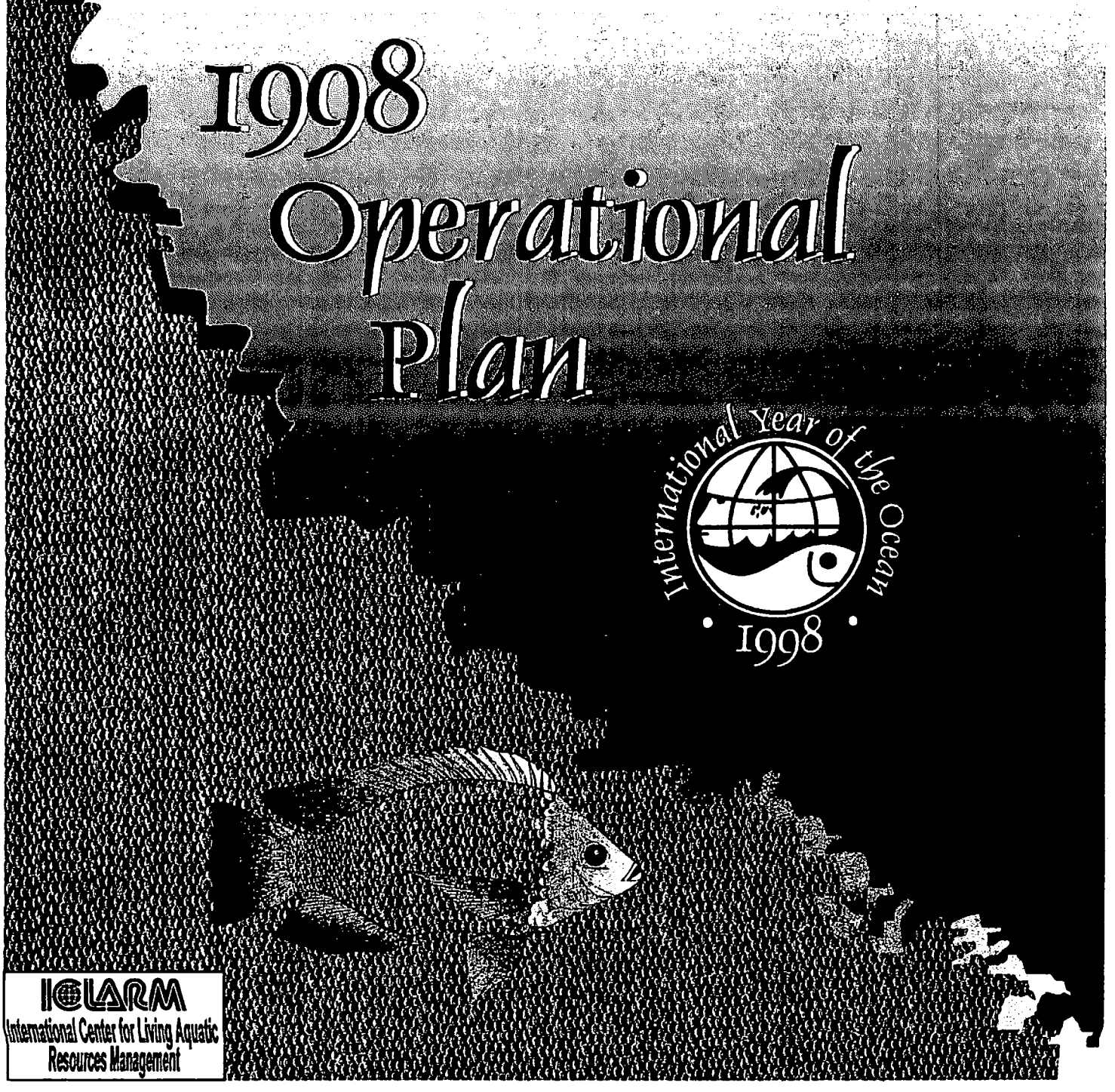
ICLARM

1998 Operational Plan



ICLARM
International Center for Living Aquatic Resources Management

ICLARM

International Center for Living Aquatic
Resources Management

Our Commitment : to improve the well-being and livelihood of present and future generations of poor people in developing countries.

A Way to Achieve This : by undertaking, facilitating and disseminating scientific research to improve the production, management and conservation of aquatic resources such as fish.

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.

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 by directly helping those who are presently disadvantaged or by allowing equal access to use of new information 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 the ultimate beneficiaries, 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.

with respect to the new initiative in Egypt) will be promoted in conjunction with the Deputy Director General (Africa and West Asia) and other colleagues. A special responsibility in 1998 is the development of ICLARM's new strategic plan looking beyond the year 2000.

15. Office of the 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 the Deputy Director General (Programs), Deputy Director General (Africa and West Asia), Associate Director General (Corporate Services) and Director of International Relations. External relations, including donor relations, are also included in the executive team.

Major challenges in 1998 will be the preparation and conduct of ICLARM's quinquenial external program and management review. ICLARM is still seeking to select a new headquarters site. Continued efforts will be made for the successful incorporation of the new Egyptian facilities and its African and West Asian research program into ICLARM. Priority will be given to efforts to resource the Medium-term Plan fully, and to the stronger development of research partnerships under it.

Management, which is seeking methods to utilize irrigated water to support aquatic biota. The Center's experiences in fisheries co-management are contributed to the System-wide Initiative on Common Property. ICLARM has also participated in the CGIAR Gender Program and has received support for the promotion of its work on women in fisheries in Bangladesh.

11. External Relations Office. This office was created in 1996 to help management and staff with fund-raising and with CGIAR and donor relations. Its plans for 1998 include development of a donor strategy to guide the Center in maintaining and, where possible, increasing the amount of unrestricted funds; assistance to staff with project development and donor negotiations to increase the flow of project-related funding to the Center; timely compliance with the CGIAR program planning documents; 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.

12. Corporate Services Division. The 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.

A new appointment of a full-time Associate Director General (Corporate Services) was made on January 1998. The division intends to focus its efforts in 1998 on the continued development and implementation of management systems that would have a significant impact on the Center's efficiency, effectivity and accountability. Priorities for 1998 include improved financial management and budget preparation; finalization of a new accounting system (Platinum); continued development of human resources policies and procedures; improved centerwide systems and telecommunications support; and administrative and operational enhancements. The office of the ADG (Corporate Services) provides support for the functioning of the ICLARM Board of Trustees.

13. Office of the 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 in 1998 for the infrastructure 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.

14. Office of the 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. The office helps coordinate the development of ICLARM's rolling Medium-term Plans and convenes the internally commissioned external reviews of ICLARM's scientific programs. New project development is carried out with the Research Committee and new activities (especially

9. International Partnerships and Networks Program. ICLARM almost invariably works with and through national programs in all aspects of its work, even where it has its own research facility as is the case in the Solomon Islands and Abbassa in Egypt. This brings ICLARM into close interaction with an enormous range of partners. The role of this program is to strengthen existing collaborations and develop new partnerships with NARS, developing countries, and regional and international organizations in research-related activities through collaborative programs and networking.

In 1997, contacts and visits were made to national fisheries institutions in Cambodia, Vietnam, Botswana, Uganda and Kenya. Efforts to strengthen and enhance ICLARM's contacts and research partnerships with Philippine institutions were also continued through workshops with senior scientists. At the regional level, meetings continue to be held with agencies such as: Network of Aquaculture Centres in Asia-Pacific, Mekong River Commission, Asia-Pacific Association of Agricultural Research Institutes and Southern African Centre for Cooperation in Agricultural Research and Training. The program interacts with international bodies, other members of the Consultative Group on International Agricultural Research, such as International Rice Research Institute, International Service for National Agricultural Research and International Centre for Research in Agroforestry, and advanced scientific institutions including FAO, International Atomic Energy Agency, Institute of Aquaculture Research of Norway and Strategy for International Fisheries Research. The program helps in identifying projects for collaboration and in developing proposals, e.g., the International Development Research Centre-supported project for the characterization and documentation of tilapia genetic resources in Africa, which is being implemented in Côte de Ivoire, Egypt, Ghana and Malawi.

The program is also responsible for the coordination of INGA in 13 member-countries in Africa, Asia and the Pacific. The Project Coordinator's links with the program development activities of the Germplasm Enhancement and Breeding Program were instrumental in the development of workshops in India and Malawi to initiate collaborative research. In 1998, the INGA network plans to organize a training course on the application of quantitative genetics to aquaculture to enhance the research capabilities of national aquatic research systems and INGA member-countries.

Another activity is the coordination of the Asian Fisheries Social Science Research Network (AFSSRN) and two information networks, the Network of Tropical Fisheries Scientists (NTFS) and the Network of Tropical Aquaculture Scientists (NTAS), for which a newsletter information series and contact-making are provided.

10. System-wide Initiatives. The CGIAR conducts several programs on subjects which include several of the centers. Two of ICLARM's contributions (through the provision of a chairperson in 1997) are to SGRP and SINGER. ICLARM is also contributing informally to the development of the System-wide Initiative on Water

On the contributions of fisheries to food security, analysis will continue for the strengthening of the institutional capacity for sustainable aquaculture development in southern parts of Vietnam and for the assessment of the supply of milkfish (*bangus*) fry in the Philippines. In 1997, ICLARM organized an international consultation in collaboration with the International Food Policy Research Institute (IFPRI) and the North Sea Centre on fisheries policy research in developing countries to evaluate the issues and priorities in this field. The proceedings of this major workshop are being prepared. A policy brief summarizing the discussion on the policy research issues and recommendations has been published jointly with IFPRI and IFM. The recommendations will be used for the development of ICLARM's policy research over the next few years. ICLARM is developing a database for the assessment of developing country fisheries and will work with IFPRI to introduce fish into the world food model.

8. Information and Training Program. The program has a critical role in the continued existence of ICLARM and its success in its mission, through the dissemination of the results of research and by raising public awareness of our mandate and activities. Traditional sources of funding for ICLARM and the other CGIAR centers have become more difficult to access. This emphasizes the need for a clear identification of the impact of our research and the people who benefit from it. More widespread dissemination of ICLARM's work will contribute to a greater impact from the research while the marketing of ICLARM's mandate will promote an understanding of the need for this research.

In 1997, ICLARM produced 31 publications (scientific reports and public awareness and corporate outputs) and copyedited and cleared 81 contributions (to international and regional scientific journals and internal and external publications).

The Library and Information Services Unit operates and updates five databases, which had a total of 47,059 entries as of December 1997. During 1997, 457 queries from 79 countries were answered, 66% of these being from developing countries. Demonstrations on the use of information databases, online searches and library orientation were provided to 541 users/visitors. The Unit had an exchange agreement with 135 libraries and institutions. Services and inputs to other libraries and international databases were also provided.

In 1998, the program will develop projects and lobby for funding for the first time and will continue to integrate its activities more closely into ICLARM's research projects. The program will be a major contributor in developing ICLARM's donor strategy. In tandem with this, it will formulate a public awareness strategy focused on the development assistance community to enhance ICLARM's profile and chances of success.

Training has been conducted in conjunction with different research activities in the past. In 1998, the Program will focus on determining the role training should play in ICLARM's future work and how it should be formally incorporated into our activities.

Work will continue in monitoring the effects of the implementation of marine protected areas (MPA): (1) for coral reef fish in two sites in the Caribbean; and (2) for invertebrate species in the Solomon Islands. Results in 1997 have shown that light traps are efficient means of monitoring recruitment and residents in MPA in Discovery Bay in Jamaica and sites in the British Virgin Islands. Tagging and release experiments on some species of coral reef fish have shown that they can travel distances of several kilometers beyond the boundaries of MPA. There was little evidence after three years of closure of MPA of an increasing number of invertebrate species, with the exception of trochus. This is much as expected and monitoring will continue for a further three-year period to properly evaluate the effects of the implementation of MPA.

In 1998, the program will begin a project to analyze existing trawl data from several countries in South and Southeast Asia to determine more precisely the current status and dynamics of coastal fish stocks in the region. This follows from a workshop held in 1997 on the status and management of tropical coastal fisheries in Asia, which served as an initiation meeting for the project. An integral part of the new project will be the development of TrawlBase, a new software for the accumulation, storage and analysis of trawl data.

7. Policy Research and Impact Assessment Program. The program aims to improve policies to ensure that benefits of improved management of aquatic resources and increased aquatic production go to the sector of society which needs it the most, and to help increase and sustain aquatic output in developing countries by providing proper measures for assessing the impact of biophysical research. The program is grouped under three major activities: (1) ecological economics for sustainable use of aquatic resources; (2) impact of aquatic resources research methods and assessment; and (3) policy analysis in the contribution of fisheries to food security.

In 1997, the Co-management Project published its findings on rapid appraisal approaches to valuation; a review and evaluation of Philippine community-based management projects for the decade 1984-1995; an analysis of the role of government in fisheries co-management; as well as factors contributing to the success of community-based coastal resources management. The project continues with a number of case studies in Asian and African countries, among which are analyses of different fisheries systems in the Philippines, Indonesia and Bangladesh. The ecological valuation subproject will be enhanced in 1998 by work on the evaluation of coral reef systems in the Philippines and the valuation of the use of wetlands in Indo-China countries, in tandem with an analysis of legal and institutional implications for their management.

Impact research has focused on socioeconomic and environmental impacts of improved tilapia germplasm in Asian countries. The Dissemination and Evaluation of Genetically Improved Tilapia Species in Asia Project report was successfully completed in 1997. Work with Australian collaborators will concentrate on analysis of the impacts of ICLARM's giant clam research.

1997, the program released ReefBase 2.0 with information on over 7,000 coral reefs. ReefBase served as the major source of information for the State of the Reefs Report, the primary background document for the International Coral Reef Initiative (ICRI) Global Workshop. ReefBase is the official database of the Global Coral Reef Monitoring Network and directly addresses priority actions of ICRI, now endorsed by 80 governments. Current activities include the development of capacity for the utilization of remote sensing of coral reef parameters, the design and promulgation of reef evaluation methods, and the accumulation of socioeconomic and management parameters.

The PISCES project aims to determine the importance of pelagic transport of reef species in maintaining the biodiversity and fisheries of reefs in the South China Sea. In 1997, a small laboratory was developed at ICLARM, Manila, for the isoenzyme analysis of four target coral reef species, *Heiniochus acuminatus*, *Dascyllus trimaculatus*, *Thallasoma hardwickii, Linckia laevegata*. Work will continue in 1998, in partnership with research institutes in Malaysia, Indonesia, Taiwan, Vietnam, the Philippines and ICLARM's CAC in the Solomon Islands.

ICLARM has currently reduced its work in coastal zone management but contributes to the national training program on integrated coastal management. A United Nations Development Programme (UNDP) accredited training manual will be finalized in 1998. ICLARM will convene a workshop on its future involvement in integrated coastal zone management.

6. Fisheries Resources Assessment and Management Program. The program develops methods and means of analysis for tropical fish stock assessment and management, the role of marine reserves in fisheries management and biodiversity conservation, and in developing methods for acquiring data for aquatic resources management. In collaboration with FAO and other partners, ICLARM has developed stock assessment tools to increase the understanding of the dynamics of exploited tropical fish communities and to develop stock assessment methods which are straightforward and readily applicable to these areas, such as the FiSAT reference manual and a new version of the ABee software for the estimation of length-weight coefficients. The new versions of yield-per-recruit and auximetric grid analyses of growth parameters (AUXIMS) software modules have been developed and incorporated into FishBase 1997. The major activity of the program in 1997, to be continued in 1998, was the modelling of multispecies fisheries. This has been done through the development of an ecosystem modelling tool called Ecopath, which is being developed in collaboration with the Fisheries Centre, University of British Columbia, Canada. Two new modules, EcoSim and EcoSpace, have been integrated into the Ecopath package. They allow for dynamic simulation of the state of fisheries ecosystems and formatting of the distribution of fisheries groups across two-dimensional space for any fishery. The beta version of Ecopath with EcoSim will be developed and utilized for training courses in both developed and developing countries in 1998.

This approach is similar to the development of aquaculture research projects at the farming community level.

4. Coastal Aquaculture and Stock Enhancement Program. The objectives of this program are the development of sustainable farming methods for valuable marine resources and the improvement of fisheries production through the release of hatchery-bred juvenile organisms. In 1997, the work focused on giant clams, black-lip pearl oysters, and research on the husbandry and ecology of the sea cucumber species *Holothuria scabra.* Results in 1997 included the demonstration that *Tridacna derasa* was the most appropriate clam species for the development of a meat trade for the Solomon Islands. The systems have been provided to a Solomon Islander to develop a hatchery for *T. derasa* and other species, such as *T. crocea*, that are demanded by the marine aquarium trade. The hatchery will supply ICLARM's contact farmers who are engaged in growout operations. A project on the collection of wild spat of the black-lip pearl oyster and the optimization of growout and pearl setting procedures has been completed. The successful spawning trials of the sea cucumber *H. scabra* have been completed in the nursery tanks at ICLARM's Coastal Aquaculture Centre in the Solomon Islands. An ecological evaluation of the behavior of sandfish is being conducted so that the release of hatchery-reared juveniles for the enhancement of wild stocks can be optimized.

In 1998, ICLARM will continue to promote the development of giant clam farming and marketing in the Solomon Islands as a means of providing income to poor coastal farming communities and, with the Policy Research and Impact Assessment Program, conduct an impact evaluation of the Center's research on giant clams. ICLARM will promote its methods of pearl oyster farming in appropriate Pacific island countries and will extend research on sea cucumbers to white sandfish, red sandfish and other high-value species of sea cucumbers. It is anticipated that the studies will include the documentation of reproductive cycles of wild broodstock and provide life history information for juvenile sandfish in the wild. A new initiative will be the evaluation of methods for the capture and culture of high-value juvenile reef fish, to be undertaken in conjunction with Australian partners.

5. Aquatic Environments Program. The objectives of the program are the systems management of coral reef degradation, the facilitation of decisionmaking in coastal zone management and the improvement of multisectoral use of inland aquatic resource systems. In 1998, focus will be mainly on coral reefs. Existing projects include: (1) ReefBase, the development of a global database on coral reefs and their resources; (2) Population Interdependencies in the South China Sea Ecosystems (PISCES), a genetic study of the heterogeneity of target coral reef species; and (3) contributions to the national training program on integrated coastal management.

A new project involves the incorporation of CoralBase into the ReefBase CD-ROM, with automatic search linkages between the two databases. CoralBase is a compilation of biological information on the world's corals, developed at the Australian Institute of Marine Science. ICLARM's role in the activity will commence in 1999. In

research in the Philippines to African countries and to establish similar genetic enhancement schemes at ICLARM's Regional Center for Africa and West Asia in Egypt.

In 1997, the program changed leadership, and has implemented a new project sponsored by the Asian Development Bank on genetic improvement of carp species in Asia. Several species of carp are important food fish in the countries of Asia, about 20 species are extensively cultured under diverse farming systems, and there are a number of commercial traits that might be improved for each species depending on the user's perspective. The carp project is therefore a combined genetics and socioeconomic evaluation of the appropriate species, farming systems and breeding goals that will yield the highest potential impact in developing countries in regards to increased protein production, efficiency, equity, sustainability and environmental issues. The study will be implemented in Bangladesh, the People's Republic of China, India, Indonesia, Thailand and Vietnam as these countries contribute more than 90% of the world's production of carp. Expected outputs in 1998 include an *ex-ante* assessment of potential impact of carp genetic research and a book including a report on the carp genetic resources of Asia. Similarly, the status of carp genetic improvement programs in Asia will be documented and research work will begin on carp genetics research in Bangladesh, China, India, Indonesia, Thailand and Vietnam.

The work of this program also contributes to activities of ICLARM's International Network on Genetics in Aquaculture (INGA).

3. Integrated Aquaculture-Agriculture Systems Program. So far, the activities of the program have been focused on the improvement of small farm productivity through the introduction of multi-use waterbodies. The program has examined the introduction of aquaculture into farming systems in: (1) Bangladesh, a country with abundant rainfall and a great variety of waterbodies that can be used for aquaculture; (2) Malawi, a semi-arid country in Southern Africa dependent upon seasonal rainfall; and (3) the Philippines, where the project site seeks to combine aquaculture with forest buffer zone management in the highlands. Research at these sites is linked to the development of a software package called RESTORE (Research Tool for Natural Resource Management, Monitoring and Evaluation). At each site, the integration and uptake of aquaculture is supported by biological research and the adaptation of aquaculture systems to suit the conditions of these countries.

As a result of a review in late 1997, the program will develop new strategic research in inland aquatic resource systems above the farm level. These systems include reservoirs, small lakes, flood plains and waste waters. A new project for increasing and sustaining the productivity of fish and rice in the floodplain ecosystems of South and Southeast Asia has already been initiated in Bangladesh and Vietnam. The objectives are to: analyze alternative resource management strategies in floodplain ecosystems; study participatory development and viable income generating options and their field validation; identify viable community-based mechanisms to secure target group access to waterbodies, an adequate provision of inputs and access to markets.

1. Biodiversity and Genetic Resources Program. This program 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, nongovernmental organizations, scientists, farmers and fishers. The BGRP contributes to the meetings of the Convention on Biological Diversity (CBD), including its Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), to the Global Biodiversity Fora (GBF) that are held in conjunction with CBD meetings and to the Species 2000 Initiative. The program collaborates with international organizations concerned with the sustainable use and conservation of living aquatic resources, including the Food and Agriculture Organization of the United Nations (FAO) and the World Conservation Union. It provides ICLARM's contributions to the CGIAR's System-wide Genetic Resources Programme (SGRP) and System-wide Information Network for Genetic Resources (SINGER). In 1998, the BGRP will organize and hold, on behalf of ICLARM and with the Rockefeller Foundation and FAO, a conference for the development of policies for the conservation and sustainable use of aquatic genetic resources.

The BGRP's largest activity is a European Union-funded project which focuses on capacity building in fisheries and biodiversity management in the national programs of 55 African, Caribbean and Pacific (ACP) countries. The project emphasizes training for establishing national fish biodiversity databases, based on the concepts implemented in FishBase (a compendium of information about the world's finfishes on CD-ROM), and the forging of regional and intraregional partnerships through electronic networking. The production of versions of FishBase in major languages other than English is also in progress.

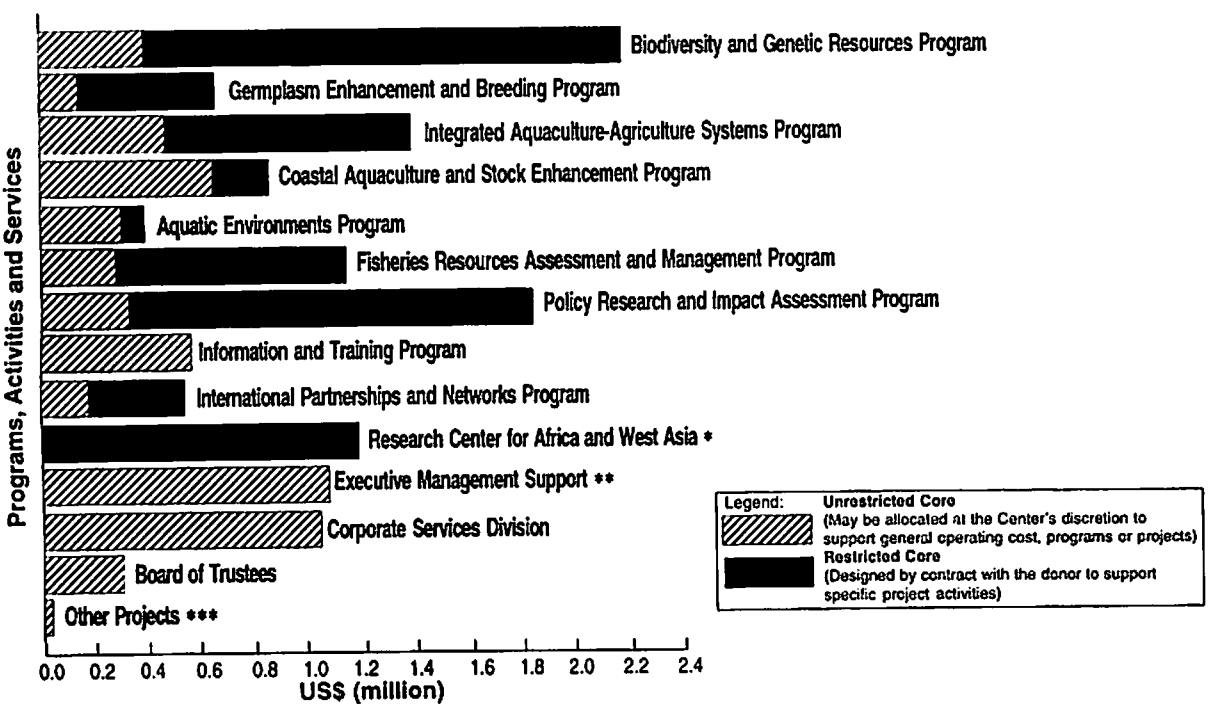
Research projects on documenting genetic resources for their sustainable use and conservation are also in progress: case studies on tilapia *(Sarotherodon melanotheron)* in the coastal lagoons and estuaries of West Africa and on an Asian carp (*Puntius gonionotus*) that is rapidly gaining popularity 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, the dissemination of these techniques and the training of staff on their use. The program focuses on carp and tilapia species which are important for aquaculture systems prevalent in developing countries.

In tilapia research, the program is winding up the successful project on genetically improved farm tilapia (GIFT) which has demonstrated the capability of improving the growth of tilapia through the development of a base strain and selective breeding. A final generation will be evaluated for the frequency of late maturing females in 1998. A foundation has been established for distribution of the improved strain in the Philippines. Plans have been developed to transfer the lessons learned from the

12. Corporate Services Office	Providing the Center's management, staff and organizational units the needed support services to carry out programs and research activities.
13. 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.
14. Office of the Deputy Director General (Programs)	Assisting the Director General in planning, implementing, monitoring and reporting ICLARM's research and related programs.
15. 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 current and potential donors.

Resource Allocation for 1998



* Funds allocated for work through the Research Center for Africa and West Asia but with no further restriction. An additional $1million restricted funding (not shown) will be used to finish the facilities upgrade.

** • Office of the Director General
• Office of the Deputy Director General (Programs)
• Office of the External Relations
• New ICLARM Headquarters Facility
• Strategic Plan
• External Programs and Management Review
• Contingency Funds

*** Support for the Asian Fisheries Society

OVERVIEW

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

Program	Focus
1. Biodiversity and Genetic Resources Program	Monitoring and conservation of aquatic biodiversity.
2. Germplasm Enhancement and Breeding Program	Improving fish breeding techniques.
3. Integrated Aquaculture-Agriculture Systems Program	Improving productivity and sustainability of small farms.
4. Coastal Aquaculture and Stock Enhancement Program	Increasing marine harvests through farming and restocking valuable aquatic species.
5. Aquatic Environments Program	Improving ecosystem health and management.
6. Fisheries Resources Assessment and Management Program	Developing tools to improve assessment and management of fish stocks.
7. Policy Research and Impact Assessment Program	Improving policy decisions by evaluating the impact of management practices and socioeconomic structures.
8. Information and Training Program	Disseminating ICLARM's research results and creating an awareness of the role of science in global fisheries issues.
9. International Partnerships and Networks Program	Strengthening collaborations through research and information networks.
Activity or Service	**Focus**
10. System-wide Initiatives	Coordinating activities with other centers within the Consultative Group on International Agricultural Research (CGIAR).
11. External Relations Office	Assisting the Director General in maintaining, developing and enhancing ICLARM's relationships with its major stakeholders.

prices. Richer consumers were not likely to change their dietary habits if prices were reduced. Few extra employment opportunities will be created by the new strain.

In 1998, ICLARM starts the first year of its new 1998-2000 Medium-term Plan. Significant developments will include the first full year of work on a six-nation Asian project to genetically improve carps, the start of a major project on the assessment of Asian tropical trawl fisheries and their management, and further development of fisheries policy research related to fisheries co-management, global fisheries supply and demand, and valuation of natural resources important to fisheries. Significant progress will be made towards the full estimation of the importance of the world's coral reefs to fisheries production; development of new initiatives in coastal aquaculture research in the Pacific; and a major startup of research in African aquaculture from the new ICLARM Research Center for Africa and West Asia in Egypt. Aware of the implications of the International Convention on Biological Diversity, ICLARM has been developing internal policies on genetic resources and, in early 1998, will lead a high-level Bellagio Conference on policy issues confronting the use of and access to aquatic genetic resources. Following a review in late 1998, ICLARM will be examining new resource systems to be utilized in addition to farm ponds for integrated aquaculture-agriculture, including small dams, reservoirs and irrigation systems. ICLARM continues to develop its leading edge capacity in fisheries ecosystem modelling and, in collaboration with partners at the University of British Columbia, is pursuing spatial and stochastic elements to the Ecopath model. In 1998, ICLARM commences new planning efforts to determine the most appropriate directions for its research in integrated coastal resources management.

In 1998, ICLARM will have the opportunity to present its work and the impacts of its work to the scrutiny of its External Program and Management Review by the Consultative Group on International Agricultural Research (CGIAR). The review will commence in September 1998. This is ICLARM's first full review since joining CGIAR, although a full external review was conducted in 1992 as part of the process of admitting ICLARM to CGIAR.

Our research is guided strongly by our Partnership Policy which was first adopted in 1996. In 1997, we adopted a Staff Code of Conduct and in 1998 we expect to complete a Researchers' Code of Conduct to give full definition to the ethical principles and practices of operating in tomorrow's world. The Researchers' Code will cover the conduct of field work and specimen collection and use, animal welfare, genetic resources policy and research involving people, their households and communities.

And finally, 1998 is also the year in which ICLARM is committed to capitalizing on the benefits of its new program structure by creating synergies through more cross-program activities. These will network scientists in our small and focused programs with those of multidisciplinary teams working on time-bound projects.

MERYL J. WILLIAMS
Director General
ICLARM

FOREWORD

The 1998 Operational Plan is dedicated to ICLARM's research partners and stakeholders who share our concerns for improving the lives of the poor in the developing countries and to enhancing the productivity and durability of the natural resource base on which such progress depends.

The year 1998 is being celebrated around the world as the International Year of the Ocean, taking up where the International Year of the Reef left off in 1997. Although 70% of our planet is covered by the oceans and half the world's population, including many of the poor, live within 200 km of the coast, mystery still surrounds the functioning of the oceans, their effects on world climate and climate change and how to conserve and wisely use their wealth. ICLARM's mandate covers an important component of the wealth of the oceans - the living resources. Only in recent years has the public spotlight been turned on the state of the world's fisheries resources, both in the oceans and in freshwaters, and how their contributions to food security for the poor are threatened. A major transition is underway.

