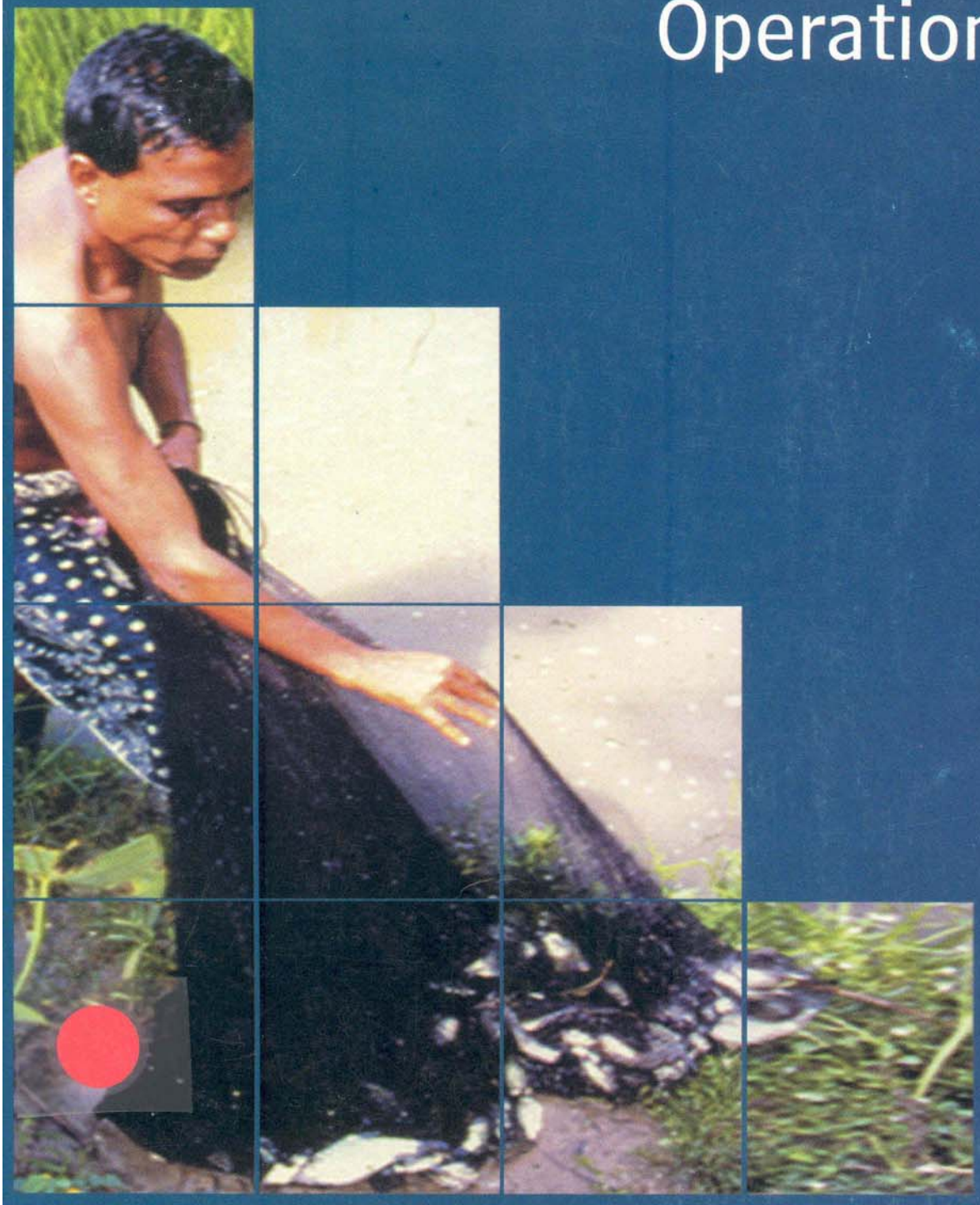
# ICLARM 2000 Operational Plan



ICLARM
International Center for Living Aquatic Resources Management

International Center for Living Aquatic
Resources Management

**Our Commitment** : to contribute to food security and poverty eradication in developing countries.

**A Way to Achieve This** : through research, partnership, capacity building and policy support, we promote sustainable development and use of living aquatic resources based on environmentally sound management.

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.

ICLARM is one of the 16 international research centers of the Consultative Group on International Agricultural Research (CGIAR) that has initiated the public awareness campaign, Future Harvest.

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2000

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# FOREWORD

With great pleasure I present the 2000 Operational Plan for ICLARM. This plan presents the full workplan of the Center for 2000, and reports in detail on major achievements in 1999. The work program is designed to help eradicate poverty, ensure food security and conserve the environment through promoting the sustainable development and use of living aquatic resources, particularly in developing countries.

The new century and the new millennium present many threats and opportunities to those who depend on living aquatic resources. For ICLARM and our efforts to assist poor people meet those challenges, it also marks a new outlook for our Center. In February 2000, our headquarters will be reestablished in a new city and country – Penang, Malaysia. In January 2000, we created a new Philippine site at Los Baños, on the campus of the International Rice Research Institute. ICLARM now works out of seven countries (Malaysia, Egypt, Bangladesh, British Virgin Islands, Malati, Philippines, Solomon Islands) and has active projects in 22 countries. Through our research and information networks, we reach scientists, fisheries policymakers, teachers and the interested public in over 100 countries.

In 2000, our research work will be conducted through five interacting Programs, namely, the Biodiversity and Genetic Resources Research Program, the Coastal and Marine Resources Research Program, the Freshwater Resources Research Program, the Policy Research and Impact Assessment Program, and the Partnerships, Information and Training Program. The year's research activities presented in this Operational Plan are organized under these Programs.

