

Conduct government-level research, focusing on legal, institutional and administrative conditions for coastal zone management and fisheries co-management.

Background Justification

Under two of ICLARM's research programs, Policy Research and Impact Assessment (PRIA) and Aquatic Environments (AE), there is a priority need for a scientist with expertise in law and policy, with knowledge of fisheries management and coastal resources management. Specifically, the PRIA program requires a scientist to lead research on national government laws and policies for its fisheries co-management project; the AE program needs a scientist to coordinate activities in the development

and implementation of research on coastal environments. The skills and knowledge which Dr. Magnus Torell possesses would meet these priority needs and assist ICLARM in implementing its planned research programs.

Scores Against Principles

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

1996 Results

Arrival of Dr. Torell on 01 October 1996. Preparation of workplan.

Expected Outputs in 1997

Initiation of legal and policy analysis studies with national partners in the Philippines, Vietnam, Thailand, Indonesia, Bangladesh and Cambodia.

7.1.5. Evaluation of the Performance of Fisheries Co-Management Institutions

ICLARM Staff	:	Ms. Ingvild Harkes (Project Leader), Dr. Robert S. Pomeroy
Collaborating Institutions	:	To be identified
Donor	:	The Netherlands
Duration	:	1 November 1996 - 31 October 1998

Objective

To evaluate the performance of fisheries co-management institutions in terms of sustainability, flexibility and stability.

Background

A component of the research strategy of the fisheries co-management project is country research conducted in collaboration with NARS and NGO research collaborators. The country research is a comparative assessment to evaluate and

document the approaches and processes of fisheries co-management implementation at the community/fisher organization level. The purpose of the country research is to gain detailed and specific practical understanding and experience into the approaches, institutional arrangements, performance, and legal and policy factors affecting implementation of fisheries co-management at both government and community/fisher organization levels.

As part of the country research, a number of detailed case studies of fisheries co-management will be undertaken at the community/fisher level using the institutional analysis research framework. Performance of the systems will be evaluated in terms of equity, productive sustainability and efficiency. Certain hypotheses related to co-management will be tested including rationality (improved knowledge, information and data of the resource); resiliency (system adapts to change over time); improved legitimacy of the system; and improved communication and goodwill of the community.

Scores Against Principles

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

1996 Results

Arrival of Ms. Harkes on 01 November. Preparation of workplan.

Expected Output in 1997

Initiation of research activities in the Philippines and Indonesia.

7.2. Impact of Aquatic Resources Research: Methods and Assessment

Three projects will be considered for evaluation of their impacts in 1997:

a. Giant clam project (1997 - 1998)
b. GIFT project (1997 - 1998)
c. Carp genetic research project (1997 - 1999)

In giant clam and GIFT projects, evaluation will focus on *ex-post* assessment; in carp genetic research project, emphasis will be given on prioritization of carp genetics research followed by an *ex-ante* evaluation of the research from 1997 to 1999.

In addition, assessment of socioeconomic impact of fish culture extension will be carried out in Bangladesh under a Phase 2 project with the same title.

7.2.1. Impact of Giant Clam Productivity Enhancement Research

ICLARM Staff	:	Dr. Mahfuzuddin Ahmed (Project Leader), others to be identified
Collaborating Institutions	:	Department of Agricultural and Resource Economics, University of New England
Donor	:	UCore
Duration	:	1997 - 1998

Objectives

General:

To assess the impact of research and technology development for giant clam mariculture (i.e., the marine phases of giant clam aquaculture) in the Indo-Pacific region.

Specific:

- To develop a biological model which captures the relationships inherent in the marine production system for cultured giant clams.

- To develop a bioeconomic model which links the biological model to market conditions through an economic model.

- To identify and demonstrate the possible applications of the bioeconomic model, such as evaluation of the:
  - ◊ optimal management strategy for the village farmer facing three different markets;
  - ◊ effects of marketing, extension and biological research on the profitability of the village farm; and
  - ◊ possible losses to the village farm due to externalities caused by the third party activities.

- To investigate the factors affecting the rate of adoption of giant clam mariculture by potential village farmers.

Background and Justification

Giant clams have been harvested for both subsistence and commercial purposes by coastal communities in the Indo-Pacific region. Traditionally, they were harvested for their flesh for human consumption, and their shells for ornamental and utilitarian uses. More recently, they have also been harvested for trade as aquarium specimens. Due principally to unsustainable exploitation of the giant clam capture fishery, as well as general deterioration of coral reef environments, many species of giant clam became locally extinct in areas within their natural range. This resulted in all giant clams being listed under the Convention on International Trade in Endangered Species in 1983, prohibiting international trade between its signatories in giant clam products obtained from wild stocks. Since that time significant research efforts have been directed into developing methods for the aquaculture of giant clams in the tropical Indo-Pacific region. ICLARM itself has devoted significant resources over the last one decade in developing breeding and farming technologies for enhancement of production of giant clams in the South Pacific region. Initially, the motivation for research was to develop aquaculture techniques to restock reefs where giant clams had become extinct, thereby providing coastal communities in the Indo-Pacific with giant clam stocks sufficient to satisfy their subsistence needs. However, the interest in and prospects for commercial giant clam aquaculture were greater than for subsistence aquaculture. Hence, the ultimate goal of research, which continues, has become to develop commercially viable giant clam aquaculture industries. Despite favorable research results, however, commercial giant clam aquaculture has not yet been well adopted by potential village farmers. There is, therefore, a need to assess the impact of research and development investment in giant clam mariculture to determine the research benefits as well as to provide guidelines for future research and development initiatives on giant clams.

Scores Against Principles

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

Expected Output in 1997

Collaboration in Ph.D. research with the University of New England, Australia.

7.2.2. Socioeconomic Impact of Fish Culture Extension on the Farming Systems of Bangladesh, Phase II

ICLARM Staff	:	Dr. Paul Thompson (Project Leader), Dr. Mahfuzuddin Ahmed
Collaborating Institutions	:	Department of Fisheries, Bangladesh
Donor	:	IFAD

Duration : July 1996 - June 1998

Objectives

General:

To develop policy recommendations regarding viable and sustainable fish culture technologies for different situations; and to provide data and models for assessing future development projects.

Specific:

- To evaluate the sustainability of fish culture based on technology transfer and extension efforts in the first phase, and present use of those technologies.

- To make a comparative study to assess the efficacy of extension with and without credit availability. This is expected to cover Mymensingh Aquaculture Extension project (DANIDA funded) which has a higher input approach to promotion of aquaculture (provision of credit to fish farmers), and the original control areas in Sreepur to provide a comparison with continuing normal DOF extension programs.

- To compare the above with the extension approaches and impacts of other pond fish culture programs in other Districts of Bangladesh where the normal DOF extension program is in operation through the trickle-down approach of Fish Culture Extension at Thana level (GOB funded), and where enhanced extension systems have been tried through intensive training under the Northwest Aquaculture Development Project (ODA funded). Recommendations on extension methods will then be made based on the range of current practice and experience. Through this, recommendations for extension assessment methodologies will be developed for the DOF and others involved in fish culture projects.

- To make a whole farm analysis of fish culture input-output relationships. This will expand existing models and involves detailed farm household surveys and monitoring of: inputs and outputs, nutritional changes, and employment and income of men and women.

Background and Justification

During 1990-94 ICLARM in collaboration with Government of Bangladesh agencies carried out the project "Socioeconomic Impact of Fish Culture Extension Program on the Farming Systems of Bangladesh" in Gazipur District of Bangladesh with IFAD and DANIDA funding.

Although aquaculture in ponds has been the main source of additional fish production in Bangladesh in recent years, and has much potential for further expansion, high input cost technologies are beyond the means of the mass of rural poor people. It was expected that an extension program to provide pond owners with information on pond

fish cultivation would have a significant impact on incomes and production. The extension program aimed to make fish cultivation accessible to all rural households; to increase pond fish productivity, on-farm fish consumption and household incomes; and to increase the general supply of fish.

Before the project started, fish culture knowledge in the target area was low, and there was potential to improve techniques, input use patterns and pond management. The extension program focused on a participatory information exchange where flexible aquaculture techniques were suggested to meet the needs and problems identified by farmers, for example, using fish species preferred by poor people and using feed available on-farm. It was hoped that this approach would be more cost effective and sustainable than provision of packages including credit. The project provided extension services to some 1 800 households.

A project-control methodology was adopted, with Kapasia Thana forming the target area and Sreepur Thana the control area. A benchmark survey was carried out at the start of the project, and an impact survey near completion to measure relative changes with and without the extension program. The benchmark survey showed that owners and operators of small waterbodies average higher socioeconomic status than the rest of the farming community in terms of land ownership, farm size and income. It also indicated that functionally landless households (those with under 0.2 ha of own land) could be involved in aquaculture in small ponds and roadside ditches.

Assessment at the end of the project showed that minimal investment without credit produced appreciable increases in production and incomes for participating fish cultivators. Fish yields for carp and tilapia were four times higher than they were before the project extension activities. For 215 ponds where the technology was adopted, average annual production was highest for carp polyculture (2.7 tonnes per ha per year) and Nile tilapia (3.3 tonnes per ha per year), compared with average pre-project production of 0.6 tonnes per ha per year from locally developed systems of polyculture of Indian major carp. Input costs averaged just over Tk 14,000 per ha for technology adopters over a 12-month period for carp and tilapia, but of this 25-50% is an imputed value for inputs provided from on-farm sources. Overall net return to purchased inputs averaged Tk 45,700 per ha for the same period, but this included ponds affected by fish disease. The return on investment (ratio of net income to total costs) for disease-free carp polyculture was about 500%.

The project was therefore regarded as successful in providing an extension program of low-cost fish culture technology, which was adopted by the target population and proved to be profitable. However, the true test of such a program is the sustainability of increases in production and incomes when there are no project interventions and no intensive extension efforts. The present project will assess longer-term sustainability of the technologies introduced and the extension approach adopted three years after the intensive extension effort ended. Whole farm models including aquaculture will be refined, and the impacts of the previous project compared with other ongoing programs to promote and support pond fish culture both in the government and nongovernment sectors. This will help to guide future fish culture extension programs in Bangladesh, while an evaluation of the sustainability of such aquaculture is of international importance.

Scores Against Principles

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

1996 Results

The start of project activities has been delayed since the Technical Assistance Project Proforma (TAPP) of the Government of Bangladesh was still being prepared and processed. ICLARM attempted to have the project approved without requiring this, but the Ministry of Fisheries and Livestock (MOFL) did not agree to this approach. It should also be noted that ICLARM has no general formal working agreement in Bangladesh with either the DOF or MOFL, so a separate TAPP is needed even for a small project such as this one. A TAPP was finalized by the DOF and forwarded to MOFL in September 1996. Subsequent changes in staffing in MOFL delayed processing, but by early January 1997 required changes were informed by MOFL to ICLARM and a quick approval of the project was assured by MOFL staff upon receipt of the corrected TAPP.

Expected Outputs in 1997

By 1997 the sample design and databases of the earlier study will be reviewed and sampling for the impact study designed. National staff will be recruited to the project. Field data collection in 1997 is expected to involve both return interviews with fish cultivators who received extension messages under the previous project in Kapasia Thana and with pond owners in the original control area. Detailed monitoring of fish culture in a sample of ponds farmed by these households will take place throughout the year. The detailed monitoring will generate farming system data for modelling, while the return interviews will help to assess the overall sustainability of fish farming initiated under the earlier project. Interview surveys and possibly monitoring will also take place with participants under the ongoing fish culture extension project in nearby areas for use in the comparative assessment. The details of these surveys will depend on joint review of existing data collection by the DANIDA-funded project.

In 1997 the study will form links with other organizations involved in fish cultivation which could make use of the results, and will exchange information on fish culture technologies and extension practices. This phase will include a supporting role for aquaculture in the four regional NGO fora which have been established to coordinate activities.

7.3. Policy Analysis of the Contribution of Fisheries to Food Security

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

ICLARM Staff	:	Dr. Robert S. Pomeroy (Project Leader), Ms. Arlene L. Garces
Collaborating Institutions	:	Faculty of Fisheries, Cantho University (CTU), Vietnam; Asian Fisheries Social Science Research Network (AFSSRN), ICLARM, Southeast Asian Fisheries Development Center (SEAFDEC)
Donor	:	Fish Culture Research Institute (HAKI), Szarvas, Hungary
Duration	:	September 1994 - 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 West-East-South (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 the Faculty of Economics at CTU, the Faculty of Fisheries at the University of Agriculture and Forestry, and the Farming Systems Research and Development Center of CTU. The project will be implemented in three phases with a total period of three to four years. These 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 AFSSRN members.

Scores Against Principles

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

1996 Results

For 1996, there are four planned research activities: (1) socioeconomic analysis of fish farming households; (2) economic analysis of fish farming systems; (3) production analysis of fish farming systems; and (4) marketing analysis of fish farming systems.

A socioeconomic baseline survey of farm households in the central area of the Mekong Delta Region (Cantho and Vinh Long provinces) was undertaken from the middle of March until the end of April. The farm households surveyed were classified according to the type of farming system they operate. There are four basic classifications of farming systems prevalent in the Mekong Delta region: "A" farms, those that have an aquaculture enterprise but not integrated with any other farm enterprise; "AC/VAC" farms, those that have an aquaculture enterprise integrated with crop cultivation and/or livestock/poultry-raising activities; "AR" farms, those that have an aquaculture enterprise integrated with rice cultivation; and "Nonfish" farms, those that do not have an aquaculture enterprise in the farm. Of the 489 farm households surveyed, 124 survey questionnaires were discarded due to lack of information, leaving a total sample of 365.

Results of the survey indicated, among others, that the integrated farms, i.e., AC/VAC and AR farms, are economically better-off than nonintegrated farms (A and Nonfish farms). Integrated farms have better quality consumer durables and more farm assets. Farm income and total household income in general are also higher in the integrated farms than in the nonintegrated farms. It was also determined that lack of capital and technical know-how on integrated farming practices, including aquaculture practices, significantly affect the farmers' decision to integrate their farming practices. In turn, a large number of farm households which do not engage in farm integration indicated their willingness to practice integration, particularly integration of aquaculture into their existing farm activities, provided adequate technical support from agricultural extension services and better credit facilities will be made available to them.

Data for the economic and production-function analyses are currently being gathered through the record-keeping activities. The record-keeping started at the end of July and will continue for one year. The activities involve asking farm households to keep records of their production activities, i.e., costs and quantity of inputs, salaries and wages for hired and family labor, major repairs and other expenses, sales or revenues, etc. Field enumerators from the Faculty of Fisheries of CTU visit the farmers twice a

month to gather the necessary information. Record-keeping activities are expected to capture farm activities in different production periods of the year.