ICLARM's current research activities, described in our fourth annual Operational Plan document, outline what we and our partners around the world are doing to provide insights and products which will help reverse the trend towards overuse of natural living aquatic resources and the degradation of aquatic environments; promote the sustainable and equitable development of aquaculture; and forestall the potential looming gap between the supply and demand for fish.

Recent studies by ICLARM have helped highlight the scientific basis of the concerns hinted at in the global fisheries production statistics compiled and published by the Food and Agriculture Organization of the United Nations. They have also analyzed the likely benefits of new aquaculture technology for fish farmers and consumers.

In 1995, an ICLARM study by Pauly and Christensen estimated that humans eventually appropriated 8% of the aquatic primary production through their harvesting of living aquatic resources. In some aquatic resource systems, the figure is as high as 35%. More recently, Pauly and other scientists at the University of British Columbia in Canada and at ICLARM showed that humans have, indeed, been 'fishing down the food web'. In most of the world's fisheries, the average trophic level (approximate position on the pyramid of who eats who) has declined as the top level predators have been depleted and often smaller, less valuable, species are now more common in the harvests.

Having worked since 1988 with its Philippine and Norwegian partners to breed faster-growing Nile tilapia, in 1997 ICLARM and its partners in the major tilapia farming countries of the world (Philippines, Bangladesh, China, Vietnam and Thailand) completed an assessment of the likely impacts of the new strain of tilapia, the GIFT (genetically improved farm tilapia) strain. The results indicate that, at all production scales, producers will be able to benefit from the new strain as it outperformed other strains grown under similar conditions, regardless of the level of inputs. Poor consumers, though not the very poorest, will benefit from the resulting decline in tilapia

ACTIVITIES AND SERVICES

CONTENTS

ICLARM 1998 OPERATIONAL PLAN

1998

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

Printed in Manila, Philippines.

ICLARM. 1998. ICLARM operational plan 1998. International
Center for Living Aquatic Resources Management,
Manila, Philippines. 153 p.

Editor: Peter R. Gardiner
Managing Editor: Joanna Kane-Potaka
Associate Editors: Rita Kapadia and Marie Sol M. Sadorra
Layout: Albert Contemprate, Ma. Graciela R. Balleras and Lourdes Hortelano
Cover design: Albert Contemprate
Indexing: Norma Jhocson

ISBN 971-8709-93-2

ICLARM Contribution No. 1431

ICLARM 1998 OPERATIONAL PLAN

International Center for Living Aquatic Resources Management

MCPO Box 2631, 0718 Makati City, Manila, Philippines
Telephones: (63-2) 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/*

THE PROGRAMS

1. BIODIVERSITY AND GENETIC RESOURCES PROGRAM (BGRP)

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. Daniel 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. Alice Laborte; Ms. Cristina V. Garilao; Ms. Christine Marie V. Casal; Ms. Grace Tolentino-Pablico; Ms. Maria Teresa G. Cruz; Mr. John Falcon.

Collaborating Institutions :

Food and Agriculture Organization of the United Nations (FAO); American Fisheries Society; California Academy of Sciences, San Francisco; British Museum, London; Ocean Voice International, Ottawa; Caribbean Community (CARICOM) Fisheries Resources Assessment and Management Program, Belize; World Conservation Monitoring Centre, Cambridge, UK; Musée Royal de l'Afrique Centrale, Tervuren; Museum National d'Histoire Naturelle, Paris; World Conservation Union, Gland, Switzerland; University of British Columbia, Vancouver, Canada; South Pacific Commission (SPC), Noumea, New Caledonia; National Marine Information and Research Centre, Swakopmund, Namibia; the national programs of 55 countries in the ACP regions; other institutions and individual researchers.

Donor : European Union (EU).

Duration : November 1996 - October 2000.

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 national 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 facilitating cooperation between national 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 national aquatic research systems' scientific and resource management staff. Accessibility of relevant information is crucial for success.

FishBase is a large biological database developed by ICLARM in collaboration with FAO and many other partners. It currently contains key information (nomenclature, morphology, trophic ecology, population dynamics, physiology, pictures, maps, etc.) for 17,600 of the estimated 25,000 species of finfish. It acts as a host to important databases that are developed by collaborators, such as FAO Catches 1950-1994, FAO Aquaculture Production 1984-1994, IUCN Red List Data, Eschmeyer's *Genera of Recent Fishes*, Myers' database of recruitment time series, Houde's LARVDYN database and many others.

FishBase forms 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 is 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

1997 Results

- FishBase 97 was released in September 1997. It covers information on 17,600 fishes drawn from over 12,000 references. The most significant improvement of this fourth release are the numerous analytical graphs covering a wide range of analytical topics.

- The project's Steering Committee had its inaugural meeting in Manila in June 1997. The committee's role is to guide and assist the project team in the course of project implementation. It decided on the setting up of the following regional training nodes: for the Pacific, the SPC in Noumea, New Caledonia; for the Caribbean, the CARICOM

Fisheries Resources Assessment and Management Program, Port of Spain, Trinidad and Tobago; and for Southern Africa, the National Marine Information and Research Centre, MFMR, Swakopmund, Namibia. All three institutions were visited by project staff in 1997 and Memoranda of Agreement were signed.

- A curriculum for two-week training courses on biodiversity and fisheries management was developed. It emphasizes three aspects: (1) importance of biodiversity in the sustainable use of living aquatic resources; (2) methods to record information on and to assess the status of biodiversity; and (3) use of information on biodiversity in ecosystem-based approaches to fisheries management. FishBase plays an important role in these training courses, both as a source of existing information and as a tool for a structured approach to research on fish biodiversity.

- The first training course organized by the project was for the Pacific region and took place in Noumea from 20 to 31 October 1997. It was attended by 13 participants from eight ACP countries: Fiji, Kiribati, Papua New Guinea, Solomon Islands, Tonga, Tuvalu, Vanuatu and Samoa. Letters of Agreement were signed with the participating ACP institutions in the region as a basis for their future collaboration with ICLARM. This included provision of the computer hardware and software necessary for further use of the tools and methods presented during the training course and assistance in the generation of scientific contributions.

- Four subcontracts were made with major museums (see collaborating institutions) to increase the inclusion of biodiversity data in FishBase. For the same purpose, a subcontract was made with Ocean Voice International, Ottawa, Canada, to include grid map analyses in the WinMap software. A subcontract was signed with IUCN to prepare region-specific reports on the status of threats to aquatic resources and to participate in all training activities of the project.

Expected Outputs in 1998

- Additional regional training nodes (East and West Africa) will be identified and made operational in terms of staff employed and equipment provided.

- Two-week training courses will be organized for ACP countries in the Caribbean region and in Southern Africa.

- A workshop will be held in Manila for training coordinators from the five regional nodes. This workshop will provide the participants with information and skills for their work as trainers and coordinators in their respective regions.

- FishBase 98 is planned for release in May 1998. It will cover 20,000 species, contain new biodiversity maps and will be linked to the Ecopath software.

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; Ms. Christine Marie V. Casal.

Collaborating Institutions :

Water Research Institute, Accra, Ghana; Zoologisches Institut und Zoologisches Museum, Universität Hamburg, Germany.

Donor : BMZ/GTZ.

Duration : March 1997 - September 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 *(S. melanotheron)* is a coastal zone species inhabiting brackishwater and freshwater lagoons and watercourses in West Africa. It ranges from Sénégal to the Democratic Republic of Congo (formerly 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 freshwaters 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 support 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 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 to evaluate fish genetic resources.

- Its populations are threatened by 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

1997 Results

- Project planning meeting of staff from all partner institutions in March, Hamburg.

- Participation in the meeting, Genetics and Aquaculture in Africa, March/April, Grand Bassam, Côte d'Ivoire, with about 50 scientists, to discuss tilapia genetics and information on *S. melanotheron.*

- Gathering of relevant literature on *S. melanotheron,* including searching grey literature in the FAO Fisheries Division Library, Rome.

- Major collections of *S. melanotheron* tissue samples from Benin, Côte d'Ivoire, Ghana, Sénégal, Sierra Leone and Togo, with Côte d'Ivoire also supplying material from a population that originated from Kouilou (Congo).

- Hemoglobin analysis for nine populations of *S. melanotheron*, ranging from Sénégal to Congo, revealed three distinct phenotypes (Sénégal, Côte d'Ivoire/Ghana and Congo). Further genetic variation was bound at α-globin chain loci, separating populations in Congo, Côte d'Ivoire, Ghana and Sénégal and two different populations from within Sénégal. Some differences were seen between populations of the same subspecies. Allozyme studies on erythrocytes supported the present classification of *S. melanotheron* subspecies.

Expected Outputs in 1998

- Further analyses of *S. melanotheron* tissue samples in hand.

- Further studies on populations of *S. melanotheron* from Côte d'Ivoire to Cameroon to elucidate variation within subspecies *S.m. melanotheron*.

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

ICLARM Staff :

Dr. Roger S.V. Pullin; Ms. Christine Marie V. Casal.

Collaborating Institution :

University of Wales, Swansea, UK.

Donor : Department for International Development, UK.

Duration : October 1997 - September 2000.

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.

- 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

P. gonionotus (Bleeker), the silver barb, is an Asian carp that is popular as a food fish, and 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 it may have been originally introduced to 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 too 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 status in terms of conservation. They can then be used for the further domestication of the species in breeding programs. There is presently very little information available on the population genetics of *P. gonionotus*; a knowledge gap which this project will contribute to filling.

Scores Against Principles

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

1997 Results

- In November, a visit was made to Indonesia to establish contacts with the Fisheries Department and the Indonesian Institute for Sciences, to which an application was made for permission to do the research.
- Primers for five microsatellite loci, developed specifically for *P. gonionotus* by Dr. Wongpathom Kamonrat (Department of Fisheries, Thailand) have been optimized for use in this study. Dr. Kamonrat has kindly consented to the use of these primers prior to their publication. In addition, a primer pair for the 5' portion of the mtDNA control region has been optimized and will be used to sequence about 400bp from this region.

Expected Outputs in 1998

- A trip to sample fish from a total of eight rivers, in Java and Sumatra, will be made in July and August, facilitated by the staff of the Zoological Museum and the Fisheries Department. Further trips to sites in Kalimantan and Sulawesi are planned for 1999.
- Primers will be designed for the ND4 and ND6 regions of mtDNA.
- Taxonomic analyses will be carried out on museum specimens of *P. gonionotus* mailed from Southeast Asia and Indonesia. Such comparisons have never been done thoroughly and there remains some doubt as to the species designation *of P. gonionotus* from these two areas.
- An image analysis based system, for morphometric analysis of specimens collected in the field, will be further developed.

1.4 Bellagio Conference: Towards Policies for Conservation and Sustainable Use of Aquatic Genetic Resources

ICLARM Staff :

Dr. Roger S.V. Pullin; Ms. Christine Marie V. Casal; Dr. Rainer Froese; Dr.

Modadugu V. Gupta; Ms. Cynthia Villaflor.

Collaborating Institution :

FAO.

Donors : FAO; Rockefeller Foundation.

Duration : 8 - 14 April 1998.

Objectives

The overall objective of the conference is to contribute towards the development of policies for the conservation and sustainable use of aquatic genetic resources, by reviewing critical policy issues and suggesting ways and means to address these.

In order to accomplish this overall objective, the conference will:

- Review and comment upon the laws and protocols (local, national, regional and international) that apply to the conservation and use of aquatic genetic resources.
- Review institutional responsibilities and roles, present and future, that apply to the conservation and use of aquatic genetic resources.
- Devise strategies to inform and to educate those concerned with the conservation and sustainable use of aquatic genetic resources, especially those tasked with the framing and implementation of policies at the international, regional, national and local levels.
- Prepare flowcharts and plans for the development of tools to assist policymakers, for example, databases and decision-support software.
- Publish and disseminate its findings in a comprehensive proceedings volume.

Background and Justification

International, regional and national policies for the conservation and sustainable use of aquatic genetic resources are urgently needed. Without such policies, fisheries will continue to decline, with increasing conflicts over diminishing stocks; aquaculture will fail to realize its potential for growth in both developed and developing countries; and much of the aquatic biodiversity, upon which the environmental health of the planet's fresh, brackish and marine waters depend, will be reduced or lost. The Convention on Biological Diversity requires the establishment of such policies for the conservation and use of aquatic ecosystems, organisms and genes.

Policymaking for aquatic biodiversity and genetic resources lags far behind that for exploited plant species and livestock. Previous consultations and mechanisms relating to aquatic genetic resources, have been convened and established mainly by fish geneticists. This conference is different. It is focused on *policy,* emphasizing the human dimensions in conservation and use scenarios and the legal, political, ethical and economic issues that must be faced.

Some of the policy issues for aquatic genetic resources are similar in scope to those for terrestrial plants and livestock, including legislation,

institutional responsibilities and roles, ownership and access, intellectual property rights, farmers' and breeders' rights, users' perspectives (from indigenous peoples and from the public and private sectors), biosafety introductions and transfers of aquatic organisms and the pros and cons of using genetically modified aquatic organisms. However, the connectivity of aquatic systems and the common property aspects of fisheries and some of the resources used for aquaculture mean that there are policy issues that have special characteristics and importance in the aquatic realm. Aquatic biota and habitats are extremely vulnerable to change from human interventions. Such changes are often irreversible, and may have consequences beyond national and other boundaries. Equity issues, including intergenerational equity, have been little considered for aquatic genetic resources. This conference will explore these issues and the possibilities for developing tools to assist policymakers, such as databases and decision-support software.

Scores Against Principles

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

Expected Outputs in 1998

- Summary report of the proceedings of the conference, including a consensus statement with recommendations; full edited proceedings will be published in 1999.

2. GERMPLASM ENHANCEMENT AND BREEDING PROGRAM (GEBP)

2.1 GENETIC IMPROVEMENT OF CARP IN ASIA

ICLARM Staff :

Dr. Rex A. Dunham (Program/Project Leader); Dr. Madan Mohan Dey (Project Leader); Dr. Modadugu V. Gupta; Mr. Gaspar Bimbao; Ms. Belen O. Acosta; Ms. Perla M. Virly.

Collaborating Institutions :

Bangladesh: Department of Agricultural Finance, Bangladesh Agricultural University and the Fisheries Research Institute; China: Shanghai Fisheries University and the Freshwater Fisheries Research Center; India: Central Institute of Freshwater Aquaculture (Indian Council of Agricultural Research) and National Bureau of Fish Genetic Resources; Indonesia: Research Institute for Freshwater Fisheries and the Universitas Hasanuddin; Thailand: National Aquaculture Genetics Research Institute, Department of Fisheries, Ministry of Agriculture and Cooperatives, and Asian Institute of Technology; Vietnam: Research Institute for Aquaculture No. 1 and Research Institute for Aquaculture No. 2.

Donors : ADB, ICLARM core funds.

Duration : Phase I, 1997 - 1999.

Objectives

- To document carp genetics resources in Asia.
- To document genetic improvement of carps in Asia.
- To conduct baseline surveys to understand the existing farming practices, marketing and consumption patterns and care.
- To identify constraints to carp productivity improvement in different ecological and socio-economic environments.
- To prioritize selection of carp species, choice of farming system and selection of traits for research.
- To genetically improve carp for aquaculture.
- To transfer technology to collaborating country scientists and to farmers.

Background and Justification

Prioritization of carp genetic research in Asia is needed. 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. There are a number of commercial traits that might be improved for each species, depending on the users' perspective. Carp genetics research will begin by

choosing species, farming systems and breeding goals with the highest potential impact in regards to increased protein production, efficiency, 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 more than 90% of the world production of carps. In these countries, carps constitute about 50% of the total aquaculture production.

In analyzing priorities 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 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 which include activities to (1) increase biological efficiency (productivity); (2) reduce production costs; and (3) improve quality.

2.2 Initial Projects on Genetic Improvement of Carp Species

The project was initiated in mid-1997. Selective breeding and line crossing will be utilized to improve growth and reproduction in silver barb (*Puntius gonionotus*) and catla (*Catla catla*) in multiple environments in Bangladesh. Mass selection will be applied to blunt snout bream (*Megalobrama amblycehala*) and mass selection, crossbreeding and hybridization will be applied to common carp (*Cyprinus carpio*) to improve growth and flesh quality in pond and cage polyculture in China. Initial priorities for work in India are still being discussed. Indonesia will evaluate multiple trait selection for growth, disease resistance and delayed sexual maturity of common carp in multiple environments, pond and cage monoculture and in rice-fish ponds. Thailand will test multiple programs such as family selection, monosex production and crossbreeding to improve survival, parasite resistance, growth and body shape in silver barb and common carp in pond polyculture with tilapia. The growth of silver barb, and the growth and appearance of common carp will be improved with monosex production and selection, respectively, in multiple environments in Vietnam.

However, the species, farming systems and traits being considered are preliminary and may be changed in the latter stages of the project based on the results of prioritization exercise being carried out under the socioeconomic component of the project.

Scores Against Principles

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

Expected Outputs in 1998

- Completion of baseline survey on farming practices, marketing and consumption patterns.
- *Ex-ante* assessment of potential impact of carp genetics research.
- Report on carp genetics resources in Asia.
- Report on status of carp genetic improvement programs in Asia.
- Initiation of carp genetics research in Bangladesh, China, India, Indonesia, Thailand and Vietnam.

2.3 GENETIC IMPROVEMENT OF TILAPIAS

ICLARM Staff :

Dr. Rex A. Dunham (Project/Program Leader); Ms. Belen O. Acosta; Ms. Perla M. Virly; Mr. Cirilo Federigan.

Collaborating Institutions :

To be identified.

Donors : ICLARM core funds.
To be identified.

Duration : 5 - 10 years.

Objectives

- To develop improved breeds of tilapia and provide these to national testing programs and hence to fish farmers.
- To develop breeding plans for tilapia genetic enhancement in Africa and Asia.

Background and Justification

Tilapia is a major aquaculture species in Asia, Africa and throughout the world. The characteristics of this fish should allow its utilization to increase protein production, profits and quality of life of poor fish farmers and consumers. Previous research indicates great potential for the genetic improvement of this species for aquaculture. Our aim for 1998 is to develop additional programs of research and to secure funding to strengthen tilapia genetic improvement programs in Africa and Asia.

Scores Against Principles

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

Expected Outputs in 1998

- Develop breeding plans.
- Develop reports on status of tilapia genetic improvement.
- Submit proposals to donors.
- Secure funding for tilapia genetics research for discrete continental foci in Africa and Asia.

3. INTEGRATED AQUACULTURE-AGRICULTURE SYSTEMS PROGRAM (IAASP)

3.1 REVIEWS ON INLAND AQUATIC RESOURCE SYSTEMS

ICLARM Staff :

To be determined.

Collaborating Institution:

Imperial College, London.

Donors : To be identified.

Duration : 1998 - 2000.

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 1994-1998 Medium-term Plan (MTP) 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 1994-1998 MTP period, to focus the work of its Inland Aquatic Resource Systems Program on the resource system for which the most pressing needs and opportunities could be seen with respect to resource-poor farmers: i.e., ponds and rice floodwaters. This was based upon the priority setting done in ICLARM's strategic planning. However, other inland aquatic resource systems (reservoirs, small lakes, floodplains and wastewaters) have potential for fish production and livelihood, and strategic research agendas are needed for this, with ICLARM's possible roles clarified for future research periods. This can be done through commissioned reviews.

Scores Against Principles

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

1997 Results

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

Expected Outputs in 1998

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

3.2 Integrated Resources Management (IRM) Group and Development of RESTORE Software

ICLARM Staff :

Dr. Mark Prein (Project Leader); Ms. Mary Ann P. Bimbao; Ms. Teresita S. Lopez; Mr. Farlyz Villanueva; Mr. Roberto T. Oficial.

Collaborating Institutions :

ICLARM outreach teams and national collaborators in Bangladesh, Malawi and other countries.

Donor : ICLARM core funds.

Duration : 1991 - 1998.

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 IRM approach. This transformation process is guided by a set of 'sustainability indicators' to ensure that the farming systems developed are ecologically and economically sustainable and that many resource-poor farmers can adopt them.

Scores Against Principles

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

4. Participation H
5. Systems Approach H
6. Anticipatory Research H

1997 Results

- Data from collaboration worksites in the Philippines, Ghana, Malawi and Vietnam were consolidated and converted to the file format of the present version of Research Tool for Natural Resource Management, Monitoring and Evaluation (RESTORE). A final technical report and publications are in preparation.

- RESTORE was completed with accompanying user's manual and field guide and released to 35 further voluntary collaborators, totalling approximately 110 testers. Presentations on RESTORE were given to numerous visitors. Based on feedback from beta-testers, a number of changes are being made, including a transfer to a newer version of the database software.

- A one-week training course was held for 30 staff of the Office of Agricultural Research and Development, Ministry of Agriculture, Thailand, and copies distributed to participants.

Expected Outputs in 1998

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

- Alpha-test in-house.

- Release of RESTORE version 1.0, along with a revised user's manual and field guide.

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

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

3.3 Development of Sustainability Indicators for Integrated Agriculture-Aquaculture Farming Systems

ICLARM Staff :

Dr. Mark Prein (Project Leader).

Collaborating Institutions :

University of Kassel (GHK), Germany; National institutions in the Philippines; ICLARM outreach teams and national collaborators.

Donor : BMZ/GTZ.

Duration : October 1994 - December 1998.

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 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 data sets and indicators will identify key relationships and governing variables. Dynamic simulation models of representative farms will enable testing and characterization of the indicators in terms of sensitivity and precision.

Scores Against Principles

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

1997 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.

Expected Outputs in 1998

- RESTORE training workshops will be conducted.

- Data from secondary sources will be processed.

- Indicators will be formulated, tested and characterized.

3.4 Research for Development of Sustainable Aquaculture Practices

ICLARM Staff :

Dr. Satyendra D. Tripathi (Project Leader).

Collaborating Institutions :

Bangladesh Fisheries Research Institute, Mymensingh; various NGOs.

Donor : USAID.

Duration : June 1993 - December 1999 (extension approved).

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, 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	H
6.	Anticipatory Research	H

1997 Results

- Development of ecoregion-specific technologies through on-farm, farmer-participatory research is in progress. Weed-based carp poly-

culture has been found to be an appropriate system for high rainfall, flood-free medium highland eco-region. Similarly, prawn-carp poly-culture appears to be ecologically and economically sustainable in the low-saline, coastal belt in the south-western region of Bangladesh.

- Technical and logistic support was provided to private hatcheries for spawning the rare, indigenous small and medium-sized carps *Labeo gonius, Cirrhinus reba* and *Puntius sarana* for biodiversity conservation, increased production and meeting consumers' and farmers' demands. Studies on their growth and production performance in ponds, ricefields and beels are in progress. Earlier studies have shown that *C. reba* achieves the marketable size of 40 g in six months in seasonal ponds and 80 g in a year in perennial ponds when cultured along with other carps.

- A great emphasis on improvement of seed quality of cultivable species was laid and training workshops organized for hatchery and nursery operators. Simple methods were suggested to avoid inbreeding and thereby control mortality of eggs and spawn in hatcheries.

- New initiatives have been taken in pen/cage culture and deepwater rice-fish.

Expected Outputs in 1998

- Development of sustainable low-cost, ecoregion-specific, IAA technologies.

- Development of IAA systems in the eastern hill/forest region of Bangladesh.

- Studies on integrating aquaculture with horticulture in medium and deeply flooded lowlands.

- Studies on seed production and culture of rare and disappearing indigenous carps and catfishes.

- Increased linkages with governmental organizations and establishment of a network of NGOs.

- Training of national scientists in RESTORE and Ecopath.

- Organization of three national workshops on (1) improvement of fish seed quality; (2) gender involvement in fisheries and aquaculture; and (3) role of NGOs in technology development and dissemination.

- Training of extension personnel of NGOs and Departments of Fisheries (DOF) and Agricultural Extension (DAE).

- Preparation of a video film on 'Women in aquaculture in Bangladesh'.

3.5 Aquaculture Research and Development for Smallholder Farms in Southern Africa

ICLARM Staff :

Dr. Randall Brummett (Project Leader); Mr. Fredson Chikafumbwa; others to be determined.

Collaborating Institutions :

Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR); FAO; Malawi Fisheries Department, Malawi National Aquaculture Center; Malawi Ministry of Agriculture and Livestock Development; University of Malawi; Malawi-German Fisheries and Aquaculture Development Project; Aquaculture for Local Community Development Programme (ALCOM/FAO); Japanese International Cooperation Agency.

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 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. 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, which proposes a project to work in a strategic, cross-sectoral, collaborative and farmer-participatory mode to provide the answers to long-standing questions about how smallhold farms function and evolve. It would 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/International Centre for Research in Agroforestry (ICRAF) and the FAO Farming Systems Programme). The project aims to generate new IAA farming systems for direct use by smallholders.

Scores Against Principles

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

1997 Results

ICLARM has now been directly involved in Malawian aquaculture development for over a decade. The majority of this time has been spent on issues related to IAA, an approach pioneered in Malawi by ICLARM. Average fish productivity of Malawian IAA farms is now 1,350 kg/ha/year in rainfed areas and 1,650 kg/ha/year in springfed areas compared to an average of about 900 kg/ha/year for the 'most productive' fish farms identified in a recent survey. The difference stems from the range of inputs available as pond inputs and the location of the ponds relative to other farm enterprises and the household.

Economically, IAA farms produce almost six times the cash generated by the typical Malawian smallholder. The integrated pond-vegetable garden is the economic engine on these farms, generating almost three times the annual net income from the staple maize crop and the homestead combined. The vegetable-fish component contributes, on average, 72% of annual cash income. On a per unit area basis, the vegetable garden/pond resource system generates almost $14 per 100 m^2 per year compared with $1-2 for the maize crop and homestead, respectively.

All of the farmers with whom ICLARM has worked and who have access to permanent water supplies are continuing to grow fish and improve their production. Among those farmers with only rainfed fishponds, 36% dropped out for one reason or another (40% of those dropping did so because of family deaths or illness rather than for any agricultural reason), but those remaining also have continuously improved their ponds and production. For example, average pond size has increased from 64 m^2 to 88 m^2 and new gardens are being planted around the ponds.

Of Malawian farmers who have been exposed to IAA technology through various participatory mechanisms, 86% have adopted at least one of the demonstrated technologies, 76% adopted at least two and 24% adopted

four. Interestingly, in followup interviews it was discovered that the adopters did not simply copy what they had seen, but rather took the basic ideas and modified them to suit their individual circumstances and farming systems.

Once in the rural community, the technologies spread and evolved without further extension support. A survey found that, within six months of the May 1990 open day, 46% of adopters in the target area had learned about it from other farmers. A third of these farmers had adopted two or more technologies from their neighbors. By the end of 1992, almost 80% of the farmers practicing integrated rice-fish farming in Zomba District had witnessed first hand an extension demonstration. In Zomba East, where ICLARM worked with 34 farmers from 1991 to 1995, there are now 225 practicing fish farmers.

Research

Most ICLARM-Malawi research follows the Farmer-Scientist Research Partnership (FSRP) protocols. The FSRP is a collaborative process which brings researchers and smallholders together to capture indigenous knowledge, identify agricultural and socioeconomic constraints and then develop realistic solutions which are owned by the farmer. The history and a fuller description of the FSRP can be found in ICLARM Technical Reports No. 46.

Market Price Setting in Southern Malawi (Brummett): In an effort to determine how technology might best serve the development of more commercial fish farming, ICLARM-Malawi conducted a survey of rural and urban fish markets in Southern Malawi. Sizes, species and preservation state of fish vs. their retail prices in various markets were compared. Degree of freshness was found to be important, but no premium is paid for larger fish in Southern Malawian markets. The findings have been reported to the Malawi aquaculture community at the National Fisheries and Aquaculture Research Symposium and are now being finalized for publication submission.

Foodwebs in Tropical IAA Systems (Brummett): A better understanding of how IAA ponds produce different sorts of natural food items is crucial for improved management. This research is aimed at understanding how the ontogenetic dietary shifts of indigenous fishes interact with pond input strategy to influence fish growth. Zooplankton, phytoplankton, soil organic matter and pond water quality are being compared with fish stomach content data to identify new researchable topics in pond trophic dynamics. To date, six University of Malawi students (three each in 1996 and 1997) have been involved in this work. Preliminary results were reported in Naga's Aquabyte section and a fuller report is now being prepared for presentation to the World Aquaculture Association and subsequent publication in a peer-reviewed journal.

Indigenous Fish Diets (Brummett): In collaboration with a University of Malawi initiative to find new fish culture candidates from among Malawi's rich aquatic biodiversity,

ICLARM-Malawi is studying the diets of local fishes to: (1) try to determine *a priori* how they might fare under artisanal culture conditions; (2) develop new methods for the quantitative analysis of detritivore diets; and (3) define new protocols for the identification of indigenous fish species for aquaculture. Four species have been examined to date and stomach contents from 11 new species are now being analyzed. Three papers have been published on this work and a third is pending clearance. Data will be communicated to the FishBase Project for publication advice.

Macronutrients in IAA Pond Sediments (Chikafumbwa): Ponds fed agricultural wastes may accumulate nutrients in sediments which could be used for terrestrial plant production. F. Chikafumbwa and his University of Malawi student assistant, with financial support from the International Foundation for Science, have been studying nitrogen accumulation in pond sediments for three years. In the first year, sediments in tanks lost nitrogen while accumulating phosphorus and potassium. Last year, maize grown on pond mud performed better than on normal topsoil but results were compromised by pond leakage which has since been corrected. This year's results should be ready for analysis by mid-1998.

Azolla in IAA Systems (Kankoma, Makuwa and Kaziona): *Azolla nilotica* harvested from fishponds is being used by some farmers as a soil amendment for maize production. *Tilapia rendalli* is a macrophytophage as an adult and may be able to take advantage of azolla to produce fish protein. Three concurrent studies are underway at the National Aquaculture Centre (NAC) to learn (1) how much azolla different sizes of tilapia can consume; (2) how azolla might be incorporated into prepared diets; and (3) how azolla serves as a soil amendment for row crops. The results of study 1 have been submitted for publication clearance. The results of study 2 are being analyzed now. Study 3 is partly complete and should be finalized by April 1998.

IAA Kites (Brummett and Chikafumbwa): Farmponds are being surveyed to determine if a relationship exists between level of integration, water quality and fish production. Water samples collected at harvest are being analyzed for total suspended and dissolved solids. Farmers are requested to provide information concerning the number of inputs used for fish production and the number of roles played by the pond in other farm activities. These four parameters (two water quality, two integration) will then be graphed on four axes to form a kite which might then be related to fish harvest data. If a strong relationship exists, these kites could be useful tools for researchers and extension agents working with productivity problems in IAA systems. Field data collection is scheduled for completion at the end of September.

Partial Harvesting Systems (Brummett): A three-year study to identify critical components of partial harvesting systems, and so elucidate the causes for the wide variability in results from past trials, will finish in

October this year. Key variables being manipulated are: size at stocking (a determinant of time until first reproduction), size partially harvested (determining level of intraspecific competition) and intensity of harvest (determining standing stock and growth rate).