Our achievements in 1999 included a very positive assessment of the Center from the Second ICLARM External Program and Management Review which reported to the Consultative Group on International Agricultural Research (CGIAR) that the Center had made remarkable progress in all aspects of its work since it was admitted in the CGIAR in 1992, and in particular since the mid-term review of 1995. The report was very supportive of the Center's research and management, and contained a set of recommendations and many useful suggestions which are being followed up by Board and Management of ICLARM.

In October 1999, ICLARM's second Strategic Plan, addressing the period from 2000 to 2020 was released, accompanied by an extensive databook showing the background statistics and information on aquatic resources by geographical region and aquatic resource system. The new strategy broadens ICLARM's priority resource systems from ponds, coastal waters and coral reefs to also include other freshwater systems such as lakes, small waterbodies and floodplains. We continue our focus on Asia but are enhancing activities in Africa and the small island developing states of the Pacific and Caribbean.

This, the ICLARM 2000 Operational Plan, is the first to be based on the new strategy. In it, we look forward to addressing the many challenges that lie ahead.

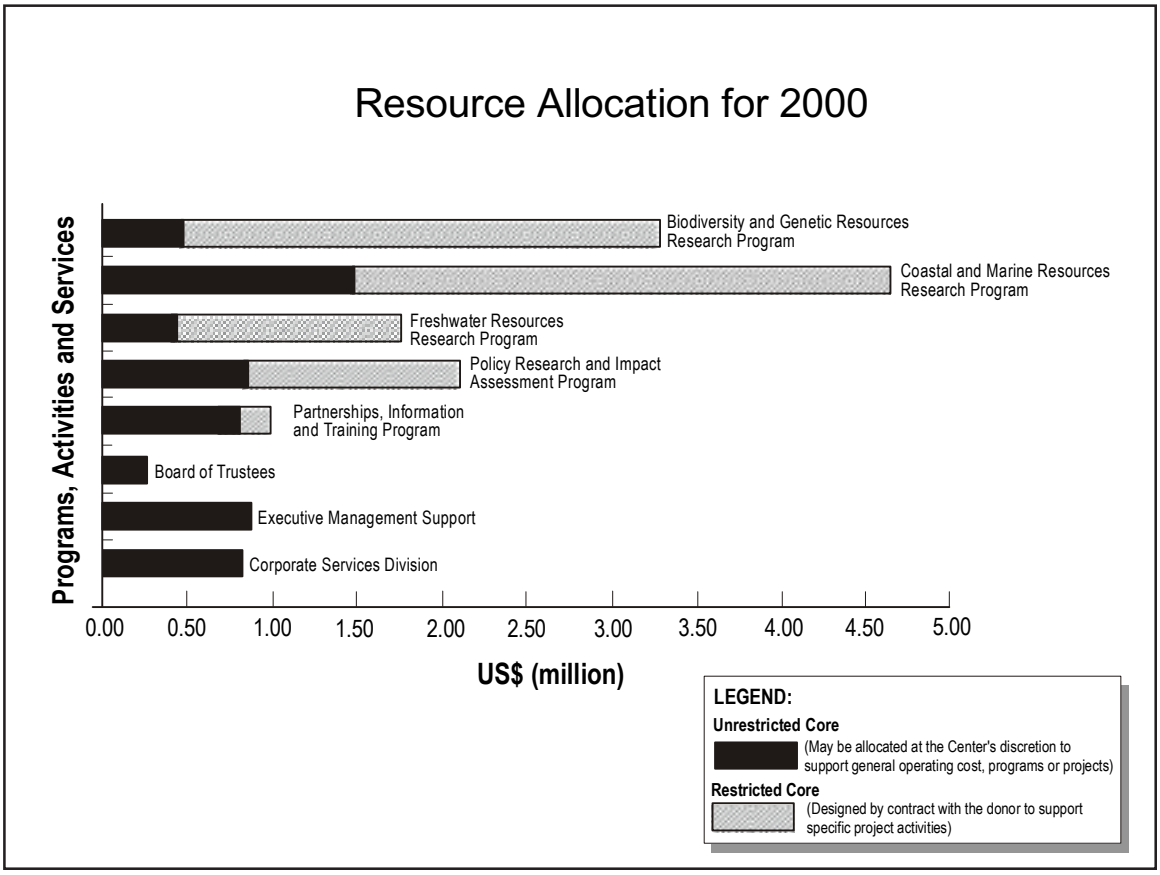
**Meryl J. Williams**
Director General
ICLARM

# 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 and disseminated through the following five programs.

| Programs | Focus |
|---|---|
| 1. Biodiversity and Genetic Resources Research Program | Conserving aquatic biodiversity and developing techniques for genetic improvement of species. |
| 2. Coastal and Marine Resources Research Program | Developing techniques for farming and restocking of marine species; improving aquatic ecosystems; and assessment of fish stocks. |
| 3. Freshwater Resources Research Program | Improving productivity and sustainability of small farms and inland waters. |
| 4. Policy Research and Impact Assessment Program | Improving policy decisions by evaluating the impact of management practices and socioeconomic structures. |
| 5. Partnerships, Information and Training Program | Disseminating ICLARM's research results and promoting the role of science in the development of fisheries, through publications, research collaborations and networks. |

| Activities and Services | Focus |
|---|---|
| 6. CGIAR System-wide Initiatives | Coordinating activities with other centers within the CGIAR. |
| 7. Corporate Services Division | Providing the Center's management, staff and organizational units the needed support services to carry out programs and activities. |
| 8. Office of the Deputy Director General - Africa and West Asia | Managing ICLARM's research projects in Africa and West Asia. |
| 9. Office of the Deputy Director General - Programs | Assisting the Director General in planning, implementing, monitoring and reporting ICLARM's research and related programs. |
| 10. Office of the Director General | Managing the Center, raising resources 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 2000
Programs, Activities and Services
Biodiversity and Genetic Resources Research Program
Coastal and Marine Resources Research Program
Freshwater Resources Research Program
Policy Research and Impact Assessment Program
Partnerships, Information and Training Program
Board of Trustees
Executive Management Support
Corporate Services Division
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
US$ (million)
LEGEND:
Unrestricted Core
(May be allocated at the Center's discretion to support general operating cost, programs or projects)
Restricted Core
(Designed by contract with the donor to support specific project activities)

# OUR GUIDING PRINCIPLES

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

THE DEFINITION OF EACH PRINCIPLE IS:

**Sustainability:** if successful, the result of the activity will lead to better ecological and/or economic sustainability, taking a long-term perspective that respects the right of future generations.