Preparations for the marketing study of freshwater aquaculture products in the central area of the Mekong Delta region are underway.

Expected Outputs in 1997

- Socioeconomic baseline survey report
- Economic analysis of fish farming households
- Marketing analysis of freshwater aquaculture products in central area of Mekong Delta Region

7.3.2. Bangus Fry Resource Assessment Project

ICLARM Staff	:	Dr. Mahfuzuddin Ahmed (Project Leader), Ms. Rowena Andrea V. Santos (beginning 1 January 1997), Mr. Francisco Torres, Jr., Mr. John Marie T. Gacutan (beginning 1 September 1996), Ms. Malu Tungala
Collaborating Institutions	:	BFAR, PCAMRD, SEAFDEC
Donors	:	Bureau of Fisheries and Aquatic Resources (BFAR), Philippine Council for Aquatic and Marine Research and Development (PCAMRD)
Duration	:	March 1996 - July 1997

Objectives

- To review existing municipal catch and effort data on fry production.
- To monitor fry supply information from selected regions in the Philippines for a period of one year.
- To estimate the total demand for milkfish fry.
- To assess the correlation between coastal environmental parameters and/or human development parameters against productivity of spawning/nursery grounds.
- To train data enumerators in fry data collection techniques.
- To recommend a system for continuous data collection of fry production.

Background and Justification

The annual shortage of milkfish fry is a primary issue in the industry. Whether such shortage is real or pure conjecture cannot be ascertained because no reliable database exists. Statistics gleaned by the Philippine Department of Agriculture (DA) from its Regional Offices indicate that the milkfish fry deficit is in the range of 1.6 billion fry. This is based on total fry requirement of 1.7 billion and annual fry production of 160 million.

A succinct proof of this alleged scarcity is the importation of milkfish fry from Taiwan, for which already 500 million fry have been imported as of September 1995.

The study verifies the issue of "scarcity" as it has been plaguing the industry since the '70s. Likewise, it determines the causes so that appropriate policies may be instituted or enforced properly and development priorities realigned.

Scores Against Principles

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

1996 Results

As part of a baseline survey, 190 questionnaires have been administered to fry gatherers/cooperators from the five selected regions and almost 80% of the data have been encoded. Fry-gathering activities are monitored monthly by the regional coordinators. The latest data transmitted was for the month of November 1996.

Monthly monitoring of volume of trade of bangus fry for 12 selected fry traders/buyers was also conducted.

Collection of time series information on fry production from the five regions under the project was initiated. Data from several towns in Sarangani Province representing Region XI (General Santos) showed a declining trend in the production of fry.

The trainings in data collection techniques were provided to ten data enumerators.

Preparation of proposal for a national/regional workshop on Bangus Fry Resource Assessment was also completed. Funding requested from BFAR and PCAMRD is underway.

Expected Outputs in 1997

- A culminating activity of the project will be a national workshop and three regional workshops that would include various stakeholders in the milkfish fry industry. Study results will be presented and ensuing policy recommendations and further research areas determined.
- Proceedings of the Workshop will be published.
- Technical reports will be submitted after the project activities.

7.3.3. Socioeconomic and Policy Analysis of Freshwater Capture Fisheries of Cambodia: Training, Data Analysis and Report Preparation

ICLARM Staff	:	Dr. Mahfuzzudin Ahmed (Project Leader), Ms. Portia Bonilla
Collaborating Institutions	:	Department of Fisheries (DOF), Cambodia; Mekong River Commission (MRC)
Donor	:	MRC
Duration	:	October 1996 - March 1997

Objectives

- To provide training assistance in data analysis and report writing to the staff of DOF, Cambodia.
- To strengthen capacity of the DOF in socioeconomic and policy analysis.
- To generate socioeconomic information on the freshwater capture fisheries of Cambodia.

Background and Justification

Lack of vital information on social and economic state of fisheries and weak institutional capacity are the main constraints to planning and implementing sustainable management systems for Cambodia's freshwater fisheries. In view of the importance of the freshwater capture fisheries to the food and national security of Cambodia, there is an urgent need to support the country's effort in generating the information and developing trained human resources.

Scores Against Principles

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

1996 Results

A female fisheries social scientist from DOF, Cambodia, was trained for a month on the analysis of household survey data in fishing dependent communities. Also, a database consisting of surveys of nearly 5 000 households was created for DOF under the MRC Project for Management of Freshwater Capture Fisheries of Cambodia. Analysis of the data will continue and a final report on the socioeconomic and policy issues in the management of freshwater capture fisheries of Cambodia will be prepared in early 1997.

Expected Outputs in 1997

- Workshop on Household Survey of Fishing Communities in Cambodia, February 1997.
- Workshop on Data Collection Framework for Family Fishery Statistics (subsistence fisheries).
- Finalization of report on household survey of fishing communities in Cambodia.

7.3.4. International Consultation on Fishery Policy Research in Developing Countries: Issues, Priorities and Needs

ICLARM Staff	:	Dr. Mahfuzuddin Ahmed (Project Leader), Dr. Meryl J. Williams, Dr. Peter Gardiner
Collaborating Institutions	:	International Food Policy Research Institute (IFPRI); Institute of Fisheries Management and Coastal Community Development (IFM), North Sea Center; Royal Veterinary and Agricultural University (RVAU), Denmark
Donor	:	Danish International Development Assistance (DANIDA)

Objectives

General:

- To determine the role of and desirable directions for fisheries policy research in developing countries, in addressing the fundamental questions of achieving economic growth, reducing poverty and protecting natural resources and the environment.

Specific:

- Identify priority areas where policy research can identify options for fisheries policies to promote these objectives more fully.

- Capacity-building for fisheries policy analysis in the developing countries.

Background and Justification

Fisheries constitute an important growth sector in many developing countries. Their role as a major supplier of vital micronutrients and protein for humans cannot be overemphasized. During the latter part of the current century, the world has witnessed a phenomenal growth in production and trade in fisheries from both capture and farmed sources. More than one-third of global fishery production is currently traded internationally. Research, technological innovation, infrastructural investment and policy reform has on the one hand affected growth and productivity; on the other, it has raised fundamental policy questions with regard to food security, poverty and sustainability, including environmental and ecological sustainability.

What happens to fish once they are harvested is increasingly becoming a major concern. The role of fish in global and local animal protein consumption and nutritional security is becoming critical as a result of changes in fishing regimes, income distribution, demand and international trade. Conflicts between policies aimed at increasing export earnings from fishing and those aimed at increasing food security have grown over the decades in the developing countries. Likewise, a growing trend in the use of low-value species to feed high-value species low in the food chain has raised both national and international concerns.

At risk are the food and income systems in many low-income countries whose population continues to increase. As the world moves to the 21st century, the role of fisheries, like many other sectors, is being redefined. Fisheries policy research at the household, community, national and international levels needs to be better prioritized. This will help ensure that a fair share of the benefits of harvesting the fish stock, and utilizing natural resources for increased aquatic production, goes to the sectors of society that need them most.

Scores Against Principles

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

1996 Results

- Mission to IFPRI to discuss proposal for an international consultation on fisheries policy research.
- Submission of proposal to DANIDA for funding a workshop.
- Formation of a Workshop Organizing Committee consisting of ICLARM, IFPRI, FAO, IFM and RVAU.
- Agreement with IFM to hold the Workshop in the North Sea Center, Hirtshals, Denmark from 3 to 6 June 1997.

Expected Outputs in 1997

- The workshop to be held 3-6 January 1997 will:
  - ◊ determine policy research priorities for fisheries;
  - ◊ draw an agenda for international and national research initiatives; and
  - ◊ set guidelines for improving the capacity of developing country institutions in fisheries policy research.
- Publication of workshop proceedings.
- Publication of a policy supplement in the ICLARM Quarterly, Naga.

7.3.5. Database for the Assessment of Developing Country Fisheries

ICLARM Staff	:	Dr. Mahfuzuddin Ahmed (Project Leader), others to be identified
Collaborating Institutions	:	FAO, INFOFISH, NACA and others to be identified
Donor	:	Ucore
Duration	:	1997 - 2000

Objectives

General:

To establish and maintain a database for policy analysis, and to provide analysis of technological development, market movements and institutional changes in developing country fisheries.

Specific:

- To develop and adapt databases for impact assessment and research priority setting.
- To create, maintain and update a secondary database combining biophysical and socioeconomic information on world fisheries with special reference to developing country fisheries.
- To make projections and forecasting of trends and prospects for the sector to assist research and development priorities.

Background and Justification

Impact assessment and policy analysis will require a wide range of data over time and space. Data are needed to assess developing country fisheries to guide policy measures, technological development and institutional changes. Development of an impact database will allow storage, retrieval and integration of primary and secondary impact data. Primary data will include results of adoption and information on adoption variables from formal and informal surveys at the levels of farm and fisher households, and community. Secondary data will be based on documentation and reports from various sources.

Score Against Principles

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

In addition, four new projects are anticipated to begin in 1997:

1. monitoring and evaluating the impacts of the coastal resources management project in the Philippines, to be funded by USAID, Philippines;
2. increasing and sustaining the productivity for fish and rice in the flood-prone ecosystem in South and Southeast Asia, to be funded by IFAD;

3. institutional capacity-building for community-based fishers management in Bangladesh, to be funded by Ford Foundation; and

4. strengthening the institutional capacity in socioeconomic research in the management of reservoir fisheries in the Mekong river basin, in collaboration with the Mekong River Commission.

If resources are available, initiatives will also be taken to develop projects on:

1. gender research; and
2. database for fisheries policy analysis.

8. FISH HEALTH

This program is a recent initiative and a research plan is being developed.

9. INFORMATION AND TRAINING

9.1. PUBLICATIONS UNIT

ICLARM Staff	:	Dr. Leticia B. Dizon[1] (Unit Manager), Ms. Marie Sol M. Sadorra, Mr. Albert Contemprate, Mr. Alan Esquillon, Ms. Ma. Graciela R. Balleras, Ms. Alma G. Canuto, Mr. Rodel Resurreccion, Mr. Ariel Aquisap[2] and Mr. Roberto Cada (on contract)
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

To 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	H
5. Systems approach	N/A
6. Anticipatory research	N/A

[1]Retiring effective 24 March 1997.
[2]On contract until 28 March 1997.

1996 Results

The Publications Unit published the following in 1996: *ICLARM Report 1995*; four issues of the magazine *Naga*; twelve issues of *ICLARM Newsplash*; one issue of *ICLARM Newsbriefs*; an ICLARM publishing guide; the San Miguel Bay Bulletin; one conference proceedings (CP 42); two studies and reviews (SR 23 and SR 25); a manual on tilapiine fishes (Education Series 17); one technical report (TR 43); and nine brochures.

Four other conference proceedings (CP 41 in French, CP 41 in English, CP 48 and CP 50), another education series (ES 12 in Spanish), as well as the Library Serial Holdings List were also about to go to press in early January.

Contractual staff were hired during the year to meet the increasing demand on the Unit; this consisted of six editors, one layout artist, and one artist to scan photos/slides.

The Unit also produced the graphics and layout of two issues of *Asian Fisheries Science*, the journal of the Asian Fisheries Society, for which ICLARM hosts the Secretariat.

The Unit also prepared press releases for the launching of the Genetic Improvement of Farmed Tilapias Foundation on 9 October and the International Year of the Reef. The GIFT Foundation news release was published by most of the major Philippine newspapers including the *Philippine Daily Inquirer, Philippine Star, Bulletin Today, Philippine Journal,* and *Today*.

Two Philippine television channels covered the press conference on the GIFT Foundation event and consequently featured the GIFT Project in two weekly shows, *Usapang Bisnis* of ABS-CBN Channel 2 and *Mag-Agri Tayo* of the Government PTV Channel 4. Eleven newspaper and radio reporters also covered the GIFT Foundation event, representing different newspapers and radio stations. Channel 4 ran a 10-minute GIFT feature for three consecutive Saturdays starting 12 October, while Channel 2 allowed a 7-minute segment focused on the GIFT Project alone, aired on 21 October.

During the Fish Conservation Week (13-20 October), ICLARM was invited to contribute articles for a supplement in the *Philippine Daily Inquirer*. Two of the four articles submitted by the Publications Unit were used in the supplement, which appeared in the 15 October issue of the *Inquirer*.

After reading the press coverage on the GIFT Project, two Swiss journalists indicated their interest to interview ICLARM staff and write about ICLARM's research work. Dr. Ambekar Eknath and Mark Prein were interviewed about their respective programs. The interview was an opportunity for ICLARM to make its research and impact known.

Materials for presentation by ICLARM staff during meetings and workshops are constantly being prepared, as well as public awareness materials (posters, slides/overhead transparencies, news clippings, folders) and even business cards. The Unit also handled the photography needs of the Center.

Twenty ICLARM contributions for submission to international refereed journals and external publications, such as conference proceedings and magazines/newsletters, and web pages have been copyedited.

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 168 000. *Naga* recipients as of December 1996 number 4 725. Publication sales from mail order and walk-in buyers totaled about US$11 000 in 1996.

In September-October, staff were busy preparing materials for the International Centers' Week in Washington, DC - part of a CGIAR 25th anniversary display; an ICLARM publications display; and presentation by the ICLARM Director General.

ICLARM books were displayed at nine other local and international exhibits: the International Coral Reef Symposium, Panama; Third INGA Steering Committee Meeting, Cairo; Frankfurt Book Fair, Germany; First Ghana International Book Fair; Aquarium Association of the Philippines General Assembly, Manila; Manila Book Fair; exhibits of the Advisory Committee on Protection of the Sea, Manila; and aboard a research vessel, the *TRV Sardinella*, in Manila.

A paper on the citation impact of ICLARM publications was presented by L. Dizon during the Fifth Communication Workshop of the ICLARM/International Rice Research Institute/International Institute for Rural Reconstruction in March 1996. The workshop is a continuing one which ICLARM Publications staff attend to exchange experiences in production, publishing, graphics, distribution and other related topics.

L. Dizon conducted a course on technical writing for 36 Philippine government research staff in a training course sponsored by the Bureau of Fisheries and Aquatic Resources.

A survey questionnaire was given out to 4 778 readers in the January 1996 issue of *Naga* to determine the profile of readers, as well as to update the mailing list. As of 20 December, 416 readers have responded. A follow-up questionnaire was included in the October 1996 *Naga.*

Some Publications staff attended courses for their development: Artist A. Contemprate completed a course on CorelDraw, a graphics software, in May; C.I. Guevara and M.G.R. Balleras attended a course on Microsoft Access in June 1996; and A. Canuto also attended a Microsoft Access training in December.