Rice-Fish Survey (Chikafumbwa): Rice-fish integration was pioneered in Malawi by ICLARM and had been successfully transferred to 57 smallholders by the end of 1991. Anecdotal evidence suggests that the technology has further spread and evolved, an observation which is now being quantified through field interviews with smallholders. Data collection and report preparation should be completed by the end of 1997.

Community Management of Thamandas (Chikafumbwa and Katambalika): The two-year pilot study of how communities in the Lower Shire River Valley might utilize temporary rainpools (*thamandas*) for aquaculture was completed in September. Final data from 22 participating villages are now being analyzed and a report will be submitted before the end of the year. The potential for these small waterbodies to produce income and fish has been demonstrated and a management/extension approach to facilitate sustainable community management has been described. However, a mechanism for the regular supply of fingerlings remains an outstanding problem. Results of the first year's work will be presented at the upcoming Fourth International Symposium on Tilapia in Aquaculture. A proposal to support follow-on work by the Department of Fisheries and ICLARM is planned.

Feed Formulation for Horizontal IAA (Brummett): Most IAA systems are based on a single farm unit, the integration being vertical. Commercial investors are more likely to integrate horizontally (i.e., purchase manures and other inputs from outside the farm) in order to boost productivity above that which a smallholding can support with only internally generated resources. Four students from the University of Malawi spent four weeks on the road interviewing industrialists and commercial farmers and collecting samples of locally available materials which might be used in the development of a pelleted fish diet. The materials were subjected to proximate analysis and 17 diets, balanced for crude protein and energy, were designed. Following the refinement of the diets through the use of a computer diet design program, the diets deemed most likely to succeed will be tested for their usefulness in growing indigenous fish species. The results will be compiled, in early 1998, into an outreach bulletin for local aquaculture investors.

Labor and Resource Constraints to IAA (Brummett): A review of the literature and available field data elucidated the problems which seasonal rainfall and availability of labor impose upon smallholders trying to adopt IAA. While sufficient materials to feed fish are available on most farms, the times when they are most abundant corresponds to the times when labor is most needed for the staple, maize. When labor is not employed on maize, low rainfall limits the growth of green

materials used as pond inputs. Locating ponds in or near dry season vegetable gardens helps overcome these constraints.

NARS Strengthening

ICLARM-Malawi is working to improve the ability of the national aquatic research systems (NARS) to provide effective services to the country's smallholding farmers. The assistance rendered is in several forms:

Library and Information Networking: The information facility provided by ICLARM-Malawi is a valuable resource for SADC aquaculture and fisheries scientists. The NAC library has been supplied with a new computer and is now fully functional. The ICLARM librarian, appointed on a temporary contract, has been successfully fulfilling his job description by: (1) reorganizing and computerizing the collection; (2) training the newly appointed Fisheries Department librarian; and (3) establishing active relationships with other fisheries, aquaculture and aquatic biology information centers in the region.

The library now contains 1,605 books, 186 periodicals and 2,821 catalogued reprints. Information sharing relationships have been established with 20 national and/or regional institutions. There are 61 people and/or organizations on the mailing list. The library responds to an average of 56 requests for information monthly (20 library users, 1.5 ASFA searches, 4.5 interlibrary loans, 30 postal information requests).

Advisory Role in Fisheries Department: Malawi is the SADC lead country for aquaculture and late in 1996 ICLARM-Malawi was designated by the Fisheries Department as an Aquaculture Research Advisor to the Government of Malawi. In this capacity, ICLARM has been active in maintaining contacts with aquaculture-related activities and initiatives around the country and region so as to provide relevant input to the decision-making process. The establishment of a Steering Committee for the ICLARM-Malawi office provides another avenue for information exchange with government.

Training: ICLARM-Malawi has been actively upgrading the human resources of the Malawi NAC. Extension agents are currently being trained in RESTORE data collection and resource mapping (this activity is somewhat hampered by having only a testing version of RESTORE with which to work). One lab technician is receiving on-the-job training in computer usage, water quality analysis, inventory and stock-keeping. Two lab technicians are undergoing ICLARM-sponsored training in soil analysis in the ICRAF lab at Makoka experiment station. The Fisheries Department librarian is receiving on-the-job training (see above) and also participated in an ICLARM-Fisheries Department joint financed training program in library management at the University of Malawi. Eight students from the University of Malawi worked with ICLARM to conduct their 4th year research projects. Four of these were involved in the design of a commercial fish diet and four were involved in the study of pond foodwebs (see Research above). Classroom training in principles of pond management and IAA was conducted

for extension agents during a short course sponsored by GTZ at Bunda College of Agriculture.

New Proposal: Converting Technology into Rural Development and Food Security

For all of ICLARM's previous research projects, the amount of time and energy invested by researchers was very large relative to the small numbers of farmers involved. Duplicating such efforts on a large enough scale to have regional impact would probably not be cost-effective and would therefore be institutionally unsustainable. However, from the experience gained over the course of these various projects, ICLARM has extracted what we feel are the key components of a practical approach to smallholder aquaculture development:

- Information transfer: simple messages, assuming responsibility for extension message.
- Sustained adoption: realistic expectations, joint decisionmaking, sense of ownership.
- Ecological evolvability: systems vision of farm, information sharing with researchers (FSRP).
- Economic evolvability: continual increase in productivity beyond a commercial threshold, household decisionmaking, cash flow constraints.

Each of these components has a technical and social dimension. The technical dimension involves determinates of how productive a new technology is likely to be under a given set of agroecological circumstances. The social dimension involves research-extension-farmer communication and decisionmaking which leads to sustained adoption and farming system transformation.

ICLARM has two methodologies which have been found useful in Malawi and which will form the basis of a new approach to the development and sustainable growth of IAA farming systems. The general technical method proposed for in-depth investigation is the IAA technology as described by RESTORE. To address the social dimension, the FSRP will be coupled with a new functional relationship between extension agents and researchers. A second draft of the proposal is now under review at HQ.

Expected Outputs in 1998

- Funding levels will not permit any research this year. Development of the aquaculture research and information network for SADC will be limited to furthering the collaborative relationship with Rhodes University. Effort will be concentrated on: (1) publishing completed research; (2) providing advisory services to the Malawi Fisheries Department and the SADC Inland Fisheries Technical Coordination Unit; and (3) searching for funds to support future research.
- Research to be written-up includes: (1) documentation of the results of commercial feed trials at Bunda

College of Agriculture to be completed in March; (2) analysis of the multidimensional tilapia partial-harvesting study; (3) compilation of the University of Malawi pond ecology projects; and (4) compilation of integrated azolla systems research conducted by Malawi Fisheries Department.

3.6 Upland Integrated Aquaculture-Agriculture Systems in Forest Buffer Zone Management

ICLARM Staff :

Dr. Mark Prein; Mr. Roberto Oficial.

Collaborating Institutions :

Community Forestry Project Quirino (CFPQ); Department of Environment and Natural Resources (DENR); Peoples' Organizations of Baguio Village and Don Mariano Perez.

Donors : Republic of the Philippines/Germany CFPQ; BMZ/GTZ.

Duration : July 1996 - December 1998.

Objectives

- To conduct a rigorous assessment of the usefulness of farm ponds for aquaculture and of the potential for integration of ponds and ricefields into existing farming systems within the forest buffer zone 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 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 ha, of which 19,300 ha 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 2,000 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 giveaways to neighbors. Few nutrients are added to ponds, and only in form of direct feed to the fish and in form of leaves or rice hulls.

Based on observations and suggestions by CFPQ staff and an initial visit of an ICLARM team to CFPQ areas in Baguio Village and Don Mariano Perez in May 1996, it was concluded that a 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 farmponds (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 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 Research	H

1997 Results

- Monitoring of 30 farm households in two barangays was continued on the impact of IAA adoption through the RESTORE approach, which also produced map transects, calendars and bioresource-flow diagrams.

- Training workshops on IAA and followup visits were conducted with individuals and groups of farmers. Fingerlings of Nile tilapia, common and silver carp were delivered to farmers through CFPQ based on farmer requests.

- Initial impact workshop conducted with farmers showing results. Farmers requested for continued collaboration and support.

Expected Outputs in 1998

- Analyses of IAA impact after two years of trials presented to farmers and CFPQ staff in workshop in October.
- Report to CFPQ and newsletter articles.
- Decision whether or not to embark on greater involvement with a larger activity.

3.7 Increasing and Sustaining the Productivity of Fish and Rice in the Flood-Prone Ecosystem in South and Southeast Asia

ICLARM staff :

Dr. Madan Mohan Dey (Project Leader); Dr. Mark Prein; Dr. Robert S. Pomeroy.

Collaborating Institutions :

Bangladesh Fisheries Research Institute; Bangladesh Rice Research Institute; Proshika Manobik Unnayan Kendra (MUK); Research Institute for Aquaculture No. 1; Research Institute for Aquaculture No. 2; Vietnam Agricultural Science Institute, Cantho University; International Rice Research Institute.

Donors : International Fund for Agricultural Development; Ford Foundation.

Duration : June 1997- May 2000.

Objectives

Overall objective

- To develop a sustainable resource management system in the deepwater rice ecosystem, through action research. The aim is to integrate 'indigenous' resource management techniques with semi-intensive rice-fish culture and management technologies that promise to increase the incomes of rice farmers.

Specific objectives

- To make a comparative analysis of alternative resource management strategies in flood-prone ecosystems.

- To have a participatory development of viable income-generating technical options and their field-testing and validation.

- To identify viable community-based mechanisms and tenurial/institutional arrangements to secure target group access to waterbodies; adequate provision of fingerlings; and access to fish processing and marketing facilities.

Background and Justification

Deepwater subsistence rice farmers are among the poorest socio-economic groups in South and Southeast Asia. The low yields of deepwater rice have made it increasingly difficult for farmers to make a living. While deepwater rice cultivation is one of the most sustainable of farming systems, at its present low-yield levels, the flood-prone ecosystem cannot supply adequate food to meet growing demands. As a result, farmers are compelled to look for every possible additional avenue of increasing the food supply. In so doing, some of their measures have adversely affected the environment There is therefore an urgent need to identify high-yielding, yet sustainable, technological and resource management options for the flood-prone ecosystem to improve the livelihood of people dependent on it.

Bangladesh and Vietnam are two countries which are heavily reliant on the flood-prone rice ecosystem. More than half of Bangladesh's 10.2 million ha of riceland and about 10% of Vietnam's 7 million ha of arable land are flooded to depths of 30-180 cm during the rainy season. Traditionally, in the rainy season, farmers grow deepwater rice and capture fish in the flood-prone ecosystem.

The flood-prone ecosystem (with floodwater depth of up to 180 cm, here termed as 'shallow flooded areas') has considerable potential for increased food production through the integration of fish culture with deepwater rice farming. Preliminary research has shown that fish production of 1-2 t/ha/year is possible with deepwater ricefields compared with 50-200 kg/ha/year in irrigated fields. This is accounted for by higher stocking densities, the abundance of natural food, the better quality of water and the absence of pesticides and herbicides associated with cultivating high-yielding rice varieties. These floodprone areas are seasonally flooded during the monsoon and remain submerged for 4 to 6

months. The vast water bodies and the rice canopies that result provide natural habitats for various aquatic resources including wild fishes and shrimps. The yearly silt deposition and organic matter decomposition favor the growth of naturally occurring flora and fauna. The abundance of natural organisms favors the cultivation of fish for 4 to 5 months in a deepwater rice environment.

During the dry season, land ownership is fixed according to tenure arrangements. At times of floods during the wet season where land is not bounded, fish are a community property granting members access to fish in all the communities' areas. This, together with experience from other areas, makes it likely that poor communities may sustainably manage common property resources over which they have effective control. In the case of stocking of certain areas with fish fingerlings and necessary investment in fencing materials, this will be a crucial issue.

Resource management approaches, such as integrated resource management and ecosystem-based planning, are essential for the sustainable use of natural resources. Community-based management approaches have been successfully used to achieve both socioeconomic and ecological objectives through integrated conservation-development planning. Community-based management can also serve as a mechanism for economic development by promoting participation of resource users and the community in actively solving problems and addressing needs.

The considerations establish the basis for an interdisciplinary and integrative research project for increasing and sustaining the productivity of rice and fish in the seasonally flooded ecosystem of Bangladesh and Vietnam.

Scores Against Principles

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

1997 Results

- A reconnaissance field visit and planning meeting was conducted in Bangladesh, Red River Delta (North Vietnam) and Mekong River Delta (South Vietnam). In consultation with research partners in Bangladesh and Vietnam, study sites have been selected, and methodology and implementation arrangements have been finalized. We are in the process of signing two memoranda of agreement (MOA) between ICLARM and participatory institutes in Bangladesh and Vietnam.

- Small-scale experiments have been conducted in Vietnam, both in the Red River and Mekong River Deltas. Results show the technical feasibilty of culturing rice-fish during rainy season in the flood-prone environment in the Red River Delta, and culturing fish alone during rainy season, in between two rice crops,

in the flood-prone environment in the Mekong River Delta.

- A questionnaire has been prepared for conducting baseline surveys in Bangladesh and Vietnam, and a first round of surveys was completed in Vietnam.

- Information on the extent of flood-prone ecosystem in Bangladesh was collected from 480 thanas. We are in the process of analyzing these data.

Expected Outputs in 1998

- Completion of baseline surveys in Bangladesh.

- Preliminary analysis of survey data.

- Implementation of experiments on rice-fish in Bangladesh and Vietnam.

- Preliminary analysis of experimental data.

- Conduct of baseline institutional and organizational analysis in Bangladesh and Vietnam.

- Identification of institutional arrangements in Bangladesh and Vietnam.

- Training on common property and community-based management in Vietnam.

- Conduct of review workshop in Bangladesh and Vietnam.

- Organization of exchange visits for the collaborating scientists from Bangladesh and Vietnam.

4. COASTAL AQUACULTURE AND STOCK ENHANCEMENT PROGRAM (CASEP)

4.1 Village Farming and Restocking of Giant Clams

ICLARM Staff :

Dr. J. Bell (Project Leader); Mr. R. Pitt; Mr. I. Lane; Mr. C. Oengpepa; Mr. H. Tafea; Mr. F. Lasi; Ms. A. Grice; Ms. J. Battaglene.

Collaborating Institutions :

Solomon Islands Ministry of Agriculture and Fisheries; James Cook University, Australia.

Donors : EU; FAO South Pacific Aquaculture Development Programme; Economic and Social Commission for Asia and the Pacific (ESCAP).

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 these have been overfished or extinguished.
- To transfer methods for propagating and growing giant clams to the private sector in the Pacific.
- To develop cost-effective methods for restocking giant clams.

Background and Justification

Coastal communities adjacent to coral reefs in developing countries have few opportunities to develop low-cost industries capable of generating income and food on a sustainable basis. Giant clam farming is one option. Past research by the Micronesian Mariculture

Development Center, James Cook University, the University of the Philippines and ICLARM's Coastal Aquaculture Centre (CAC) in Solomon Islands, resulted in development of reliable methods for the spawning and land-based larval rearing of giant clams. The ultimate goal of this research - to develop viable giant clam farming industries for coastal villages - was, however, never realized. The CAC is completing the international research effort by developing methods to grow five species of giant clams in villages, and 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 'village' farms for giant clams. 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 growout technology to a variety of countries, will facilitate the continuation and expansion of giant clam farming, and re-establishment 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 of giant clams for food, aquaria and shellcraft.

Scores Against Principles

1.	Sustainability	H
2.	Systems Approach	H
3.	Gender	M
4.	Equity	H
5.	Partnership	H
6.	Anticipatory Research	H

1997 Results

Production from the CAC's nursery resulted in the distribution of 70,000 giant clam 'seed' to coastal villagers in 1997. The species distributed were *Tridacna crocea*, *T. derasa* and *T. maxima*. In addition, a Solomon Islander received a grant from the Pacific Development and Conservation Trust to construct his own giant clam hatchery. ICLARM assisted him to design and commission the hatchery, and provided training in the larval rearing of giant clams. In November 1997, he produced his first batch of *T. crocea*.

Growout experiments for *T. derasa, T. maxima* and *T. crocea* at village farms in Solomon Islands were completed and submitted for publication in 1997. *T. derasa* had the best growth and survival, attaining a mean shell length (SL) of 150 mm ± 19.8 SD, and mean weight of 710 g ± 26 SD, after 24 months growout. Mean survival of *T. derasa* over this period was 92.2% ± 9.1 SD. *T. maxima* grew to a mean size of 78.4 mm ± 14.9 SD in 19 months, and

T. crocea reached 50.2 mm ± 8.1 SD in 22 months. After 19 months growout, survival of *T. maxima* was 38.9% ± 16.6 SD, and survival of *T. crocea* after 17 months was 39% ± 22.6 SD. Factors influencing growth of all species included water temperature, exposure to wave action, water clarity and water flow. The results also highlighted the importance of protecting clam seed immediately after delivery to growout sites, and confirm that the most critical stage for village farming of giant clams is during the initial weeks and months following distribution of seed.

In 1997, ICLARM continued to coordinate sales to the aquarium market on behalf of village farmers. Sales did not exceed those made in 1996 because stocks of *T. gigas*, *T. squamosa* and *T. crocea* were low, and because there was considerable competition with other countries for sales of *T. derasa*. Net revenue for village farmers growing giant clams for the aquarium market was greatest for *T. derasa*, due to high survival. Although *T. crocea* is in great demand by the aquarium trade, it was the least suitable species for village farming because it has slow growth and low survival.

It is now evident that the future expansion of giant clam farming will depend on gaining access to seafood markets in Asia. *T. derasa* is the outstanding candidate for these markets due to its high rates of growth and survival. During 1997, ICLARM collaborated with the Government of Solomon Islands and ESCAP to study live seafood markets for giant clams in Taiwan and Hong Kong. Mr. Mike Riepen, a consultant appointed by ESCAP, spent a week at CAC inspecting the production of *T. derasa* at village farms, and travelled to Hong Kong and Taiwan to promote clams of 150 mm SL as a live product.

In support of ICLARM's effort to test seafood markets for *T. derasa*, the FAO South Pacific Aquaculture Development Programme provided funding for a person to coordinate the collection of cultured *T. derasa* from village farmers, and to dispatch trial shipments to prospective buyers in Asia.

Efforts to reduce the cost of restocking giant clams, by linking restocking with the small-scale farming of giant clams, continued in 1997. The 26 farmers engaged in the growout of *T. derasa* each allocated 60 individuals for restocking. These clams are now an average size of 160 mm SL. To assess whether clams of this size can be transplanted to reefs without the protection of cages, we protected and exposed four groups of 40 clams at each of three sites. Survival of exposed clams at one site was <20% after one month, demonstrating conclusively that *T. derasa* of 160 mm SL are still vulnerable to predators. Conversely, the protected clams had 100% survival after 280 days.

On the basis of growout experiments for giant clams, which demonstrate that the clams need to be protected in cages for 3-4 years before they can escape predation, ICLARM has developed a model for restocking giant clams. The model links restocking of giant clams to the farming of giant clams, and has three components:

1. allocation of a small proportion of each cohort received by a farmer for restocking;

2. protection of these clams in cages by the farmer for 3-4 years as part of the normal rearing process; and

3. placement of clams large enough to escape predation onto coral reefs at or near each farm.

This model reduces the cost of rearing clams until they escape predation, decreases the likelihood that clams will be poached and results in several aggregations of clams being established over a broad area.

In 1997, papers on the cultivation and restocking of giant clams were presented to the Southeast Asian Fisheries Development Center (Philippines), the First International Symposium on Stock Enhancement and Sea Ranching in Norway, and the University of Perpignan, France.

Expected Outputs in 1998

- Publications documenting the methods used by ICLARM to propagate and growout giant clams, and the variability in survival and growth of *T. derasa*, *T. crocea* and *T. maxima* at village farms.

- Presentation of keynote address on the status of efforts to farm and restock giant clams at an FAO Workshop on Economic Strengthening of Fisheries Industries in the Pacific Region.

- A workshop in Solomon Islands to update giant clam farmers on improvements to growout methods and developments in the market place.

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

- Increased sales of live giant clams to seafood markets in Asia.

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

- Discussions with major donors about future research needed to complete the transfer of technology to the private sector and to test ICLARM's model for the restocking of giant clams.

4.2 Development of Village Farms for Blacklip Pearl Oysters in Solomon Islands

ICLARM Staff :

Dr. J. Bell (Project Leader); Mr. K. Friedman; Mr. I. Lane, Mr. B. Dunne; Ms. R. Dunne.

Collaborating Institutions :

Solomon Islands Ministry of Agriculture and Fisheries; James Cook University, Australia; Cook Islands Ministry of Marine Resources; US Peace Corps.

Donor : Australian Centre for International Agricultural Research (ACIAR).

Duration : Operational since 1993. This phase from early 1998 to December 2000.

Objectives

- To produce blacklip pearl oysters in ICLARM's hatchery in Solomon Islands.
- To continue experimentation to identify the optimum system for collecting spat of the blacklip pearl oyster.
- To compare the growth and survival of cultured and wild spat.
- To develop methods for maximizing the survival of oysters in the juvenile growout phase.
- To transfer methods for collection of spat and growout of juvenile oysters to Fiji.
- To maintain 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 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 the western Pacific. This project builds on the results of research funded by ACIAR to assess the potential for establishing village farms for blacklip pearl oysters based on the collection of wild spat. During that research, spat collectors were deployed across much of Solomon Islands. Spatfall occurred mainly during early summer, and was estimated to be great enough at a few sites to sustain commercial operations. However, due to the relatively nutrient-rich inshore waters in Solomon Islands, and the abundance of predators, ICLARM had to develop alternative methods for rearing oysters for the culture of pearls. This work has now been done and the future emphasis will be on transferring the methods to other countries in the region, encouraging the commercial sector to apply the technology and assessing the practicalities of using hatchery-reared spat to culture pearls.

Scores Against Principles

1.	Sustainability	H
2.	Systems Approach	M
3.	Gender	M
4.	Equity	H
5.	Partnership	H
6.	Anticipatory Research	H

1997 Results

Routine collections of spat in the vicinity of ICLARM's field station at Nusa Tupe in the Western Province of Solomon Islands continued to yield catches considered to be economically viable for the establishment of pearl farming.

Research conducted during 1997 identified methods to reduce the cost of collecting spat and improve the survival of juvenile oysters. Field experiments confirmed that: (1) collections of spat were increased by deploying collectors outside coastal lagoons; (2) survival of spat was improved when they were removed from collectors after four months; and (3) collectors returned to the water immediately after spat and predators had been removed attracted as many spat as those which where cleaned and dried in the sun for two weeks before they were redeployed.

Improved methods for growing-out spat, by using cyano-acrylate glues, were also developed. The use of glues for holding spat in growout systems proved to be advantageous in three ways. First, spat could be held behind larger mesh sizes, which facilitated water flow and reduced the effects of fouling. Second, spat were not able to aggregate, which resulted in better growth rates and reduced numbers of misshapen shells. Third, spat could be separated, making it easier to check the oysters for predators.

Experiments were also conducted to examine the effects of different cleaning regimes and ear hanging methods on the growth and survival of larger oysters held on chaplets for culture of pearls.

A major achievement in 1997 was the establishment of a demonstration pearl farm at the Nusa Tupe field station. In September, approximately 2,000 oysters, originally caught as wild spat and grown out to a size of 100 mm shell height, were seeded by a commercial pearl farmer from Cook Islands. Mean retention rate of the nuclei was 65% (above average for the region).

Overall, the project continued to heighten the awareness of the value of blacklip oysters among the coastal villagers. This has two benefits: villagers now understand the reasons for the national ban on export of pearlshell and conform to it; and villagers now safeguard wild broodstock to provide a source of spat for future industry.

Expected Outputs in 1998

- Assessments of the potential for using hatchery-reared spat to culture pearls in Solomon Islands.
- Refinement of methods to achieve high survival of spat during growout.
- Publications on spatial and temporal variation in abundance of spat, effects of location ('inshore' vs 'offshore') on collection of spat and methods for maximizing the survival of spat once they have been collected.
- Completion of an economic analysis of pearl farming using oysters collected as spat.

- Discussions with the private sector in Solomon Islands about establishment of pearl farms.

- Improved capacity of fisheries staff in Fiji to assess the nation's potential for pearl farming.

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

ICLARM Staff :

Dr. J. Bell (Project Leader); Dr. S. Battaglene; Dr. A. Mercier; Dr. J.F. Hamel; Ms. E. Seymour; Mr. C. Ramofafia.

Collaborating Institutions :

Solomon Islands Ministry of Agriculture and Fisheries; Advisory Panel from Advanced Scientific Institutions in Australia coordinated by ACIAR; University of Sydney.

Donors : ACIAR; CIDA.

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.

- To understand the ecology of juvenile sea cucumbers in the wild as the basis for designing field experiments to identify methods to optimize the release of hatchery-reared juveniles into the wild.

Background and Justification

Bêche-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 particularly strong demand for bêche-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) they are low on the food chain, so impact on other species is unlikely to be a major limiting factor; and (3) they 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 four pieces of research have been completed. These are: (1) development of cost-effective methods for producing larvae *en masse*; (2) description of the ecology of wild juvenile sea cucumbers; (3) identification of strategies for maximizing the survival of released juveniles; and (4) evaluation of the profitability of large-scale releases of juveniles to existing fisheries. ICLARM is addressing the first task with funds from ACIAR, and the second one with support from CIDA.

Scores Against Principles

1.	Sustainability	H
2.	Systems Approach	M
3.	Gender	M
4.	Equity	Variable
5.	Partnership	H
6.	Anticipatory Research	H

1997 Results

Broodstock of the three target species (sandfish, *Holothuria scabra*, white teatfish, *H. fuscogilva*, and surf redfish, *Actinopyga mauritiana)* were collected regularly and transported successfully to CAC for spawning induction trials. In general, males spawned before females, and in greater numbers. In some cases, broodstock spawned without direct application of stimuli. At other times, a range of stress treatments and/or the addition of blended gonads dissected from mature animals, was needed. Spawning was induced for all species by elevating seawater temperature by 3 to 5°C. Spawning occurred in 8% of *H. scabra* and 33% of *A. mauritiana,* but only 2% of *H. fuscogilva.*

Monthly samples of approximately 30 animals of each species were also processed to determine their reproductive cycles. The peak reproduction periods were May and November for sandfish, September for white teatfish and October for surf redfish. However, a small proportion of animals in monthly sample of sandfish and surf redfish were reproductively mature.

Four batches of sandfish, totaling 150,000 juveniles from 19 million fertilized eggs, were reared in the hatchery. The optimal density for static incubation of eggs was 0.1eggs/ml, whereas larvae were cultured at densities of 0.1 to 4 larvae/ml using periodic exchange of water.

Larvae were fed a mixture of up to seven types of microalgae; *C. muelleri (gracilis), C. calcitrans, C. simplex, Chroomonas* sp., *Isochrysis galbana, Pavlova salina* and *Tetraselmis chuii.* Feeding started at 20,000 cells/ml

at day 2 and increased to 40,000 cells/ml by day 14. Settlement of sandfish started from day 10 to 14. A combination of fresh microalgae and commercial dried microalgal products "Algamac 2000" and "Livic" were fed from day 10. Survival ranged between <1% and 35%, depending on initial stocking density and other husbandry factors.

Preliminary growth trials with sandfish indicate that larvae of this species grow quickly, and can be reared in concrete and fiberglass tanks with minimal addition of artificial diets. Maximum growth occurred in tanks with sand substrates, no shade cover, addition of powered algae and low stocking densities. Growth of sandfish juveniles raised under optimal conditions ranged from 0.3 to 0.5 g/day. Juveniles as small as 3 mm were transferred successfully to sand substrates, although survival was better when transfer was delayed until the juveniles reached a size of 10 mm.

Juvenile sandfish >20 mm appear to be robust enough to stock in the wild, i.e., they become less cryptic and move about during the day. An experiment in 50 l outdoor fiberglass tanks indicated that juveniles of 30 mm grew faster on sand substrates than those on bare surfaces, and that shading tanks inhibited growth. The juveniles in tanks with sand substrates without shade attained a length of 65 mm, and a mean weight of 18.6 g at 4 months of age.

Research on the ecology of wild juvenile sea cucumbers started late in 1997, and focused on sandfish. The major research activities of this component of the project include:

- Conducting surveys of habitats reported to hold juveniles.
- Identifying patterns in distribution and abundance of juveniles.
- Determining the peak times of recruitment of juveniles.
- Determining the influence of density, migration, physical contact and other behavioral exchanges on the distribution of juveniles.
- Identifying the role of predation in regulating abundance of juveniles.
- Describing the physical and chemical habitats in which juveniles are found.

Expected Outputs in 1998

- Methods for larval rearing of white teatfish and surf redfish.
- Documentation of reproductive cycles of wild broodstock.
- Optimized methods for production of juvenile sandfish.
- Life history information for juvenile sandfish in the wild.
- Publications on larval rearing of sandfish, the reproductive cycle of white teatfish, and the patterns of feeding and burial in juvenile sandfish.
- Presentation of a paper on reproduction, spawning induction, development and larval rearing of sandfish at the Third International Larval Biology Meeting.

5. AQUATIC ENVIRONMENTS PROGRAM (AEP)

5.1 REEFBASE: A GLOBAL DATABASE ON CORAL REEFS AND THEIR RESOURCES

ICLARM Staff :

Dr. John W. McManus (Project Leader); Ms. Sheila G. Vergara (Team Leader); Ms. Irene Uy (Programmer); Mr. Lambert Menez; Ms. Mahar Gorospe; Ms. Kathleen K. Reyes (Research Personnel); Mr. Marco Noordeloos (Associate Expert); and Ms. Cindy Cabote (Secretary).

Collaborating Institutions :

World Conservation Monitoring Centre (WCMC); World Resources Institute (WRI); University of Rhode Island (URI); Global Coral Reef Monitoring Network (GCRMN); National Center for Atmospheric Research (NCAR); Earth Observations Program, National Aeronautics and Space Administration (NASA) - Johnson Space Center; and other institutions and individuals who contribute data and pictures to the database.

Donors : ReefBase funding consortium; USAID; SIDA; ICLARM core funds; others.

Duration : October 1996 - September 2000.

Objectives

ReefBase is a user-friendly database on coral reefs and their resources. Designed as a repository of the available information on coral reefs, ReefBase presents this information through a user-friendly software on a CD-ROM. ReefBase has been created for scientists, academics, students, resource managers in government and private institutions, divers and other coral reef enthusiasts. ReefBase aims to make reef information available to a wide range of audiences to promote awareness and informed management of coral reef systems. In order to facilitate the management of coral reefs, ReefBase will:

- Develop a relational database for structured information on coral reefs and their resources that will serve as a computerized encyclopedia and analytical tool for use in reef management, conservation and research.
- Collaborate with other national, regional and international databases and geographical information system (GIS) facilities relating to reefs and provide a means of comparing and interpreting information at the global level.
- Develop and distribute analytical routines for ReefBase that will make full use of the information and ensure appropriate interpretation and synthesis.
- Contribute to the database of GCRMN.