**Equity:** the results of the activity will promote a more even distribution of benefits, either by directly helping the disadvantaged or by improving their access to use of new information and technologies.

**Gender:** the extent to which the activity considers and impacts gender issues.

**Participation:** the extent to which the ultimate beneficiaries and their requirements are included in priority setting, planning and implementation of the activity.

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

**Anticipatory Research:** the extent to which the activity anticipates its potential impacts, plans to minimize the negative consequences and ensures adoption of its results.

# SUMMARY

## PROGRAMS

### 1. Biodiversity and Genetic Resources Research Program

*Biodiversity and Genetic Resources.* The Program pursues strategic research on biodiversity and genetic resources and contributes to the development of research methods and policy. It provides training in 55 African, Caribbean and Pacific national aquatic research systems (NARS), emphasizing biodiversity databases (learning from FishBase), ecosystem-based management and electronic networking. A database on fish larvae, LarvalBase, was started in 1998. Other projects target genetic characterization of fish important to the poor: tilapia *(Sarotherodon melanotheron)* in West Africa and silver barb *(Barbodes gonionotus)* in Asia. The Program contributes to the work of: the Convention on Biological Diversity and its Subsidiary Body on Scientific, Technical and Technological Advice and Clearinghouse Mechanism; Global Biodiversity Fora; Species 2000; Food and Agriculture Organization (FAO) Fisheries Division and Commission on Genetic Resources for Food and Agriculture (CGRFA); World Conservation Union; Consultative Group on International Agricultural Research (CGIAR) System-wide Genetic Resources Program (SGRP); and CGIAR System-wide Information Network for Genetic Resources.

Key achievements in 1999 were: increasing the content ( > 23,600 species), utility (new graphs for analysis of fisheries data) and accessibility (Internet) of FishBase; capacity building for NARS in Africa; new genetic data on *S. melanotheron* and *B. gonionotus*; a book (with FAO) on policies for aquatic genetic resources; and raising the profile of *in situ* genetic resources conservation and use in the SGRP and CGRFA.

A Program Leader has been recruited to develop projects under ICLARM's new Program structure. At ICLARM Philippines, the FishBase team will complete the ongoing project by December 2000. Aquaculture coverage of FishBase will be strengthened. Management and partnership structures for continuing the development of FishBase beyond 2000 will be established. LarvalBase will continue data collection and harmonization, with access through FishBase. The *S. melanotheron* project will be extended, for more collections, laboratory analyses and aquaculture trials. The *B. gonionotus* project will end in September 2000. Funding will be sought for a project on endangered freshwater fishes titled Fishes for the Future.

*Germplasm Enhancement and Breeding*. The Program aims to develop techniques for improving breeds of fish for aquaculture, disseminate these techniques and train NARS in their use. It focuses on carp and tilapia species that are important for aquaculture systems prevalent in developing countries.

### 2. Coastal and Marine Resources Research Program

*Coastal Aquaculture and Stock Enhancement.* This component focuses on developing methods to increase the productivity of species associated with coral reefs. Its location at the Coastal Aquaculture Centre (CAC) in the Solomon Islands enables staff to undertake projects on the conservation and management of inshore marine resources. In 1999, research was concentrated on the farming and restocking of giant clams, culture of blacklip pearl oysters, stock enhancement of sea cucumbers and development of artisanal fisheries for aquarium species based on the capture and culture of postlarval fish. A major project on the effects of runoff from different types of forestry operations on freshwater and inshore marine habitats was initiated.

The aim of the research on giant clams in 1999 was to add value to cultured specimens sold to the aquarium trade by identifying environmental factors that promote iridescent mantle colors, and to reduce the labor costs of raising giant clams through polyculture with trochus. The establishment of restocking projects will be the focus for research on giant clams in 2000.

The first crop of black pearls was harvested from the demonstration pearl farm and spat were reared in the hatchery at the CAC in large numbers for the first time. Methods for collection and growout of spat were transferred to Fiji and will be introduced in Tonga in 2000.

The research on sea cucumbers concentrated on documenting the ecology of juvenile sandfish in the wild, including settlement on the leaves of seagrass, and routine methods for rearing sandfish in hatcheries.

Arrangements were made with the Australian Centre for International Agricultural Research for continuing the development of optimal strategies for releasing cultured juvenile sandfish into the wild in 2000.

Research on postlarval reef fish began in May and demonstrated that >25% of species caught were of value to the aquarium trade. Work in 2000 will focus on quantifying temporal availability of juvenile fish and development of methods for rearing them to market size.

The investigation on the effects of runoff from forestry operations was confined to the selection of study areas and a pilot study to determine the best methods for sampling sedimentation, freshwater fauna, coral communities, marine benthos and reef fish. The first of four annual samplings from the study sites will be done in June 2000.