Assistant Editors M.S.M. Sadorra and C. Guevara attended meetings of the Book Development Association of the Philippines to touch base with their counterparts in the Philippines and to keep up-to-date with developments in publishing in the Philippines. C. Guevara was sent to a regional publishing seminar in Malaysia in August.

Expected Outputs in 1997

- The Unit intends to produce *ICLARM Report 1996, 1997 Operational Plan*, four issues of *Naga, the ICLARM Quarterly*, twelve issues of *ICLARM Newsplash*, one or two issues of *ICLARM Newsbriefs*, four conference proceedings (CP 41 in French, CP 41 in English, CP 48, CP 50), an education series (ES 12 in Spanish), the Library Serial Holdings List, one technical report (TR 53), and two to three issues of *Asian Fisheries Science.*

- The Unit will continue to do typesetting and drafting of figures/graphics for other Center staff needs, as well as posters, slides, and overheads for presentation at meetings. Books and other publications will continue to be distributed free to recipients in free and exchange lists and to subscribers. The Unit will also continue to handle sales through the mail and over the counter.

- The overall management of the publication and distribution procedure will be reassessed and a complete "project management" procedure designed in light of priorities, efficiency and timeliness. This will include formalizing, for example: prioritizing publication work; timetabling; use of internal and external resources; resource allocation; costings; and reviewing and clearing procedures.

- The future direction and presentation style of *Naga* will be reassessed. Responses to the *Naga* survey will be analyzed, along with further analysis of the clients and the market place. Consideration of connections with other journals and organizations, as well as translation opportunities will also be considered for *Naga.*

- The style of ICLARM publications and public awareness materials will be assessed/designed for a consistent ICLARM image - focus on people; lively, attractive, clear presentation; and consistent with ICLARM's role.

- Initiation of areas where publication, dissemination and distribution can more effectively use technology.

9.2. Translation Services Unit

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

Objectives

- To coordinate translation services in the languages of the countries in which ICLARM is or may be involved.
- To continue the expansion of this capability into a structured unit .
- To work towards the establishment of a CGIAR system-wide language policy.

Background and Justification

Translation activities started in 1980 with the ICLARM translation series. These 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 in Francophone Africa, it was deemed appropriate to give ICLARM a translation capability and to expand it in the future.

Non-English-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 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 is 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	NA
2. Equity	H
3. Gender	NA
4. Participation	H
5. Systems approach	NA
6. Anticipatory research	NA

1996 Results

Translations into English and French of all manuscripts of the Third International Symposium on Tilapias in Aquaculture (ISTA III) were completed. Temporary additional staff were hired. The proceedings were entirely produced using a machine translation software, and the scientific and technical terminology pertaining to the subject areas of the book was added to its growing database. The Unit was also in contact with ISTA donors to report on the work progress and in close contact with the other ISTA co-editors to help resolve translation and publication problems.

Machine translations using this software greatly improved in 1996. Also, an additional site license was purchased for use in another ICLARM project (FishBase) and in-house informal collaboration has started between this project and the Translation Unit. An upgraded version of the machine translation software was acquired; this includes Spanish, along with other languages.

The Unit also revised the *Atlas démographique des populations de poissons d'eau douce d'Afrique*, published by J. Moreau, M.L.D. Palomares, F.S.B. Torres, Jr. and D. Pauly under ICLARM Technical Reports Series (TR 45).

Other functions of the Unit during the year included translation of other technical articles for publication including the last issue of Naga. The Unit experimented with Internet to find qualified translators for its regular freelance roster. For example, an Arabic translator from Toronto, Canada, was able to deliver the translation of ICLARM's portfolio into Arabic using e-mail. The Unit handled the translation of letters of inquiry and responses, as well as liaison with French agencies on behalf of the Center. Contacts were maintained with translators and translation units of other institutions, particularly of the CGIAR, via e-mail. The unit head subscribed to a translator e-mailing list originating from Canada. Through this e-mailing facility, matters of difficult, specialized terminology are discussed and assistance is offered by and to subscribers. Also, the unit subscribed to Eurodicautom, a large database in Europe which gives access to terminology databases.

Expected Outputs in 1997

- French translations and coordination of other translations:

  The Unit will continue its translation activities, including one major research work given priority for translation. Regular translations for Naga into French will resume, and other languages such as Spanish and Arabic will be undertaken, depending on readers' needs and resources available. The Unit will continue coordinating and translating ICLARM correspondence.

- ISTA III distribution:

  The proceedings of ISTA III will be distributed in early 1997 to the conference participants and other users in Africa, Asia and Latin America as well as in Europe and the USA.

- Capitalization on technology and Networks:

  The Unit will continue to enrich its terminology database and use its translation software for maximum efficiency. The Unit will increase contacts with the Translation Division of other CG centers to consider possible ways to optimize the translation "mission" of the centers. This will be done via the creation by the Unit in early 1997 and the use of an e-mailing list for general and specific cooperation towards the establishment of a CGIAR system-wide language policy. The unit will continue to experiment with Internet to access world terminology databases and to increase its resource pool.

Planning and development of the Unit:

A plan for the Unit will be prepared and revised as necessary, including the objectives, possible activities and services, priority-setting procedures, (human) resource sources, costings and funding.

9.3. Library and Information Services

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

Objective

To promote and effectively provide information services (including identifying, collecting, processing, storing, analyzing and disseminating) to ICLARM management and staff, and ICLARM clients (including donors, researchers, collaborators and users of the information in developing countries).

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. It aims 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 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

1996 Results

Collections

The library collections include a wide variety of materials in many formats: books and monographs; reprints; theses; serials; maps; videorecordings; slides; photos; CD-ROMs; software; newspaper clippings; pamphlets; microforms; posters; and other materials. As of December 1996, the collection comprised 14 927 volumes of books and monographs; 6 994 titles of reprints; 397 items of nonbook materials; 3 307 slides; and 4 332 photos. There were about 826 currently received serial titles from a total holdings of 1 297 serials. About 672 (81%) titles were received as gifts or exchange items and only 154 (19%) titles were on subscription.

Subscription to two versions of *Current Contents* (1. *Agriculture, Biology and Environmental Sciences*; 2. *Social and Behavioral Sciences*) was upgraded from diskette to CD-ROM network version (licensed for 1-3 simultaneous users) in late 1996.

Access to the information sources available is provided through five bibliographic databases serving as catalogs and indexes to the collections. The library's databases and their total number of entries as of December 1996 are:

LIBRI	11 242
SERIE	1 297
NAGA	14 874
RED	453
CAD	14 000

From these databases, the following were produced:

- Five "New Acquisitions" lists (with 1 105 bibliographic entries)
- IRSMLDC 1995 Book Catalogue (1 150 entries)
- ICLARM Library Serial Holdings List (1 277 entries)
- Four issues of "Information Department" in *Naga* (800 entries)

Services

The library continued to provide information and reference services to 1 739 users, mostly university students from Metro Manila, growers, volunteers, academic/library personnel, government workers, consultants, administrators and policy makers. Of the 15 409 library materials being used, serials (47%) were most frequently

used, followed by books and monographs (42%) and reprints and other types of documents (11%). The five most important/used serial titles were: *Aquaculture, Coral Reefs, Bulletin of Marine Science, Hydrobiologia*, and *Naga, the ICLARM Quarterly*. Demonstrations on the use of information databases, on-line searching and library orientations were provided to 915 users/visitors.

As part of a current awareness service for ICLARM projects in Bangladesh and Malawi, 421 pages of table of contents from 310 volumes/issues of different journals and 294 titles (2 215 pages) of photocopied journal articles were sent during the year. Likewise, we continued to provide photocopies of documents to our Coastal Aquaculture Center (CAC) in Solomon Islands. During the year, 182 titles with a total of 2 627 pages were sent. Malawi Office library was given library holdings on diskettes and ASFA CD-ROM 1988-December 1995 on 23 September. The library also facilitated the acquisition of books needed by ICLARM outreach offices.

Under the Selective Fisheries Information Service (SFIS), 345 queries from 66 countries were responded to during the year. Two hundred sixty-five (265) queries were answered free; 40 were charged; 22 offered on exchange; and 18 referred to others. Queries from developing countries (67%) continue to be the largest users of SFIS.

To publicize the library and its services to a wide audience, a "*Guide to ICLARM Information Resources and Services*" and a library flyer were produced. A general information article about the library was also submitted to six different newsletters for publication.

To facilitate easy access and retrieval of acquisition information on materials acquired by the library, order information fields were added to two in-house databases, Libri and Serie.

Linkages and Cooperation

As an inputting center to the Aquatic Sciences and Fisheries Information System (ASFIS), the library has submitted 524 citations since November 1995. Entries of all ICLARM publications to the *Aquatic Sciences and Fisheries Abstracts* (ASFA) database are now fully up-to-date.

The library arranged an interactive session for ICLARM research staff to enhance users' knowledge in *Current Contents* and *Science Citation Index*. The session was conducted on 14 August by a representative of the Institute for Scientific Information, Philadelphia.

Subscription to ASFA CD-ROM was facilitated for the Fisheries Research Institute, Mymensingh, Bangladesh.

The library continued to strengthen its ties with libraries and institutions worldwide through increased cooperation and assistance. An exchange of publications with four additional institutions - (1) Intermediate Technology and Fauna & Flora International, UK; (2) International Collective in Support of Fishworkers, India; (3) Rodale Institute, USA; and (4) West African Regional Program Improvement of Post-Harvest Utilization of African Freshwater Fish Catches, Abidjan, Cote d'Ivoire - has also

been established. Through the Duplicate Exchange Program of the IAMSLIC (International Association of Aquatic and Marine Science Libraries and Information Centers), requests from ten foreign libraries were filled in exchange for nine volumes of books and nine titles of journals including *Scientific American* (1958-1967). Library duplicates such as journals and reprints were donated to the PCAMRD (Philippine Council for Aquatic and Marine Research and Development) Library.

To ensure that ICLARM publications reach those who benefit from them, a questionnaire update form has been sent to exchange partners. Approximately 85% have been returned so far.

Briefings on library and information services were made for several visitors and new ICLARM staff.

Advice and practical training on computer-based information system and services were provided to staff of the Philippine Department of Agriculture Region IV, Freshwater Fisheries Research Station and the Philippine Council for Health and Research Development.

Information Project

The project "Union Catalog of Fisheries Serial Holdings in Asia" is being conducted by Ms. Rosalinda M. Temprosa (Project Leader) and Ms. Norma I. Jhocson, with many libraries/institutions in the Asian region as collaborators.

The objective is 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.

This project is a part of the regional survey conducted by ICLARM on behalf of the Study of International Fisheries Research in September 1993. ICLARM was asked to undertake 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. A prototype has already been prepared and was distributed to 49 participating institutions/libraries, and their feedback collated.

In April 1996, the database was weeded out of nonaquatic serial titles (1 080 records). It now contains 9 337 data holdings records with 1 972 serial citations from 33 participating libraries and institutions. During the period, 2 910 entries were selected and cataloged ready for data entry. There were 12 more additional agencies participating in the project.

Expected Outputs in 1997

- Further promote and develop Selective Fisheries Information Service (SFIS) to inquirers worldwide.

- Continue to adopt and use current information systems and technology in the efficient delivery of information services and for more efficient operational activities, including:

  ⇒ library holdings made accessible via Internet; and

  ⇒ the merging of three library databases, i.e., Libri, Naga and Red, into one large database.

- Inputs of ICLARM publications to ASFIS will be kept up-to-date.

- ICLARM's project library in outreach centers, including Malawi, will be assessed and monitored, and services improved where practical opportunities are identified.

- ICLARM's regional library in Abbassa will be set up.

- Complete the "sort-out" of the recently acquired ICLARM photo and slide collection; and research and prepare a plan for the future management and development of the collection.

- ICLARM will make major progress towards the development of the Union catalog widely available on diskette.

10. INTERNATIONAL PARTNERSHIPS AND NETWORKS

10.1. NETWORK OF TROPICAL FISHERIES SCIENTISTS (NTFS)

ICLARM Staff	:	Dr. Modadugu V. Gupta (Coordinator), Dr. Villy Christensen and Mr. Geronimo Silvestre (Fishbyte Co-Editors), Ms. Ma. Rosandra Gayosa (Secretary, until 1 March), Ms. Edna Tuico (Secretary, from 2 March 1997)
Collaborating Institutions	:	FAO/DANIDA Training Course in Tropical 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.

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

1996 Results

Seventeen new scientists were admitted to NTFS in 1996, bringing total members to 1 383 individuals. *Fishbyte* as a section of *Naga* totaled 71 pages, and included 20 contributions by 38 authors/coauthors in 17 countries. In *Fishbyte,* a Software Review section was included to inform readers of the availability of different stock assessment and modeling software and of their worthiness.

Starting with the April 1996 issue, G. Silvestre joined the editorship of *Fishbyte* with D. Pauly, who will relinquish the post to V. Christensen in 1997. Early this year, the coordination of NTFS, together with other networks based at ICLARM, was transferred to the International Relations Office. The changes in the structure of NTFS mentioned above did not make it possible to launch a questionnaire update in 1996. It is thus expected that this will be among the outputs in 1997.

Expected Outputs in 1997

- Four issues of *Fishbyte* in *Naga*.
- An update on the membership through a survey questionnaire.
- Turning over of NTFS secretariat to the International Relations Office.

10.2. Network of Tropical Aquaculture Scientists (NTAS)

ICLARM Staff	:	Dr. Modadugu V. Gupta (Coordinator), Ms. Natalie Macawaris (Secretary)
Collaborating Institutions	:	-
Donor	:	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. Often they lack access to information 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 research	N/A

1996 Results

Thirteen articles have been published in three issues of Aquabyte in *Naga*. About 70% of these published articles were authored by NTAS members. Forty-nine new members joined NTAS during 1996. These members were from 22 countries from Asia, Africa, Latin America and Europe.

Expected Outputs in 1997

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

- Free computerized literature searches, supply of published materials 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.

10.3. Asian Fisheries Social Science Research Network (AFSSRN)

ICLARM Staff	:	Dr. Robert S. Pomeroy; 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 in 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	:	ICLARM Core; Asian Fisheries Society
Duration	:	Continuous

Objectives

- To promote effective interaction and cooperation among persons involved in living aquatic resources social sciences research.

- To encourage and promote investigation and advances in knowledge of living aquatic resources social sciences.

- To focus attention on living aquatic resources social sciences problems by disseminating technical and other information on all aspects of living aquatic resources social sciences and management.

- To promote the proper use of living aquatic resources social sciences research practices and results in the region.