- Define and use criteria for reef health to refine procedures for coral reef assessments and to determine coral reef status at the regional and global scales.

- Determine the relationships among coral reef health, fishery production and the quality of life of reef dependent people.

Background and Justification

A great part of the coral reef resources in the world are in danger of destruction due to overexploitation, degradation of the habitat and, possibly, changes in global climate conditions. A survey by the International Union for the Conservation of Nature concluded that coral reefs in 93 countries have been damaged or destroyed. In the Philippines alone, fisheries' loss due to reef degradation amounts to millions of dollars a year, directly affecting thousands of jobs and indirectly affecting family members dependent on them. On a global scale, the loss in fisheries income may reach billions of dollars a year and affect millions of people.

Few figures are available to indicate the sustainable yields that might be extracted for different reef types, current and potential yields of different reef species, how yields are affected by declining reef health and loss of productive capacity, and the value of non-extractive uses of reefs such as tourism. Sophisticated methods to quantify the deterioration of coral reefs have been initiated in some area, while hardly any assessment or monitoring activities exist in other areas. Information from these activities is usually published in primary scientific literature and may not be readily understood by a nontechnical reader. A larger body of information has been compiled in technical reports, which are generally for limited distribution. This makes it extremely difficult for the people tasked with managing coral reefs to obtain the information needed for good management even when comprehensive information exists.

Several initiatives are underway to monitor the status of and threats to reefs at the global, regional and national levels, but little progress has been made in 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.

ReefBase is an effort to gather the available knowledge about coral reefs into one information repository. 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. After two and a half years of development with support from the European Commission, the Government of the Netherlands and the US Agency for International Development, ReefBase 1.0 was officially released in June 1996. ReefBase 2.0 followed in June 1997, with information on over 7,000 coral reefs. ReefBase served as the major source of information for the State of the Reefs Report, the primary background

document for the International Coral Reef Initiative (ICRI) workshop. ReefBase is the official database of GCRMN and directly addresses priority actions of ICRI, now endorsed by 75 governments.

In order that the reach of survey contributions to the database is expanded, the ReefBase Aquanaut survey method for coral reefs was developed by ICLARM. It allows quick and efficient monitoring of a broad geographical area. For many volunteers, this will be the primary method by which divers can contribute to existing knowledge about coral reefs. Volunteer organizations and scientists using other monitoring methods may find the ReefBase Aquanaut survey method useful as a supplemental source of information for broad comparisons or standard baseline information. The new method is designed to produce data which can be compared in broad categories with that gathered using the standard method of GCRMN.

Scores Against Principles

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

Project Components and Expected Outputs in 1998

ReefBase continues with the following project components: (1) database structuring and data entry; (2) presentation packaging; (3) networking; (4) developing analytical tools to facilitate summarization and assessments; and (5) promoting the Aquanaut method of reef resources assessment. These are expressed in the following:

- a listing of coral reefs and their distribution with descriptions for most of the reefs;
- ecological surveys on benthic and reef fish communities;
- existing stresses on the reefs;
- information on the fishery, mariculture and coastal tourism activities on the reefs;
- management practices and legislation for national and international protected areas;
- detailed maps of the reefs of the world;
- information on the political, socioeconomic and cultural variables related to reef use (rapid assessment of management parameters or RAMP);
- the Ecopath 3.0 software; WinMap, a low-level geographic access system to display information on reefs;
- a dictionary, references list and picture show; and
- a simple query and report system.

The information in ReefBase is gathered from published literature as well as conference proceedings,

technical reports, news articles, theses and manuscripts contributed by institutions and other research groups involved in the study of coral reefs.

In 1998, ReefBase will be expanded leading to analytical results of major significance for coral reef conservation and management.

- One intended addition will be the Association of Southeast Asian Nations-Australia Database, which holds data from thousands of transects on coral reefs conducted over a five-year period. This database will complete a large block of data on the benthic ecology of coral reefs in ReefBase, and permit the application of multivariate techniques to the establishment of acceptable bounds for sets of variables to differentiate healthy from stressed coral reefs.

- A second addition will be the estimation of national reef fish harvests from FAO data through the application of a weighting procedure to compiled reports of fish harvests by standard reporting category. The weighting procedure will use data from ICLARM's FishBase on fish habitats. Hypotheses concerning the progression of reef fisheries through mean trophic level states will be tested using trophic level data gathered from ICLARM's Ecopath ecological modeling software. This will add substantially to our understanding of reef health and responses to stresses.

- Further collaborative work will be done with WRI, NCAR and NASA as explained in the collaboration subheading of this plan.

- Structural modifications will include:

  - charts created for ecology, coastal tourism and RAMP;

  - traditional Management forms, revised to link via country and governmental management;

  - output presentation of the Dot Map to include screen, printer, excel and text file options;

  - coral reef fish information to be accessed via country and country summary reports;

  - revision of Ecology Reef Fish Community forms;

  - additional query for Life form and stress type in Picture Show feature;

  - taxonomic forms with additional subforms for Growth, Larvae and Spawning; and

  - beginning in 1998, ReefBase will assemble information on the policy instruments protecting coral reefs around the world.

- Finally, 1998 will see the initiation of a major effort to systematically analyze major coral reefs using remote sensing technology. New advances in this field permit the

development of detailed bathymetric maps from Landsat data, and the determination of habitat types to increasing levels of precision. ICLARM will review and field test existing approaches and develop a standard protocol for producing images to include in ReefBase. These images will greatly enhance the capacities of managers to establish marine reserves and take other steps to protect and monitor coral reefs.

Collaboration

- Earth Observations Program NASA - Johnson Space Center: NASA satellite low orbit earth photos will be added into ReefBase 3.0.

- NCAR: Probable coralline areas of oceanic shelves will be broken down by country based on the principles of international law to result in estimates of reef area on a national basis. These will be distributed to regional fishery experts for comparison with known data from trawling studies. The resulting national reef area estimates will be compared with the estimates of national reef fish harvests and facilitate a variety of management decisions at national levels for over 100 nations.

- WRI: The results of the ongoing 'Reefs at Risk' project, involving collaborative work with WRI and WCMC, will be integrated into the database. Country information within ReefBase will be updated to include national reef risk indicators. When combined with the other three new data sets in ReefBase, one will be able to assess at a national level not only the level of risk to the reefs, but also potential losses of income from fisheries. This study will result in the first semi-quantitative assessment of the global status of coral reefs.

5.2 Population Interdependencies in the South China Sea Ecosystems (PISCES)

ICLARM Staff :

Dr. John W. McManus; Ms. Ma. Carmen A. Ablan; Ms. Mayeth Rodriguez.

Collaborating Institutions :

Coastal Aquaculture Centre (Solomon Islands); Universiti Malaya (Sabah, Malaysia); Institute of Zoology Academia Sinica (Nankang, Taipei); Department of Marine Living Resources, Institute of Oceanography (Nhatrang, Vietnam); Environment Study Center, Universitas Pattimura Ambon (Ambon, Indonesia).

Donors : John D. and Catherine T. MacArthur Foundation, World Environment and Resources Program.

Duration : January 1997- June 1999.

Objectives

- To conduct a 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 facilitate collaboration among scientists in the South China Sea and adjacent areas through a scientific study involving representatives from various institutions.

- To facilitate the development of improved management strategies for the living resources of the South China Sea by providing information on the interconnections among marine populations.

- To undertake the development of a model to estimate relative contributions to a mixed stock.

Background and Justification

The importance of the South China Sea to dwellers in the region cannot be overemphasized. This body of water provides food, livelihood and other services to millions of economically disadvantaged coastal dwellers. The area also supports tens of thousands of marine species, and thus has been identified as part of the center of marine biodiversity. The number of marine species in this area is the highest in the world.

Intense pressure on the resources threatens both the productivity and biodiversity of the region. Extreme competition to harvest has led to Malthusian overfishing, and the use of destructive fishing methods which destroy not only the sustainability of the resources but the environment as well. Further stress comes from coastal pollution and other forms of habitat destruction.

Various programs to manage the resources in the South China Sea are implemented at the national, provincial and municipal levels. Regional initiatives among governments and scientists are also underway. However, the concept of reef biotic interconnectedness and sharing of stocks within the region needs to be included in the management initiatives.

Given the available information on current circulation patterns, it is very likely that the resources in the South China Sea are highly interdependent. Data on the fish and invertebrate larvae duration before settlement further strengthen the conjecture of such interdependence.

The best evidence will come from a combination of genetic studies, investigations on life history strategies, tagging experiments and current pattern analyses. Of these, the greatest return for minimal funding is in the genetic studies. The project concentrates on determining interconnectivity between coral reef systems based on results from reef species chosen by collaborators from the participating countries.

Scores Against Principles

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

1997 Results

Within 1997, the focus was mainly on the startup and initial

screening activities. The PISCES collaborators meeting was conducted in April 1997. Each collaborator was an accomplished scientist currently involved in marine ecosystems research in their country. Discussions were centered around the project design and implementation as well as the relevance and application of the project to the collaborator's current research. Major decisions and commitments for the success of the project were arrived at during the meeting. These included:

- Three fish species (*Heiniochus acuminatus, Dascyllus trimaculatus* and *Thallasoma hardwickii*) and one invertebrate (*Linckia laevegata*) were chosen for the study.

- The project time frame and activities and the addition of a study on DNA markers to be spearheaded by the Academia Sinica in Taiwan.

- Avenues for exchange of information and collaboration.

A modest laboratory was set up to do allozyme electrophoresis work. This involved outfitting an old apartment, importing equipment and chemicals, and hiring an assistant.

Screening for isozyme markers and buffer systems for two of the four species were completed within the year. There are now 27 markers in 17 enzyme systems identified for *Dascyllus trimaculatus*, while a total of 22 markers in 20 enzyme systems have been identified for *Heiniochus acuminatus*. Of the six buffer systems tested, two proved to be most versatile for work with these two species.

Work has also gone into obtaining samples from the different collaborators and from within the Philippines. This required some negotiations with the Inter-Agency Committee on Biological and Genetic Resources.

Expected Outputs in 1998

Work on screening markers and gathering the samples will continue. However, the focus would be more on data gathering and analysis and disseminating information.

- Screening for markers for the two other species, and hopefully another two species, will be done within the first quarter of the year. Gathering of samples for the chosen species will also continue in the early part of the year.

- Extensive data gathering from the samples that arrive will be done this year. Electrophoresis procedures are very time-consuming and will be done routinely. PISCES expects to receive around 3,000 samples.

- Analysis of the data will be done as runs are completed. Population genetic parameters will be calculated initially using the BIOSYS 1 software and compared with results obtained using other statistical software (POPGENE and GDA).

- Initial attempts to develop a model to estimate relative contributions to a mixed stock will be done towards the end of the year when a significant amount of data has been gathered.

- Visits to ICLARM or from ICLARM to collaborating institutions will also take place to allow short-term training and/or opportunities to give talks about PISCES and/or related research.

5.3 Coastal Management Training Program in the Philippines

ICLARM Staff :

Ms. Audrey Banzon (Research Assistant); Sheila G. Vergara (Research Associate).

Collaborating Institutions/
Other Partners :

PCAMRD; DA-BFAR; DENR; IIRR; and Haribon Foundation.

Visayas State College of Agriculture - GTZ Tropical Ecology Program; USAID Coastal Resources Management Program; UN Train-Sea-Coast Programme; British Embassy; and OXFAM-UK.

Donor : Rockefeller Brothers Fund.

Duration : MOU for five years from signing in 1997.

1997 Results

A training needs analysis of coastal management practitioners was conducted to produce the modules and curriculum design, course masterplan and the National Course on Integrated Coastal Management (NCICM). A total of 198 middle management participants from the Philippines were successfully trained in nine courses. The Coastal Management Training Bulletin continues to be distributed. With the accreditation by the UN Train-Sea-Coast Programme, the national training course was elevated to an international one. Two project staff received a course development training and others participated in different regional and international conferences. The project has strengthened the ICM capability of project-involved personnel among the six collaborating institutions.

Project Components and Expected Outputs in 1998

- Project components: (1) LGU-adapted ICM training courses; (2) impact evaluation; (3) training of trainers on facilitation and presentation of skills and on selected coastal management techniques; (4) convention of coastal management practitioners; (5) publications; and (6) institutionalization of ICM training within two major government agencies involved in ICM initiatives - DA-BFAR and DENR; and (7) possible adaptation of the training course in other countries.
- Adaptation of the training for use by the local government units (training needs assessment stage).
- Second half of the training of trainers.
- Networking: periodic publication of the course bulletin and developing webpage for the project.
- Production of the Train-Sea-Coast version of NCICM Manual.

6. FISHERIES RESOURCES ASSESSMENT AND MANAGEMENT PROGRAM (FRAMP)

6.1 TROPICAL FISH STOCK ASSESSMENT

ICLARM Staff :

Dr. Villy Christensen (Project Leader); Mr. Felimon C. Gayanilo, Jr.; Mr. Geronimo Silvestre; Mr. Francisco Torres, Jr.

Collaborating Institutions :

Predominantly in-house, 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, and working on length frequencies for stock assessment.

Since its inception, this project has continued to supply national aquatic research systems with conceptual and methodological advances to understand and manage fisheries resources 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.

In late 1989, it was agreed that a single software be developed that merges the routines in the ELEFAN and 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 is being distributed since 1996.

As a 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 (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 (see report on 'Regional Technical Assistance Toward Strategies and Action Plans for Sustainable Utilization of Coastal Fish Stocks in Tropical Asia' below).

Scores Against Principles

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

1997 Results

- The FiSAT reference manual that describes the theoretical foundation of the various routines in FiSAT was submitted to FAO for printing. It is expected that this manual will be ready for distribution by mid-1998. The manual will come with disks containing an update to some of the routines as a result of new developments and the new version of ABee software (for the estimation of the length-weight coefficients). The wide distribution of the software package is continuing and expected.

- A version of the yield/recruit and AUXIMS software modules was incorporated in FishBase 97 with its documentation. Updating of both modules is continuing, as well as work on the development of a version of ABee that is compatible with Microsoft Windows 95/NT.

Expected Outputs in 1998

- Work will focus on the finalization of user-interface of the CD title 'Materials for the Study of Tropical Fisheries and Aquaculture' with two volumes. 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 library. Volume 2 contains the publications of Dr. Daniel Pauly which will also be made available through the facilities of the Internet.

- Additionally, updating the released versions of the yield/recruit program and AUXIMS will continue to make the system compatible with the data structure of the trawl survey database. New versions are expected. Distributing the FiSAT software, most specially the reference manual with the attached updated version of the ABee software will be one of the major activities of the project.

6.2 MODELING OF MULTISPECIES FISHERIES

ICLARM Staff :

Dr. Villy Christensen (Project Leader); Mr. Felimon Gayanilo, Jr.

Collaborating Institutions :

Fisheries Centre, University of British Columbia (UBC); Danish Institute for Fisheries Research, North Sea Centre, Denmark.

Donors : Danish International Development Assistance; ICLARM core funds.

Duration : Continuing since February 1990.

Objectives

- To develop modeling approaches for management of ecosystem and of multispecies fisheries incorporating biological interaction.
- To make the methods available and develop them further in cooperation with scientists in national institutions.

Background and Justification

A method for ecosystem analysis has been developed at ICLARM over the last few years 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 (600+ registered users in 74+ countries) and has been used for description of more than 60 ecosystems, for regular course work at universities, theses work, etc. Interest is now growing in its potential for ecosystem management.

Lately a new methodology, EcoSim, for describing ecosystem dynamics has been developed by Prof. Carl Walters, UBC, Vancouver, and integrated in the Ecopath software, now called Ecopath with EcoSim. EcoSim makes it possible to simulate the impact of changes in fishing pressure on ecosystems.

There are no 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 Research	H

1997 Results

- The two Advanced Programmers and the Research Assistant that worked on the project all resigned in 1996. None of them was replaced due to budgetary constraints. Through the use of a Consultant Programmer for one month and the programming performed by the Project Leader, it was possible during the year to develop a restructured version of Ecopath for use in the Windows 95 environment. Through the cooperation of the Fisheries Centre, UBC, a new version of EcoSim was integrated with Ecopath, and an alpha version of Ecopath with EcoSim was under testing at the end of the year.

- A number of project-related publications appeared in primary literature and elsewhere. Ecopath was presented, by invitation, at a number of international fora. These included a European Union (EU)-funded Ecopath Workshop on Placing Fisheries in Their Ecosystem Context at the University of Cape Town, South Africa; an Ecopath course at Academia Sinica, Taiwan, and an International Conference on Ocean Harvest 97, Southampton Oceanographic Centre, UK.

Expected Outputs in 1998

- The new Ecopath with EcoSim will be further developed. Included in this is the integration of a new routine, EcoSpace, for spatial modeling based on Ecopath models, presently being developed by Prof. Carl Walters. The beta version of Ecopath with EcoSim version 4 will be used for a FAO-funded Workshop on EcoSim at the Fisheries Centre, UBC.

- Ecopath training courses and workshops will be held in Costa Rica, Denmark and Brazil as part of an EU-funded activity aimed at increasing cooperation between African, Caribbean and Pacific (ACP) and EU countries.

- A followup Ecopath workshop is to be conducted in Taipei.

- Ecopath with EcoSim will figure centrally at an EU-funded Workshop on Trophic Relations in the Oceans and Economic Productivity to be held at the EU Pavilion during the 'Ocean Expo 98' in Lisbon. Convenors of this workshop are Dr. Pauly and the Project Leader. Release of Ecopath with EcoSim is pending.

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

ICLARM Staff :

Dr. J.L. Munro (Project Leader); Dr. M. Watson (Research Associate); and Mr. A. Roberts (Technician).

Collaborating Institutions :

Centre for Marine Sciences, University of the West Indies, Kingston, Jamaica; Conservation and Fisheries Department, Tortola, British Virgin Islands (BVI).

Donors : Inter-American Development Bank (IDB, Jamaica component); United Kingdom Department for International Development (BVI component)

Duration : January 1996 - December 1999.

Objectives

- To develop scientifically validated criteria for the establishment of marine protected areas (MPA).

- To establish methods for identifying optimal locations for MPA and for the implementation of management

strategies based on sound social, economic and ecological evaluations.

Background and Justification

MPA or marine fishery reserves (MFR) have been established in many countries, usually for the express purpose of 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 MPA and such areas are, therefore, a source of increased production of eggs and larvae. Additionally, MPA serve as reservoirs of genetic diversity, which can be diminished in heavily exploited fish stocks. However, in some cases unfavorable currents might entrain the eggs and larvae and sweep them into the deep sea where no suitable habitats are available and the MPA might, consequently, be ineffective in enhancing recruitment to stocks in adjacent exploited areas.

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

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

The major variable is recruitment, in that 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 MPA, but also good fishing areas. Poorly situated MPA will have no effect on fish harvests because larvae are lost. Stocks in MPA 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.	Partnership	H
6.	Anticipatory Research	H

1997 Results

The 10-year Host Country Agreement with BVI was finally completed on 29 November 1996 and the BVI component of the Project commenced operations on 2 January 1997, and was fully staffed and operational by the end of February.

The Jamaican component of the project yielded a full year of routine recruitment monitoring, using small-meshed fish traps. The trapping techniques for juvenile fish developed in Jamaica were replicated in BVI, commencing in March.

Light traps were 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 to the fisheries. Comparisons of results with those gathered in Jamaica show order-of-magnitude differences in the abundances of presettlement and juvenile reef fishes and reveal a massive decline in biodiversity of reef fish species on the north coast of Jamaica. This affords evidence that these fisheries are not replenished by recruits spawned elsewhere and that overexploitation of multispecies fisheries will lead to local extinction of the most desirable and catchable species.

A major fish tagging effort was mounted in Jamaica with the objective of tagging a total of 6,000 fishes of all species. By the end of the year, 5,527 fishes had been tagged in the fishery reserve and 3,789 recoveries made in the Project's traps within the reserve. Fish recovered in the reserve are marked and released and many fish have been recaptured on numerous occasions over an extended period. Additionally, 145 marked fish have been recaptured outside the reserve and returned by fishers. A number of fishes had moved substantial distances along the coast. The largest movement was by a parrot fish, *Sparisoma chrysopterum*, which moved about 40 km along the coast. Others of the same species have not moved from the reserve over extended periods. The reserve is mostly comprised of shallow seagrass and sand, with coral patches in the back-reef area. Many species would be expected to move to deep fore-reef areas as they matured or, at least, make daily feeding or spawning excursions to the fore-reef and thus become vulnerable to capture. Nevertheless, there are indications of a build-up of biomass and an increase in mean size for a number of species in the reserve.

A plan to review the status of MPA in the Caribbean was abandoned when it was discovered that similar exercises had been independently undertaken by UNEP's Caribbean Environment Programme and by the US National Parks Service in St. John, US Virgin Islands.

Expected Outputs in 1998

- The first phase of the Jamaica component of the project will be

completed at the end of August 1998. Renewal will be sought from IDB for a second phase. The tagging program is expected to terminate in May, with a total of about 8,000 fishes tagged. Efforts to recover tagged fish will continue to the end of the project and, hopefully, into the second phase. Additionally, routine monitoring of the abundance of recruits and of the status of adult stocks in the Discovery Bay Fishery Reserve will continue. Light traps for catching presettlement reef fishes will be deployed in coordination with the BVI component.

- In BVI, work will continue to focus on recruitment monitoring using small-meshed fish traps and light traps. Development work on light traps will be aimed at increasing the effectiveness of the traps and reducing costs. Crest nets, which have been used with much success on the seaward edges of Pacific coral reefs, will be tested in selected areas. However, few areas in the Caribbean offer opportunities for their deployment, because of the limited tidal range and the configuration of the reefs.

- Preliminary trials will be undertaken on the use of floating cages in lagoons for rearing post-larval reef fish captured in light traps. It is planned to feed these fishes by attracting plankton and small clupeoids into the cages using photovoltaic lights. This will yield information on growth rates of newly settled reef fishes.

- Social scientists will be contracted on a short-term basis to study the economic and social factors operating in BVI and Jamaican (north coast) fisheries. For Jamaica, a graduate student in the University of the West Indies (UWI) Economics Department will undertake the work. For BVI, we expect to contract the services of an NGO which is located in the region.

6.4 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. Daniel Pauly; Dr. Mahfuzuddin Ahmed; Dr. Villy Christensen; Dr. John W. McManus; Mr. Felimon Gayanilo, Jr.; Mr. Len R. Garces.

Collaborating Institutions :

Various developing member-countries (DMC); Bangladesh - Department of Fisheries, Fisheries Research Institute; India - Central Marine Fisheries Research Institute; Indonesia - Directorate General of Fisheries, Central Research Institute for Fisheries; Malaysia - Department of Fisheries, Fisheries Research Institute; Philippines - Bureau of Fisheries and Aquatic Resources, University of the Philippines in the Visayas; Sri Lanka - Ministry of Fisheries and Aquatic Resources Development, National Aquatic Resources Agency; Thailand - Department of Fisheries, Southern Marine Fisheries Development Center; Vietnam - Ministry of Fisheries, Research Institute of Marine Products.

Donor : Asian Development Bank (ADB).

Duration : 1998 - 2000.

Objectives

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

- To develop resource databases and enhance management information in order to meet the resource management needs of selected DMC.

- To develop appropriate strategies and action plans to assist selected DMC in rehabilitating their coastal stocks and sustaining the resulting benefits.

- To 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 dependent on institutional capabilities and resources mobilization in the DMC, which face considerable technical, staff 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 DMC in identifying, prioritizing and orchestrating the interventions to many of the issues at hand.

This RETA supports the objectives of participating DMC, 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 DMC. 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 Research	H

Project Components and Expected Outputs

Target outputs for the proposed RETA will be generated via the implementation of two interrelated components, namely: (1) research, information and training; and (2) management policy and planning. The first component consists of three main

tasks, namely, database development (Task 1.1); the conduct of regional and national training for DMC scientists in the required fields of expertise for successful RETA implementation (Task 1.2); and analyses of the compiled data and related information at the national and regional levels (Task 1.3). The management policy and planning component consists of three main tasks for the conduct of national and regional workshops (Task 2.1); elaboration of national strategies and action plans for participating DMCs (Task 2.2); and the development of strategies and action plans at the regional level (Task 2.3).

The main outputs 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 1998

- Completion of startup activities and the elaboration of TrawlBase from the initial prototype developed under RETA 5651. These activities will include work programming, team formation (at ICLARM and participating DMC) and submission of inception report to ADB.

- TrawlBase programming and revision is envisioned to be completed by mid-1998, preparatory to the host of training activities and the start of data inputting by August 1998.

- Regional training activities to be conducted include stock assessment and community/ ecological analysis, socioeconomic analysis, fisheries, management policy and planning and use of TrawlBase. Participating DMC will nominate at least one scientist for each of the topics.

- Preparation and coordination of national consultative planning workshops should be done by year-end, preparatory to the series of national consultations during 1999.

6.5 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. P. Ramohia (Solomon Islands MAF); Mr. R. Pitt; Mr. I. Lane.

Collaborating Institutions :

Great Barrier Reef Marine Park Authority (GBRMPA); Solomon Islands MAF; Solomon Islands Ministry of Forests, Environment and Conservation, The Nature Conservancy (TNC).

Donor : Australian Centre 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, relative to reefs that remain open to fishing, and that the average sizes of individuals in reserves will be greater than those in fished areas.

Background and Justification

The resources needed to obtain information on the growth and mortality of commercially exploited marine species, necessary to establish catch levels in conventional fisheries management, is beyond the means of some developing countries. Fisheries managers in such nations are now looking for alternative ways of achieving sustainable harvests. One of the most appealing methods is to use MPA, also known as marine refugia, to protect a proportion of the stock. A well-designed system of reserves, in conjunction with appropriate levels of fishing effort, has the potential to sustain catches for two main reasons.

First, the prevention of fishing allows fish to accumulate and grow in size. The protected fish then produce far greater numbers of eggs because there is an exponential increase in fecundity with increasing body size. Second, the eggs and larvae of most marine species have an extended pelagic (floating) stage, during which they are likely to be dispersed outside the reserve. At the end of this process, the larvae "settle" as juveniles in areas open to fishing. Provided reserves are located in places where larvae are distributed to areas open to fishing, populations in the refuge should contribute an increased number of juveniles to the fishery.

ICLARM is testing the first of these ideas in conjunction with the declaration of a marine conservation area (MCA) of 83 km^2 at the Arnavon Islands, Solomon Islands. TNC has negotiated a three-year closure to fishing in the MCA for trochus, sea cucumbers and giant clams with the traditional users. GBRMPA has provided assistance with the statistical design of a monitoring program to assess the effect of the closure. This monitoring program is based on a 'before vs. after, impact vs. control' design. In this particular case, abundance of all species is estimated from six transects at each of four sites at 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, once in 1996 and 1997, and will be done 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 MPA 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. Partnership H
6. Anticipatory Research H

1997 Results

- The second of the post-declaration surveys of abundance of invertebrates was made. The aims of the survey, which was done two years after declaration of the MCA, were:

  i. 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.

  ii. To maintain the interest of the local communities in the project.

- After two years, there was little indication of increasing numbers of commercially exploited invertebrates in the MCA. The exception was trochus, which has increased in abundance at seven 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 1998

- Surveys of invertebrate populations at all study sites three years after the declaration of the MCA.

- Meetings with the Management Committee for the MCA to provide an update on the status of invertebrate populations, and to discuss the merits of extending the duration of the closure on fishing.

7. POLICY RESEARCH AND IMPACT ASSESSMENT PROGRAM (PRIAP)

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 Trinidad-Juan; Ms. Maricel C. Gamo.

Collaborating Institutions :

Denmark - North Sea Centre, 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, Universitas Pattimura Ambon, Yayasan Hualopu; 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 - Southeast Asian Regional Center for Graduate Study and Research in Agriculture, Tambuyog Development Center, University of the Philippines in the Visayas (UPV), Haribon Foundation, Palawan Council for Sustainable Development; Mozambique - Institute for Development of Small-scale Fisheries; Zimbabwe - Center for Applied Social Sciences, University of Zimbabwe, Lake Kariba Fisheries Research Institute; Malawi - Fisheries Department, Chancellor College; West Africa - Programme for Integrated Development of Artisanal Fisheries; Zambia - Department of Fisheries; South Africa - University of Cape Town, Sea Fisheries Research Institute; Caribbean - Caribbean Community Fisheries Resources Assessment and Management Program.

Donor : Danish International Development Assistance (DANIDA).

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, Africa and the Pacific, towards the goal of sustainable and equitable management of fisheries in developing countries to meet the

nutritive and economic needs of poor people.

Background and Justification

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

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

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

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

Scores Against Principles

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

1997 Results

- Publication of four scientific journal articles:

  1. Pido, M., R.S. Pomeroy, L.R. Garces and M.B. Carlos. 1997. A rapid appraisal approach to evaluation of community-level fisheries management systems: framework and field application at selected coastal fishing villages in the Philippines and Indonesia. Coast. Manage. 25(2):183-204.

  2. Pomeroy, R.S. and M.B. Carlos. 1997. Community-based coastal resource management in the Philippines: a review and

evaluation of programs and projects, 1984-1994. Mar. Policy 21(5):445-464.

3. Pomeroy, R.S. and F. Berkes. 1997. Two to tango: the role of government in fisheries co-management. Mar. Policy 21(5):465-480.

4. Pomeroy, R.S., R.B. Pollnac, B.M. Katon and C.D. Predo. 1997. Evaluating factors contributing to the success of community-based coastal resource management: the Central Visayas Regional Project-1, Philippines. Ocean Coast. Manage.

- Completion of several Africa co-management case studies:

  1. From no management to co-management? a case study on artisanal fisheries in Angoche District, Nampula Province, Mozambique.

  2. An analysis of emerging co-management arrangements for the Olifants River harder fishery, South Africa.

  3. Artisanal fisherfolks involvement in fishery rehabilitation in Senegal: co-management perspectives.

- Completion of several Asian co-management case studies:

  1. The Marine Conservation Project for San Salvador Island, Zambales, Philippines.

  2. Fisheries co-management case study in the Oxbow Lakes of Bangladesh.

- Second Africa Regional Workshop on Co-management, Malawi.

- Asian Fisheries Co-management Workshop, Phuket, Thailand.

- Completion of baseline surveys for pilot site in Honda Bay, Puerto Princesa City, Palawan, Philippines, and preparations of a project proposal for donor funding.

Expected Outputs in 1998

- Completion of co-management case studies in Philippines (Cogtong Bay, Bohol; Sarangani Bay; Malalison Island, Antique), Vietnam, Thailand, Indonesia, Bangladesh and Laos.