*Aquatic Environments.* During 1999, data gathering, consolidation and dissemination activities have been supplemented by increased efforts to analyze the data and address major concerns in coral reef management. Genetic data from the project Population Interdependencies in the South China Sea Ecosystems (PISCES) are being analyzed to see if and how reefs in one country depend on reefs in adjacent countries for propagules. Selected ecological variables within ReefBase, the Global Coral Reef Database, are being analyzed in terms of statistical distributions to determine norms and bounds for the evaluation of ecosystem health. The Rapid Assessment of Management Parameters (RAMP) data have been compared to ecological variables through multivariate analyses to determine the degree to which socioeconomic variables can predict reef health. Both the ecological health variables and their socioeconomic predictors will be used in a *Reefs at Risk* study for Southeast Asia. The study will use data records from many sources in a geographical information system-based analysis of coral reef status. It will provide a basis for reef management in the region and a protocol for similar studies in other regions.

ICLARM has been a catalyst for interaction among a variety of coastal zone projects under the MacArthur Population, Consumption and Environment Program. Principles elucidated under these projects have been incorporated into the training material being developed as part of the United Nations Train-Sea-Coast Network. The International Coral Reef Action Network, currently being developed, integrates PISCES, ReefBase, RAMP, *Reefs at Risk* and the Coastal Management Training project along with other relevant projects to assist the United Nations Environment Programme Regional Seas Program in upgrading the management of coral reefs globally.

*Fisheries Resources Assessment and Management.* The Program has a strong track record of developing and supporting the use of fisheries assessment software for use in national research institutions, be it through the Compleat Elefan, FiSAT (FAO-ICLARM Stock Assessment Tools) or one of the many other software packages released as part of the fisheries assessment programs at ICLARM. In recent years the focus has been widened from the initial focus on tools for the analysis of fish stocks. The Ecopath work is the best example. It allows fisheries to be analyzed in the context of the ecosystems that support them and helps in designing policies for ecosystem-based management of fisheries. With the realization that fisheries are inherently difficult to manage through catch or effort regulation, attention has been drawn to using protected areas (with fishing restricted or banned) as part of management schemes. To participate in this effort, ICLARM is undertaking projects in two island states in the Caribbean aimed at a better understanding of how marine protected areas function and how they can be used to improve the management of tropical fisheries. This work is supported by the recent development of spatial modeling as part of the Ecopath with Ecosim system that allows for model-based studies of protected areas.

The tropical fish stock assessment activity is in maintenance mode. The activities in 1999 were limited to the continuing distribution of tools and support to the users. A module to calculate the biomass from trawl surveys is under development. It will be used with the Fisheries Resource Information System and Tools (FiRST) software package that will be produced under the Sustainable Management of Coastal Fish Stocks in Asia project. An updated version of FiRST was released in June 1999 during an Ecosystem Workshop.

During the first half of 1999, major effort was allocated to reviewing suggestions for improvement from the application of the Ecopath with Ecosim test version at international workshops conducted in the previous year. This approach was used to identify and add a number of new features to the database and to improve the programming structure of the software. The updated version was tested with good results at the coastal trawl fisheries Regional Ecosystem Modeling Workshop on 7-11 June 1999 in Manila, Philippines. The software will be officially released by the end of 2000.

TrawlBase activities programmed for 2000 include: continuation of data and policy analyses; further development of FiRST and release of the 1999 version; preparation and submission of draft technical reports; conduct of national/regional fisheries resources management and planning workshops; and formulation of national development strategies and action plans. A regional consultative workshop for the presentation of technical outputs will be held before the end of 2000.

A final technical report on the Caribbean marine protected area project to the Inter-American Development Bank, covering activities in Jamaica for the three years ending in June 1999, has been prepared for submission to the Centre for Marine Sciences of the University of the West Indies. A follow-up phase of the project has been initiated.

The last of the three independent samples to be taken three years after the establishment of the Arnavon Islands marine conservation area (MCA) was collected by May 1999. Preliminary analysis shows that there has been a substantial increase in the abundance of trochus sea cucumbers and giant clams in the MCA relative to the three areas outside the MCA that remain open to fishing. Regrettably, increases in trochus at some of the eight sites monitored within the MCA have not been as great as they could have been because of poaching. The response of other species (sea cucumbers, giant clams) to protection from fishing has been negligible over the three year closure, indicating that far greater periods of protection are needed for recovery. The consultant completed the final report for the project in November 1999.

**3. Freshwater Resources Research Program**

*Integrated Aquaculture-Agriculture Systems*. The activities have been focused on the improvement of small farm productivity through the introduction of multiuse waterbodies on farms in Bangladesh, a country with abundant rainfall and a great variety of waterbodies that can be used for aquaculture; Mala*t*i, a semi-arid country in southern Africa dependent upon seasonal rainfall; and the Philippines, where the project 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 local conditions. A project for increasing and sustaining the productivity of fish and rice in the floodplain ecosystems of South and Southeast Asia is in operation 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 and adequate provision of inputs and access to markets.

In 1999, the technical report of a previously completed BMZ-funded project undertaken in collaboration with the University of Göttingen, Germany, was edited and published; the RESTORE package was externally reviewed and the software further improved; an Orientor framework for sustainability indicator selection was formulated; and a set of simulation models of rice-based integrated aquaculture-agriculture (IAA) farming systems was completed.

IAA technologies are being extended to 6,000 new farm households throughout Bangladesh. Monitoring and socioeconomic impact analysis are being conducted on a large sample of these households.

The Mala*t*i Department of Fisheries is implementing its newly adopted strategy of Research-Extension Teams developed by ICLARM. Center staff continue to provide guidance.

A study on the status and reproductive success of two small *Barbus* species that are of high nutritional importance to humans, was completed in the Lake Chilwa watershed of Malawi. The results will be used to develop a management plan for the watershed.

In an upland forest buffer zone area in the Philippines, the introduction of IAA contributed only a small share to overall farm income but, in terms of returns to labor per unit area, aquaculture was the most productive enterprise.

In community-shared management of deepwater rice-fish culture in Bangladesh and Vietnam, trials showed that well functioning institutional arrangements between different social groups can be achieved. The technology introduced proved to be economically beneficial.