Background and Justification

The 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 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 15 research teams, totaling more than 80 researchers at universities, research institutions and government fisheries agencies in Indonesia, Malaysia, Thailand, the Philippines and Vietnam. These AFSSRN member institutions have a strong commitment to social science research relative to capture fisheries, coastal management and aquaculture.

As the founding member institution of the AFSSRN, ICLARM has a lead role to play in the AFSSRN's future. Under the new AFSSRN constitution, an ICLARM staff member shall serve as vice-chairman of the executive committee. ICLARM staff will continue to provide technical guidance to the AFSSRN.

Scores Against Principles

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

1996 Results

The AFSSRN project officially ended on 31 March. Members of the Network expressed a desire to continue Network activities. The AFSSRN is now a section under the Asian Fisheries Society. A constitution was prepared and an executive committee established.

Other activities that were undertaken in the Network were the holding of the (1) Regional Workshop on Evaluating the Effectiveness of Environmental Policies and Programs, 20-25 March 1996, Bali, Indonesia, and AFSSRN Members' and Team Leaders' Meeting on 24 March 1996, Bali, Indonesia; (2) publication of AFSSRNews in

NAGA; (3) completion of Phase III and Phase IV research projects; and (4) publication of research reports.

Expected Outputs in 1997

Three activities are planned in 1997: (1) a regional training course; (2) publication of the AFSSRNews in Naga; and (3) establishment of a website on the Internet. The executive committee will meet several times in 1997 to prepare long-term plans for the AFSSRN and to seek additional funding for activities.

10.4. International Network on Genetics in Aquaculture (INGA)

ICLARM Staff	:	Dr. Modadugu V. Gupta (Coordinator)
Collaborating Institutions	:	**Bangladesh** - Fisheries Research Institute, Mymensingh; **China** - Department of Aquaculture, Shanghai Fisheries University; **Côte d'Ivoire** - Fish Research Center, Bouake; **Egypt** - National Aquaculture Research Center, Sharkia; **Fiji** - Ministry of Agriculture, Fisheries and Forestry, Suva; **Ghana** - Institute of Aquatic Biology, Achimota; **India** - Central Institute for Freshwater Aquaculture, Bubhaneswar; **Indonesia** - Central Research Institute for Fisheries, Jakarta; **Malawi** - University of Malawi, Zomba, Fisheries Department, Lilongwe; **Malaysia** - University of Malaya, Kuala Lumpur; **Norway** - AKVAFORSK; **Philippines** - Bureau of Fisheries and Aquatic Resources, Quezon City, and Freshwater Aquaculture Center, Nueva Ecija; **Thailand** - National Aquaculture Genetics Research Institute, Bangkok; **Vietnam** - Research Institute for Aquaculture No. 1, Ha Bac, and Research Institute for Aquaculture No. 2, Ho Chi Minh City.
Donor	:	ICLARM core funds; Norway
Duration	:	Ongoing since August 1993

Objectives

- To provide a forum for exchange of information, methods and germplasm.
- To evaluate culture performance of promising lines of tilapias and carps.

- To contribute to the domestication and sustainable performance of tropical finfish species farmed in developing countries.

- To demonstrate potential for increasing production through application of genetics and selective breeding.

- To develop national capabilities through training, exchange of germplasm and methodologies.

- To strive for conservation of biodiversity.

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 Norway and the Philippines 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 interests 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 freshwater cultured fish, targeted to the aquaculture systems in developing countries.

Strategy

- Exchange of methodologies and materials
- Research planning meetings and workshops
- Formulation and implementation of collaborative research projects
- 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	N/A
4.	Participation	H
5.	Systems approach	M
6.	Anticipatory research	H

1996 Results

A. Research progress

Progress in the aquaculture genetics research in member countries:

Bangladesh: Clonal lines of Rohu (*Labeo rohita*) through meiotic gynogenesis in the F_2 generation have been produced. Studies undertaken for selective breeding of *P. gonionotus* resulted in production of two lines (Indonesia x Bangladesh and Thailand x Bangladesh). Evaluation of these two lines during nursery and grow-out stages showed that overall, the Indonesia x Bangladesh hybrid line grew better than Thailand x Bangladesh line.

China: Selective breeding program of bream in China showed that the growth rate of F_4 generation of two lines was 19.1% higher than the original strain and the selection response was 4.8% higher for each generation. The program also showed that improper management and breeding method of the species resulted in decreased growth rate of its offspring.

Egypt: Rearing of transgenic and nontransgenic *O. niloticus* under identical conditions showed that growth of transgenic fish was higher in terms of mean weight than the nontransgenic fish. The transgenic tilapia was produced through electroporation techniques using rainbow trout growth hormone gene (rtGh1cDNA).

Fiji: Results in the genetic characterization and reproductive performance in terms of breeding efficacy, survival at early stage and growth performance assessment in four Fijian tilapia populations (*O. mossambicus* from Malaysia, *O. niloticus* from Israel, red tilapia hybrid from Taiwan and *O. niloticus* from Thailand) indicated that: (1) *O. mossambicus* stocks had the lowest level of genetic variability while the red hybrid had the highest level of heterozygosity and is also the most closely related to the *O. niloticus* stocks; (2) in terms of fry production in warmer season, *O. mossambicus* had the highest, followed by *O. niloticus* from Thailand, red tilapia hybrid, and *O. niloticus* from Israel; during the cooler months, all strains except *O. niloticus* from Thailand showed significant decrease in number of fry produced; and (3) *O. niloticus* from Thailand had the largest mean body weight at harvest and performed best under Fijian conditions.

Ghana: A compilation of the applicable techniques for biochemical characterization of tilapias has been prepared and will be published as a manual shortly. The compilation describes basic principles, procedures, sample results and interpretation of results for each technique. It also provides a summary of diagnostic test which allows for discrimination of species or closely related groups.

Indonesia: Electrophoretic and morphological characterization of the local, Thai and GIFT Nile tilapia strains showed: (1) there was no difference in meristic characters among strains except for the darker color in GIFT strain; and (2) there were no distinct patterns of Thai and local tilapia protein profiles, but GIFT was differentiated by its number of bands and protein unit molecular weight.

Diallel crossing of Rajadanu and Cangkringan Yogyakarta strains of common carp showed a decline in heterosis for the diallel crossing between the two for longer rearing period. Crossing of female Rajadanu and male Cangkringan showed higher heterosis than the reciprocal one.

Thailand: All female fry were successfully produced by oral administration of 17β-estradiol at 200 mg/kg of food to posthatch Snakeskin gourami (*Trichogaster pectoralis*) fry for 3 weeks. Likewise, hormonal feminization of mixed-sex *C. macrocephalus* fry by immersion or dietary method using β-estradiol produced *ca.* 100% females.

Spermatozoa of male Mekong giant catfish (*Pangasius gigas*) was successfully cryopreserved in liquid nitrogen retaining fertilizing capacity for up to 18 months. Fertilization rates using preserved sperm and eggs of *Pangasius gigas*, *P. sanitwongsei* and *P. sutchi* were 67.7, 67.7 and 34.7% respectively.

Vietnam: The growth rate and attractive appearance of common carp *(C. carpio)* after five generations of mass selection have improved substantially. The total genetic gain of body weight in the sixth generation was 33%. However, a gradual decline in realized heritability of body weight was observed during the selection process.

Induction of triploids in common carp showed that subjecting the eggs for 5-15 minutes after fertilization to cold shock at 2-4°C for 30-45 minutes resulted in highest hatching percentage and survival of embryos. Highest percentage of larval hatching (61.2% in one case and 25% in the other) was also obtained by giving heat shock after 2.5 minutes of fertilization at 40°C for one minute.

B. Collaborative regional research

1) Genetic improvement of carps

Planning has been completed for a collaborative Research and Training Project on *Genetic Improvement of Carps in Asia* involving six carp-producing countries (Bangladesh, China, India, Indonesia, Thailand and Vietnam). Funds for implementation have been approved by the Asian Development Bank. The three-year project will be implemented from April 1997.

2) Genetic improvement of tilapias

Plans have been developed for a collaborative Research and Training Program for Characterization and Documentation of Tilapia Genetic Resources for Aquaculture in four INGA member countries (Côte d'Ivoire, Egypt, Ghana and Malawi). Donors have been approached for funding.

C. Development of national breeding programs in the Philippines, Indonesia and Vietnam

Philippines: Development of the Philippine National Tilapia Breeding Program is underway.

Indonesia: Reportedly, there are nine strains of common carp in the country with different colorations and body shapes. The scientists have identified common carp and GIFT strain of Nile tilapia as priority candidate species for selective breeding. Plans have been developed for selective breeding of common carp, continuation of selective breeding of GIFT strain and selective breeding of milkfish (*Chanos chanos*).

Vietnam: Plans have been developed for selective breeding of common carp, mrigal *(Cirrhinus mrigala)* and GIFT, to be undertaken by the Research Institute for Aquaculture No. 1 in Ha Bac and selective breeding of silver barb *(Puntius gonionotus)* at Aquaculture Research Institute No. 2 in Ho Chi Minh City.

D. Involvement of national systems in planning and governance

As part of the agenda for better coordination and strengthening aquaculture genetics research, national INGA chapters have been formed in India, Indonesia, Malawi and the Philippines.

E. Training

Indonesia: A two-day training workshop on *Quantitative Genetics and Selective Breeding* was held during 14-15 November 1996 at the Research Institute for Freshwater Fisheries, Sukamandi, Indonesia. It was attended by 40 participants from different research and academic institutions in Indonesia. The resource person for the training were Dr. M.V. Gupta of ICLARM and Drs. Trygve Gjedrem and Hans Magnus Gjøen of AKVAFORSK, Norway. During the workshop, local scientists were trained in the application of tools in quantitative genetics and selective breeding and selection in finfish and shellfish research.

Vietnam: Vietnam scientists have been trained in quantitative Genetics and Selective Breeding through a training workshop organized by INGA in Hanoi.

F. Germplasm exchange

Protocols and quarantine procedures for the transfer of germplasm based on international codes of practice have been formulated and currently serves as guidelines to be observed by countries, organizations and individuals importing germplasm from ICLARM.

Between 1994 and 1996, GIFT fingerlings have been disseminated to five countries: Bangladesh, China, Indonesia, Thailand and Vietnam. The number of fingerlings per shipment ranged from 750 to 8 000.

G. Information dissemination

As a means to strengthen communications and information exchange among INGA member countries, a two-page section featuring INGA-related activities and news have been incorporated in *Naga, The ICLARM Quarterly*, starting with the October 1996 issue.

H. Meetings and workshops

The Third Steering Committee Meeting and three concurrent special sessions were held in Cairo, Egypt, in July 1996 on: (1) development of salt-tolerant Nile tilapia; (2) genetic improvement of carps; and (3) strengthening partnerships, information exchange and communications. Thirty-one scientists from 12 INGA member countries and resource persons participated in the Meeting.

Development of Salt-tolerant Nile Tilapia: The session has drawn up guiding principles for conducting research aimed at development of salt-tolerant Nile tilapia for aquaculture in brackish/marine waters. These guidelines would help ICLARM and the participating INGA member countries in arriving at common goals and approaches to the problem of brackishwater utilization so that a proposal could be formulated.

Expected Outputs in 1997

- Further exchange of genetic materials per plans formulated in the third Steering Committee Meeting.
- Publication of revised versions of research methodologies and transfer protocols.
- Organization of a meeting of the Senior Planners/Administrators of fisheries research institutions in INGA member countries.
- Initiation of collaborative research and training programs for genetic improvement of carps in Bangladesh, China, India, Indonesia, Thailand and Vietnam.
- Initiation of a collaborative research and training program for characterization and documentation of tilapia genetic resources for aquaculture in Africa, subject to availability of funding.
- Development of collaboration with Asia-Pacific and African NARS.

10.5. Dissemination and Evaluation of Genetically Improved Tilapia Species in Asia (DEGITA)

ICLARM Staff	:	Dr. Madan M. Dey (Project Leader), Dr. M.V. Gupta, Mr. Gaspar B. Bimbao, Ms. Maricon Gayanilo
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 - June 1997

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 analyze the overall impact of the improved tilapia strain on different groups of the society (farmers, consumers, landless laborers, etc.).
- To disseminate promising tilapia strains among small-scale fish farmers 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

ICLARM, in collaboration with national aquaculture research institutes of the Philippines and the Institute of Aquaculture (AKVAFORSK) of Norway, with funding support from the Asian Development Bank (ADB) and the United Nations Development Program (UNDP), has developed an improved Nile tilapia (*Oreochromis niloticus*) strain through selective breeding which performs significantly better in terms of both growth and survival 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, in line with the precautionary approach to introducing new types of aquatic organisms, there is a need to assess its performance, economic viability, social acceptability and environmental compatibility under biophysical and socioeconomic environments.

The intention of the DEGITA Project is that developments associated with growing the improved tilapia fish in the five collaborating countries should give proper consideration to the resource base of the tilapia farmers, the perspectives of the different stakeholder groups - producers, consumers, marketing agents, landless laborers, etc. - and the overall impact on household, ecosystem and community. The five components of the work integrate the disciplines of genetics, economics, sociology and environmental science, and almost define anticipatory research.

Scores Against Principles

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

1996 Results

Through on-station trials, institutions in four countries (this was done previously in the Philippines) compared GIFT and local tilapia strains. In Bangladesh, where Nile tilapia has a short history with very limited broodstock management, the GIFT strain appears to be 50% superior, in terms of growth, to local strain. In China, Thailand, and Vietnam, where there are longer histories of tilapia farming, greater climatic variation, and therefore the possibility of both natural and artificial selection of local strains to their environments, the GIFT strain appears to be about 10-15% superior to local strains in terms of growth. The on-station data did not show any definite pattern in terms of survival.

Baseline surveys covering both the supply and demand sides of the tilapia industry were carried out in all the five participating countries (Bangladesh, China, the Philippines, Thailand and Vietnam). On the supply side, the surveys covered detailed accounting of production and input usage of fish operator's aquaculture and agriculture enterprises, aimed to analyze the interaction between tilapia and other aquaculture/agriculture sectors. On the demand side, information mainly on the level of fish consumption of consumers, the volume of fish transaction of fish traders/sellers, and fish prices were collected quarterly. These data are being analyzed. Baseline models (supply and demand) representing aquaculture-agriculture sector of different participating countries are being estimated based on these survey data and other time series secondary data.

On-farm trials of GIFT and local strains were conducted in all the participating countries. The GIFT strain gave about 15 to 25% higher yield than the genetically superior existing strains like '1978' introduced, '1988' introduced and hybrid strain of China, and Chitralada strain of Thailand. However, the GIFT strain gave more than 50% higher yield than the poorer-quality strains.