- Completion of study on transaction costs and co-management.

- Completion of institutional analysis of "sasi laut" in Maluku Province, Indonesia.

- Analysis of fisheries co-management policy in Malaysia.

- Completion of several synthesis report on lessons learned for successful co-management in Asia and Africa.

7.1.2 Valuation of Coral Reef Systems - Case Studies of Philippine Coral Reefs

ICLARM Staff :

Dr. Mahfuzuddin Ahmed; Ms. Rowena Andrea V. Santos; Mr. Len R. Garces.

Collaborating Institutions :

UPV (Social Sciences Institutions Department, Biological Sciences Department); UP Marine Science Institute.

Donor : ICLARM core funds.

Duration : January 1997 - December 1998.

Objectives

- To develop and 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) and Taklong Island (marine sanctuary).

Background and Justification

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

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

Non-use value applies to the value individuals place on resources, regardless of their present/future or consumptive/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; Taklong Island, a marine sanctuary.

Scores Against Principles

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

1997 Results

- The project was approved for funding in October 1997. The project staff met with one collaborator, UPV, in November 1997 to discuss the project proposal, activities and workplan. A letter of agreement on project collaboration between UPV

and ICLARM was signed. An initial assessment of the project site, Taklong - Tandog Island Marine Reserve in Guimaras, Iloilo, was conducted on 17 November 1997. Literatures and past studies conducted by UPV were gathered. The same activities, i.e., meet with collaborators, discuss project proposal and visit project sites, will be done in Anilao, Batangas, and Bolinao, Pangasinan, in 1998.

Expected Outputs in 1998

- Technical report, conference paper and journal articles 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; Nurul Islam; Manjur Kabir; Dr. Mahfuzuddin Ahmed; Dr. Robert S. Pomeroy.

Collaborating Institutions :

Department of Fisheries (DOF), Bangladesh institutions: Caritas, Proshika MUK, BRAC, Banchte Shekha and CRED.

Donor : Ford Foundation.

Duration : July 1995 - June 1998.

Objectives

General objective

- 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 objectives

- 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 governmental organizations (GO)-nongovernmental organizations (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 amongst the diverse populace.

Since the 1970s, 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 NGO (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 relationship 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.

In the past, ICLARM 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. The Bangladesh Project and the Fisheries Co-Management Project are mutually strengthened through collaboration and networking.

Scores Against Principles

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

1997 Results

- In May 1997, BRAC (the largest NGO in Bangladesh) signed a Memorandum of Understanding with DOF and joined the project partnership, adding five beels (lakes) to the project. In 1997, the project worked in 20 locations with five NGO (one of the smaller NGO included in 1996 was dropped due to problems in the field). Flowing rivers, seasonal and open beels, and more closed beels and oxbow lakes are now all covered. However, fisher rights in the rivers are still a problem as rivers have been declared open access

resources, so the fishers organized by the NGO lack administrative support for introducing management plans.

- The baseline survey revealed that about 87% of all households living around these waterbodies fish at some time. The NGO have organized about 20% of households and of these about 90% fish for an income. Most other households fish for food, except in the rivers where about half of non-NGO participants also fish for an income. The NGO participants are on average poorer than other households in terms of landholding, housing and number of months reported to be in food deficit. A majority of the NGO-organized fishers use more expensive and efficient gear particularly boats and seine nets, often on a team basis. The only effective fishing restrictions widely reported in 1995-1996 by fishers were payments for access. There was general agreement that fish in all the waterbodies are declining, and all fishers want to improve their fish stocks and fishery management. There was general support for stocking of waterbodies, but in the rivers the fishers also want measures to conserve fish such as gear restrictions, and to protect their access, while in the beels the fishers want to restore wetland habitat by excavating silted-up areas.

- Needs identified in the survey are being followed up by the partner NGO and DOF. All of the households covered by the baseline survey were revisited one year later to monitor changes in fishing, access and exploitation of the fishery, and impacts of NGO support. Analysis of this is underway. Routine monitoring of fish catches and fish markets has continued for 15 sites throughout the year. At three waterbodies, fish consumption and fishing have been monitored daily for a week in each month for a sample of households; a fourth seasonal beel was added later in the year. Processing of these data sets is now underway, and this monitoring will continue in 1998 to determine impacts of management activities introduced during 1997. Baseline socioeconomic surveys have been completed in the new BRAC sites. The DOF field teams have been responsible for these surveys, and DOF, NGO and ICLARM staff have been involved in two rounds of open meetings with the fishing communities in each site to review progress and findings.

- A national workshop jointly organized with DANIDA and supported by Oxbow Lakes Project II was held in March 1997. Presentations and working groups brought together government and NGO representatives to develop recommendations towards policy improvements for inland fisheries management. A project workshop was held in August 1997 to bring together project field staff and fisher representatives, the DOF-NGO teams working at each site reported on their progress and problems, which has helped to improve linkages and activities under the project. Both workshops produced recommendations that have been widely circulated as an input to fisheries

policy revisions which the government has been undertaking during the year.

- Two study visits to eastern India were arranged for the Minister of Fisheries and Livestock (MOFL) and for senior government officers responsible for fisheries. They concentrated on freshwater capture fisheries, stocking-based management of lakes, and community involvement and management. Linked with the project, 20 NGO and DOF staff attended a training program on community-based fisheries management organized in the Philippines by ICLARM and Tambuyog Development Center in November 1997 and supported by a separate grant from Ford Foundation.

- Technical guidance and fieldwork funds are being provided to six Master's students of Dhaka University to carry out biological studies on indigenous fishes in project waterbodies. This research will continue through 1998. Likewise a PhD student of Bangladesh Agricultural University is being supported to complete ongoing research on the impacts on indigenous fish of stocking carp in oxbow lakes. During 1997, ICLARM produced on behalf of all partners a quarterly project newsletter, a calendar, coordinated displays at the annual fish fair, and arranged cross visits between sites. This has helped to improve networking and exchange of ideas and experience between NGO and government staff.

Expected Outputs in 1998

- It is expected that the project will be extended with existing funding to the end of 1998.

- Publication of workshop proceedings, technical report and at least one site specific case study of community-based management following the co-management project research framework.

- Continue production of project newsletter, calendar and publicity activities, and present papers at international conferences to disseminate findings.

- Participatory planning for fishery management in ten of the project's waterbodies, and associated local training.

- Finalization of a proposal for a second phase program to build on the existing project and the wider program in community-based inland fisheries management initiated by Ford Foundation.

- Analysis of the impacts of the first full year of the program - socio-economics, catches and fish consumption.

- An end of project workshop to review findings and progress, and set up the second phase.

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 :

USA - World Resources Institute; Thailand - Coastal Resources Institute, Prince of Songkla University; Bangladesh - Bangladesh Environmental Lawyers Association; Philippines - Department of Environment and Natural Resources; Vietnam - Continental Shelf Committee, Vietnam-Canada Ocean Policy Project; Indonesia - Office of the State Ministry for Environment; Cambodia - Wetlands International.

Donors : 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, and Aquatic Environments, there is a priority need for expertise in law and policy with knowledge of fisheries management and coastal resources management. Specifically, PRIAP wishes to conduct research on national government laws and policies to enhance the analysis by the Fisheries Co-Management Project.

Scores Against Principles

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

1997 Results

- Organization and initiation of legal, policy and institutional studies on co-management and coastal resource management with national partners in the Philippines, Thailand, Cambodia, Indonesia, Vietnam and Bangladesh. Initiations of overview paper on the topic for Asia.

Expected Outputs in 1998

- Completion of legal, policy and institutional studies in partner countries.

- Workshop with national partners on legal, policy and institutional analysis for co-management and coastal resources management.

- Completion of research report including summary of country studies and synthesis.

7.1.5 Performance and Evaluation of Fisheries Co-Management in Indonesia and the Philippines

ICLARM Staff :

Ms. Ingvild Harkes (Project Leader); Dr. Robert Pomeroy.

Collaborating Institutions :

Component 1 - Yayasan Hualopu, Ambon, Indonesia; Universitas Pattimura Ambon, Indonesia; Component 2 - Center for West Visayan Studies, Panay, Philippines.

Donor : Dutch Government (DGIS); IDRC.

Duration : 1 November 1996 - 31 October 1998.

Objectives

- Component 1: To evaluate the performance of *sasi*, a traditional fisheries management system in terms of sustainability, equity, efficiency and resiliency to provide a basis for further development of successful co-management in the region.

- Component 2. The development of a method to measure the success of co-management.

Background and Justification

A component of the research strategy of the Fisheries Co-Management Project is country research conducted with local (NGO) partners. Within the country research, a fisheries management system in Indonesia is evaluated and compared to approaches and processes of fisheries co-management in other research sites (component 1). Additionally, a method to measure success of co-management projects will be developed in the Philippines (component 2). The purpose of this research is to gain detailed and specific understanding of the community-based and co-management approaches with regard to factors that affect design and implementation of these projects on government and local level.

Institutional arrangements, performance, policy factors, internal and external contextual attributes will be the focus of a comparative analysis using the institutional analysis framework. Performance of the systems will be evaluated in terms of sustainability, equity, efficiency and resiliency. Hypotheses will be tested concerning the factors for successful co-management projects, including level of participation, awareness, types of leadership, legitimacy, etc. The influence of these factors on the resilience of the system, together with the development of a method to evaluate success, will enable us to further develop co-management projects worldwide.

Scores Against Principles

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

1997 Results

- *Component 1*: Design and execution of *sasi* research in Ambon and Lease Islands, Indonesia. Data input and analysis of research framework. Preparation and presentation of paper at Asian regional workshop.

Second field period to test additional hypotheses.

- *Component 2*: Literature study and development of hypotheses on how to measure success of co-management projects. Presentation of draft paper at Asian regional workshop.

Expected Outputs in 1998

- *Component 1*: Inventory of the *sasi* fisheries management system in Ambon and the Lease Islands, Indonesia. Description of the performance of the *sasi* system and institutional analysis.

- Report on institutional resilience of the system. A number of research papers on *sasi* and co-management issues. Research report in both English and Indonesian by July 1998, and a third report submitted to the local communities.

- *Component 2:* Execution of research on the measurement of success of co-management projects in the Philippines. Research report and publication on this subject by October 1998.

7.1.6 An Institutional Analysis of the *Sasi Laut* System in Maluku Province, Indonesia

ICLARM Staff :

Dr. Robert S. Pomeroy; Ms. Ingvild Harkes.

Collaborating Institutions :

Universitas Pattimura Ambon; Yayasan Hualopu, Indonesia.

Donor : IDRC.

Duration : July 1997 - December 1998.

Objectives

General objectives

- To better understand the extent and functioning of traditional community-based coastal resource management systems in Indonesia, specifically the *sasi* system in Maluku province, for improved coastal resource management.

- To develop policy recommendations to support, maintain and develop effective community-based coastal resource management institutions in Maluku province and Indonesia for national, provincial and village governments.

Specific objectives

- To identify the extent of operating *sasi* systems and practices in Maluku province.

- To undertake descriptive and comparative case study analysis of the *sasi* system in Maluku province using the institutional analysis research framework.

- To measure the impacts and performance (equity, efficiency, sustainability) of the *sasi* system, especially in comparison to communities without *sasi*.

- To make policy recommendations to government to support, maintain and develop community-based coastal

resource management institutions, and especially *sasi.*

Background and Justification

The Indonesian province of Maluku is where *sasi*, a community-based resource management (CBRM) system exists. *Sasi* regulation controls and manages forestry and fishery resources. The government of Maluku realizes that *sasi laut* (for marine resources) is very effective in some parts of the province in managing coastal resources in a sustainable manner. However, many studies and observations indicate that in some parts of Maluku, this CBRM system has totally vanished, and elsewhere, is in the process of dying out.

To gain an overall picture of the *sasi* system is the initial step in understanding the CBRM institutions in Indonesia as a whole. Based on this understanding, processes and strategies for maintaining, transferring and revitalizing the system, or establishing a new CBRM system where *sasi* no longer exists, can be developed. Descriptive studies of *sasi* have been undertaken. A performance analysis and comparison study needs to be carried out to gain an idea about factors affecting the advantages and disadvantages, equity, efficiency and sustainability, and the success and failure of this CBRM system. Once the factors have been identified, policy recommendations concerning *sasi*, and CBRM in general, can be made to government and communities. The results of the analysis will also be of worldwide interest in the development of CBRM and co-management systems.

Scores Against Principles

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

1997 Results

- Design of four component *sasi* research in collaboration with Indonesian counterparts (inventory of *sasi* systems, performance of *sasi* systems, institutional analysis and a study on the resilience of the system). Training of field staff and preparation for fieldwork.

- Fieldwork period in June and July 1997 in the Lease Islands, Ambon, and a part of Seram. Data input in statistical package for the social sciences (SPSS) in Indonesia and start with the analysis of quantitative data. Analysis of qualitative data on resilience in the Philippines.

- Preparation of papers and presentation of the preliminary results at the Asia Regional Work-shop on Co-management organized by ICLARM.

- Second field period planned in December to test additional hypotheses.

Expected Outputs in 1998

- Checking of results and testing of hypotheses through participatory activities in the villages. Final analysis and synthesis of results.

- Physical outputs are: An inventory of the *sasi* fisheries management system in the Lease Islands, Ambon, and a part of Seram (Indonesia); description of the performance of the *sasi* system and institutional analysis; report on institutional resilience of the system; a number of research papers on *sasi* and co-management issues; research report in both English and Indonesian by July 1998; and a third report submitted to the local communities.

7.1.7 Institutional Capacity Building for Community-based Fisheries Management in Bangladesh

ICLARM Staff :

Dr. Robert S. Pomeroy; Dr. Paul Thompson.

Collaborating Institutions :

Philippines – Tambuyog Development Center; Bangladesh – Department of Fisheries, Caritas, Proshika MUK, BRAC, Banchte Shekha, CRED, CNRS.

Donor : Ford Foundation.

Duration : 1 January 1997 - 31 December 1999.

Objectives

- To provide training for government (national and local) and NGO personnel consistent with the needs of community-based fisheries management (CBFM) activities in Bangladesh.

- To contribute to the establishment of linkages between Bangladesh government and NGO institutions and Southeast Asian institutions involved in CBFM activities to strengthen overall fisheries resource management.

- To contribute to the establishment of collaborative research and development activities in CBFM in Asia to improve overall fisheries management and policy.

Background and Justification

The proposed project will contribute to meeting the training needs of GO and NGO staff in Bangladesh in support of CBFM Program, funded by the Ford Foundation Bangladesh. This project will complement the practical development and action research work being undertaken by DOF and NGO in Bangladesh in collaboration with ICLARM. The overall goal of the project is institutional capacity building for CBFM in Bangladesh, and the training of government and NGO personnel to meet their development and research needs.

CBFM in Bangladesh is focused on inland openwaters (rivers, beels/ lakes and floodplains). The DOF and NGO are working as partners to enable local communities, particularly people who depend on fishing for their livelihood, to manage fisheries in more sustainable ways. This includes developing alternative and enhanced sources of income for lean seasons, and an emphasis on protecting access to fisheries for food by the many poor households who catch small fishes for their own consumption. This is being

tested by several NGO collaborating with DOF in a range of waterbodies. Training is needed to enhance the capacity of staff and local communities to assess and analyze existing management systems, in participatory rapid appraisal (PRA) and participatory planning of community-based initiatives (for example, for fish conservation), in analysis of survey results to assess the sustainability and equity implications of fishing management, and to learn from experience and approaches to CBFM adopted in other countries.

Training and study program will include:

- Custom-designed CBFM training and study programs designed to strengthen the capabilities of teams of government and NGO personnel involved in CBFM at specific waterbodies covered by existing projects.
- Policy-oriented training programs for policymakers.
- Technical or academic training to meet specific needs of fisheries staff regarding studies and management of inland openwater fisheries.

Scores Against Principles

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

1997 Results

- Visit to Bangladesh to plan training, August.
- Training, field visit and case study analysis conducted by Tambuyog Development Center for 20 DOF and NGO staff and four policy-makers, Manila, Philippines, 9-25 November 1997.

Expected Outputs in 1998

- Followup visit for evaluation of training and review of case studies.
- Final project evaluation.

7.2 Impact of Aquatic Resources Research: Methods and Assessment

7.2.1 Impact of Giant Clam Productivity Enhancement Research

ICLARM staff :

Dr. Mahfuzuddin Ahmed.

Collaborating Institution :

Department of Agricultural and Resource Economics (DARE), University of New England (UNE).

Donor : ICLARM core funds.

Duration : 1997 - 1998.

Objectives

General objective

- 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, including the analysis of factors affecting the adoption of giant clam mariculture.

Specific objectives

- To estimate the effects of giant clam breeding and enhancement research on:
  - * income and output stabilization;
  - * productivity of marine and coral reef systems; and
  - * reducing risks to a stable supply of food and income to coastal communities.
- To provide a framework for monitoring farming trials of *T. derasa*, determine its potential for adoption and provide ex-ante assessment (e.g., productivity, income and market).
- 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;
  - * 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 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 to date, 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 the 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 Research	M

1997 Results

- A Memorandum of Understanding was signed by ICLARM and DARE.

- Dr. Oscar Cacho, UNE Professor and Ms. Robyn Hean, Ph.D. student conducted field visit to Solomon Island. They developed a conceptual framework on the bioeconomics of giant clam mariculture as part of the Ph.D. research by Ms. Hean.

- Visit of M. Ahmed to UNE and Solomon Islands and commencement of fieldwork by Ms. Hean.

Expected Output in 1998

- A technical report will be submitted by the end of December 1998.

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

Note: This will now be titled as follows: **Developing an Appropriate Fishery Extension System for Transfer of Technology Based on Evaluation of Existing Alternative Extension Approaches.**

ICLARM Staff :

Dr. Paul Thompson; Dr. Mahfuzuddin Ahmed; others to be identified.

Collaborating Institution :

Department of Fisheries, Bangladesh.

Donor : IFAD.

Duration : July 1996 - June 1998.

Objectives

General objectives

- To develop policy recommendations regarding viable and sustainable fish

culture technologies for different situations.

- To provide data and models for use in assessing future development projects.

Specific objectives

- 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 programme is in operation through the trickle down approach of Fish Culture Extension at Thana level (Government of Bangladesh [GOB]-funded), and where enhanced extension systems have been tried through intensive training under the Northwest Aquaculture Development Project (Overseas Development Administration-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 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 involve detailed farm household surveys and monitoring of inputs and outputs, nutritional changes, and employment and income of men and women.

Background and Justification

During 1990-1994, ICLARM in collaboration with GOB agencies carried out a project 'Socioeconomic Impact of Fish Culture Extension Programme 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 socio-economic 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 t/ha/year) and Nile tilapia (3.3 t/ha/year), compared with average pre-project production of 0.6 t/ha/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 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 Research	M

1997 Results

- Government of Bangladesh procedures for reviewing and finalizing the Technical Assistance Project Proforma resulted in continued delays in starting the project. However, by August, the project was approved by GOB, and in October, a Project Director in DOF was appointed. The original objectives were retained but, at the request of MOFL, there would now be more emphasis on assessing extension methods. This was agreed with IFAD. It was expected that NRS would be appointed by the end of 1997, and an overall workplan had already been agreed.

Expected Outputs in 1998

- Field surveys will take up most of 1998, with the main outputs due in 1999 now that the project period has been revised.

- The first phase sample design and participants' experience will be reviewed through workshops with the previous contact farmers. An extensive survey of fish farmers in the original project area of Kapasia (main contacts, secondary contacts and control farmers) will be undertaken and finalized.

- Detailed monitoring of a sample of ponds and the associated households and farms from the original project will be started and will continue for a production cycle (into 1998).

- Liaison with and review of DFID-supported Northwest Aquaculture Development Project and DANIDA-supported Mymensingh Aquaculture Project on their fish farming extension systems. A system for rapid evaluation of extension systems and impacts will be developed and applied in one of these project working areas.

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 Garces; Mr. Emmanuel L. Genio.

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 CTU. In order to expedite a multidisciplinary approach towards fish farming systems and a constructive cooperation, project activities will be implemented with Faculty of Economics at CTU, the Faculty of Fisheries at the University of Agriculture and Forestry, and the Farming Systems Research and Development Centre of CTU. The project will be implemented in three phases with a total period of three to four years: I: Upgrading of Staff and Facilities; II: Interdisciplinary Approach Towards Farming Systems Analysis, Assessment of Needs; and 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 Research	M

1997 Results

- Completion of household socioeconomic analysis of fish farmers research report.

- Completion of marketing analysis of freshwater aquaculture products in central area of Mekong Delta region report.

- Completion of one-year record-keeping activities on farm households for use in economic analysis.

- Completion of economic analysis of fish farming activities in integrated farming systems.

Expected Outputs in 1998

- Extension of project until 31 December 1998.
- Completion of production functions analysis of fish farming.
- Training course on economic statistical analysis and writing scientific papers.

7.3.2 Bangus Fry Resource Assessment Project

ICLARM staff :

Dr. Mahfuzuddin Ahmed (Project Leader); Ms. Annabel Cruz-Trinidad (until November 1996); Mr. Francisco Torres, Jr.; Mr. John Marie Gacutan (until 31 July 1997); Ms. Rowena Andrea V. Santos (beginning 1 January 1997); Ms. Marites M. Tiongco (beginning 15 January 1997); Ms. Maria Lucia Tungala.

Collaborating Institutions :

BFAR, PCAMRD, SEAFDEC.

Donors : BFAR; PCAMRD.

Duration : March 1996 - March 1998.

Objectives

General objective

- To verify if there is actually a scarcity in milkfish fry in the Philippines and if so provide inferences as to the likely causes.

Specific 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 correlation between coastal environmental and/or human development parameters against productivity of spawning/nursery grounds.
- To train enumerators in fry data collection techniques.
- To recommend a system of 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 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 1970s. 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 Research	M

1997 Results

- A total of 194 questionnaires have been administered to fry gatherers/ cooperators from the five selected regions. Fry gathering activities were monitored monthly by the regional coordinators and all the data were transmitted by June 1997.

- Monitoring of volume of trade of bangus fry for 13 selected fry traders/buyers on a monthly basis was also conducted.

- Collection of time series information on fry production from the five regions under the project was also undertaken. Data from several towns in Sarangani Province (Region XI - General Santos) showed a declining trend in the production of fry. Preparation of the final report is underway.

- A proposal for a national workshop has been submitted to BFAR and PCAMRD for funding.

Expected Outputs in 1998

- Submission of final terminal report to BFAR, PCAMRD and SEAFDEC.

- Presentation of project results to collaborators.

- Followup on the national/regional workshop proposal.

7.3.3 International Consultation on Fisheries Policy Research in Developing Countries: Issues, Priorities and Needs

ICLARM staff :

Dr. Mahfuzuddin Ahmed; Dr. Meryl J. Williams; Dr. Peter Gardiner; Ms. Rowena Andrea V. Santos.

Collaborating Institutions :

International Food Policy Research Institute (IFPRI); Institute of Fisheries Management and Coastal Community Development (IFM), North Sea Centre (NSC); Royal Veterinary and Agricultural University, Denmark.

Donor : DANIDA.

Objectives

General objective

- 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 objectives

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

- To develop 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 twenty-first 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, go 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 Research	H

1997 Results

- Conduct of the Workshop on International Consultation on Fisheries Policy Research in Developing Countries: Issues, Priorities and Needs on 2 - 6 June 1997, NSC, Hirtshals, Denmark. About 40 participants involving developing country representatives, policymakers and policy analysts, resource persons from developed and developing countries, donor

representatives and international agencies attended the workshop. Drs. Meryl J. Williams, Peter R. Gardiner, Mahfuzuddin Ahmed and two members of the ICLARM Board of Trustees, Drs. Serge Garcia and Ellen Borteidoku-Aryeteey participated in the workshop. Dr. Williams gave one of the two keynote addresses entitled "Achieving food security for all: key policy issues for developing countries" and Dr. Ahmed presented a paper entitled "Policy issues deriving from the scope, determinants of growth, and changing structure of supply of fish and fishery products in developing countries".

- A press conference was also held in conjunction with the workshop on 4 June 1997 in NSC where the director generals of ICLARM, IFPRI and IFM spoke on a number of important research topics addressing policy issues concerning food security, poverty alleviation and environmental protection.

- A special in-house seminar was held in ICLARM on 16 July 1997. Delivered by Drs. Williams and Ahmed, the seminar presented the summary and highlights of the workshop and recommended actions/researchable topics within ICLARM's agenda.

- Publication of the following:

  1. Ahmed, M. and R.A.V. Santos, Editors. 1997. International Consultation on Fisheries Policy Research in Developing Countries. Naga Supplement (July - December):16 p. (Released in July 1997).

  2. Ahmed, M., C. Delgado and S. Sverdrup-Jensen. 1997. A brief for fisheries policy research in developing countries. ICLARM. 16 p. (Released in November 1997 in time for the International Centers Week held in Washington, DC).

Expected Output in 1998

- Publication of workshop proceedings.

7.3.4 Database for the Assessment of Developing Country Fisheries

ICLARM Staff :

Dr. Mahfuzuddin Ahmed; others to be identified.

Collaborating Institutions :

FAO; INFOFISH; NACA; others to be identified.

Donor : ICLARM core funds.

Duration : 1997 - 2000.

Objectives

General objectives

- To establish and maintain a database for policy analysis.

- To provide analysis of technological development, market movements and institutional changes in developing country fisheries.

Specific objectives

- To develop and adapt databases for impact assessment and research priority setting.
- To create, maintain and update a secondary database combining bio-physical 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 for assessment of 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 in adoption and information on adoption variables from formal and informal surveys at the levels of farm and fisher households and the community. Secondary data will be based on documentation and reports from various sources.

Scores Against Principles

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

1997 Results

- A concept note entitled 'Assessment and monitoring of supply and demand for fish and seafood products in Asia' was prepared for ADB funding. This proposal will include direct input of information/data into the database.
- Compilation of fishery statistics data from FAO's State of the World Fisheries and Aquaculture and other related agencies.

  Progress was only partial due to lack of resources.

Expected Outputs in 1998

- Development of a secondary database combining biophysical and socioeconomic information on world fisheries with special reference to developing country fisheries.
- Compilation of secondary data on the biophysical and socioeconomic information of developing countries in the database.
- Preparation and inception of a new Project on Ecological Economics Assessment (Valuation) and Policy Analysis of Wetlands and Aquatic Resources in the Mekong River Basin may also take place in 1998 through SIDA, MRC and OxFAM - America collaborations.
- PRIAP will implement the socio-economic and policy analysis component of the Project on Strategies and Action Plans for the Sustainable Utilization of Coastal Fish Stocks in Tropical Asia under FRAMP.

8. INFORMATION AND TRAINING PROGRAM (ITP)

8.1 PROGRAM OFFICE

ICLARM Staff :

Ms. Joanna Kane-Potaka (Program Leader); Ms. Fanny Llego (Secretary).

Donor : ICLARM core funds.

Duration : Continuous.

Objectives

- To actively initiate and participate in the dissemination of ICLARM's research outputs, through the use of the skills of the program.
- To initiate the marketing of ICLARM as a corporate entity with a clearly defined mission.
- To develop the structure and skills within ITP and, where relevant, within ICLARM to achieve these objectives.

Background and Justification

Dissemination of research results and the marketing of ICLARM is critical for its continued existence and success in its mission. The increased demand by donors for identification and assessment of the impact of our research further emphasizes this requirement.

Scores Against Principles

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

1997 Results

Achievements not already listed under the individual Units include:

- Developed a Program Plan including newly defined goals, strategies and priorities.
- Encouraged the development of dissemination strategies as part of projects at the proposal stage. Used the Program's Units as dissemination tools and, hence, resources to draw on for a dissemination strategy (rather than previous independent operations of each unit).
- Concept notes for major fundable projects were developed for the Program for the first time. This change is planned to be an important component in developing and expanding the services of the ITP.

Expected Outputs in 1998

- Further development of and lobbying for funding for information and training initiatives.
- Further encouragement for the inclusion of dissemination strategies in the preparation of proposals for scientific research.

8.2 PUBLICATIONS UNIT

ICLARM Staff :

Ms. Marie Sol M. Sadorra (Manager); Ms. Rita Kapadia; Ms. Sheila Siar; Ms. Ma. Graciela Balleras; Mr. Albert Contemprate; Mr. Alan Siegfrid Esquillon; Ms. Alma Canuto; Mr. Rodel Resurreccion.

Collaborating Institutions :

Various external authors contributing articles (Naga and the Center's Technical Series); a few authors on commission; external reviewers.

Donor : ICLARM core funds.

Duration : Continuous.

Objective

- To publish effectively and disseminate efficiently ICLARM research findings and results.

Background and Justification

ICLARM always aims to publish findings and results from its research to ensure that these reach the intended user groups, especially in developing countries, as a commitment to donors and to the scientific community.

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

1997 Results

- *A major analysis and restructuring was undertaken.* Vacancies (retirement of the Unit Manager and resignation of two staff) opened ways to the restructuring. While the Assistant Editor was made officer-in-charge (OIC) of the Unit, positions (for Manager, Editors and Writers) were advertised in major national dailies and other venues for employment opportunities for expatriates. In September, the Unit OIC was appointed Manager. The created Senior Editor position was also filled, and then the Assistant Editor was named. The Typesetter was appointed Editorial Assistant. From five, the Artists/Typesetter became three.

- During most of the year, work was unusually heavy in the Unit because of the restructuring and orientation of the new appointees in the job. Amidst inundating work requests, most of the staff often had to perform tasks beyond their normal duties. With the able guidance of the Program Leader and the dedication of the staff, outputs were produced. Contractual staff (editors and artists) were hired. A few staff from other programs and projects cooperated in production which proved valuable in coming out with the publications in time.

- *Project management procedures were initiated.* While the positions were being filled, the overall management of the publication phases and distribution procedure was assessed. Team-style work

groups were formed. "Project management" was being integrated in light of priorities, efficiency and timeliness: timetabling of projects; allocating of responsibilities; feed-back and monitoring process; resource allocation; proactive involvement of staff with scientists in determining the products and their dissemination, etc.

- *Monthly updates* on the specific jobs (current and completed) of the Unit were initiated and informed of to senior management.

- *Staff training.* Because of the restructuring of the Unit and the filling in of positions, training for most staff was temporarily set aside. This situation may be rectified in 1998.

- *Thirty-one publications completed.* The following were published in 1997:

  - ICLARM 1997 Operational Plan;
  - ICLARM Annual Report 1996;
  - three issues of Naga, the ICLARM Quarterly;
  - one Naga Supplement (July-December 1997 issue), International Consultation on Fisheries Policy Research in Developing Countries);
  - 11 issues of ICLARM Newsplash;
  - one Studies and Reviews (SR 25);
  - one Technical Reports (TR 43);
  - eight Conference Proceedings (CP 41, 42, 48, 50, 51, 52, 53 and 54);
  - two Education Series (ES 12 and 17); and
  - two brochures (on FishBase and on ICLARM).