In 2000, project designs and proposals will be prepared in line with a new Program strategy; the RESTORE package with two manuals will be officially released; the impact analysis of a large IAA technology transfer program in Bangladesh will be completed; the effect of the introduction of IAA to farmers in the Mbowe district of Malawi will be demonstrated and quantified; the impact of IAA on gender relations within upland farming communities in the Philippines will be characterized and the negative or positive effects identified and described; and institutional arrangements for community management of deepwater rice-fish culture in Bangladesh and Vietnam will be verified on a wider database. Recommendations will be made to policymakers and decisionmakers.

**4. Policy Research and Impact Assessment Program**

ICLARM's programs seek innovations and new technologies to augment aquatic production and find better ways to manage the aquatic environment. PRIAP's research continues to support them by examining the policy environment to ensure wider adoption of these technologies to benefit the poorer people in developing countries. In 1999, PRIAP developed a new research logframe and restructured its focus around three main thematic areas: (i) monitoring and economic evaluation of fisheries in developing countries; (ii) aquatic resources planning and impact assessment; and (iii) legal and institutional analysis for fisheries management.

PRIAP set new milestones in its research on policies for sustainable governance of aquatic resources in 1999, with the completion of the DANIDA-supported Phase 1 of the fisheries co-management project and the analysis of the legal and institutional framework for fisheries and coastal resources management in Southeast Asia and Bangladesh under Swedish support. While the former project has generated a large body of knowledge and information on the institutional approaches to aquatic resources management in developing countries, the latter has indicated a strong link between the existing legal and institutional framework and the performance of the management regimes dealing with fisheries and coastal resources. Phase 2 of the fisheries co-management project will evaluate the process and feasibility of co-management at the national and local level, including a strong focus on providing inputs to strengthen national policies, laws and programs for co-management in selected countries.

PRIAP has expanded the scope of legal and institutional policy analysis to a more specific project on legal and institutional analysis and economic valuation of wetlands and aquatic resources in the Mekong river basin. The project logframe and work plan have been established. Work will start in early 2000 due to delay in the funding arrangements with SIDA. The project will focus on dissemination of information on legal and institutional aspects as well as the economic valuation of aquatic resources in the wetlands of the Mekong river region, through links with relevant national, regional and international agencies. A much stronger collaborative link with the Mekong River Commission's wetland and fisheries programs will be established.

PRIAP also embarked on research on the valuation of coral reefs and policy analysis for sustainable management of reef resources. The methodology and framework to be used in the Mekong river basin wetlands project and the coral reef valuation project will benefit from their similarity. Significant efforts have been devoted to the review of literature on methods of economic valuation done elsewhere. An important activity under the project is the development of a socioeconomic module for integration into

ReefBase. It will take full shape in 2000.

The community-based fisheries management project prepared for the second five-year phase will be supported by DFID. Monitoring and data collection during Phase 1 revealed that stakeholder management can be extended to the wider community, to ensure cooperation among fishers and other users of the aquatic environment as well as to mediate conflicts.

Impact assessment research included the publication of a methodological framework for use on other major projects (ongoing and forthcoming) of the Center. A planned consultative workshop on determination of key indicators of impact and methods for their estimation has been deferred until 2000 due to lack of funds and staff.

PRIAP further prioritized research on the analysis of the contribution of fisheries to food security. The focus was on assessment and monitoring of the supply and demand for fish and seafood in developing countries, and on the integration of fish into the world food models. Three project proposals have been prepared to cover Asia, Africa and Latin America. The Asian proposal may be implemented in 2000. Substantial progress has been made towards undertaking collaborative activities with IFPRI and other relevant organizations (e.g., FAO, INFOFISH) on incorporating fish into IFPRI's food model, known as IMPACT. The proceedings (published in 1999) of the 1997 international consultation highlighted the need to improve policy awareness of the importance both of fisheries development and of factoring fish into the global food model. An Oxfam America-funded project on Assessment of the Contribution of the Aquatic Resources in the Mekong River Basin to Food and Nutritional Security has provided baseline information on household benefits and consumption patterns of fish and other aquatic resources.

PRIAP will examine the economic efficiency, compliance to and legitimacy of resource use rules, and the long-term social, institutional and ecological sustainability of co-management. Other participatory management arrangements will be studied over the medium term. Research on the economic valuation of critical resources, e.g., wetlands, coral reefs, mangroves and related coastal ecosystems, will be prioritized over the medium term. This will highlight the importance of these resources in intersectoral policy debates and provide a basis for intersectoral policy decisions.

For impact assessment research in the medium term, the indicators will be defined and measured through project-specific implementation and *ex post* studies.

In some research areas, centerwide projects and multidisciplinary research teams will be needed. These will include coral reef management, marine protected area management and the economics of biodiversity.

**5. Partnerships, Information and Training Program**

*International Partnerships and Networks*. ICLARM's work in research and related activities (training/workshops/conferences/information dissemination) is carried out in partnership with national institutions and regional and international organizations. The role of this Program is to strengthen existing collaborations and to develop new partnerships with NARS, nongovernmental organizations, regional and international organizations, advanced scientific institutions (ASI) and the private sector, in research and related activities. A database of all ICLARM partners has been prepared.

The Program coordinates the research network International Network on Genetics in Aquaculture (INGA) and the information network Network of Tropical Aquaculture and Fisheries Professionals (NTAFP). INGA successfully held its Fifth Steering Committee Meeting, attended by scientists from nine member-countries and 11 ASI and regional and international organizations from Europe, USA, Middle East and Asia. The proceedings of the meeting are being edited for publication.