A workshop on "Impact Evaluation of Genetically Improved Farm Tilapia Technology" was held in Los Baños, Philippines, 11-30 March 1996. The workshop had two parallel training workshops, Impact Evaluation Framework and Models (11-28 March) and Methods for Analysis of On-station and On-farm Experimental Data (26-28 March), followed by a two-day final workshop (29-30 March). The workshop: (1) developed country-specific analytical and estimation models for impact assessment; (2) analyzed the data of the surveys and on-station and on-farm experiments so far completed; and (3) finalized 1996 workplans and schedule of activities. Thirteen national scientists from Bangladesh, China, the Philippines, Thailand and Vietnam participated in the workshop.

The project has developed a protocol for the participatory rapid evaluation of the ecological and socioeconomic impacts of improved tilapia species. Following the protocol, participatory rapid evaluation was carried out by an interdisciplinary team in six regions in the Philippines. The report on this exercise is being finalized.

Based on the information collected during his tour to different DEGITA participating countries during July-August 1996, Dr. Sena De Silva, Project Consultant, has prepared a draft report on the likely environmental impact of GIFT strain in Asia. The draft report indicates that the introduction of GIFT fish in tilapia producing Asian countries will not be harmful.

Regression models for average growth and survival were estimated based on the data of on-farm trials conducted during 1992 to 1994 in the Philippines. The reasons for faster growth of the GIFT strain were also identified using statistical decomposition method. The results indicate that 90% of the incremental growth of the GIFT strain is due to the higher efficiency in protein and nitrogen utilization.

A stochastic frontier model of average weight at harvest was fitted based on the on-station experimental data from Bangladesh, China, Thailand, and Vietnam using the maximum likelihood estimation technique. The estimated frontier model shows the maximum body weight that can be obtained from a specific level of inputs. The yield potential of the GIFT strain is about 11% higher than that of the best existing strains. Results also indicate a high yield gap between the potential and actual farm yield.

National workshops were organized in Bangladesh, China and Thailand during December 1996 to get opinion of different stockholders involved (farmers, nongovernmental organizations, hatchery operators, etc.) on the nature of future national tilapia-breeding programs in respective countries. Similar workshops are planned for the Philippines and Vietnam to be held during January 1997.

The project activities were reviewed by a mission from ADB. The Mission observed that the project had so far been implemented satisfactorily, and noted that the unified methodology developed by the project to evaluate the performance of genetically improved tilapia had demonstrated its usefulness and applicability in studying the impact of new agriculture/aquaculture technology during the technology development phase.

The progress of DEGITA activities were presented and discussed during the third steering committee meeting of the International Network on Genetics in Aquaculture (INGA), 8-11 July 1996. In total, seven presentations were made covering various aspects of DEGITA activities, which were well received.

Expected Outputs in 1997

- Data of the on-station and on-farm experiments and the surveys will be fully analyzed, and the potential impact of GIFT fish will be assessed.
- Organization of final workshop.
- Preparation of workshop proceedings, final project report, and publications.

10.6. INTERNATIONAL PARTNERSHIPS

ICLARM Staff	:	Dr. Modadugu V. Gupta (Director), Ms. Natalie Macawaris (Senior Research Assistant), Ms. Edna Tuico (Secretary)
Collaborating Institutions	:	Regional and National Research Institutions
Donor	:	ICLARM core funds
Duration	:	Continuous from 1996

Objectives

- To strengthen national programs by forming productive partnerships with research and nonresearch groups including NARS, ARIs, NGOs, the private sector and development assistance agencies.
- To strengthen NARS through the establishment of a Tropical Fisheries Research Forum.

Background and Justification

The need for strong national research systems, better utilization of scarce resources, quicker gains from strategic research and matching of complementary skills of agencies, underscores the importance of ICLARM working in partnership with national systems (government and nongovernment organizations), advanced scientific institutions, individual scientists, the private sector and farmer/fishers.

ICLARM almost invariably works with and through national programs, even where it has its own research facilities as is the case in the Solomon Islands. This policy will continue when new research facilities are added at Abbassa and Subic Bay. In a broad sense, therefore, all its activities are serving to strengthen NARS. This means forming productive partnerships and collaborative research with national research institutions, the private sector and development assistance agencies as well as undertaking related activities such as workshops, training and advisory services.

Scores Against Principles

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

1996 Results

ICLARM partnership policy for research and related activities has been prepared and approved by the Board of Trustees.

A workshop organized in November 1996 to identify areas of possible collaboration with Philippine NARS resulted in ICLARM being requested for collaboration in a number of research areas. Further discussions are in progress.

Dr. Meryl J. Williams and Dr. Modadugu Gupta participated in the recent priority-setting exercise of the Asia-Pacific Association of Agricultural Research Institutions (APAARI).

Memoranda of Understanding (MOUs) for collaboration in research and selected activities have been signed with the Indian Council of Agriculture Research (ICAR), India; Department of Fisheries; Royal Government of Cambodia; Dhaka University, Bangladesh; University of Bergen, Norway; the University of Malaya, Malaysia; and the International Institute of Rural Reconstruction (IIRR).

Expected Outputs in 1997

- Further discussion on collaborative research areas between ICLARM and Philippine research institutions.
- Development of partnerships/collaboration in Asia and Africa.

ACTIVITIES AND SERVICES

11. 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:

11.1. GENETIC RESOURCES PROGRAM (SGRP)

Five of the 16 CGIAR 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 the 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.

11.2. WATER MANAGEMENT

The System-Wide initiative on water management has the overall objective of enhancing the productivity of water in agriculture in an environment of growing scarcity and competition and provides an umbrella for several projects executed jointly by multidisciplinary partners. ICLARM, through its Integrated Aquaculture-Agriculture Systems Program, collaborates with one project within this umbrella, entitled "Valuing the Multiple Uses of Irrigated Areas" which is administered jointly by the International Irrigation Management Institute (IIMI) and the International Food Policy Research Institute (IFPRI). The purpose of this project is to generate knowledge and understanding of the choices of users, and the determinants, the value, and the consequences of multiple uses of water in irrigated areas (i.e., domestic water supply, livestock, home gardens, fisheries, and other rural enterprises, including human and environmental health issues).

12. EXTERNAL RELATIONS OFFICE

ICLARM Staff : Director (to be hired); Edeena R. Pike (Assistant)

Donors : ICLARM core funds

Duration : Continuous from 1996

Objective

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

Background and Justification

The External Relations Office was created to help management and staff with all activities related to fund-raising and CGIAR relations. The ERO will be assisting the Director General of ICLARM in developing, maintaining and enhancing the Center's relationships with its donor stakeholders. This will involve developing and implementing strategies and methods for fund-raising and donor relations, assisting scientists in the preparation of proposals for submission to donors, and keeping informed of changing donor priorities and requirements.

Expected Outputs in 1997

- Improved and more timely compliance with the CGIAR program planning documents.
- Development of a donor strategy to guide the Center in maintaining, and where possible, increasing its quantum of unrestricted funds. The office will act in the integrationand targeted delivery of proposals within the donor strategy.
- Assistance to staff with project development and donor negotiations to increase the flow of project-related funding to the Center.
- Better information of donors and agencies in support of fisheries and agricultural research in Africa and West Asia.

13. CORPORATE SERVICES OFFICE

ICLARM Staff : Dr. James McMahon (interim), Rachel Josue

Donors : ICLARM core funds

Duration : Continuous

With research being the main activity or "product" of ICLARM, the Corporate Services Division acts to support the research efforts by providing most of the operational support to the Center's research activities.

The Corporate Services responsibilities include:

- Providing efficient and reliable information and services to Center management, staff and other stakeholders such as trustees, NARS and donors;
- Providing reliable communications on behalf of the Center and its staff;
- Developing, implementing and monitoring policies to support the Center's financial health;
- Providing a human resource environment which supports excellent staff; and
- Improving the Division's services by regular analysis of existing services and continually improving these services.

The Division is organized into the following functional units:

1. *Finance and Management Information:* This unit manages the Center's financial resources to ensure that these are available for the Center's operations. The Unit also generates the financial information required by Center management and staff to manage their resources. The reporting function of the Unit has made it the focal point for developing management-related information systems.
2. *Human Resources:* This unit is responsible for all of the staff support needs within the Center, including policy development and administration. This unit advises management on matters pertaining to the development and support of a strong and capable staffing component.
3. *Program and Administrative Services:* This unit provides much of the administrative services support to the Center, including general administration, research administrative support and budgeting.
4. *Computer Services:* This unit manages the Center's Local Area Network and related communications, and provides staff with support services for ongoing computer activities.

An internally commissioned, external review of the Corporate Services Division was completed during the second quarter of 1996. The results from the review provided a number of particular focuses which were incorporated in the 1996 workplans for these units. (Note: the review did not include the Computer Services Unit, as this unit did not report to Corporate Services at that time). Action items resulting from the review which were not accomplished during 1996 have been incorporated into 1997 operational plans along with other plans.

Highlights of the 1997 operational plans include:

13.1. Finance and Management Information

Background

The Finance and Management Information (FMI) Unit is primarily a support group. It plays a critical role in the Center's successful attainment of its mission and objectives. The unit manages the Center's financial resources to ensure availability of funds and generates financial information to enable management to make correct and timely decisions. Other related functions include the maintenance of adequate operating, accounting and internal control systems in safeguarding and maximizing Center assets and other resources, and the assurance of the accuracy and reliability of the generated financial information.

The priorities of the FMI Unit for 1997 are the following:

13.1.1. Implementation and Operation of the Platinum Computerized Systems

ICLARM Staff : FMI staff

Duration : Ongoing

Objective

To fully operate the Platinum computerized systems.

Background and Justification

The need for accurate, reliable and timely financial information and reports in view of the Center's growing activities prompted the acquisition of the Platinum software in 1995 as a move to upgrade the Center's finance and accounting systems. Further, a project team of in-house programmers and consultants from Price Waterhouse (PW) Information and Technology Division was formed to complete the system designs/ programs to ensure the implementation and integration of Platinum into the current systems.

The Platinum and supporting computerized system modules to be implemented are the modules for purchasing and inventory, fixed assets, disbursements, bank books, payroll, overhead allocation, foreign currency transaction translation and the general ledger.

1996 Results

System development work began in 1996 with the goal of full implementation by January 1997. System modifications have delayed the progress; the design of the covering programs is yet to be completed. Full implementation is now scheduled for the second quarter of 1997.

Expected Outputs in 1997

- Completion of the system designs including the testing and parallel runs by the first quarter of 1997.
- Training of users by the first quarter of 1997.
- Full implementation of the Platinum systems by the second quarter of 1997.

13.1.2. Design of an Outreach Operating System on Finance and Accounting Systems

ICLARM Staff	:	FMI Manager and staff
Duration	:	3 months or ongoing

Objective

To design and implement a uniform outreach operating system.

Background and Justification

With the expansion of outreach research activities, an outreach operating system is deemed necessary to enable Headquarters to better monitor financial transactions, enhance financial reporting, and improve communication and coordination with the outreach offices. This system is also expected to emphasize the optimum use of resources vis-a-vis approved research strategies.

The ultimate goal of this operating system is the easier preparation of financial reports using consolidated results of activities and finances of the outreach offices and Headquarters. It will also ensure uniformity and consistency in implementing control procedures for both Headquarters and outreach offices, thereby facilitating monitoring of

compliance. This was a 1995 concern discussed with the Board, and activities are ongoing.

1996 Results

In November 1996, two members of the FMI unit visited the Solomon Islands outreach office. A review of the finance and accounting systems of this office was conducted primarily to gather data that will be used as basis or model for the design of an outreach operating system. A complete fixed assets count was also made to establish accountabilities and to initialize the database for accounting and monitoring fixed assets.

The results of the visit are under evaluation and the preparation of the final report is pending. The highlight and the final output of the report will be the design of an outreach operating system and the establishment of the balances of fixed assets. It will also be evaluated how the Platinum computerized systems are to be integrated with the operating system of the outreach operations.

Expected Outputs in 1997

- A second or follow-through visit by March 1997 to the Solomon Islands outreach office to implement the outreach operating system and train personnel on the covering policies and procedures.

- Evaluation of the applicability or possibility of extending the Platinum computerized finance and accounting systems to outreach offices.

- Full implementation of the outreach operating system by the end of 1997, particularly in the Abbassa regional facility.

13.1.3. REORGANIZATION OF THE FMI UNIT

ICLARM Staff : FMI Manager and Staff

Duration : 2 months

Objective

To restructure the FMI unit to promote efficiency and effectivity of procedures for better support services.

Background and Justification

The FMI unit, which is primarily a support group to management and project activities, continues to improve its services in generating accurate and reliable information. Such efforts ensure compliance with Center policies and procedures and the further enhancement of its operating, financial, accounting and internal control systems. This will only be possible with a structure that promotes efficiency and effectivity of processes and the proper and timely coordination with the other operating groups. The FMI unit is being restructured with these objectives in mind.

Expected Outputs in 1997

- Hiring of an Assistant FMI Manager to provide senior staff support and back up to the FMI Manager.
- Realignment of certain functions to eliminate duplication of efforts and thus promote efficiency and effectivity of functions.
- Continued development of the FMI staff; and consequently,
- Optimization of manpower resources.

13.1.4. Improvement of the Center's Financial Position, Operating Reserves and Overhead Recovery Levels

ICLARM Staff : FMI staff

Duration : Ongoing

Objective

To improve the Center's finances, operating reserves and overhead recovery levels.

Financial Position

Background

The financial position of the Center in 1996 has been greatly affected by delays in the collection of unrestricted donor grants. Because of greater activities and increases in the operating requirements, restricted project funds have been "borrowed" and used for operations towards the end of the year 1996 and in previous year-ends. This issue concerns management and is one financial management priority area for 1997.

Expected Outputs in 1997

- Improving finances by additional funding, earlier collection of fund commitments, and expense controls, including the implementation of a system that will control spending against uncollected grants.

- Closer monitoring and better management of financial resources through relevant and timely financial information on grant negotiation/collection and current expenditure levels.

- The design/implementation of a system wherein unrestricted spending will be contained, to the extent possible, to funds already received and not against uncollected unrestricted funds.

Operating Reserves

Background

The external review conducted in 1996 emphasized the need for the Center to increase its operating reserves to meet CG system-wide recommendations in order to avoid any potential financial crisis in cases of noncollection of grants or shortfalls in funding.

1996 Results

Management fully agreed with this concern and has made significant improvement through efforts to improve the level of operating reserves by enhancing the Center's donor-reporting systems to speed up collection efforts, and the improved investment of surplus funds. Currently, management is looking into other ways, particularly in cost management, so expenses will be closely monitored to set certain spending limits against expected funding.