- *Eighty-five contributions copyedited and cleared.* During the year, 85 ICLARM contributions were edited (technical and/or copyedited) and cleared for submission to international and regional refereed journals; internal and external publications, such as conference proceedings, technical reports, and studies and reviews; magazines and newsletters; web pages; and others.

- *Other production work.* For internal and external presentations of various staff, the Unit made posters, overhead transparencies, slides and folders. Business cards, conference/ workshop invitations, certificates and handouts were also prepared. Photography and videography were handled, too.

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

- *17,700 copies of ICLARM publications distributed and promoted.* In 1997, from sales, library exchange and free issue, the total number of ICLARM publications

(technical series and Naga) distributed was 17,700. Naga recipients, as of December 1997, number 4,830 (with an increase of 105, from 1997's 4,725). Publication sales from mail and internet orders and walk-in buyers totaled US$13,515 (an increase of $2,515 from last year's figure).

- *Introduction of a two-tiered pricing system for publications.* In mid-1997, for strategic marketing, a two-tiered pricing scheme for publication sales was introduced - one for less developed countries (LDC) and another for highly developed countries (HDC). The prices were developed based on the production costs and marketing information. Valuable sales feedback on this two-tiered scheme was received from the International Specialized Book Services (ISBS), the distributor of ICLARM books in the USA, Canada, Central and South America. According to the ISBS Marketing Director, the scheme is appropriate for ICLARM's markets and will give a better image for the Center's high-quality publications.

- *Analyzing and trialing options to deal with massive postage cost increases.* In 1997, postage rates in the Philippines increased by at least 50% for airmail and 70% for seamail. To cope with these increases, a wide variety of options were and are currently analyzed and trialed. Currently being undertaken is bulk mailing, that is, mailing several publications at one time to take advantage of the maximum allowable weight of a mailing rate. Mailing several publication copies to a country for distribution by a collaborator there was trialed. Discounts with different couriers are being negotiated. Placing a number of publications on CD is being considered. Using distribution centers in countries with cheaper mailing costs is also being studied.

- *Follow-up to the Naga survey.* In the January 1996 issue of Naga, a survey questionnaire was distributed to 4,778 readers of Naga to determine their profile, as well as to update the mailing list. A follow-up questionnaire was included in the October 1996 issue of Naga. Information from this survey will help shape Naga in the future.

- *ICLARM publications promoted at four local and ten international conferences/exhibits.* These included: March - *Settimana della Scienza*; May - ICLARM - Abbassa, Egypt, office inauguration; June - mass book donation, spearheaded by the Philippine National Book Development Board; July - Planning Workshop of ADB Carp Genetics Project; August - Zimbabwe International Bookfair; September - Australian Embassy - ICLARM exhibit; the Philippine Bookfair; ICLARM board display; October - Conference on Coral Reefs; ICW '97; Japan Day International Cooperation; November - Symposium on Sustainable Aquaculture; Workshop on Marine Protected Areas; and December - International Fund for Agricultural Development.

- *A monitoring, updating and development plan for the ICLARM homepage was created and implemented.* Information in the homepage is prepared by the Unit, in collaboration with the programs and projects. Uploading is done by CSU. Sections undergo different levels of revision and clearance. Because of staff shortage in 1997, updating of some sections was needed. However, with the assumption of the Assistant Editor to office in November, some updatings and developments were already made.

- *Translation and public awareness services.* With the budget cut, the coordination of translation services was done by PU until staff can be resourced. Public awareness outputs also have a large involvement by the Publications Unit, while the Public Awareness Unit budget was short.

  An ITP display board was also launched during the Board of Trustees Meeting in September. Programs and projects may use the board in promoting their work.

Expected Outputs in 1998

- *Unit management.* Team-style responsibilities and accountabilities will be further developed through training. As needed, contractual staff will be employed to produce publications on time. PU staff will continue to be more proactively involved in the presentation of the scientific and technical information, according to their target audience. Also, cooperation of programs and projects in the production phase will be further developed. Further timetabling of projects and allocation of resources will be developed and computerized. Standards and procedures to follow will be further documented.

- *Publications and other services.* The Unit will produce the following staple publications: ICLARM 1997 Operational Plan, ICLARM Annual Report 1997, four Naga issues and 12 ICLARM Newsplash issues. Under the technical series, these are in the pipeline: three Technical Reports; three Conference Proceedings; one Studies and Reviews; one Education Series; and two - three issues of Asian Fisheries Science.

  There is a plan to put significant sections of ICLARM publications on the internet for the sake of timeliness and to reach specific user groups.

  The Unit will continue to draft figures and graphics; prepare posters, slides and overheads; and assist in encoding and proofing corrections to manuscripts and layouts.

- *Distribution and promotion.* This aspect of publishing will be made more vigorous. Attractive flyers will be released with new publications. These flyers will be distributed with Naga and in relevant conferences and workshops. The homepage will be used more to feature new publications - their table of contents, authorship and significance. The

prices in the two-tiered pricing scheme will be further studied with help from authors and distributors. Other current ways of distribution and sales will continue to be followed.

- *Public awareness.* The Unit is poised to prepare for several exhibits in 1998.

- *Translation services.* Translation of correspondence and other simple documents is and will be coordinated by the Unit. Internal (i.e., within the Center) and external translation skills will be tapped and pooled.

8.3 Library and Information Services Unit

ICLARM Staff :

Ms. Rosalinda M. Temprosa (Manager); 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 partners (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

1997 Results

8.3.1 Collections

The library collections include a wide variety of materials in many formats: books and monographs; reprints; theses; serials; maps; video-recordings; slides; photos; CD-ROMs;

softwares; newspaper clippings; pamphlets; microforms; posters; and other materials. As of December 1997, the collection comprised 14,023 volumes of books and monographs; 7,324 titles of reprints; 77 items of nonbook materials; 6,277 slides; and 4,500 photos. There were 819 currently received serial titles from a total holdings of 1,318 serials. About 702 (84%) titles were received as gifts or exchange items and only 117 (16%) titles were on subscription.

Acquisition of additional library materials has been greatly affected by the centerwide budget cuts and the increasing costs of books and serial subscriptions. As a result, out of the 148 serial titles for 1997 renewal only 76 titles were renewed. Also, Executives and Program/Project Leaders were requested to accommodate renewal subscription cost of the remaining journals which the library couldn't afford to pay, thus, 41 titles were covered.

In February, a database for ICLARM's media coverage called PRESS was completed using the UNESCO's CDS/ISIS system software package. The database contains information on outgoing press releases and incoming media mentions since 1977, when ICLARM was established. The database can be searched by subject, title, author, year, project title, book title announced and staff quoted in the news or article.

In April, the retrospective conversion of the library's catalog card records into machine-readable format began. There were 315 records loaded onto LIBRI database during the year which improved users' access to the availability of information.

Library and Information Services Unit (LISU) began work on a project to organize and process the slide/photo collection. An inventory of all slide and photo collections was initiated during the year. As plans were being developed on its preservation, storage and retrieval systems, LISU solicited information on how other libraries, information centers and institutions manage their image collections to gain further insights.

In July, the RED database which contains bibliographic records on Indo-Pacific red tides was merged with LIBRI, the library's online catalog. After considerable evaluation, it was not deemed efficient to pursue the plan of merging the library databases LIBRI and NAGA into one large database.

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 1997 are:

LIBRI	12,450
SERIE	1,318
NAGA	16,299
PRESS	692
CAD	16,300

From these databases, the following were produced:

Eleven "New Acquisitions" lists (with 1,080 bibliographic entries). The production of the printed version was discontinued as a cost-saving measure with January/February 1997 as the last

bi-monthly issue. Announcements of newly added titles and the lists are sent monthly via electronic mail to headquarters staff and outreach offices.

Three 1997 issues of 'Information Department' in Naga (1,200 entries). This section has been enhanced by adding data fields for the fax and e-mail address of the senior author. The Information Department includes the latest publications on all aspects of fisheries and aquaculture related to tropical and developing countries, as well as notices of meetings and courses.

The IRSMLDC 1996 Book Catalogue and the ICLARM Library Serial Holdings List have not been issued due to budgetary constraints. However, on 24 November, the ICLARM Library Serial Holdings List (1,304 citations) was submitted to the Publications Unit for uploading onto the ICLARM homepage.

The present ICLARM's CD-ROM tower accommodates only seven CDs used by LISU and FishBase Project. In mid-July, a new arrangement was made to install newly acquired CDs of the Zoological Record replacing LISU's two annual CDs of Current Contents. LISU still keeps and maintains its most frequently used CDs in the tower, i.e., Aquatic Sciences and Fisheries Abstracts (ASFA); and the latest two disc editions of Current Contents: Agriculture, Biology and Environmental Sciences (ABES) and Social and Behavioral Sciences (SBS). Database searching of the replaced Current Contents editions (ABES and SBS) CDs can be made only in the premises of the library.

In December, the FishBase project donated one computer (486 DX2 with CD-ROM drive) to the library.

8.3.2 Services

The library continued to provide information and reference services to 1,681 users, mostly university students from Metro Manila, growers, volunteers, academic/library personnel, government workers, consultants, administrators and policymakers. Of the 16,382 library materials being used, serials (52%) were most frequently used, followed by books and monographs (37%) and reprints and other types of documents (11%). The five most important/used serial titles were: Aquaculture, INFOFISH International, Marine Pollution Bulletin, Hydrobiologia and Journal of Fish Biology. Demonstrations on the use of information databases, online searching and library orientations were provided to 541 users/visitors.

LISU continued to support the research needs of the outreach staff by ensuring that they had access to the current information available. The "New Acquisitions" lists are sent by electronic mail to outposted officers and outreach sites in Bangladesh, Egypt, Malawi and Solomon Islands. A total of 125 titles/ 4,117 photocopied pages were requested from the list. During the year, 1,306 pages of table of contents from 900 volumes/issues of different journals and 1,113 titles (8,168 pages) of photocopied journal articles were sent to

Bangladesh, Egypt, Malawi and Solomon Islands as part of the Serial Contents Page Service to outreach sites. LISU also arranged the acquisition of books, reprints and serial subscriptions for all the outreach sites. Additionally, subscription to ASFA CD-ROM was facilitated for the Bangladesh Fisheries Research Institute; and updates of the library databases (NAGA, LIBRI and SERIE) were sent to the library of ICLARM Malawi Project Office on 10 October.

Under the Selective Fisheries Information Service (SFIS), 457 queries from 79 countries were responded to during the year. Three-hundred-twenty queries were answered free; 50 were charged; 18 offered on exchange; and 69 referred to others. Queries from developing countries (66%) continued to be the largest users of SFIS.

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

8.3.3 Linkages and Cooperation

As an international inputting center to the Aquatic Sciences and Fisheries Information System (ASFIS), the library has submitted 570 citations since November 1995. Entries of all ICLARM publications to the Aquatic Sciences and Fisheries Abstracts (ASFA) database are fully up-to-date.

In cooperation with the International Agricultural Research Centers (IARC), LISU participated in a cooperative project on the Union Catalog of Serial Resources in IARCs. The objective of the project is to make available serial holdings to libraries and information centers in the IARCs and in the national agricultural research systems (NARS) of the developing world. LISU's serial holdings of 1,297 titles were submitted to ICRISAT, the coordinating library in early January 1997.

In February, LISU started to send ICLARM press clippings to CGIAR Secretariat for inclusion in the CGIAR Media Digest. Of the 31 ICLARM press clippings sent, 13 were included in the Digest plus seven more items with mentions of ICLARM.

On 19 May 1997, LISU agreed to collaborate with the Intergovernmental Oceanographic Commission (IOC) Global Directory of Marine Scientists (GLODIR) Project by coordinating input for ICLARM and Philippine fisheries scientists. GLODIR is an online database containing information on scientists and their scientific interests. It is a product developed under the auspices of the International Oceanographic Data and Information Exchange's (IODE) Group of Experts in Marine Information Management (GE-MIM). During the year, 130 questionnaire forms were distributed to ICLARM and other scientists working in the Philippines. Of these, 68 were returned and entered onto the database.

In November, LISU assisted the Information Resources Development Program of SEAMEO/SEARCA in Los Baños, Laguna, in conducting Information Needs Survey by distributing questionnaire forms to

ICLARM research staff. The survey aims to determine the information requirements of scientists, academicians, planners, extension personnel and others who are interested in agricultural information.

The library continued to strengthen its ties with libraries and institutions worldwide through increased cooperation and assistance. An exchange of publications with 10 additional institutions - University of British Columbia, Fisheries Centre, Canada; Inland Fisheries Society of India; Kerala Agricultural University; Iran Agricultural Research, Education and Extension Organization; Shad Foundation, USA; Winrock International, USA; Laboratoire d'Oceanographie Biologique et Ecologie du Plancton Marin, France; Malawi Fisheries Department; Royal Institute, The Netherlands; and Organisation of Eastern Caribbean States (OECS), Natural Resources Management Unit, St. Lucia, WI - has also been established. Through the Duplicate Exchange Program of the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC), requests from 10 foreign libraries were filled in exchange for 10 volumes of books and 26 titles of journals.

As of December 1997, LISU had exchange agreements with 135 libraries/institutions.

LISU also continued to provide Document Delivery Service to the Regional Co-operation in Scientific Information Exchange in Western Indian Ocean Region (RECOSCIX-WIO) Project of the IOC based in Mombasa, Kenya. A total of 102 titles/1,130 photocopied pages of articles and one ICLARM Technical Reports were sent during the year.

Advice and practical training on the library and information system was provided to our staff of Bangladesh Office on 6-7 October.

In September, the LISU Manager was invited to and accepted the membership to the Protected Areas Resource Centres (PARC) Advisory Group. PARC is an initiative to create a worldwide information system for protected areas consisting of information resources, information services, networking and training under the general sponsorship of the World Commission on Protected Areas of the IUCN (The World Conservation Union).

8.3.4 Information Project

LISU continued work on a project 'Union Catalog of Fisheries Serial Holdings in Asia.' The objective of the project is to disseminate a database of serial holdings on aquatic sciences in the Asian region which would facilitate easy and quick access to serial sources available and promote resource sharing and active interlibrary loans. In July 1997, the database was recovered (the database was lost due to a computer crash incident last October 1996) and was ready for new entries as new entry forms were developed. The database now contains 11,671 data holdings records with 3,082 serial citations from 43 participating libraries and institutions. While encoding task is almost

completed, assistance for other programming tasks is needed first to fully develop and complete the database structure.

Expected Outputs in 1998

- 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; a monthly selected list of new acquisitions be made available on ICLARM's homepage; and use of MS-ACCESS, a relational database for the Citation Analysis Database (CAD).

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

- Assess and monitor services to outreach sites, and improve services where practical opportunities are identified.

- Assist in the setup of ICLARM's regional library in Abbassa, Egypt.

- Keep inputs of ICLARM publications to ASFIS up-to-date.

- Continue citation analyses of ICLARM documents to find out the extent to which the publications have been used by other researchers in various countries.

- Develop a bibliographic database of the slide and photo collections.

- Complete the development of the Union Catalog and make it widely available on diskette.

- Continue to work on the retrospective conversion of the library's catalog records into machine readable format.

- Continue cooperation and resource sharing with other fisheries and aquatic libraries worldwide.

- Assess the usage of and demands for ICLARM subscriptions to determine a priority listing.

- Develop concepts of potentially fundable projects that assist ICLARM in further fulfilling its information services role.

8.4 Public Awareness Unit

ICLARM Staff :

Vacant.

Donor : Mainly ICLARM core funds.

Duration : Continuous since 1995.

Objectives

- To coordinate Public Awareness (PA) of ICLARM at a corporate level. Priority target audience is the current and potential development assistance community.

- Encourage building of PA into scientific research projects as a component of the dissemination strategy for the research outputs.

Background and Justification

Traditional sources of funding for ICLARM and the other CGIAR centers have tightened and become more competitive to access. The centers need to justify their work, its impact and purpose much more clearly and emphatically for continued support. PA has a large role to play in this and, hence, can influence and support ICLARM's future existence.

Increased recognition for dissemination has increased with the need to show impact of the scientific research. PA is one component or dissemination tool that can be important for this purpose, but is currently underutilized. PA, therefore, needs to be built into projects and funded as an integral part of a project.

Scores Against Principles

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

1997 Results

ICLARM's PA activities increased significantly in 1997. Some of the highlights were:

- A large display of ICLARM's research at the official opening of ICLARM's newest research site, Regional Center for Africa and West Asia, in Egypt.
- A month-long display with coordinated activities for ICLARM's 20th Anniversary. This featured a Science Day with presentations of ICLARM's research by the scientists involved; an Ambassadors' Day with research project presentations; Students' Week with tours and presentations for high school and university students and lecturers; displays of a wide variety of scientific research; computer demonstrations; genetically bred live tilapia; display of publications; etc. Funding was also successfully obtained for the display.
- A special 20th Anniversary logo was designed and an array of merchandise, stationery and folders displaying the logo was produced and gifted or sold.
- Displays for the CGIAR biannual meetings in Washington DC, USA, and Cairo, Egypt.
- A new concept and product was developed for an ICLARM brochure allowing easily updatable and customized inserts.
- Introduction of an annual theme for ICLARM's PA materials and activities. The first theme, "media and collages" was reflected in: the content and presentation of the Director General's speeches; exhibitions; PA materials; Annual Report; etc. The theme for 1998 is "faces", bringing the people whose life ICLARM is trying to impact to the forefront to emphasize that people are our focus.

- A detailed plan for updating and developing the ICLARM HomePage.

- The wording of ICLARM's aims and strategies was closely scrutinized and made more up-to-date, focused and public-orientated.

- A booklet was designed and printed featuring the "Blue revolutionaries" article from *New Scientist* where ICLARM's DG was interviewed and quoted throughout.

- Media coverage of ICLARM was achieved through press releases and itineraries and interviews arranged for visiting journalists.

- Various other initiatives including: writing and developing a PowerPoint presentation about ICLARM for use in displays, for visitors and for public presentations; organizing an article and video on ICLARM's work with women farmers in Bangladesh; and designing and producing a "Seasons Greetings" card that converts into a calendar, promoting 1998 as the 'International Year of the Ocean'.

- Contributing to CGIAR system-wide PA through attendance at meetings (Public Awareness Association and Public Awareness and Resources Committee); advice (e.g., to the CGIAR Public Awareness Campaign and to the development of the systemwide PA Strategy); contributions to CGIAR video and slide series, information requested and preparation of materials for systemwide displays (Rio +5: UN General Assembly Special Session in June and Japan Day of International Cooperation in October).

Expected Outputs for 1998

- A donor PA strategy will be developed. A more focused and creative approach is planned.

- Communication was started in 1997 for ICLARM to participate in 1998 in a science display at EPCOT - Disney's science and technology theme park in USA.

- A speakers kit will be completed for ICLARM management and staff.

- New ICLARM brochures, merchandise, stationery, reports and other PA materials will be created.

- Continued and strengthened coordination with CGIAR's systemwide PA through participation in strategy development and related activities.

8.5 Translation Services Unit

ICLARM Staff :

Vacant.

Donor : 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 search for funding to develop this capability into a structured unit.

Background and Justification

Translation activities started in 1980 with the ICLARM translation series. These were strengthened for French translations in 1988 when the French government started to fund ICLARM's project on Transfer of Aquaculture Technologies from Asia to Africa. In the interest of Francophone Africa, it was deemed appropriate at the time 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 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 developed countries. Scientists and other key people in the developing countries are experiencing big gaps in their access to scientific and technical knowledge and are systematically lagging behind, partly due to the lack of access to scientific literature in their own language.

Scores Against Principles

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

1997 Results

- A list server was initiated for translators and related positions in each of the CGIAR centers. This has been very useful in capitalizing on the numerous though scattered skills of the centers by sharing information and assisting with translation problems.

- Translations from English into French were done for:

  1. Households, agroecosystems and rural resources management: a guidebook for broadening the concepts of gender and farming systems (ICLARM Educ. Ser. 12);

  2. The synopses of articles in several issues of the Naga, the ICLARM Quarterly; and

  3. Naga Supplement on International Consultation on Fisheries Policy Research in Developing Countries.

- French and Arabic translations were coordinated for the introduction sections of the ICLARM Annual Report 1996.

- Assistance was given in the final production stage and for the distribution of the English and French versions of the Third

International Symposium on Tilapias in Aquaculture (ISTA III).

- Translations of inquiry and response letters were made, as required.

- Due to budget constraints in 1997, the Translation Unit was only able to fund a translator for half the year.

- A survey of how the other CGIAR centers structure their Translations Unit was undertaken and the results collated.

Expected Outputs in 1998

- With no funding for an internal translator or Translation Services Unit Manager, translations will be undertaken on a project by project basis where funding is available. The coordination of translations will be undertaken by the Publications Unit.

- ICLARM continues to aim for the development of a Translation Services Unit to identify and initiate translation activities to better disseminate scientific information and stimulate communications. This can only be possible when a funding source is identified.

8.6 Training Unit

ICLARM Staff :

Vacant.

Donor : ICLARM core funds.

Duration : Continuous from 1996.

Objective

Currently under development.

Background and Justification

ICLARM has a long history of training activities. Most of the training is a component of individual projects as well as capacity building of visiting specialists and students. The need for a more formal and strategic approach to training was identified a few years ago and a partnerships strategy initiated in 1996. However, as a formal training strategy was still thought to be crucial for ICLARM's projects to sustain a long-term impact, the training responsibility was given to the Information and Training Program in 1996. Without a budget allocation in 1997, discussions on and formulation of a draft training strategy were initiated.

Scores Against Principles

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

1997 Results

- A written survey was e-mailed to all CGIAR centers inquiring about their training programs for students. The majority of Centers have responded and the results will be collated and summarized.

- A workshop was conducted with all senior staff at ICLARM to brainstorm on the direction and issues the center needs to confront in developing its training strategy.

Expected Outputs in 1998

- A training strategy will be developed for ICLARM. In addition to articulating the philosophy and objectives of the training, two important components will be the methodology for funding and the procedures for implementation. This will require ongoing planning and development.

9. INTERNATIONAL PARTNERSHIPS AND NETWORKS PROGRAM (IPNP)

9.1 INTERNATIONAL PARTNERSHIPS

ICLARM Staff :

Dr. Modadugu V. Gupta (Director); Ms. Natalie Macawaris, (Senior Research Assistant); Ms. Edna Tuico (Secretary).

Collaborating Institutions :

National and regional research institutions.

Donor : ICLARM core funds.

Duration : Continuous from 1996.

Objective

- To strengthen existing collaborations and develop new partnerships with national aquatic research systems (NARS) in developing countries and regional and international organizations, in research and related activities, through collaborative programs and networking.

Background

The need for strong NARS, 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 non-government organizations), advanced scientific institutions, individual scientists, the private sector and farmers/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	M
4.	Participation	H
5.	Systems Approach	H
6.	Anticipatory Research	H

1997 Results

9.1.1 NARS Collaboration

Contacts were made with a number of NARS in developing countries in Asia and Africa, through visits and correspondence to: (1) strengthen the existing collaborations and identify new research areas for

collaboration with ongoing partners and (2) develop new collaborations/ partnerships.

- Efforts to strengthen/enhance ICLARM-Philippine institutional research partnerships started with a workshop with senior scientists from different research institutions in the Philippines who expressed interest in collaborating with ICLARM in 57 research areas. The workshop was followed by a number of meetings with the Philippine Council for Aquatic and Marine Research and Development (PCAMRD); and with representatives from various research institutions that resulted in a short list of five areas for research collaboration.

- Visits were made to national fisheries institutions in Cambodia, Vietnam, Botswana, Uganda and Kenya and discussions were held to identify possible areas for research collaboration. Results of discussions were communicated to concerned program leaders for followup.

- Organization of the yearly meeting of ICLARM-Philippine Biosafety Committee with various Philippine institutions to keep abreast of current developments in policies and issues concerning biodiversity and conservation worldwide and, in particular, within the Philippines.

9.1.2 Regional Collaboration

Meetings were held with the following regional institutions leading to identification of areas for research collaboration.

- *Network of Aquaculture Centres in Asia-Pacific (NACA)*: Memorandum of Understanding (MOU) has been signed with NACA, areas for collaboration identified; and use of NACA databases by an ICLARM project was agreed upon.

- *Mekong River Commission (MRC)*: Discussions were held and areas for collaboration identified. One collaborative project is likely to be initiated in 1998.

- *Asia-Pacific Association of Agricultural Research Institutes (APAARI)*: ICLARM was requested by APAARI during an Expert Consultation Meeting for Research Priority Setting to take the lead in the formation of Fisheries Subgroup under APAARI. The Fisheries Subgroup is aimed at identifying regional research priorities; formulating collaborative programs based on identified priorities and promoting interests in aquatic resources research at regional and global fora. Consultations were held with the 19 APAARI member countries and responses received to date indicated their support and appreciation for efforts made in elevating the profile of fisheries research at international fora.

- *Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR)*: Assistance was provided in regional research priority setting exercise conducted in Botswana.

9.1.3 International Collaboration

- *International Rice Research Institute (IRRI)*: Collaboration has been established in undertaking a project for increasing productivity of rice and fish in deep water ecosystems in Bangladesh and Vietnam.

- *International Service for National Agricultural Research (ISNAR)*: Agreed upon developing a framework and module for training NARS in research priority setting in aquatic resources management. The module would be used starting with a joint exercise in Iran to be followed by a training workshop(s) for Asia-Pacific NARS, subject to availability of funding.

- *International Centre for Research in Agroforestry (ICRAF)*: Discussions were held for possible collaboration in integrated resources management in smallholder farms.

- Collaborations with advanced scientific research institutions (ARIs): *Food and Agriculture Organization of the United Nations (FAO)*: Agreed upon collaboration in developing and implementing fish health and quarantine guidelines for responsible movement of aquatic animals in Asia-Pacific.

- *International Atomic Energy Agency (IAEA)*: Agreed upon collaboration in aquaculture genetics. IAEA, in collaboration with FAO, has developed a genetics project, which will be linked with ongoing activities of International Network on Genetics in Aquaculture/ICLARM.

- *Institute of Aquaculture Research of Norway (AKVAFORSK)*: Agreed to collaborate in strengthening aquaculture genetics research capacity in INGA member-countries.

- *Strategy for International Fisheries Research (SIFR)*: Good relations developed for identifying NARS' needs and locating donor funding.

9.1.4 Identification of Projects for Collaboration

- Negotiations with the International Development Research Centre (IDRC) led to their funding a regional Project for Characterization and Documentation of Tilapia Genetics Resources in Africa which is being implemented in four countries in Africa: Côte d'Ivoire, Egypt, Ghana and Malawi.

- Negotiations with Bangladesh, Vietnam and International Fund for Agricultural Development (IFAD) resulting in the formulation, funding and implementation of the project called Improving Productivity of Rice and Fish in Deep Water Ecosystem under IAASP.

- Negotiations with United States Agency for International Development (USAID) and Ford Foundation in Bangladesh resulting in additional funding for continuation of activities in Bangladesh.

- Obtained funding from Norway for strengthening research capacity in INGA member-countries.

- Discussions were held with the United Nations Development Programme (UNDP) for genetics research projects.

- Correspondence made with European Union for financial support to genetics research.

Expected Outputs in 1998

- Assist APAARI in the establishment of Fisheries Subgroup.

- Continue assisting Philippine NARS in developing national action plans and policies for aquatic resources management, biodiversity and conservation, and research impact assessment.

- Continue strengthening/developing research partnerships with institutions in Asia and Africa.

9.2 INTERNATIONAL NETWORKS

9.2.1 International Network on Genetics in Aquaculture

ICLARM Staff :

Dr. Modadugu V. Gupta (Research Coordinator); Ms. Natalie Macawaris.

Collaborating Institutions :

Bangladesh - Fisheries Research Institute, Mymensingh; China - Department of Aquaculture, Shanghai Fisheries University, Freshwater Fisheries Research Center, Wuxi; Côte d'Ivoire - Fish Research Center, Bouake; Egypt - Central Laboratory for Aquaculture, Abbassa; Fiji - Ministry of Agriculture, Fisheries and Forestry, Suva; Ghana - Water Research Institute; India - Central Institute for Freshwater Aquaculture, Bhubaneswar; Indonesia - Central Research Institute for Fisheries, Jakarta; Malawi - University of Malawi, Zomba, Fisheries Department, Lilongwe; Malaysia - Universiti Malaya, Kuala Lumpur; Philippines - Bureau of Fisheries and Aquatic Resources, Quezon City, Freshwater Aquaculture Center, Nueva Ecija; Thailand - National Aquaculture Genetics Research Institute, Bangkok; Vietnam - Research Institute for Aquaculture No. 1, Ha Bac, and Research Institute for Aquaculture No. 2, Ho Chi Minh City.

Donors : ICLARM core funds; Norway; IDRC.

Duration : Continuous since August 1993.

Objectives

- 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 evaluate culture performance of promising lines of tilapias and carps.

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

- To provide a forum for exchange of information, methods and germplasm.

- To strive for conservation of biodiversity.

Background

The aquaculture sector, which is expected to contribute significantly to world food production, has made only modest gains from genetic research to date, particularly in tropical developing countries. Recent studies in Norway and 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.

Strategies

- 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

1997 Results

Collaborative Regional Research

- *Genetic improvement of carps.* The regional project for genetic improvement of carps, which was requested for in 1995 by the carp producing member-countries, has been funded by the Asian Development Bank (ADB). The planning workshop for the project was organized in Bhubaneswar, Orissa, India, during 26-29 July 1997. The workshop, which was inaugurated by the Chief Minister of Orissa State, was attended by 30 participants from the six participating countries, Bangladesh, China, India, Indonesia, Thailand and Vietnam and an observer from Malaysia. Detailed workplans were successfully developed for the participating countries. The activities of the

project include: (1) systematic documentation of carp genetic resources, their evaluation and sustainable use in aquaculture; (2) prioritization of species, farming systems and breeding goals; (3) design of research activities based on identified priorities; and (4) initiation of research leading to development of high-yielding strains (see also the report on this subject under GEBP section).

- *Genetic improvement of tilapias.* A three-day planning workshop was conducted in Malawi to start the implementation of the Collaborative Research and Training for Documentation and Characterization of Tilapia Genetic Resources for Aquaculture in Africa Project financed by IDRC, Canada. Aquaculture geneticists from the four participating countries (Côte d'Ivoire, Egypt, Ghana and Malawi), resource persons from IDRC and ICLARM participated in the workshop to finalize workplans for the project's implementation. The project aims to: (1) gather and document indigenous knowledge on culture of tilapias; (2) characterize and document biochemical and/or performance traits of tilapias that have high potential for culture; and (3) assess socioeconomic value of tilapias and the impact of genetic improvement made through selection, management, or both in each country. The need for training of scientists from participating countries in: (1) characterization techniques and data analysis; (2) quantitative genetics (experimental design and data analysis); and (3) enhancement of computer skills, was identified.