The Asia-Pacific Association of Agricultural Research Institutions (APAARI), ICLARM and the International Service for National Agricultural Research have agreed to organize a Training Workshop on Research Priority Setting for NARS in the Asia-Pacific region. The training will include the member institutions of

the Group of Fisheries and Aquatic Research (GoFAR) which was established in 1998 under APAARI to identify and implement regional priorities in research and capacity building in aquatic resources management. The training workshop and second annual meeting of APAARI/GoFAR are scheduled for 2000. A number of memoranda of agreement have been signed with national/regional/international organizations for collaboration.

During 2000, the Program will continue to forge new partnerships, further strengthen existing partnerships and networks, organize training workshops for NARS capacity enhancement, undertake a Survey of Partners and assess the feasibility of initiating an African Coastal Resources Management Network.

*Information and Training*. The Program has an important role in ensuring the success of ICLARM's mission through the dissemination of the results of its research and by raising public awareness (PA) of its mission and activities. Widespread dissemination of ICLARM's work contributes to a greater impact from its research, while the marketing of the Center's mandate promotes an understanding of the need for this research. Information dissemination is done through publications, library services and PA activities.

In 1999, ICLARM, through the Publications Unit, produced 42 publications (scientific reports and PA and corporate outputs), and copyedited and cleared 68 contributions to international and regional scientific journals and internal and external publications. Four issues of the *Naga, the ICLARM Quarterly* were published. In 2000, ICLARM will continue to produce high-quality publications.

In 1998 and 1999, the first two PA series were created: (i) 'Focus for Research' which highlights specific aquatic resources management issues and indicates the important areas for future research; and (ii) 'Research Highlights' which presents some highlights of ICLARM's research in story-style. The corporate PA materials were expanded with the development of ICLARM's 'Capability Statement', new folder and flyers. The third series in scientific PA materials, 'Impacts', will be released in 2000. This series will be a short description of the science and benefits of ICLARM's project work. A 'What is ICLARM' booklet is also planned for 2000.

In 2000, the Library and Information Services Unit will continue to operate and update six databases, that had a total of 54,555 entries as of October 1999. Other library activities are expected to further increase in 2000. From January to November 1999, 426 queries from 75 countries were answered, 66% of these being from developing countries. Seventy-nine percent of all queries were answered free of charge. Information and reference services were also provided to 1,309 users. Demonstrations on the use of information databases, online searches, library orientation and technical advice on library and information systems and services were provided to 335 users/visitors. ICLARM had an exchange agreement with 153 libraries and institutions. Services to other libraries and inputs to international databases were also provided.

In 2000, the Program will capitalize on technology for information services and dissemination with an enhancement in technical staffing. Electronic publishing and ICLARM's home page will be expanded.

The year 2000 will see the preliminary development and initiation of a strategy for fundraising from private industry. A stronger corporate identity will be developed. PA will focus on host country relations at the new headquarters site as well as on general PA through the media. To be able to attract private funding, it is important that ICLARM is well-known and has international status and credibility.

## ACTIVITIES AND SERVICES

### 6. CGIAR System-wide Activities

ICLARM is an active member of several CGIAR system-wide activities, including research programs and support initiatives. It participates in: SGRP; System-wide Initiative on Water Management; System-wide Initiative on Property Rights and Collection Action; system-wide PA activities; and the gender and diversity program. ICLARM will continue its contribution to these and any other relevant system-wide initiatives.

**7. Corporate Services Division**

The CSD provides the operational and logistical support to the Center's Programs and Units. 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 the BOT and management in developing appropriate policies, procedures and systems. Regular reviews of the Division's services are done to indicate areas for improvement.

The CSD is undergoing a reorganization, which commenced in 1998. The Division has been organized into the following functional units: Human Resources; Finance and Management Information; Administrative and Liaison; Information Technology (Computer Services); Financial and Administrative Systems Development; and Planning and Budgeting.

**8. Office of the Deputy Director General - Africa and West Asia**

The regional research center develops and conducts a program of research and training to facilitate and encourage better management and use of living aquatic resources in Africa and West Asia. This is done in close cooperation with the national programs in the region as well as ICLARM's global Programs coordinated at its headquarters.

The project to renovate the facilities in Abbassa, Egypt, was completed in 1999. Research, training and housing facilities are in operation. The first cycle of selection of tilapia populations was completed. Simple procedures for increasing spawning of catfish and earlier spawning of tilapia were recorded. Steps were taken to establish a fish health network for Africa. Work to evaluate the quality of water for fish production in Egypt has started. Fish production training was completed for 14 Egyptian fish producers from Fayoum and for 19 from Abbassa. A regional training program, developed in collaboration with FAO, was conducted in October 1999. Proposals are under consideration for increasing research activities in several countries in the region.

In 2000, new equipment for research and operations and additional renovation work are required, but are subject to funding. The next cycle of evaluation and selection of tilapia will be completed. An international conference on the potential risk associated with the commercial culture of genetically modified tilapia will be organized. The research and training program will continue to extend its work into other countries in the region. An important goal is to establish a project in the humid zone of West Africa on the integration of aquaculture into the farming systems of the region. Responding to the recommendations of the External Program and Management Review (EPMR) and finding new funding will be special challenges.

**9. Office of the Deputy Director General - Programs**

The office oversees the planning, implementation, impact assessment and reporting of ICLARM's scientific programs. The office coordinates the development of ICLARM's rolling medium-term plans. Major activities in 1999 were the finalization of ICLARM's Strategic Plan for 2000-2020 (published in October 1999), outlining a new Program structure and development of an inter-Center project initiative. A new schedule for internally commissioned external reviews of ICLARM's Programs has been developed.

Project development is carried out with the Research Management Committee (RMC). New activities (especially with respect to the initiative in Africa) will be promoted in conjunction with the ODDG-AWA and other Programs. In 2000, the office will focus on the development of a new staffing pattern, following the headquarters move to Malaysia and the formulation and implementation of research in line with the new Strategic Plan.