Expected Outputs in 1997

- Continuing assistance by the FMI unit to management in providing prompt and reliable donor financial reports.

- Investment of surplus funds and development of short-term investment strategies taking into consideration the foreign dollar currency fluctuations, tax exemption privileges and the improving Philippine economy.

- Improvement of cost-management policies and procedures to identify operating areas where cost-saving measures can be implemented and/or enhanced.

- A spending objective wherein expenses will be less than funding to allow a build-up of Center reserves and capital funds.

- Establishment of reserves as a separate line item.

Overhead Recovery

Background

One significant item negatively affecting operating reserves is the limitation on the ability of the Center to recover overhead. Current contracts with donors on certain projects contain no or very limited provisions on overhead. Several projects with overhead provisions have been "underspent", thereby limiting the ability of the Center to recover overhead. Thus, the overhead recovery rate policy established in early 1996 has not been fully achievable.

Considering such limitations, the Center nevertheless significantly improved its overhead recovery for 1996. This is directly attributable to the 1996 overhead policies that provided a clearer definition of direct and indirect costs. This has resulted in certain indirect costs being identified as directly allocable and therefore chargeable to the restricted projects.

Progress

The FMI unit is currently analyzing the latest financial information related to overhead. It also intends to study and fully understand overhead allocation and charging vis-a-vis CGIAR overhead recovery policies and methodology. It will also review the current policy for improvements and establish realistic rates. These rates will be presented for the better understanding of donors and thus allow the Center to be more aggressive in future donor negotiations.

Expected Outputs in 1997

- Identification of additional costs that can be directly related, and therefore chargeable, to the projects.

- Realistic overhead rates in the light of current financial data for future overhead negotiations with donors.

- Greater overhead recovery.

13.1.5. OPERATIONS OF THE ABBASSA REGIONAL FACILITY

ICLARM STAFF : FMI Manager and staff

Duration : 12 months

Objective

To assist in the start up activities of the Abbassa regional facility and implement an outreach operating system.

Background and Justification

ICLARM expects to take responsibility for the Abbassa regional facility mid-1997. This facility will be by far the largest "outreach" office and will require a significant amount of financial resources for its operations. There is thus a need to establish an operating system that will allow financial, project and administrative reporting and coordination with the Headquarters. The Board, in the September 1996 meeting, requested FMI to prepare a financial workplan to assist management in setting up the financial operations of this facility.

1996 Results

A financial workplan has been prepared outlining the planned activities and timetable. It will also be later evaluated how the Platinum computerized finance and accounting systems can be extended to the Abbassa regional operations.

Expected Outputs in 1997

- Ongoing support and guidance to the new DDG-WANA on the financial start-up requirements.
- A visit by FMI management to the Abbassa regional facility to assist in the start-up activities and implement the outreach operating system and train personnel.
- Fully operational financial, accounting and internal control systems by the end of 1997.
- Full coordination and complete financial and project reporting by the outreach office to the Headquarters.
- Evaluation of the applicability and possibility of extension of the Platinum computerized systems to the Abbassa regional financial operations.

13.1.6. Further Improvement of Skills and Services

ICLARM Staff : FMI staff

Duration : 12 months or ongoing

Objective

To assist the FMI staff in their skills and professional development.

Background and Justification

For better support services, skills of the FMI staff will be further improved. The FMI staff will be encouraged to attend seminars and workshops for professional and personal development. Staff meetings will be held regularly to foster teamwork, improve communication and promote coordination. Staff activities will likewise focus on building morale and motivation.

Expected Outputs in 1997

- Improved skills
- Better support services
- High employee morale and motivation
- Limited staff turnover

13.2. HUMAN RESOURCES MANAGEMENT

13.2.1. ORGANIZATION OF THE HUMAN RESOURCES (HR) UNIT

ICLARM Staff : HR Manager, HRM Staff

Duration : 1 month

Objectives

To organize the existing HRU staff such that:

- all HR functions critical to ICLARM operations are carried out effectively, despite limited manpower resources; and
- in the process, also assist ICLARM employees achieve their career development goals, thus enhancing their capabilities to contribute to total organizational effectiveness.

Background and Justification

The organization of the HR Unit (HRU) requires significant analysis as the unit has been understaffed for most of the past year including a vacancy in the HR Manager position for more than six months.

Expected Outputs in 1997

- A formal HRU organizational structure with the corresponding manpower complement will be finalized.
- Functions, areas of responsibility, time frames for action items, as well as reporting relationships, will be clearly defined.
- If necessary, new Terms of Reference will be prepared.

13.2.2. STANDARD RECRUITMENT POLICIES AND PROCEDURES

ICLARM Staff	:	ADG Corporate Services, HR Manager
Duration	:	2 to 3 months

Objective

To develop clear, written guidelines on the recruitment, selection, orientation and placement of staff.

Background and Justification

Although general policy statements exist, ICLARM has no specific written policies and procedures on recruitment activities.

Expected Outputs in 1997

- Written specific guidelines on NRS recruitment, selection, orientation and placement.
- Review of existing, and (if necessary) design of new HRU forms pertaining to all recruitment and placement activities, such as Personnel Requisition Forms and Interviewer's Forms.
- Development of an effective Talent Bank.
- Possible acquisition of preemployment IQ and aptitude tests for support staff.
- Creation of innovative sourcing strategies.
- Training of all supervisors on recruitment.

13.2.3. NRS Job Analysis and Evaluation and Salary Restructuring

ICLARM Staff : ADG Corporate Services, HR Manager

Duration : 4 months

Objectives

- To clearly describe and differentiate all NRS positions and salary bands.
- To ensure that the worth of each NRS position in the ICLARM organization is properly determined based on standard compensable factors.
- To ensure that the NRS salary structure and pay ranges are internally equitable and externally competitive.
- To provide a system which can be used internally to determine appropriate position levels within the organization.

Background and Justification

Following identification of a high priority HR need, an NRS position and pay study began in September 1996. An external consulting organization (Watson Wyatt) was hired to perform the study, with help from ICLARM management and staff. The early phases of the study are complete, with finalization expected in the first quarter of 1997.

Expected Outputs in 1997

- A revised NRS salary structure and corresponding pay ranges.
- A revised NRS position classification and job-grading system.
- Job descriptions for each NRS position will be standardized and finalized. The job descriptions are also meant to facilitate both recruitment and performance evaluation.
- The results of the Watson Wyatt study will be explained to all ICLARM staff.

13.2.4. NRS Medical Insurance Benefits

ICLARM Staff : ADG Corporate Services, HR Manager, Compensation and Benefits Specialist, NRS Advisory Committee

Duration : 3 months

Objective

To review the current medical insurer and level of coverage provided to NRS.

Background and Justification

NRS, both individually and through the NRS Advisory Committee, have requested management to explore additional medical options. Also, management and staff believe the current insurer should be evaluated against other insurance organizations.

Expected Outputs in 1997

- A survey among ICLARM NRS will be conducted.
- Proposals from different health care organizations will be solicited and evaluated.
- A survey of medical/health benefits being provided by top multinational companies in the Philippines will be conducted.
- Recommendation to management will be made on a comprehensive medical insurance plan and responsive insurer.

13.2.5. Staff Training and Development

ICLARM Staff : ADG Corporate Services, HR Manager, ICLARM Staff

Duration : Continuing

Objectives

- To coordinate the conduct of in-house training programs for Senior Management and Secretarial support staff.
- To conduct a training needs analysis for ICLARM staff.

Background and Justification

ICLARM management believes that continuing training and development of employees improves employee morale, helps people identify with organizational objectives and contributes to ICLARM's overall effectiveness.

Within budgetary capabilities, a few selected training programs will be conducted in 1997. The programs provided are those which have been identified as having the greatest developmental impact on staff where the greatest need exists.

1997 Expected Outputs

- The conduct of a Senior Management Training Program will be coordinated.
- The conduct of Secretarial Support Training Courses will be coordinated.
- A Training Needs Analysis will be conducted for ICLARM staff.
- Coordination and support will be provided to three management staff in their attendance at CG-wide "Women in Management" course.
- Other Center-wide training needs will be recommended to management.

13.2.6. Other HR-Related Matters

ICLARM Staff : HR Manager, HRU Staff

Duration : Ongoing

Background and Justification

HRU supports the concept of continuous improvement and recognizes that HR's task is never finished. There will always be room for improvement and new areas for exploration. Thus, aside from the personnel programs above, other projects/tasks will be implemented.

Expected Outputs in 1997

- A Table of Organization and staffing complement for each group in ICLARM will be prepared.
- HRU files and records will be classified and updated.
- Standard settling-in assistance procedures for IRS will be developed.

- The capabilities of the new HRIS will be expanded and fully utilized.
- Outreach site HR support services will be formalized.

13.3. PROGRAM AND ADMINISTRATION UNIT

13.3.1. IMPLEMENTATION OF ICLARM'S HEADQUARTERS AGREEMENT WITH THE GOVERNMENT OF THE REPUBLIC OF THE PHILIPPINES

ICLARM Staff : Projects and Administration Staff

Duration : Fully operational by first quarter of 1997

Objective

For ICLARM to fully enjoy the benefits and privileges as contained in the Headquarters Agreement.

Background and Justification

On 22 April 1993, ICLARM became an international organization with international juridical personality, with the signing of the "Agreement to Constitute the International Center for Living Aquatic Resources Management (ICLARM) as an International Organization". On 28 November 1995, the "Headquarters Agreement between ICLARM and the Philippines" was signed. This agreement established ICLARM's headquarters in the Philippines and set the conditions, facilities, privileges and immunities which the government of the Philippines shall accord ICLARM for its proper operation. This agreement was ratified by the Philippine Senate on its third and final reading on 7 October 1996. Although the ratification was the final step for the agreement to take effect, ICLARM is required to make several coordinations, representations and submissions to various Philippine government agencies, specifically the Protocol Office of the Department of Foreign Affairs, Department of Justice, Bureau of Immigration, Land Transportation Office, Bureau of Post, Bureau of Customs and Bureau of Internal Revenue, to make the agreement operational.

Expected Outputs in 1997

- Guidelines and Procedures from the Protocol Office of the Department of Foreign Affairs and other Philippine government agencies regarding visas, importations, tax exemptions, staff immunities and privileges, transport, and others.
- Information dissemination to all ICLARM staff on the various guidelines and procedures relating to the implementation of the Headquarters Agreement.

- Ongoing use of the immunities plus privileges resulting from the agreement.

13.3.2. Implementation of a Centralized Travel Management

ICLARM Staff : Projects and Administration Staff, Other CSD Units

Duration : Fully operational by the first quarter of 1997

Objectives

- To develop a system for buying travel tickets.
- To enhance efficiency/support while improving control and maximizing savings.

Background

ICLARM, by the very nature of its mandate, collaborates with various governments, organizations, NARS, ASIS and NGOS all over the world; as such a sizable portion of its resources is utilized for travel. In view of this, senior management would like to further improve control to maximize savings without sacrificing research undertakings/commitments. This need was stressed in the findings and recommendations of an Internally Commissioned External Review when it conducted a study on the operations of Corporate Services.

1996 Results

In October 1996, a review was made on existing practices. It was determined that the present decentralized system of purchasing travel tickets was consuming too much time of the secretaries. Additionally benefits from travel agencies such as better airfares and mileage earned that should accrue to ICLARM travelers and to the Center are not being maximized.

ICLARM's travel business is in the process of being bidded out to some travel agencies who do business with ICLARM. Presentations were made by these agencies to concerned staff. An evaluation will be made to choose a travel agency which will set up an in-plant facility in ICLARM to handle all travel requirements ranging from ticketing to airport and visa arrangements.

Expected Outputs in 1997

- Centralized purchasing of travel tickets.
- Maximization of travel benefits due the Center and ICLARM staff.
- Improvement of controls and efficiency with the establishment of an in-plant travel facility at Headquarters.

13.3.3. Fixed Assets Disposal

ICLARM Staff : Projects and Administration Staff, Other Staff

Duration : Second quarter 1997 and beyond

Objective

To maximize the recovery from unserviceable and obsolete assets.

Background

Through the years, ICLARM's fixed assets, specifically furniture and equipment, have been increasing in number and value. Likewise, old, obsolete and unserviceable properties have accumulated. There is a need for a fixed assets disposal policy to enable the Center to dispose of these assets and to maximize the recovery from them.

1996 Progress

A fixed assets manual containing policies and procedures for the accounting and monitoring of fixed assets was made and presented to the Board in the September 1996 meeting. Management was requested to draft and present for Board approval in the January 1997 meeting, a fixed assets disposal policy.

A draft policy on the fixed assets disposal is being presented in the Board papers for review and approval.

In preparation for certain fixed assets to be disposed in 1997, management has begun identifying and counting disposable fixed assets. Upon Board approval of the policy, implementing policies and procedures will be set up for actual disposal of the fixed assets to be made at the most reasonable and beneficial terms to the Center. The disposal also will make available space for other Center properties.

Expected Outputs in 1997

- Board approval of a fixed assets disposal policy
- Dissemination and implementation of the policy
- Disposal of fixed assets identified as idle and disposable
- Additional income on disposed fixed assets
- Additional space for other Center properties

13.3.4. MANUAL

ICLARM Staff : Projects and Administration Staff, Consultants

Duration : Ongoing

Objective

To operationalize an updated Projects and Administrative Services Manual covering policies, procedures and systems.

Background and Justification

The Projects and Administration Unit is responsible for the delivery of services and project information for the day-to-day operations of the Center. These various services should be delivered or accomplished immediately or within the shortest possible time. Project information should be current, accurate and readily available to concerned staff. To ensure a uniform and equitable application of these services and project information, structure, policies and procedures within the Unit and the Center should first be put in place. In November 1994, an Administrative Services Manual was produced and implemented. However, due to the growth in the number of staff both in Headquarters and Outreach and the expanding research work, the services and project information requirements have not only increased but in some cases became complex. Thus, some of the policies and procedures in the existing manual need to be updated and modified so they can be more responsive to the needs of a growing ICLARM.

1996 Results

In November 1996, Price Waterhouse (PW) was engaged to conduct an operational audit within the Projects and Administration Unit. The audit covered the following areas: Purchasing, Supplies, Travel, Transport and Grant/Project Contract monitoring. The audit is reviewing existing administrative policies within these areas,

implementation and work-flows. Recommendations on how to improve further the delivery of support and enhance the monitoring and control aspects will be submitted by PW.

The audit is ongoing and the recommendations of PW, if accepted, will be the springboard for preparing and implementing a revised Projects and Administration Manual.

Expected Outputs in 1997

- Revised Projects and Administration Manual.
- Information dissemination among ICLARM staff and implementation of the Projects and Administration Manual.