Involvement of National Systems in Planning and Governance

- The *Malaysian Network of Fish Genetics Research* was established. The network has seven member institutions including three universities (Universiti Malaya, Universiti Putra Malaysia and Universiti Kebangsaan Malaysia); three government fisheries research agencies (Department of Fisheries, Freshwater Fisheries Research Center, Melaka, and Institute of Fisheries Research, Pulau Pinang); and a private sector organization (Syndel Asia, Selangor). Other national INGA chapters have been formed in India, Indonesia, Malawi and the Philippines.

Germplasm Exchange

- Genetically improved common carp germplasm from Research Institute for Aquaculture No. 1 at Ha Bac, Vietnam, was shipped to National Aquaculture in Genetics Research Institute, Bangkok, Thailand, in April 1997.

- Genetically improved farmed tilapia (GIFT) from Philippines were shipped to the Research Institute for Freshwater Fisheries, Indonesia, and Ministry of Agriculture, Fisheries and Forestry, Fiji, in August 1997 for their national breeding programs.

Information Dissemination

- Three issues of INGA News were published in Naga, the ICLARM Quarterly featuring genetics

research profile of the member-countries and news items related to the network.

Meetings

- A two-day INGA Planning Meeting was held in February 1997 to discuss the strategies for strengthening the network activities. Twenty-one senior officials from INGA member-countries participated in the meeting. During the meeting the Manila Resolution: Strengthening Partnerships to Advance the Science of Fish Breeding and Genetics and Development of National Fish Breeding Programs was drafted to represent the member-countries' support to INGA activities. Other matters discussed were the inclusion of advanced research institutions in the activities of the network and the composition of the next steering committee.

Expected Outputs in 1998

- Further exchange of genetic materials as per plans formulated in the Third Steering Committee Meeting.
- Publication of revised versions of research methodologies and transfer protocols.
- Development of national breeding programs.
- Organization of training course on application of quantitative genetics to aquaculture to enhance research capabilities of NARS in INGA member-countries.
- Organization of the 4th Steering Committee Meeting.

9.2.2 Asian Fisheries Social Science Research Network (AFSSRN)

ICLARM Staff :

Dr. Robert S. Pomeroy; Ms. Anjanette Trinidad-Juan.

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 Fisheries Development Center (SEAFDEC-AQD); Department of Agricultural Economics, College of Economics and Management, University of the Philippines at Los Baños (UPLB); Faculty of Arts and Sciences, University of the Philippines 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.

Donors : ICLARM core funds; Asian Fisheries Society (AFS)

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

Background

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 of the network are even more relevant today due to the increasing recognition of social and political factors in achieving sustainable aquatic resources development.

The AFSSRN is currently composed of 15 research teams, totaling more than 80 researchers at universities, research institutions and government fisheries agencies in Indonesia, Malaysia, Thailand, 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, 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-chair of the executive committee. The Center's staff will continue to provide technical guidance to the network.

Scores Against Principles

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

1997 Results

The AFS accepted the AFSSRN as a section. A network meeting was held on 25 October in Phuket, Thailand, during which the constitution was accepted and officers were elected. The AFSSRN News was published in Naga.

Expected Outputs in 1998

- There will be a special session of the AFSSRN on socioeconomics issues in fisheries in Asia at the Asian Fisheries Forum in Thailand in

November. The AFSSRN executive committee will meet. A member meeting will be held as part of the Asian Fisheries Forum. A regional training course will be conducted on a topic of importance to scientists in the region.

- Initiation of a Fisheries Social Scientists Network for Africa is planned. Initially the network will be restricted to Southern Africa and later expanded to include West Africa.

9.2.3 Information Networks : Network of Tropical Fisheries Scientists (NTFS) and Network of Tropical Aquaculture Scientists (NTAS)

ICLARM Staff :

Dr. M.V. Gupta (NTAS/NTFS Coordinator and Aquabyte Editor); Dr. Villy Christensen and Mr. Geronimo Silvestre, (NTFS Fishbyte Co-editors); Ms. Natalie Macawaris (NTAS Secretary); Ms. Edna Tuico (NTFS Secretary).

Collaborating Institutions :

NTFS; FAO; DANIDA.

Donors : FAO; ICLARM core funds.

Duration : Continuous from April 1982 (NTFS) and July 1987 (NTAS).

Objectives

- To enhance communication among fisheries scientists working on the assessment, conservation and management of tropical stocks and among aquaculture scientists engaged in tropical research, especially in genetics, integrated agriculture-aquaculture farming systems and coastal aquaculture.

- To enhance the output by these scientists by assisting them in information and database searches and research; acquiring manuals and other literature; analyzing and interpreting methods and data; and publishing some of the research findings of members in the Fishbyte (NTFS newsletter) and Aquabyte (NTAS newsletter) sections of Naga, the ICLARM Quarterly.

Background

Progress in stock assessment work on tropical fisheries has been slow and there are very few, if any, fisheries which are rationally managed. Management is complicated by the biology of fishes, the nature of the fisheries and the institutions that manage them, as well as the limited educational and improvement opportunities available to scientists in developing countries. Moreover, 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.

In aquaculture, scientists in tropical developing countries often lack critical information for their research. 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 fisheries and aquaculture scientists therefore need a mechanism to exchange information, results and ideas: a need that would be served by the two information networks, NTFS and NTAS.

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

1997 Results

The total NTFS members in 1997 is 1,416 individuals from 133 countries. In NTAS, there are currently 668 members from 95 countries. Three issues of Fishbyte and Aquabyte as sections of Naga were published.

The networks' objectives and activities in the past decade were reviewed and recommendation was made to combine the two networks and to extend membership to the private sector and nongovernmental organizations (NGOs) who are also engaged in aquaculture/fisheries related activities.

Expected Outputs in 1998

- Four issues of the Aquabyte and Fishbyte sections in Naga, the ICLARM Quarterly, with articles, news items, letters, photoessays 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 survey of NTAS/NTFS members to update information on them.
- Exploring possibility of using available information technologies (e.g., electronic media) to facilitate information dissemination.

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

ICLARM Staff :

Dr. Madan M. Dey (Project Leader); Dr. M.V. Gupta (Director); Mr. Gaspar B. Bimbao (Research Associate).

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, 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

ICLARM, in collaboration with national aquaculture research institutes of the Philippines and the AKVAFORSK of Norway, with funding support from ADB and 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.

1997 Results

A two-day final workshop of the DEGITA Project was organized in Manila in February 1997 to discuss results of the activities carried out in five participating countries: Bangladesh, Peoples' Republic of China, Philippines, Thailand and Vietnam. Results of

comparative studies of performance of GIFT strain and existing strains carried out on-station in different participating countries revealed that the GIFT strain had a 50% higher growth over the check strain in Bangladesh while about a 10% - 25% higher growth over the check strains in China, Thailand and Vietnam. The higher yield in GIFT strain can be attributed primarily to its higher efficiency in feed and fertilizer utilization.

Furthermore, although the GIFT fish is superior to other existing strains of tilapia used in the five countries studied, its performance varied across culture systems and production environments. In order to improve and sustain the productivity of the improved strain, all the DEGITA-participating countries are in the process of developing their own national tilapia breeding programs.

ACTIVITIES AND SERVICES

10. SYSTEM-WIDE INITIATIVES

ICLARM contributes to three activities referred to as 'System-wide Initiatives' which are structured as activities of general importance contributed to by two or more centers of the CGIAR system. The leader of ICLARM's Biodiversity and Genetic Resources Program chairs the System-wide Genetic Resources Programme. In 1998, an ICLARM-led proposal will seek to regularize the taxonomic nomenclature of the genetic resources held in trust by the CGIAR centers (which includes plant, livestock and microbial resources).

A second system-wide initiative in which ICLARM participates is the System-wide Initiatives Collaboration Property Rights and Collective Action.

Experience has shown that institution of property rights and collective action plays an important role in how people use natural resources, which in turn shapes the outcomes of production systems. This systemwide program examines the formation and effectiveness of voluntary, community-level organizations and property institutions as they relate to natural resources management.

ICLARM contributes to the program through its Fisheries Co-Management Project which focuses on institutional (rights and rules) and organizational arrangements for improved coastal resources management, community-level organizations and property institutions as they relate to natural resource management.

ICLARM will continue to monitor the System-wide Initiative on Water Management which is developing programs on the use of irrigated water. There are also two major new consortia concerned with global availability and use of water, although these are not CGIAR initiatives. ICLARM monitors meetings or interacts with key scientists/issue managers, e.g., on the subject of water and food security, so that fish and aquatic biota continue to be included in these critical debates. These consortia are the Global Water Partnership and the World Water Council.

ICLARM had earlier developed a proposal for a systemwide initiative on coastal environments. This is being re-evaluated and may be considered for development as an ICLARM internal program through intensive interaction with knowledgeable parties and specialist institutions in this field, including IBSRAM and perhaps CIFOR.

11. EXTERNAL RELATIONS OFFICE

ICLARM Staff :

Dr. Meryl J. Williams (Head); Ms. Rizalina M. Camañag (External Relations Coordinator).

Donor : ICLARM core funds.

Duration : Continuous from 1996.

Objective

- To maintain, develop and enhance 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 (ERO) was created to help the 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 1998

- Development and implementation of a donor strategy that will systematize ICLARM's approach to fund raising and clarify its targets. The main objective of the strategy is to increase and stabilize the Center's funding base.
- More information about donors and agencies supporting ICLARM thrusts.
- Improved quality of proposals.
- Assistance to staff on proposal development and negotiations with donors.
- Donor database accessible to all ICLARM officers.

12. CORPORATE SERVICES DIVISION

12.1 Division Office

ICLARM Staff :

Mr. Edward N. Sayegh; Ms. Rachel Josue.

Donors : ICLARM core funds.

Duration : 1998 (12 months).

The Corporate Services Division (CSD) provides operational and logistical support to Center units and programs. The philosophy of the Division is to provide client-oriented and efficient services to donors, Board of Trustees (BOT), management and staff. It also assists BOT and management in developing the appropriate policies, procedures and regular review of the effectiveness and efficiency of the Division's services for improvements and the adaptability of these services to the constantly changing environments.

Responsibilities

- Establishing guidelines and procedures for human resource planning, staffing and development.
- Establishing guidelines and procedures for planning and resource allocation in conformity with CGIAR guidelines.
- Maintaining an efficient and reliable financial management system to provide timely and relevant financial information to donors, BOT, management and staff.
- Providing client-oriented and efficient administrative and logistical support services for Center programs and units.
- Providing long-term information technology (IT) strategy and operating support with the objective to enhancing the role of IT at ICLARM, including state-of-the-art communication technology.

Structure

The Corporate Services Division is organized into four units:

1. *Human Resources Unit (HRU)*: The Unit is responsible for staff support needs, including policy implementation and development of related procedures and guidelines. The Unit also disseminates human resources (HR)-related information to NRS and IRS, including recruitment, salary structure and changes in policies and practices. The Unit advises management on matters pertaining to HR needs and development.

2. *Finance and Management Information Unit (FMIU):* The Unit has the overall responsibility for managing the Center's financial resources. It has internal and external responsibilities. Internally, it provides client-

oriented support services to BOT, management and staff, and ensures the long-term financial viability and stability of the Center through proper accounting and reporting. Externally, it has the responsibility to ensure that donors' funds are utilized in accordance with Center policies, procedures and guidelines and in conformity with donor contracts and agreements.

3. *Program and Administrative Services Unit (PASU):* This Unit provides most of the administrative and logistical support services to the Center, including administrative and budget management support to the research programs. The Unit also assists in handling the Center budget formulation and budget clearances support to the research programs.

4. *Computer Services Unit (CSU):* This Unit provides operational support to users, and manages and maintains the local area network. It is also responsible for communications and the CGIAR Integrated Voice and Data Network (IVDN).

The newly appointed Associate Director General for Corporate Services (ADG-CS) will review in 1998 the activities and priorities of the Division and make the necessary changes in its organization to improve efficiency and to respond to the changing internal and external needs of the Center.

12.2 Human Resources Unit

1997 Results

- A new HR Manager was appointed in April 1997. A formal re-organization of HRU has been completed, positions have been reclassified to reflect the focus on development and pro-activity, and areas of responsibilities have been clearly defined.

- New guidelines on orientation and placement of new staff have been implemented. Guidelines on recruitment and selection are being developed and will be implemented 1st quarter of 1998.

- A position and pay study has been completed and a new position and salary structure has been proposed to the Board for implementation by 1 February 1998.

- A new medical insurer was selected and put in place as of 1 July 1997. Extensive consultation with NRS staff concerning the new insurer has taken place and is continuing as claims are filed.

- In-house training programs for senior management and secretarial support staff have been completed.

- A framework for an annual staff attitude survey has been developed and the survey for 1997 accomplished.

- An extensive review of Personnel Policy Manuals has been completed and revised versions sent out to all staff.

12.2.1 Standard Recruitment Policies and Procedures

ICLARM Staff :

HRU Manager; HRU Staff.

Duration : 2 - 3 months.

Objective

- To develop clear and 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 1998

- Write specific guidelines on recruitment, selection, orientation and placement.
- Review of existing and, if necessary, design of new HRU forms pertaining to all recruitment and placements activities.
- Develop an effective Talent Bank.
- Possible acquisition of pre-employment IQ and aptitude tests.
- Create innovative sourcing strategies.
- Train all supervisors on recruitment.

12.2.2 IRS Classification and Salary Structure

ICLARM Staff :

ADG-CS; HRU Manager.

Duration : 4 months.

Objectives

- To clearly describe and differentiate all IRS positions.
- To ensure that IRS salary structure and pay ranges are internally equitable and externally competitive.

Background and Justification

A new NRS classification and salary structure will be implemented in February 1998. To be consistent, an IRS classification and salary structure should be developed based on the same principles.

Expected Outputs in 1998

- A revised IRS salary structure and corresponding pay ranges.
- A revised IRS position classification system.

12.2.3 Human Resources Management Information

ICLARM Staff :

HRU Manager; HRU Staff.

Duration : 4 months.

Objective

- To operate a reliable and efficient Human Resources Information System (HRIS) to provide management and staff with relevant HR information.

Background and Justification

A new HR database was implemented in the beginning of 1997

based on MS Access. The database, however, does not generate the kind of information required and needs to be reviewed.

Expected Outputs in 1998

- A review of the existing HRIS to decide if the database should be further developed to meet the requirements or if a new software package should be purchased.

- Implementation of the approved solution.

12.2.4 Staff Attitude Survey

ICLARM Staff :

HRU Manager; HRU Staff; all ICLARM Staff.

Duration : Continuous.

Objective

- To gather information on how ICLARM staff view their job, the Center, its internal processes and other related matters.

Background

In 1997, the first ICLARM staff attitude survey was conducted. The focus in 1998 will be to establish this as an annual survey and develop tools to analyze the results properly.

Expected Outcomes in 1998

- Present the results of the 1997 staff attitude survey to all staff.

- Conduct the 1998 staff attitude survey.

- Further develop the database and its possibilities to generate the kind of information required to improve the analysis of the results.

12.2.5 Staff Training and Development

ICLARM Staff :

HRU Manager; HRU Staff; all ICLARM Staff.

Duration : Continuous.

Objectives

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

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.

Expected Outputs in 1998

- A training needs analysis will be conducted for ICLARM staff.

- Within budgetary capabilities, a few selected training programs will be conducted.

12.2.6 Other HR-Related Matters

ICLARM Staff :

HRU Manager; HRU Staff.

Duration : Ongoing.

Background and Justification

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

Expected Outputs in 1998

- Revision/implementation of out-reach site Personnel Policy Manuals.
- Review the current medical insurer and consider a full HMO coverage.
- Develop a system for HR statistics.
- Implementation of NRS education assistance guidelines.

12.3 Finance and Management Information Unit

Background

The FMIU is primarily a support team. 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 reserves and accounting and internal control systems. Its responsibility also is to safeguard and maximize the Center's assets and resources, and ensure the accuracy and reliability of the generated financial information.

12.3.1 Implementation of the New Computerized Accounting System (Platinum)

ICLARM Staff :

FMIU Staff; CSU Staff.

Other Staff :

Price Waterhouse (PW) Staff.

Duration : 3 months.

Objective

- To fully operate the new computerized accounting system.

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 Platinum software in 1995, enhanced by development of a customized middle-ware integrating with the Platinum software. Platinum and customized software developed by PW and CSU staff comprise the new computerized financial management system of ICLARM.

An in-house team of accounting and technical staff together with PW consultants was formed to design customized modules which will be integrated with the Platinum system. The design of the whole system was not finalized soon enough to permit full implementation in 1997. For instance, several technical concerns and issues (e.g., account segments and coding, data conversion and loading, etc.) had to be resolved and certain critical features (e.g., NRS Provident Fund) had to be included. An ad hoc committee composed of staff from FMIU, CSU and PW, and chaired by ADG-CS, closely monitored progress of the project.

1997 Results

- Converted and loaded data (December 1996, January - October 1997) from current system to Platinum.
- Trained FMIU and computer programming staff in the following modules:
  - * Cash Management Middleware (which PW developed; consists of several modules);
  - * Premier ledger and FRX (report writer) of Platinum software.
- Started parallel run beginning with November 1997 transactions.

Expected Outputs in 1998

- Continue parallel runs of both systems (old and Platinum) from November 1997 to February 1998 to ensure proper performance of the new system.
- Implement the new system.
- Develop/implement a structure to ensure the long-term management of computerized financial management system and to closely monitor its implementation, performance and reliability.

12.3.2 Design and Implementation of a Uniform Outreach Financial/ Accounting System

ICLARM Staff :

FMIU Staff.

Duration : 4 months.

Objective

- To design and implement a uniform outreach financial/accounting system which is compatible with Headquarters' accounting system.

Background and Justification

With the expansion of outreach research activities and growing financial and accounting requirements of FMIU, a uniform outreach system in these areas is deemed necessary. This system will monitor financial transactions, enhance financial reporting and facilitate preparation of consolidated financial reports of the outreach and headquarters activities. It will also ensure uniformity in implementing control procedures for both headquarters and outreach offices,

thereby facilitating monitoring of compliance.

1997 Results

Expected outputs in 1997 were not totally realized due to resignations of the Unit Manager and project and general accountants, and delayed implementation of the new accounting system.

Expected Outputs in 1998

- A suitable software has been identified and implementation of the system will be completed by April 1998.

12.3.3 Continue the Development of a More Effective FMIU

ICLARM Staff :

FMIU Manager and Staff.

Duration : Ongoing.

Objective

- To structure the FMIU to promote efficiency and effectiveness of procedures for improved and responsive support services.

Background and Justification

The growing volume of transactions due to increased research activities and donor reporting requirements necessitates the constant review and examination of accounting systems, procedures and processes. In 1997, the loss of several experienced staff in the Unit caused delays in the preparation of a number of internal and external reports. In 1998, the Unit intends to improve its performance by reviewing its operations and the way business is conducted.

1997 Results

- All vacant positions of the Unit were filled by November 1997.
- Eliminated/reduced some unnecessary transactions handled by the Unit.
- Simplified and improved some critical processes and procedures, and implemented these.

Expected Outputs in 1998

- Simplify more procedures and processes.
- Reduce manual processes with the implementation of the outreach accounting and Platinum systems.
- Enhance the effectiveness and coordination among other units of the Center for improved results.
- Review staff requirements.
- Restructure/streamline functions within the Unit.
- Document detailed procedures for accounting transactions.
- Develop appropriate training programs to motivate and improve skills of staff; limit staff turnover.
- Improve financial reporting to donors, Board, management and staff.

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

ICLARM Staff :

ADG/CS; FMIU Staff.

Duration : Ongoing.

Objective

- To improve the Center's financial position and operating reserves.

Background and Justification

In 1997, the financial position of the Center was affected by the strengthening of the US dollar and by delays in the collections of unrestricted donor grants. Also the pending restricted grants for 1996 and 1997 from one major donor had major impact on the cash flow position. The Center's overhead recovery was lower than the actual level. The accumulated operating reserves were lower than the CGIAR minimum requirement. These issues are of critical concern to Board and management and consequently will be given high priority in 1998.

1997 Results

- Prompt and closer monitoring of the effect of currency fluctuation on ICLARM's finances enabled management to periodically review the 1997 budget.

- Close monitoring of cash and overall financial position.

- Regular and close monitoring of actual expenses versus budget.

- Unrestricted core travel and capital budgets were reduced to address the effect of exchange losses and delays in the collection of unrestricted donor grants. Also, other cost-saving measures were implemented.

- Informal discussions with research staff to improve understanding and importance of overhead recovery.

- Increased contingency reserves.

Expected Outputs in 1998

- Regularly report/monitor actual expenses versus 1998 budget. Interim review of the 1998 budget.

- Improve investment procedures of idle funds.

- Closely monitor cash and financial position, through 12 months rolling cash flows.

- Improve overhead recoveries and streamline overhead cost elements.

- Improve project contract processing and clearance to ensure Corporate Services' input from the sheets of project formulation. Coordinate more with project staff or donors, if necessary, regarding overhead provisions in project contract.

- Monitor foreign exchange rates movement.

- Enhance cash reserves to improve ICLARM's financial position.

- Continue cost-saving measures by improving guidelines, procedures and processes of financial management and control.

12.3.5 Financial Operations of the Abbassa Regional Facility

ICLARM Staff :

ADG-CS; FMIU Manager.

Duration : 5 months.

Objective

- To coordinate with and provide support to the DDG-Africa and West Asia for the development and implementation of adequate financial guidelines, and accounting and reporting systems.

Background and Justification

The Egypt outreach station will be fully operational in 1998. As a result, the office requires a financial management system to assist in managing and administering the funds and assets, and to record all financial transactions and reports regularly to Headquarters. The FMIU will coordinate with the DDG-Africa and West Asia in establishing the needed financial management system.

1997 Results

- Provided basic financial and accounting support to the DDG-Africa and West Asia.

- Recorded transactions for both the office and the Abbassa refurbishment activities.

Expected Outputs in 1998

- In coordination with the DDG-Africa and West Asia, establish accounting procedures and guidelines and implement a financial management system.

- Continued recording of transactions of Egypt office until accounting and reporting systems have been established.

- Assist in evaluating the fixed assets and establish proper book value.

12.3.6 Contracted Internal Audit

ICLARM Staff :

Board; ADG-CS; FMIU Manager.

Other Staff :

Outside auditing firm.

Duration : one year, renewable.

Objective

- To perform focused financial and operational audits for specific areas of Center operations. To ascertain compliance with ICLARM's established policies and procedures.

Background and Justification

The Board in its meeting in September 1997 approved contracting the services of local auditing firm to

perform the internal audit functions for the Center. An in-house regular internal audit unit is not justifiable considering ICLARM's size and level of budget. Specific audit areas and objectives will be determined by the audit firm in consultation with and approval of the Board. Administratively, the internal audit will report to the Office of the Director General and functionally to the Board of Trustees.

1997 Result

- Selected an auditing firm to conduct internal audit.

Expected Outputs in 1998

- Approval by the Board of proposed internal auditing firm.
- Approval by the Board of internal audit plan for 1998.
- Implement audit plan.

12.4 Program and Administrative Services Unit

12.4.1 Streamlining of Program Administration and Administrative Functions

ICLARM Staff :

Program Administration and Administrative Staff.

Duration : Fully operational by first quarter of 1998.

Objectives

- To further develop skills and redefine tasks of program administration and administrative staff.
- To secure a more flexible and effective delivery of project and administrative support services to ICLARM research.

Background and Justification

The requirements of ICLARM research for administrative and program support are growing. These imply a rationalization of the present procedures and staff functions vis-à-vis a multi-skilled and multi-task structure.

Expected Outputs in 1998

- Review and recommend a new organizational setup within the Unit to encourage staff to develop various skills and to learn and discharge of additional functions.
- Prepare/submit new terms of references of Program/Administrative staff.

12.4.2 Internal Documentation

ICLARM Staff :

Program Administration and Administrative Staff; FMIU; ADG-CS.

Duration : Ongoing.

Objective

- To improve communication and coordination among ICLARM staff and stakeholders on various policies, procedures and flows regarding the delivery of various support services.

Background and Justification

The increase in programs and projects within ICLARM corresponds to

a diversification of administrative and program support services. The buildup of services to be rendered requires clear delineation of the roles and responsibilities within the administration and program units as well as identification of linkages with other ICLARM units.

Expected Outputs in 1998

- Prepare an ICLARM Administrative Manual in close coordination with the ADG-CS and FMIU.

- Approval and implementation of the Project Manual.

12.4.3 Maximization of ICLARM's Privileges Under the Host Country Agreement

ICLARM Staff :

Program Administration and Administrative Staff; ADG-CS; External Lawyers.

Duration : Second quarter of 1998.

Objective

- To have ICLARM fully enjoy the benefits and privileges contained in the Host Country Agreement.

Background and Justification

Since the approval of the Host Country Agreement with the Philippine Government, ICLARM has started to enjoy some privileges such as the issuance of diplomatic plates for all ICLARM vehicles and of diplomatic identification cards, and the tax exemptions on purchases. However, there are some privileges that need to be worked out with the different government agencies.

Expected Outputs in 1998

- Inclusion of ICLARM in the 'International Organization Reception Desk' at Ninoy Aquino International Airport (NAIA) arrival area together with Asian Development Bank, World Health Organization, United Nations Development Programme and International Rice Research Institute.

- Inclusion of ICLARM in the Diplomatic and Consular List under the section 'Specialized Agencies of the United Nations and Other International Organizations' with the ADG-CS as the Center's representative.

- Getting necessary NAIA passes to personally assist special ICLARM visitors, especially Board Members.

- Look at the possibilities of getting 9E visas (diplomatic visa) for IRS instead of the usual 47(a)2.

12.4.4 Maximization of the Use of the In-Plant Travel Agency

ICLARM Staff :

Program Administration and Administrative Staff; Program and Project Secretaries.

Duration : Second quarter of 1998.

Objective

- To have a more efficient system for coordinating travel requirements of ICLARM staff.

Background and Justification

In 1997, Thomas Cook Travel Agency was awarded the contract for the in-house travel agency at ICLARM. However, there is a need to explore more options with Thomas Cook that will further improve the delivery of travel services to ICLARM staff and, at the same time, enhance control and maximize savings. Currently, a 'wholesale approach to travel' is being worked out to facilitate the processing of issuance of travel tickets and requirements of ICLARM visitors and staff. Since the travel agency has personnel stationed at the NAIA, it would be advantageous for ICLARM to coordinate with them for the transport request of visitors and staff.

Expected Output in 1998

- Coordination of visa requirements, necessary travel documents, issuance of traveler's checks and airport services (pick up to and from NAIA) with Thomas Cook Travel Agency.

12.4.5 Operations Enhancement

ICLARM Staff :

Administrative Staff.

Duration : Ongoing.

Objective

- To further develop the Administrative Section of PASU into a more pro-active and responsive support group.

Background

Increased efficiency in the support services for ICLARM staff would be the result of continuously reviewing policies and procedures and implementing cost-saving mechanisms in the transport, mailing, messengerial, purchasing and other areas.

1997 Results

- The continuing review of administrative processes resulted in improvements, particularly in the procurement of supplies and inventory.
- For purchasing, the accreditation of suppliers was initiated especially for computer and equipment purchases.
- For supplies and inventory, monthly reports were generated to reflect the usage and volume of requisitions per month by each program, project or unit. These reports served as feedback mechanisms to inform and update program/project leaders and managers on the resources used by their respective staff.
- A major improvement in the administrative system is the identification of a re-order point. This greatly enhanced the efficiency of the Section as it ensured the availability of commonly used office supplies.

Expected Outputs in 1998

- Improvement in the accreditation of more cost-effective, efficient, service-oriented and reliable auto shops and auto supply stores. Avail of 'one-stop shops' that do all kinds of auto repair, painting job, aircon service, muffler service, etc.

- Contracting out bulk mail; providing the mailing company with lists of publications and their recipients and specific packaging requirements..

- Contracting out messengerial services outside Metro Makati area to save ICLARM drivers of valuable time, minimize gasoline usage and maximize administrative personnel's main functions.

- Accrediting more competitive, low-priced suppliers in addition to existing ones.

- Maintenance and upgrading of the manual containing the Center's policies, procedures and memo-randa.

12.4.6 Vehicle Upgrading Program

ICLARM Staff :

Purchasing Staff; ADG-CS; DG.

Duration : Ongoing.

Objective

- To strengthen the delivery of transport services within ICLARM through proper timing of vehicle purchases and maintenance of road-worthy/reliable and safe vehicles.

Background and Justification

ICLARM at the moment has 28 vehicles of which 17 are assigned to IRS; four for general activities/research use of ICLARM staff; four for project use (i.e., GIFT Project and Foundation); and three, for disposal. Unfortunately, some are not roadworthy and safe which make them more often off the road due to repairs than on the road. Because of this, there is a need for a program that will strengthen provision of complete services while following CGIAR guidelines.

1997 Result

- A review of the present vehicle maintenance system was initiated. A recommendation is due for submission and approval.

Expected Output in 1998

- Recommend an ICLARM vehicle upgrading program.

12.4.7 Management and Control

ICLARM Staff :

Administrative Staff; FMIU.

Duration : Ongoing.

Objectives

- To improve the asset disposal system.

- To improve coordination among the Purchasing Staff, Program Assistants, CSU Staff and IT Manager particularly in the purchase of computers and peripherals.

- To improve proper recording, monitoring and control of the Center's assets.

Background and Justification

As a consequence of growth, ICLARM continues to acquire equipment for the use of both research and administration. PASU will maintian the equipment and monitor their accountability and inventory upon transfer of these functions from FMIU.

1997 Result

- Together with the ADG-CS, CSU and FMIU, the Administrative Section Staff was able to put a fixed asset disposal system. A Fixed Asset Disposal Committee was formed to facilitate the disposal of obsolete equipment and furniture.

Expected Outputs in 1998

- Review and improve the equipment accountability form.

- Regularly update information on the assignment/location of equipment.

- Increase awareness of ICLARM staff about their responsibility on the up-keep of ICLARM equipment.

12.5 Computer Services Unit

Background

The CSU operates and manages the central computers and network infrastructure. It provides desktop support, technical assistance and advice, and oversees database and application developments. The Unit's goal is to provide a service to researchers, managers and administrators that will impact on their ability to attain their respective goals and ultimately the goal of ICLARM.

The Unit had a change in leadership with the entry of the IT Manager in December 1997.

12.5.1 Administering the New Accounting Computerized System (Platinum)

ICLARM Staff :

CSU Staff; FMIU.

Other Staff :

PW Staff.

Duration : Continuing.

Objective

- To ensure the successful migration to the new accounting computerized system.