**10. Office of the Director General**

This office carries out the central executive management function of ICLARM and is responsible for implementing Board policies and advising the Board on management and policy matters.

In 1999, ODG directed ICLARM successfully through the second EPMR and presented the results to the CGIAR. The DG assisted the Board of Trustees in the selection of a new site for ICLARM's headquarters in

Penang, Malaysia, and successfully led the first phase of the transition process in Manila. Fundraising for the renovation of the new site and to cover transition costs was initiated.

In addition to the regular functions, the ODG will focus on starting and establishing activities in Penang; oversee the introduction of the new research program structure; and develop a corporate image for ICLARM in line with the changing research and funding priorities.

Under the ODG, the Project Development Coordination Unit (PDCU) serves as ICLARM's main mechanism for formulating, endorsing and tracking project proposals in coordination with scientists, RMC and prospective donors. PDCU analyzes donor priorities and develops alternative resource mobilization and fundraising strategies to ensure a sustained source of funds for ICLARM's projects and core operations.

In 1999, PDCU started to computerize its proposal tracking programs and donor database. A total of 37 proposals were received, of which six are being further developed, two are for donor identification or submission, 16 are under negotiation with various donors, three need to be submitted to other donors, three are funded (plus two other proposals received prior to 1999 that were also approved for funding this year), and seven have been archived or subsequently replaced with new proposals.

In 2000, PDCU expects to finalize and operationalize its donor database and tracking system and to improve its ratio of proposal approvals to submissions.

# 1. BIODIVERSITY AND GENETIC RESOURCES RESEARCH PROGRAM (BGRRP)

## BIODIVERSITY AND GENETIC RESOURCES

### Project 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. Boris Fabres; Dr. Maria Lourdes D. Palomares; Mr. Eli E. Agbayani; Ms. Rachel Atanacio; Ms. Crispina B. Binohlan; Ms. Emily D.C. Capuli; Ms. Christine Marie V. Casal; Ms. Maria Teresa G. Cruz; Ms. Cristina V. Garilao; Mr. Meynard G. Gilhang; Ms. Susan M. Luna; Ms. Grace Tolentino-Pablico; Mr. Rodolfo B. Reyes, Jr; Ms. Pascualita T. Sa-a; Ms. Arlene G. Sampang; Ms. Armi G. Torres; Dr. Daniel Pauly (Scientific Adviser)

**Training Coordinators**

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**Collaborating Institutions**

*International/Regional:* Caribbean Community; Fisheries Resources Assessment and Management Program; Food and Agriculture Organization of the United Nations (FAO); Secretariat of the Pacific Community; World Conservation Monitoring Centre; World Conservation Union (IUCN)
*Australia:* Fisheries Research and Development Corporation; Bureau of Rural Sciences
*Belgium:* Musée Royale de l'Afrique Centrale
*Canada:* Ocean Voice International; University of British Columbia
*France:* Museum National d'Histoire Naturelle
*Germany:* Institut für Meereskunde, Kiel
*Namibia:* National Marine Information and Research Centre
*Sénégal:* Centre de Recherche Océanographique, Dakar-Thiaroye
*UK:* Natural History Museum; Species 2000 Project, University of Reading
*USA:* American Fisheries Society; California Academy of Sciences
*Others:* the national programs of 55 countries in the ACP regions; other institutions and individual researchers

**Donor :** EU

**Duration :** December 1996 - December 2000

**Objectives**

- Facilitate the sustainable use and conservation of fish biodiversity by making key scientific information readily accessible through a computerized encyclopedia and research tool (FishBase).
- 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 state-of-the-art management tools, and by training them in the use of these tools.
- Promote an enabling environment for research which is relevant and critical to sustainable aquatic resources management in developing countries, by facilitating cooperation between national researchers and managers in individual countries, and by actively fostering regional and global cooperation.
- 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 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 training for NARS scientists and resource managers. Accessibility of information and knowledge is required for effective management.

FishBase is a biological database developed by ICLARM in collaboration with FAO and many other partners. FishBase contains key information (nomenclature, morphology, trophic ecology, population dynamics, physiology, pictures, maps, graphs, etc.) for 23,600 of the estimated 25,000 known species of finfish. It acts as a host to related databases that are developed by collaborators, such as FAO Catches 1950-1997, FAO Aquaculture Production 1984-1996, IUCN Red List Data, Eschmeyer's Catalog of Fishes, Myers' database of recruitment time series and Houde's LARVDYN database, among 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 databases on finfish biodiversity. Part of this is giving them access to relevant information on biodiversity currently held in the museums of developed countries. These data are being computerized, georeferenced, checked and completed with more recent information. They will be used to analyze trends and patterns in biodiversity at the national level to provide a scientific basis for national policies on biodiversity in ACP and other countries.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | H | Systems Approach | M |
| Gender | M | Anticipatory Research | H |

**Current Status**

A major breakthrough was achieved by making FishBase accessible through the Internet, including graphs and data handling facilities. The FishBase web site received, on average, 6,000 hits per day. Users can retrieve information/data required using individual search strategies. A template that can be built into any national web page was produced. This provides automated access to the various listings in FishBase on country-specific information (e.g., species list, list of endangered species, international conventions on fisheries and biodiversity). Internet access allows FishBase to reach more users, to provide faster updates (monthly vs. annually), and to provide features that surpass the abilities of the CD-ROM (easy downloading of data; availability of FishBase to non-Windows users).

New features were incorporated in FishBase: routines that summarize available estimates of parameters needed to construct ecosystem models; graphs that analyze catch data and that can be used as sustainability indicators; 'before-after' maps to indicate areas where species do not occur anymore; a printout to produce taxonomic checklists by family; and new 'aquaculture profiles' that provide a summary of important characteristics of aquaculture species.

Translation into French of the FishBase '99 book was completed. Editing, layout and printing are in progress. The FishBase '99 CD-ROM and book (in French) were produced.