13.3.5. Operations Enhancement

ICLARM Staff : Projects and Administration Staff

Duration : Ongoing

Objective

To maximize the use of the Center's resources.

Background

Although the Projects and Administration Unit is mandated to the prompt and efficient delivery of services and project information to individual staff and other stakeholders. Prudent use therefore of the Center's resources must always be a priority. Thus, policies and procedures must be continuously reviewed; efficiency-enhancing and cost-saving measures must be implemented.

1996 Results

During the third quarter of 1996 the Projects Unit and the Administration Unit were merged to improve the delivery of project information and administrative services. Through this reorganization, streamlining of functions of Projects and Administration staff was made in purchasing, supplies, transport and documentation (visas). This brought about specific work accountabilities within the Unit. Some administrative forms were revised to better monitor expenses and assure the accurate charging of such costs.

Work-flows and procedures in transport, purchasing, and supplies were reviewed and modified. For 1997 procedures will continue to be reviewed.

Expected Outputs in 1997

- Streamlining of functions to enhance efficiency and control.
- Implementation of measures to save costs in:
    - ◊ Travel
    - ◊ Supplies
    - ◊ Transport
    - ◊ Purchasing
    - ◊ Services (photocopying/messengerial)
- Implementation of additional Project Management monitoring tools.

13.4. COMPUTER SERVICES UNIT

13.4.1. UPGRADE OF THE COMPUTER NETWORK SYSTEM

ICLARM Staff : Computer Services Unit Staff

Duration : Ongoing

Objective

To keep the ICLARM computer network technically updated.

Background and Justification

ICLARM's Computer Network System requires easy and fast access to databases and files, as the majority of its databases are being developed and shared within the network. Years of research are spent to gather data for these databases, and it is CSU's responsibility to protect these data.

Currently, several of the computer network components require upgrading for a more reliable and faster system. The main component needs include:

- *ICLARM File Server.* This file server, the first installed for ICLARM, is due for replacement. It stores the Fishbase database, data files from other programs/projects, and the E-mail system.

- *Cabling.* The present cabling is inadequately designed. A new design with a cable BACKBONE should be installed for faster network access.

- *Centralized Uninterruptible Power Supply (UPS) System* should be installed to protect the File Servers and Network Components from Power outages and dirty commercial currents.

- *E-mail System.* The present E-mail system is as old as the network. It lacks some of the features that other E-mail systems have.

- *Backup System.* The Center needs a backup system for all File Servers which can restore files much faster. We also need a mirrored system that will replicate everything on the main servers and will go online if the file servers break down.

- *Network/Local Anti Virus Protection.* An updated copy of a virus protector should be installed. This will check everything that is stored within the file server including incoming E-mail and Internet downloads.

1996 Results

In the 2nd quarter of 1996, a new tape backup system was installed together with a new backup software. The backup system is capable of backing up the ICLARM file server but very slowly (4-6 hours for the whole server). Its capacity is less than that of the present and future file servers combined.

In the 3rd quarter of 1996, a new File Server (ICLARM_YL) was installed at the extension office in the YL building (across HQ's street), allowing staff to share files and computer resources. IBM Routers were also installed at the Main and YL Offices to establish a Wide Area Network (WAN) allowing computer communications between the two offices.

In the last quarter of 1996, a new 2GB (gigabyte) hard disk was installed on the Second File Server (ICLARM2), which is solely for the use of the Information and Training group. This will free some space from the ICLARM File server. Also, our staff at Muñoz, Nueva Ecija, were provided with a Remote E-mail System that allows them to send and receive E-mail from the Main HQ and the CG centers.

Expected Outputs in 1997

- A new File Server will improve network access and provide staff with more disk storage for data.
- A redesign of the network cabling will reduce network traffic and hasten communication between file servers.
- Installation of a centralized UPS will minimize data loss and unit breakdowns due to power outages. This will also prevent database corruption caused by frequent power fluctuations and surges.
- A new E-mail system will provide better E-mail management and control, allowing staff to filter incoming and outgoing mails. It will also allow redirecting E-mail messages from one mailbox to another (e.g., from a local mailbox to a travel mailbox).
- A new backup system will enable backup of all servers and restore files much faster. It will also allow file archiving.
- Installation of a new Network Anti-Virus software will minimize data corruption due to virus infections and prevent the spread of viruses to different workstations.

13.4.2. INITIAL SUPPORT FOR ABBASSA NETWORK COMPUTER SYSTEM

ICLARM Staff : Computer Services Unit Staff

Duration : 6 months

Objective

To help in design and implementation of the (ICLARM) Abbassa Network Computer System.

Background and Justification

Accessibility of important data and fast communication between local and outreach staff is essential to efficient and speedy transfer of data. A Computer Network System for Abbassa is expected to be required for the Abbassa site activities and to assist in communication between Abbassa and stakeholders.

1996 Results

In late 1996, tentative plans were considered to provide HQ computer staff support to assist in analysis and implementation of system needs at Abbassa. The Egyptian Ministry of Agriculture supported an analysis of E-mail capabilities and took initial steps to set up preliminary communication via E-mail from and to Abbassa.

Expected Outputs in 1997

Site visit to further analyze computer system needs and the implementation of recommendations resulting from the analysis.

13.4.3. OPERATIONAL AND ONGOING COMPUTER SERVICES SUPPORT FOR STAFF

ICLARM Staff : Computer Service Unit Staff

Duration : 12 months/ongoing

Objective

To provide computer support to staff.

Background and Justification

Continuous operation of the whole ICLARM computer network, including the workstations, are vital to the Center's overall operation. The Unit's main goal is to keep the computer network continuously operational with well-maintained File Servers and Workstations, while providing hardware and software support to staff.

1996 Results

- Minimized file server and workstation downtime.
- More workstations connected to the network.
- More E-mail users.
- Upgrade of a number of workstations from DOS to Windows 95.
- Optimized use of the IVDN (Internet, Voice, and E-mail).
- Fewer 286/386 computers and more Pentium computers.
- Regular maintenance of workstations and peripherals.
- Faster response time on computer services.

Expected Outputs in 1997

- Conduct training programs on computer applications used by staff.
- Formulate policies on Network and E-mail use that will serve as guidelines for staff.
- Regularly maintain computers/workstations.
- Keep staff updated on latest technology.

14. OFFICE OF THE DEPUTY DIRECTOR GENERAL (AFRICA AND WEST ASIA)

ICLARM Staff	:	Dr. Roger Rowe (Deputy Director General), Dr. John Craig, Mr. Brian Tierney
Donors	:	Japan, World Bank, Egypt (others to be identified)
Duration	:	To be initiated in 1997

Objectives

- To manage the refurbishment of the Abbassa aquaculture facility and develop and oversee its operations as ICLARM's regional headquarters for Africa and West Asia.
- To assist the Director General and Deputy Director General (Programs) develop strategic research programs on fisheries and aquaculture having direct relevance to the African continent and West Asia.

Background and Justification

In June 1997, at the mid-term meeting of the CGIAR in Egypt, ICLARM will formally take over the management of the Central Laboratory for Aquaculture Research (CLAR) at Abbassa. CLAR was built with support from USAID in 1981 and was offered to ICLARM in February 1995.

ICLARM has taken up the challenge of managing Abbassa as a center for aquaculture research and a hub for more extensive activities in Africa and West Asia. ICLARM is guided by a mandate to undertake aquatic resources research and to improve fisheries management world-wide. ICLARM recognises the ever increasing need for Africa to address the issue of food security including the appropriate use of the continent's natural resources.

Expected Outputs in 1997

- Refurbishment of the Abbassa facility
- Inauguration of the facilities in May 1997
- Commencement of development of systematic linkages with fisheries and aquatic resources research and development institutes and agencies in Africa and West Asia.
- Development of proposals for research in such fields on fish health, integrated aquaculture and improved management of inland waters.

15. OFFICE OF THE DEPUTY DIRECTOR GENERAL (PROGRAMS)

ICLARM Staff	:	Dr. Peter Gardiner (Deputy Director General), Ms. Geraldine Gilera, Ms. Sonia Rojas
Donors	:	ICLARM core funds
Duration	:	Continuous since August 1996

Objectives

- To assist the Director General in planning, implementing, monitoring and reporting ICLARM's research and research-related programs.
- To assist in presenting ICLARM's program activities and plans to donors, members of the CGIAR and others concerned with aquatic resources research and development.

Background and Justification

Membership in the CGIAR, a ten-program operating structure, and staff activities in four continents require that ICLARM's research is managed flexibly within agreed plans and goals. Major emphasis will be the completion of the Center's program plan for the period 1998-2000. The uptake of the Abbassa facility in Egypt increases the potential scope of ICLARM's research program in Africa and West Asia; detailed planning and program initiation will take place in 1997. Interactive review processes of program performance and impact assessment will be implemented. The Office of the DDG for Programs continues to assist the flow of information, research reports and proposals among Program Leaders, institute management and external stakeholders.

Expected Outputs in 1997

- Consolidated program contributions to ICLARM's Medium-Term Plan 1998-2000.
- Planning and initiation of programs at Abbassa in Egypt, commencing with a new program in fish health.
- Assistance to programs in identifying and presenting new research proposals.
- Convening internally commissioned external reviews of ICLARM's program structure (May 1997) and Integrated Aquaculture-Agriculture Systems Program (August 1997) and in-house review of ICLARM's scientific programs (October 1997).
- Initiation (with all senior staff) of a new strategic plan, built on the base of the 1992 ICLARM strategy.

16. OFFICE OF THE DIRECTOR GENERAL

ICLARM Staff	:	Dr. Meryl J. Williams (Director General), Ms. Josephine Z. Hernandez, Ms. Annabelle M. Ramirez
Donors	:	ICLARM core funds
Duration	:	Continuous

Objectives

- 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

As the only IARC concerned with fisheries research, ICLARM is seeking to increase funding that will enable the Center to expand its research agenda through establishing a major research facility at Abbassa in Egypt to facilitate outreach on the African continent. The Director General will be working closely with new senior staff at Abbassa to get African research partnerships established and the facility adequately funded. A further significant commitment is to progress planning for a new Philippine-based headquarters site. The staff of the Office of the DG support the Director General in carrying out her objectives on a day-to-day basis. Major attributes of these staff are the need to be efficient and flexible in meeting a complex and changeable schedule in a pressured atmosphere.

Expected Outputs in 1997

Lead the Center in the production of:

- The 1998-2000 Medium-Term Plan;
- Consolidation of the new Executive Management Team and recruitment and orientation of one new senior staff;
- Completion of establishments review/job evaluation/competency model development, especially for NRS staff (April 1997);
- Set of core values and a staff code of conduct (by September 1997);
- Plan for the next ICLARM External (CGIAR) Program and Management Review, including a rolling plan of internationally commissioned reviews;
- Successful selection and planning for a new ICLARM headquarters site in the Philippines;
- Development of a CGIAR coastal area environment initiative;
- Initiation of a Center-wide research project to focus all scientific disciplines and skills on a critical common issue (by September 1997); and
- Initiation of a new ICLARM strategic plan, built on the base of the 1992 ICLARM strategy.

GLOSSARY

ABee	Software for estimating coefficients of length-weight relationship
ACIAR	Australian Centre for International Agricultural Research
ACP	African, Caribbean and Pacific
ADB	Asian Development Bank
AE	Aquatic environments
AFS	American Fisheries Society
AFSRE	Association of Farming Systems Research and Extension
AFSSRN	Asian Fisheries Social Science Research Network
AIT	Asian Institute of Technology
AKVAFORSK	Institute of Aquaculture Research of Norway
ALCOM	Aquaculture for Local Community Development
APAARI	Asia-Pacific Association of Agricultural Research Institutions
ARI	Advanced research institutes
ASFA	Aquatic Sciences and Fisheries Abstracts
ASFIS	Aquatic Sciences and Fisheries Information System
AUXIM	Auximetric grid analysis
BRAC	Bangladesh Rural Advancement Committee
BFAR	Bureau of Fisheries and Aquatic Resources
BMZ/GTZ	Bundesministerium für Wirstchaftliche Zusammenarbeit/ Deutsche Gesellschaft für Technische Zusammenarbeit, GmbH
BVI	British Virgin Islands
CAC	Coastal Aquaculture Centre
CARICOM	Caribbean Community
CARITAS	An international charitable organization working in various public sectors
CFPQ	Community Forestry Project Quirino
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical (Cali, Colombia)
CLSU	Central Luzon State University (Philippines)
CP	Conference Proceedings
CRIFI	Central Research Institute for Fisheries (Indonesia)
CRM	Coastal resources management
CTU	Cantho University
DA	Department of Agriculture
DANIDA	Danish International Development Agency
DEGITA	Dissemination and Evaluation of Genetically Improved Tilapia in Asia
DENR	Department of Environment and Natural Resources
DA	Department of Agriculture
DMC	Developing member-country
DO	Dissolved oxygen
DOF	Department of Fisheries
EPOMEX	Program of Ecology, Fisheries and Oceanography of the Gulf of Mexico
ES	Education Series
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union

FAC/CLSU	Freshwater Aquaculture Center of the Central Luzon State University
FAO	Food and Agriculture Organization
FARM	Farmer-centered Agricultural Resource Management
FFI	Fauna and Flora International
GBRMPA	Great Barrier Reef Marine Park Authority
GCRMN	Global Coral Reef Monitoring Network
GHK	University of Kassel (Germany)
GIFT	Genetic Improvement of Farmed Tilapias
GIS	Geographical Information System
GLOBEC	Global Ocean Ecosystems Dynamics
GOB	Government of Bangladesh
HAKI	Fish Culture Research Institute
IAA	Integrated agriculture-aquaculture
IAMSLIC	International Association of Aquatic and Marine Science Libraries and Information Centers
IBSRAM-PACIFICLAND	International Board for Soil Research and Management (a network on sustainable land management and agriculture in small islands in the South Pacific)
ICRI	International Coral Reef Initiative
ICRAF	International Center for Research on Agroforestry
IFAD	International Fund for Agricultural Development
IIRR	International Institute for Rural Reconstruction
IFM	Institute of Fisheries Management and Coastal Community Development
IFPRI	International Food Policy Research Institute
IFSTCU	Inland Fisheries Sector Technical Coordination Unit
IIMI	International Irrigation Management Institute
ISTA	International Symposium on Tilapias in Aquaculture
IMOF	Improved Management of Openwater Fisheries
INGA	International Network on Genetics in Aquaculture
IRM	Integrated resources management
IUCN	World Conservation Union
IYOR	International Year of the Reef
JCU	James Cook University (Australia)
KfW	Kreditarstalt für Wiederaufbau (Frankfurt, Germany)
KU	Kasetsart University (Thailand)
LFSA	Length-frequency stock assessment
LGA	Local Government Academy
LGU	Local government unit
LME	Large marine ecosystem
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
MOFL	Ministry of Fisheries and Livestock
MOU	Memorandum of Understanding
MPA	Marine protected area
MFR	Marine fishery reserves