Background and Justification

The new accounting computerized system is one of CSU's main projects. Thus, the Unit is providing all the necessary services. A CSU staff is dedicated to this project to design modules that will be integrated with the Platinum system. The Unit is also responsible for administering the Platinum server and ensuring its

availability 24 hours a day. CSU also provides the computing needs of all the Platinum workstations. As part of an ad hoc committee, the Unit closely monitors the progress of this project.

1997 Results

- Formulated account code structure used in setting up references for conversion.
- Came up with a strategy for Middleware and Platinum integration.
- Set up data conversion procedure.
- Administered the Platinum server.
- Installed additional hard disk and memory for the Platinum server.

Expected Outputs in 1998

- End of data conversion.
- Checking of data conversion results through printing of trial balance reports.
- A program to automatically load/post Middleware data to Platinum.
- A program to test the synchronization of Middleware database and Platinum data.
- Continue Platinum server administration.
- Use mirroring for data security and integrity.
- Upgrade all Platinum workstations to Windows 95.

12.5.2 Continue Computing Services to Staff

ICLARM Staff :

CSU Staff.

Duration : Continuing.

Objective

- To continue the existing computing services, install new ones, and promote new technologies, as needed.

Background and Justification

Having access to the latest computing technology is essential to all sectors of the Center. In many sectors, computing technology provides the most up-to-date and efficient tools to process data and to provide the required quality of output. Speedy accesses to well-organized information and services, both inside and outside the Center, is vital to research projects, support services and administration. Thus, ensuring the smooth and efficient day-to-day operation of existing computing facilities and continually searching for ways to improve and enhance the services being provided are foremost to the Unit.

The Unit is responsible for the smooth running of PC computers on the clients' desktop. This includes ensuring that the client is aware of standards in applications and procedures, and recommended guidelines and is

instructed in efficient uses of these. User support can be in virus removal, decoding binary attachments, re-configuration after user changes, scandisk, re-installation of corrupt applications, user guidance in using applications, backup of user data, etc.

Services like e-mail, database systems and network file and print services permit information to be processed, shared, disseminated and manipulated over the network. Efficiency can be improved by observing, advising and training staff to use the correct applications with the most productive methods.

The Unit needs to continually replace equipment and install new services that will improve the service provided to clients and promote new technologies that will make day-to-day activities more efficient. The Unit needs to keep abreast of new developments in IT to keep the Center competitive with similar organizations.

1997 Results

- More productive use of computers.
- Information was shared easily and readily.
- More PCs were connected to LAN.
- More users were given access to e-mail and internet.

Expected Outputs in 1998

- New well-designed workgroup server and upgraded network and file servers.
- New and full-featured PABX system.
- Conduct of in-house training and seminars.
- Participation in IT workshops and conferences of CSU staff.
- More staff updated on IT developments.

12.5.3 Migration to Exchange

ICLARM Staff :

CSU Staff.

Duration : Ongoing.

Objective

- To be able to take advantage of the many features that Exchange offers on top of the messaging system.

Background and Justification

Exchange is not only a messaging system. It is a complete Groupware solution, enabling mail and data objects to be exchanged within an organization. There has been a lot of talk about the need to disseminate and share information within the Center, across outreach sites and to the public in general. Exchange provides the ideal forum to carry out these tasks. Public folders allow one copy of 'data objects' to be shared at various levels in an organization. The system of permissions allows the public folder owner detailed control over security and privacy. The available tools enable document tracking and detailed searching of large

data storage areas. The whole package was designed to provide complete integration with internet technologies, which in turn give the possibility of disseminating information to the general public.

1997 Result

- No changes in e-mail system due to financial constraints.

Expected Outputs in 1998

- Easy personal internet e-mail: send and receive e-mail by connecting to an internet service provider from any location with Microsoft Exchange.
- High-performance organization internet e-mail: Microsoft Exchange Internet Mail.
- Connector provides fast multi-threaded connectivity. MIME is supported for sending and receiving messages with rich attachments, including video and audio clips.
- Easy-to-control internet mail access: manage who sends and receives internet mail with the Exchange Internet Mail Connector. Reject or accept messages on a per host basis.
- Virtual networks: connect Microsoft Exchange servers together or to clients over the internet; avoid expensive WAN and dial-up charges.

12.5.4 Standardization of PC System

ICLARM Staff :

CSU Staff.

Duration : Ongoing.

Objective

- To provide standards and policies on PC systems.

Background and Justification

Currently, most PCs at ICLARM are compatibles with different brands, have slow processors and small memory. Performance of these computers is unstable and unreliable compared to the branded ones. Prices of PCs have gone down and computing power and features improved significantly in the recent months. Although the pace at which PC technology changes can't be stopped, finding a PC system that will represent the best long-term value can be looked at. This can mean paying more upfront but end up with a system that won't be outgrown in a number of months.

A policy should be made in purchasing new computers and disposing of old ones to standardize the PC requirements. Standard configurations must be specified for different categories, i.e., 'administrative computers' for use of e-mail, internet and productivity applications; 'technical computers' for database and scientific programming, desktop publishing and web design; and 'portable computers' for mobile researchers and presenters. These specifications will be updated regularly to keep pace with new developments in hardware technology.

Considerations in choosing a particular brand of PC must be reliability and manageability to reduce the total

cost of ownership. The PC must be designed for corporate installations. It should be easy to inventory and monitor from a remote console, and easy to service when upgrades or repairs are required. Features such as easy-to-service chassis, a complete inventory of system information, Wake-on-LAN capabilities, hardware monitoring, chassis intrusion alarm or even BIOS updates will be looked at.

1997 Result

- The policy was not yet in place as user preferences and prices of branded PCs are still high.

Expected Outputs in 1998

- A local supplier, which will give the largest possible discount and ease hardware support issues, will be picked. The selection will be based on price, quality and reliability of equipment, after sales service and warranty, and expected delivery time.

- Faster, more reliable and manage-able PC workstations.

- Fewer PC maintenance calls.

12.5.5 Upgrading the Existing IVDN

ICLARM Staff :

Directors; IT Manager.

Other Staff :

IRRI's Directors; IRRI's CSD Head.

Duration : Ongoing.

Objective

- To have more bandwidth available through IVDN.

Background and Justification

For ICLARM to keep up-to-date with the latest research techniques and have access to all available information resources, it is essential to have good external data communications. Conversely, ICLARM also wants to make more of its vast information resources available to the rest of the world.

The Center's current data connection to the outside world is through the 64K IVDN. The IVDN provides voice and data access via NOC in California. Voice calls can be made on-net to other CGIAR centers at no extra cost. Off-net calls onto the public telephone system in the USA are controlled by an access code.

The IVDN allows a maximum of four voice channels each using 8K of bandwidth. When all of the four voice channels are in use, 32K of bandwidth is left for data to be shared between the whole of ICLARM and IRRI. This is less bandwidth than is provided by a standard 33.6K modem that serves one workstation.

E-mail, web browsing and file transfer have traditionally been the main uses of data communications across IVDN. Traffic from all three of these sources has increased dramatically during the last two years.

1997 Results

- Negotiation with four telecommunication companies started in May 1997.
- IVDN usage was monitored.

Expected Outputs in 1998

- Negotiation will be completed.
- IVDN will be upgraded to the highest bandwidth that can be afforded.
- Improved collaboration by using the latest teleconferencing and video conferencing technologies. These provide interactive voice, video, whiteboard and chat facilities as well as sharing standard applications such as PowerPoint, Excel and Access.
- Proxy server will be used to manage internet activity through the IVDN gateway.

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

ICLARM Staff :

Dr. Roger Rowe (Deputy Director General); Dr. John Craig; Mr. Brian Tierney; Nationally Recruited Staff.

Collaborating Institution :

Agriculture Research Center, Ministry of Agriculture, Government of Egypt.

Donors :

Japan; World Bank; Egypt; United States Agency for International Development; Arab Fund; others to be identified.

Duration : Continuous since January 1997.

Objectives

- To manage the refurbishment of the Abbassa aquaculture research facility and to develop its operations as an ICLARM Regional Research Center for Africa and West Asia.
- To assist the Director General and Deputy Director General (Programs) in developing strategic research programs on fisheries and aquaculture having direct relevance to the African continent and West Asia.

Background and Justification

ICLARM has taken up the challenge of managing the Central Laboratory for Aquaculture Research (CLAR) at Abbassa, Egypt, that was built with support from USAID in 1981 and was offered to ICLARM in February 1995. This facility will be developed as a regional center of aquaculture research and as a hub for more extensive activities in Africa and West Asia. ICLARM is guided by a global mandate to undertake aquatic resources research and to improve fisheries management. It recognizes the ever-increasing need for Africa and West Asia to address the issues of food security and the appropriate use of natural resources.

During the May 1997 Mid-term Meeting of the CGIAR in Egypt, ICLARM formally opened the Regional Research Center. Later in the year, the Government of Egypt approved the Country Agreement which provides the legal base for ICLARM's operation in the country.

1997 Results

- The first phase of the refurbishment of the Abbassa facility was started at the end of February and was ready for the opening ceremony held in May. The initial project was essentially completed by the end of the year.
- The Host Country Agreement was signed at the end of March and was approved by Parliament in December.

- An initial set of aquaculture research projects was conducted in the Regional Center by national program staff.

- The first contacts were made with fisheries and aquatic resources research and development institutes and agencies in Egypt.

- Proposals for research in fish health, inland fisheries management, and for general research activities for the Middle East were developed and submitted.

Expected Outputs in 1998

- Complete the second phase of the refurbishment of the facilities of the Regional Research Center.

- Fully implement the terms of the Country Agreement and establish ICLARM's legal base for operation in Egypt.

- Employ national staff and establish management polices and procedures for the staff and for the assets of the Regional Research Center.

- In collaboration with and as an extension of ICLARM's research programs, organize and conduct a core research and training program at the Regional Research Center.

- Develop linkages with fisheries and aquatic resources research and development institutes and agencies in Africa and West Asia, and use these linkages to gain information in setting research priorities and extending research results.

- Develop and submit funding proposals for country and regional research and training activities.

14. OFFICE OF THE DEPUTY DIRECTOR GENERAL (PROGRAMS)

ICLARM Staff :

Dr. Peter Gardiner (Deputy Director General); Ma. Lourdes Hortelano; other Research Assistants for strategic planning to be identified.

Donors :

ICLARM core funds; assistance from ACIAR with strategic planning.

Duration : Continuous since August 1996.

Objectives

- To provide assistance to the Director General in the planning, implementation, monitoring and reporting of ICLARM's research and research-related programs.

- To assist in the presentation of ICLARM's program activities and plans to donors, members of CGIAR and others concerned with aquatic resources research and development.

Background and Justification

Membership of CGIAR, a nine-program operating structure and staff activities in four continents require that the Center's research is managed flexibly within the agreed plans and goals. The Office contributes to the development of ICLARM's program plans and the documents which describe them (Operational Plan, Medium-term Plan, Financing Plan and Agenda Update). Major emphasis in 1998 will be the revision of the Strategic Plan looking towards the development of the Center beyond 2000. This will be a year-long process, encompassing data collection and analysis, staff, Board and stakeholders meetings and discussion with ICLARM's External Program and Management Review. The Office of the DDG (Programs) will be involved in the preparation and documentation of the major review of ICLARM. The uptake of the Abbassa facility in Egypt has enlarged the scope of the Center's research program in Africa and West Asia, and planning and program initiation will continue in 1998. Interactions with and between programs are well established, and the Office of the DDG (Programs) continues to assist the flow of information, research reports and proposals between program leaders, management and external stakeholders.

1997 Results

- Finalized ICLARM's Medium-term Plan 1998 - 2000.

- Developed with other Directors, the ICLARM 1998 Financing Plan and 1997 Agenda Update.

- Conducted ICLARM's in-house scientific review of Programs.

- Developed position papers or Center's responses to CGIAR and TAC Secretariat and ICLARM Board, e.g., on biotechnology and genetics research.

- Convened internally commissioned external reviews of the Integrated Aquaculture-Agriculture Systems Program.

Expected Outputs in 1998

- Revise and update ICLARM Medium-term Plan 1998-2000.

- Draft ICLARM Strategic Plan, based on the 1992 strategy documents and taking account of new trends in science, aquaculture and fisheries, and new regional opportunities.

- Plan and initiate programs at Abbassa in Egypt, with renewed emphasis on aquaculture.

- Assist Programs in the identification and presentation of new research proposals.

- Convene and conduct internally commissioned external reviews of ICLARM's Aquatic Environments Program (March 1998) and in-house review of ICLARM's scientific programs (September 1998).

- Initiate (with all senior staff) a new strategic plan, built on the base of the 1992 ICLARM strategy.

15. OFFICE OF THE DIRECTOR GENERAL

ICLARM Staff :

Dr. Meryl J. Williams (Director General); Ms. Josephine Z. Hernandez.

Donor :

ICLARM core funds.

Duration : Continuous.

Objectives

- To manage the Center and assure that its programs are properly developed and carried out.
- To act as ICLARM's legal representative and, within the limits established by the Board of Trustees (BOT), to take whatever actions are necessary to attain ICLARM's purposes.
- To manage the staff of ICLARM, observing the policies approved by BOT.
- 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 international agricultural research center concerned with fisheries research, ICLARM is seeking to increase funding that will enable it to better address its important mandate by expanding its research agenda. A concerted funds mobilization strategy will be initiated and followed through to assure continued support for ICLARM's mission. The Director General will also 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 1998

Lead the Center in the production of:

- A resource mobilization strategy to take the Center into the next millenium. Preparations for the Center's first full external program management and review since joining the CGIAR.
- Initiation of a new ICLARM Strategic Plan, built on the base of the 1992 ICLARM strategy.
- Completion of full competency scale for all staff categories.
- A Comprehensive Researcher's Code of Conduct (by September 1998).

- Continue the rolling plan of internally commissioned external reviews.

- Successful selection and planning for a new ICLARM headquarters site in the Philippines.

- Development of enhanced coastal area environment research activities.

- New developments in research conducted at and out of the new ICLARM Regional Research Center for Africa and West Asia.

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
ADG-CS	Associate Director General for Corporate Services
AEP	Aquatic Environments Program
AFSSRN	Asian Fisheries Social Science Research Network
AKVAFORSK	Institute of Aquaculture Research of Norway
ALCOM	Aquaculture for Local Community Development Programme
APAARI	Asia-Pacific Association of Agricultural Research Institutes
ASEAN	Association of Southeast Asian Nations
ASFA	Aquatic Sciences and Fisheries Abstracts
ASFIS	Aquatic Sciences and Fisheries Information System
AUXIMS	Auximetric grid analysis of growth parameters
BFAR	Bureau of Fisheries and Aquatic Resources
BGRP	Biodiversity and Genetic Resources Program
BMZ	Bundesministerium für Wirstchaftliche Zusammenarbeit (Germany)
BOT	Board of Trustees
BRAC	Bangladesh Rural Advancement Committee
BVI	British Virgin Islands
CAC	Coastal Aquaculture Centre
CARICOM	Caribbean Community
CASEP	Coastal Aquaculture and Stock Enhancement Programme
CBD	Convention on Biological Diversity
CBFM	Community-based fisheries management
CBRM	Community-based resource management
CFPQ	Community Forestry Project Quirino
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CLSU	Central Luzon State University
CNRS	Center for Natural Resource Studies
CRED	Center for Resource and Environment Development
CRIFI	Central Research Institute for Fisheries
CTU	Cantho University
DAE	Department of Agricultural Extension
DANIDA	Danish International Development Assistance
DARE	Department of Agriculture and Resource Economics
DDG	Deputy Director General

DEGITA	Dissemination and Evaluation of Genetically Improved Tilapia Species in Asia
DENR	Department of Environment and Natural Resources
DFID	Department for International Development (UK)
DG	Director General
DGIS	Directorate General for International Cooperation
DMC	Developing member-countries
DNA	Deoxyribonucleic acid
DOF	Department of Fisheries
ERO	External Relations Office
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FiSAT	FAO-ICLARM Stock Assessment Tools
FIVDB	Friends in Village Development of Bangladesh
FRAMP	Fisheries Resources Assessment and Management Program
FSRP	Farmer-Scientist Research Partnership
GBF	Global Biodiversity Fora
GBRMPA	Great Barrier Reef Marine Park Authority
GCRMN	Global Coral Reef Monitoring Network
GEBP	Germplasm Enhancement and Breeding Program
GIFT	Genetically improved farmed tilapias
GIS	Geographical information system
GLODIR	Global Directory of Marine Scientists Project
GO-NGO	Government and nongovernmental organization
GOB	Government of Bangladesh
GTZ	Deutche Gesellschaft für Technische Zusammenarbeit (Germany)
HAKI	Fish Culture Research Institute (Hungary)
IAA	Integrated agriculture-aquaculture
IAASP	Integrated Aquaculture-Agriculture Systems Program
IAEA	International Atomic Energy Agency
IAMSLIC	International Association of Marine Science Libraries and Information Centers
IARC	International Agricultural Research Center
ICLARM	International Center for Living Aquatic Resources Management
ICRAF	International Centre for Research in Agroforestry
ICRI	International Coral Reef Initiative
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDB	Inter-American Development Bank
IDRC	International Development Research Centre

IFAD	International Fund for Agricultural Development
IFM	Institute of Fisheries Management and Coastal Community Development
IFPRI	International Food Policy Research Institute
IMOF	Improved Management of Openwater Fisheries
INFOFISH	Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in Asia and Pacific Region
INGA	International Network on Genetics in Aquaculture
IOC	Intergovernmental Oceanographic Commission
IPNP	International Partnerships and Networks Program
IRM	Integrated resources management
IRRI	International Rice Research Institute
IRS	Internationally recruited staff
IRSMLDC	Ian R. Smith Memorial Library and Documentation Center
ISBS	International Specialized Book Services
ISNAR	International Service for National Agricultural Research
ISTA	International Symposium on Tilapias in Aquaculture
ITP	Information and Training Program
IUCN	World Conservation Union
LFSA	Length-Frequency Stock Assessment
MAF	Ministry of Agriculture and Fisheries
MCA	Marine conservation area
MFMR	Ministry of Fisheries and Marine Resources
MOFL	Ministry of Fisheries and Livestock
MOU	Memorandum of Understanding
MPA	Marine protected area
MRC	Mekong River Commission
MTP	Medium-term Plan
MUK	Manobik Unnayan Kendra
NAC	National Aquaculture Center
NACA	Network of Aquaculture Centres in Asia-Pacific
NARS	National aquatic research systems
NASA	National Aeronautics and Space Administration (USA)
NCAR	National Center for Atmospheric Research
NFMP	New Fisheries Management Policy
NGO	Nongovernmental organization
NRS	Nationally recruited staff
NSC	North Sea Centre
NTAS	Network of Tropical Aquaculture Scientists
NTFS	Network of Tropical Fisheries Scientists

ODA	Overseas Development Administration
PA	Public awareness
PARC	Protected Areas Resource Centres
PCAMRD	Philippine Council for Aquatic and Marine Research and Development
PISCES	Population Interdependencies in the South China Sea Ecosystems
PRA	Participatory rapid appraisal
PRIAP	Policy Research and Impact Assessment Program
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 (Denmark)
SACCAR	Southern African Centre for Cooperation in Agricultural Research and Training
SADC	Southern African Development Community
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SEAFDEC	Southeast Asian Fisheries Development Center
SEAMEO	Southeast Asian Ministers of Education Organization
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SFIS	Selective Fisheries Information Service
SGRP	System-wide Genetic Resources Programme
SIDA	Swedish International Development Cooperation Agency
SIFR	Strategy for International Fisheries Research
SINGER	System-wide Information Network for Genetic Resources
SPC	South Pacific Commission
SPSS	Statistical package for the social sciences
SWIM	System-wide Initiative on Water Management
TAC	Technical Advisory Committee
TNC	The Nature Conservancy
UBC	University of British Columbia
Ucore	Unrestricted core
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNE	University of New England
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UP	University of the Philippines
UPV	University of the Philippines in the Visayas

URI	University of Rhode Island
US; USA	United States (of America)
USAID	United States Agency for International Development
UWI	University of the West Indies
WCMC	World Conservation Monitoring Centre
WRI	World Resources Institute

INDEX OF COLLABORATING INSTITUTIONS*

INTERNATIONAL AND REGIONAL ORGANIZATIONS

AUSTRALIA

---

* Page numbers refer only to sections on 'Collaborating Institution(s)' in the book.

INDEX OF DONORS*

---

* Page numbers refer only to sections on 'Donor(s)' in the book.

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 objectives are:
- raising and sustaining the productivity of fisheries and aquaculture systems;
- protecting the aquatic environment;
- saving aquatic biodiversity;
- improving policies for sustainable development of aquatic resources; and
- strengthening the capacity of national programs to support sustainable development.

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 the 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, Egypt and the Caribbean.

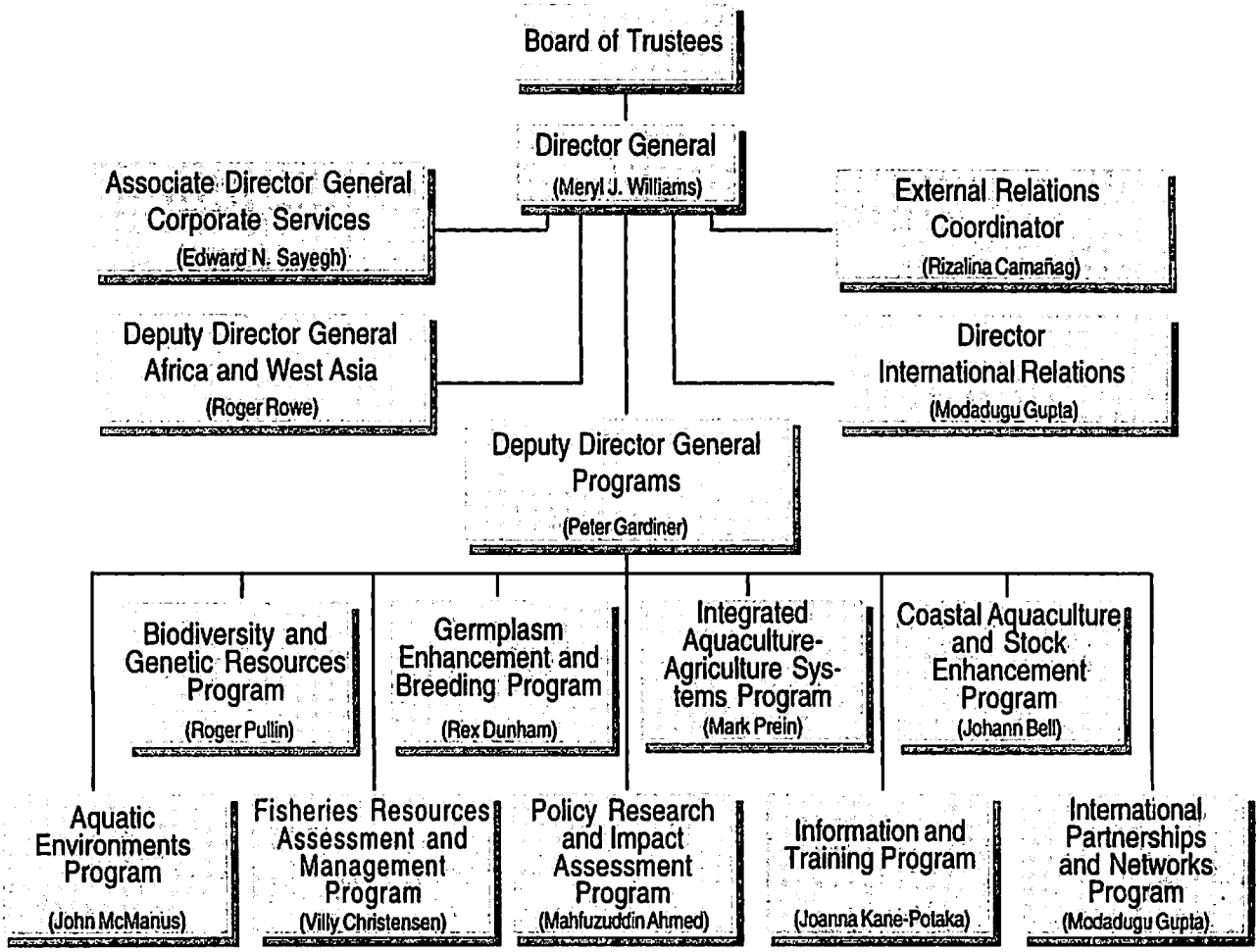
In 1992, ICLARM joined the CGIAR (Consultative Group on International Agricultural Research) which is under the umbrella of four co-sponsors - the FAO (Food and Agriculture Organization of the United Nations), World Bank, UNDP (United Nations Development Programme) and UNEP (United Nations Environment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

ICLARM ORGANIZATION

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 approximately 300 staff from 12 countries.



BOARD OF TRUSTEES, 1998

Dr. Kurt Peters
Chair
Department of Animal Breeding
in the Tropics
Humboldt University of Berlin
Berlin, Germany
Board Member since April 1995
Board Chair from 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 from January 1997

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

Dr. Nyle Brady
Arizona, USA
Board Member since 1992

Dr. Masaru Fujiya
Tokyo, Japan
Board Member since 1992

Ms. Joan Joshi
Maryland, USA
Board Member since 1997

Ms. Nyawira Muthiga
Kenya Wildlife Service
Board Member since 1996

Dr. Mohamed Shariff
Faculty of Veterinary Medicine
and Animal Science
Universiti Putra, Malaysia
Board Member since 1994

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

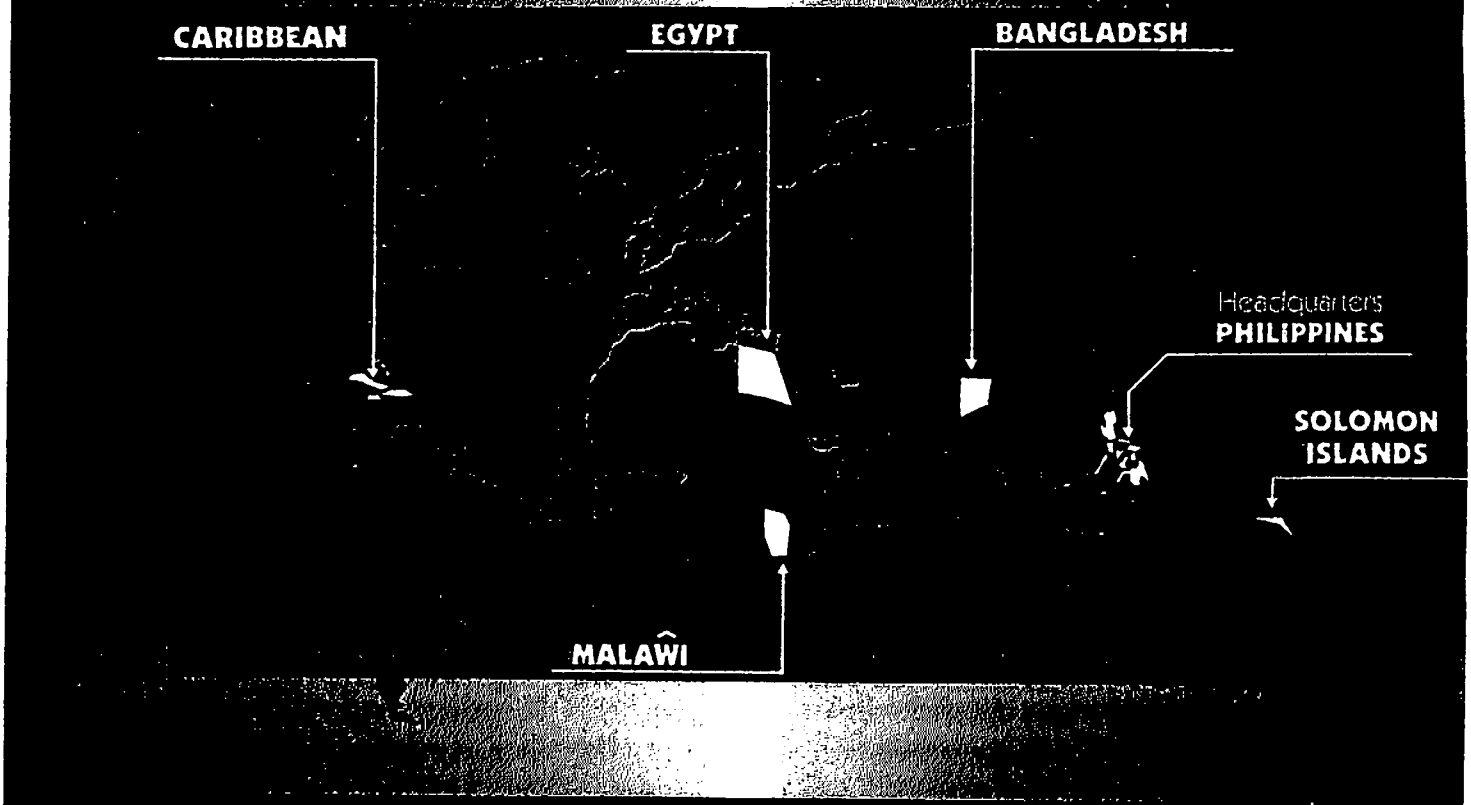
Dr. Salvador Escudero III (ex-officio)
Secretary
Philippine Department of Agriculture
Board Member since 1996

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

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

Prof. Dr. Yehia Hassan Khalil (ex-officio)
Cairo, Egypt
Board Member since 1997

ICLARM RESEARCH SITES



EGYPT
Regional Center for Africa and West Asia
PO Box 2416, Cairo, Egypt
1st Floor, 15 G Radwan Ibn El Tabib St. Giza, Egypt
Tel.: (202) 568-2660, 573-5829 ext. 21
Fax: (202) 572-8099
E-mail: ICLARM-Egypt@cgnet.com

International Year of the Ocean 1998

BANGLADESH
House No. 75, Road No. 7
Block-H Banani Model Town
Dhaka, Bangladesh
Tel.: (880-2) 871151, 873250
Fax: (880-2) 871151
E-mail: ICLARM-Bangladesh@cgnet.com

MALAWI
PO Box 229, Zomba, Malawi
Tel.: (265) 531-274, 531-215
Fax: (265) 522-733
E-mail: ICLARM-Malawi@cgnet.com

SOLOMON ISLANDS
Coastal Aquaculture Centre
PO Box 438, Honiara, Solomon Islands
Tel.: (677) 29255
Fax: (677) 29130
E-mail: ICLARM-Solomon@cgnet.com

CARIBBEAN
EASTERN PACIFIC
PO Box 3323, Road Town
Tortola, British Virgin Islands
Tel.: (1-809) 494 5681 (office); 496 6055 (mobile)
Fax: (1-809) 494 2670
E-mail: ICLARM-Caribbean@cgnet.com

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/