MRAG	Marine Resources Assessment Group
MRC	Mekong River Commission
MTP	Medium-term Plan
NACA	Network of Aquaculture Centers in Asia
NARS	National aquatic research systems
NCAR	National Center for Atmospheric Research
NCICM	National Course on Integrated Coastal Management
NFFTRC	National Freshwater Fisheries Technology Research Center
NFMP	New Fisheries Management Policy
NGO	Nongovernment organization
NORAGRIC/NORAD	Norwegian Center for International Agricultural Development
NSC	North Sea Centre
NTAS	Network of Tropical Aquaculture Scientists
NTFS	Network of Tropical Fisheries Scientists
NTPICM	National Training Program on Integrated Coastal Management
ODA	Overseas Development Administration
PISCES	Population Interdependencies in the South China Sea Ecosystems
PCAMRD	Philippine Council for Aquatic and Marine Research and Development
PME	Participatory monitoring and evaluation
PO	People's organization
PRA	Participatory rural appraisal
PRIA	Policy research and impact assessment
PSU	Prince of Songkla University (Thailand)
RIA	Research Institute for Aquaculture
RIMF	Research Institute for Marine Fisheries (Indonesia)
RAMP	Rapid Assessment of Management Parameters
RESTORE	Research Tool for Natural Resource Management, Monitoring and Evaluation
RETA	Regional Technical Assistance
RVAU	Royal Veterinary and Agricultural University
SEAFDEC/AQD	Southeast Asian Fisheries Development Center - Aquaculture Department
SEARCA	Southeast Asian Ministers of Education Organization - Regional Center for Graduate Study and Research in Agriculture
SACCAR	Southern African Center for Cooperation in Agricultural Research and Training
SADC	Southern African Development Community
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SAS	Statistical analysis software
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture (Philippines)
SFIS	Selective Fisheries Information Service
SIDA	Swedish International Development Agency
SIFR	Strategy on International Fisheries Research
SPACC	Small pelagics and climate change
SR	Studies and Reviews
STELLA	Modeling software distributed by High Performance Systems, Inc.

TAPP	Technical Assistance Project Proforma
TNA	Training needs analysis
TNC	The Nature Conservancy
TR	Technical Reports
UCore	Unrestricted core
UM	Universiti Malaya (Malaysia)
UNDP/SEED	United Nations Development Programme/Sustainable Energy and Environment Division
UNDIP	Universitas Diponegro (Indonesia)
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPLB	University of the Philippines at Los Baños
UPM	Universiti Pertanian Malaysia
UPV	University of the Philippines in the Visayas
USAID	United States Agency for International Development
UWI	University of the West Indies
WCMC	World Conservation Monitoring Center
ZDNP	Zimbabwean Department of National Parks and Wildlife Management

MORE ABOUT ICLARM

Our commitment:

ICLARM is committed to improving the well-being and livelihood of present and future generations of poor people in developing countries.

We aim for:
- poverty eradication;
- a healthier, better nourished human family;
- reduced pressure on fragile natural resources; and
- people-centered policies for sustainable development.

A way to achieve this:

We achieve this by undertaking, facilitating and disseminating scientific research to improve the production, management and conservation of aquatic resources such as fish. The research thrusts are:
- improving productivity;
- protecting the environment;
- saving biodiversity;
- improving policies; and
- strengthening national programs.

We believe this work will be most successful when undertaken in partnership with national government and nongovernment institutions and with the participation of the users of the research results.

The guiding principles for research are:
- sustainability;
- equity;
- gender role in development;
- participation;
- systems approach; and
- anticipatory research.

The values of our work are:
- excellence in achievement;
- relevance to our beneficiaries' needs;
- partnerships;
- centerwide teamwork;
- communication;
- efficiency and flexibility in program delivery; and
- continual growth in our knowledge and understanding.

International links:

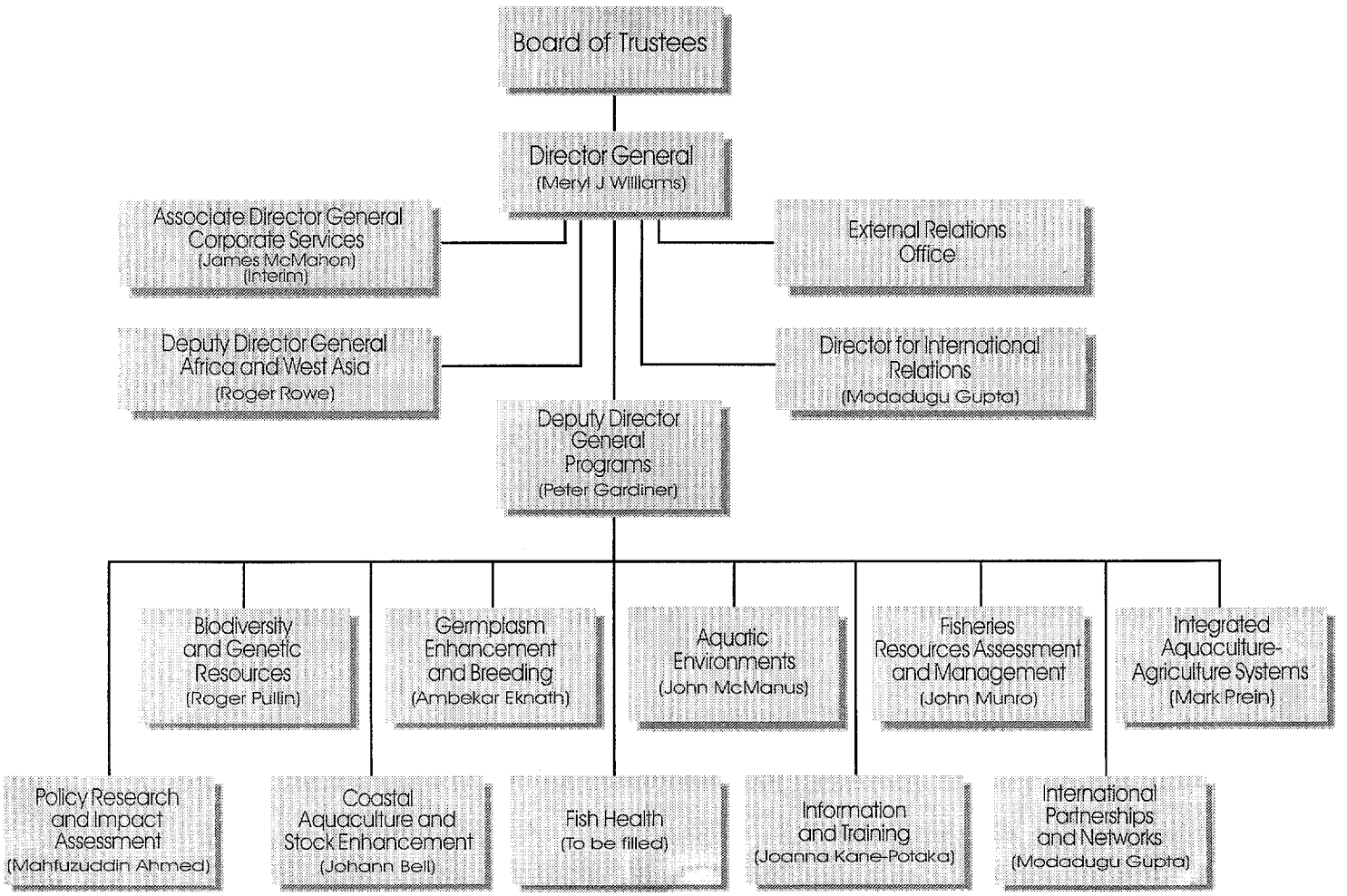
ICLARM has its headquarters in the Philippines and research sites in Malawi, Solomon Islands, Bangladesh and Egypt. We also have outposted officers in Denmark, the Caribbean, Canada and France.

In 1992 ICLARM joined the CGIAR (Consultative Group on International Agricultural Research) which is under the umbrella of four co-sponsors - the FAO (Food and Agricultural Organization), World Bank, UNDP (United Nations Development Program) and UNEP (UN Environment Program).

ICLARM's corporate makeup:

ICLARM is an autonomous, nongovernment, nonprofit organization, established as an international center in 1977 with its headquarters in the Philippines. ICLARM is an operational entity with programs funded by grants from private foundations and governments.

ICLARM is governed by an international Board of Trustees and policies are implemented by the Director General. There are 66 scientific (internal, regional and national) and technical staff, and 85 support staff from 12 countries.



BOARD OF TRUSTEES, 1997

Dr. Kurt Peters
Chair
Faculty for Agriculture and Horticulture
Institute for Applied Animal Sciences
Humboldt University of Berlin
Berlin, Germany
Board Member since April 1995
Board Chair commencing January 1997

Dr. John Dillon
Vice Chair
Department of Agricultural
and Resource Economics
University of New England
Armidale, Australia
Board Member since July 1993
Board Chair from July 1993 to January 1997
Vice Chair commencing January 1997

Ms. Ellen Bortei-Doku Aryeetey
Research Fellow
Institute of Statistical, Social
and Economic Research
University of Ghana
Board Member commencing 1997

Dr. Nyle Brady
Arizona, USA
Board Member since 1992

Dr. Masaru Fujiya
Tokyo, Japan
Board Member since 1992

Ms. Joan Joshi
Maryland, U.S.A.
Board Member commencing 1997

Ms. Nyawira Muthiga
Regional Biodiversity Coordinator
Kenya Wildlife Service
Board Member since 1996

Dr. Mohamed Shariff
Professor, Faculty of Fisheries and Marine
Science
Universiti Pertanian Malaysia
Board Member since 1994

Dr. Aprilani Soegiarto
Research Professor
Center for Research and Development
in Oceanology
Indonesian Institute of Sciences (LIPI)
Board Member commencing 1997

Dr. Salvador Escudero III (ex-officio)
Secretary
Philippine Department of Agriculture
Board Member since 1996

Dr. Serge Garcia (ex-officio)
Director
Fishery Resources and Environment
Division
FAO, Rome
Board Member since 1993

Dr. Meryl J. Williams (ex-officio)
Director General of ICLARM since 1994

ICLARM

OUTPOSTED OFFICERS

Denmark:
North Sea Centre

France:
University of Perpignan

Canada:
University of
British Columbia

Caribbean

RESEARCH SITES

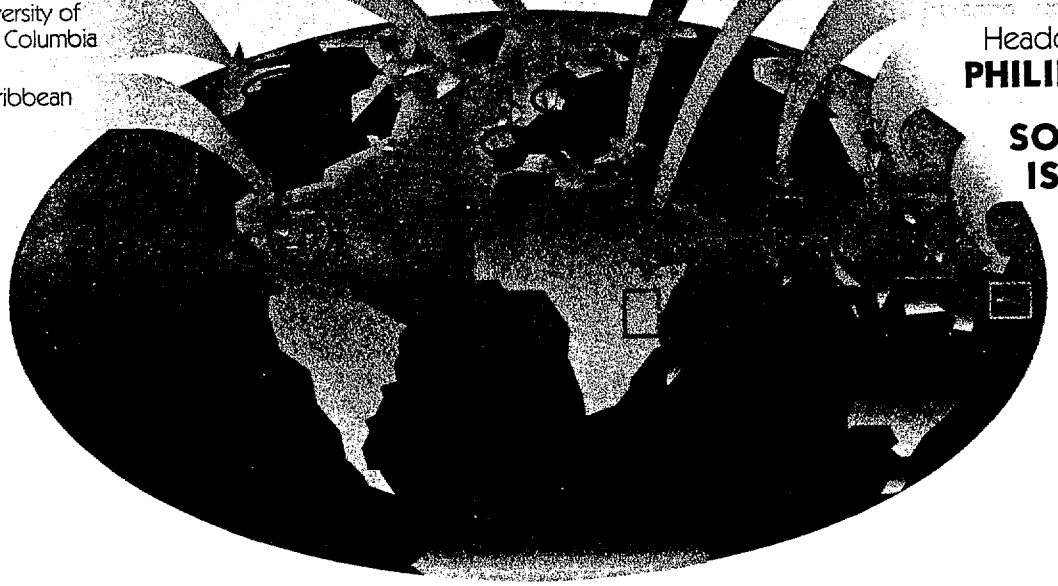
EGYPT

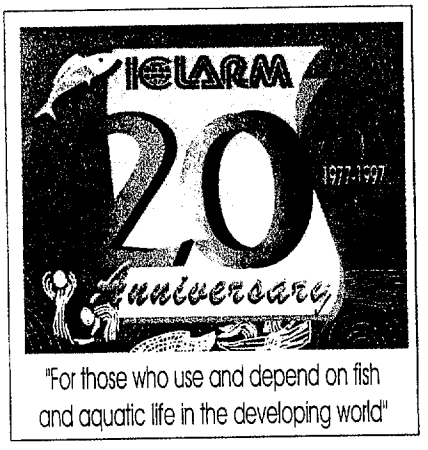
MALAWI

BANGLADESH

Headquarters
PHILIPPINES

SOLOMON ISLANDS





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

EGYPT
PO Box 2416 Cairo, Egypt
1st Floor, 15 G Radwan Ibn El Tabib St. Giza, Egypt
Tel.: (202) 5724358, 5725785, 5735829 ext 21
Fax: (202) 5728099
E-mail: ICLARMCA@intouch.com

MALAWI
PO Box 229 Zomba, Malawi
Tel.: (265) 531-274, 531-215
Fax: (265) 522-733
E-mail: rbrummet@unima.wn.apc.org

BANGLADESH
House 20, Road 9/A Dhanmondi
R/A, Dhaka 1209 Bangladesh
Tel.: (880-2) 812466, 817345
Fax: (880-2) 817345
E-mail: tripathi@dhaka.agni.com

SOLOMON ISLANDS
Coastal Aquaculture Centre
PO Box 438 Honiara, Solomon Islands
Tel.: (677) 20255
Fax: (677) 22130
E-mail: ICLARM@welkam.solomon.com.sb

Headquarters
PHILIPPINES
ICLARM,MCPO Box 2631, 0718 Makati City, Philippines
205 Salcedo St. Legaspi Village, Makati City, Philippines
Tel.: (632) 812-8641, 818-9283, 818-0466, 817-5163, 817-5255
Fax: (632) 816-3183
E-mail: ICLARM@cgnet.com
Visit our home page on http://www.cgiar.org/iclarm/