More than 114 ACP fisheries scientists and managers attended five training courses held in five training nodes. Twenty-five institutions in ACP countries were supplied with modern computer hardware to enable them to use the software tools developed by the project and presented during the training courses. All five regional nodes of the project were given support in providing training and assistance to researchers in their respective regions. Six regional coordinators were invited to ICLARM headquarters for two-week training programs on information management in FishBase. A one-week training course in fish taxonomy, for the wider Caribbean area, was held in cooperation with FAO, 9-15 July in Belize. This has doubled the number of taxonomists named as resource persons and partners in FishBase.

**Activities Planned for 2000**

Cover all 25,000 existing fish species in FishBase.

Produce a FishBase 2000 CD-ROM and book.

Continue supporting FishBase on the Internet.

Further develop applications and analytical tools to assist ACP partners in their scientific, educational, conservation and managerial tasks in fisheries and aquaculture.

Develop and further improve key fact sheets presenting simple indicators for management as well as basic information for aquaculturists and conservationists. Make the fact sheets available on the Internet and in leaflet form for the widest possible dissemination.

To date FishBase covers all freshwater fishes of four of the seven FAO inland areas. Two of the remaining areas (central America and south America) will

be covered in collaboration with regional experts in a joint effort to publish a Checklist of the Freshwater Fishes of South and Central America.

Provide more extensive coverage of aquaculture information in FishBase by: developing tools for aquaculturists, similar to those available for capture fisheries; boosting the production of aquaculture profiles by giving modest support to authors; and holding a workshop with experts willing to contribute aquaculture data or analytical tools to FishBase.

Develop the concept and curriculum for using FishBase in university teaching.

Convene a workshop to plan the next phase of the project.

Convene the Fourth ACP-EU Steering Committee Meeting.

## Project 1.2
## LarvalBase: A Global Information System on Fish Larvae

**ICLARM Staff**
Dr. Rainer Froese; Ms. Susan M. Luna; Mr. Lemuel R. Casten

**Collaborating Institution**
*Germany:* Institut für Meereskunde, Kiel (IFM-K)

**Donor :** BMZ/GTZ

**Duration :** Feasibility study, February 1998-March 1999; main project, July 1999-June 2002

**Objectives**
GENERAL
- Provide fisheries and hatchery managers in developing countries with fast and easy access to all information relevant to the identification and rearing of fish larvae for aquaculture and stock enhancement and for the conservation and re-establishment of fish biodiversity.

SPECIFIC
- Gather key information on fish larvae for identification and rearing.
- Assemble information and data in an information system, LarvalBase.
- Make LarvalBase widely available in developing countries.
- Provide training courses in the use of LarvalBase.

**Background and Justification**
Critical habitats for the spawning and early life history stages of many fish species have been degraded or lost as a result of pollution, coastal development and other human activities. In addition, recruitment overfishing (the reduction of the spawning stock below a critical threshold) has prevented many populations from replenishing themselves to previous levels. Together, these produce circumstances where aquatic habitats do not support as many fish as they could. Consequently, numerous ways are being explored to augment the natural supply of fish.

Fishery and hatchery managers in developing countries need easy access to relevant information on identifying and rearing of fish larvae for aquaculture, stock enhancement and re-establishment of fish biodiversity. To address this need, the idea of producing a global database containing biological information 'at a user's fingertips' was conceived. FishBase, the ICLARM-managed database on finfish, is a well established example of such an information system and provides an ideal vehicle to make information on fish larvae effectively and inexpensively available to a wide range of users. In this collaboration between ICLARM and the IFM-K, ICLARM will provide the FishBase format and IFM-K will provide its specialized knowledge on fish larvae. Other collaborators from fisheries institutions will be identified. LarvalBase will be made available on CD-ROM and the Internet.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | M | Systems Approach | H |
| Gender | L | Anticipatory Research | H |

**Current Status**
Feasibility study completed. The startup was delayed to 1 July 1999 due to nonreceipt of contract from the donor.

**Activities Planned for 2000**
Data gathering and entry, and linkages with experts and institutions were started during the feasibility study. In 2000, further progress will be made on the three main tasks of the project: (i) data

collection and checking on fish larvae in aquaculture will continue; (ii) data collection on fish larvae from secondary sources, including grey literature, electronic sources, etc. - data checking, harmonization, development of graphs and analytical routines, and a scientific paper; (iii) data entry and scanning of pictures of eggs/larvae into FishBase - collection of user feedback.

## Project 1.3

## 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. Grant Stewart; Ms. Christine Marie V. Casal

**Collaborating Institutions**
*Germany:* Zoologisches Institut und Zoologisches Museum, Universität Hamburg (ZIM/UH)
*Ghana:* Water Research Institute (WRI)
*Belgium:* Musée Royale de L'Afrique Centrale (MRAC)

**Donor :** BMZ/GTZ

**Duration :** March 1997 - March 2002

**Objectives**
GENERAL
- Assist in the conservation and sustainable use of the brackishwater tilapia *S. melanotheron* in aquaculture and fisheries. The species is widely exploited in the coastal zone of west Africa. The objective is to improve fish supply, provide livelihood opportunities for fishers and farmers, and demonstrate approaches that can be used in other regions and with other exploited and exploitable fishes.

SPECIFIC
- Gather comprehensive information, including indigenous knowledge, on the biology, ecology and use of *S. melanotheron* in west Africa.
- Determine the conservation status and potential for sustainable use of *S. melanotheron*.
- Identify at least two locations in Ghana with a potential for community-based sustainable aquaculture and/or fisheries development using *S. melanotheron.*
- Initiate a practical aquaculture development program for *S. melanotheron* at one site in Ghana.

**Background and Justification**
The black-chinned tilapia is a coastal species inhabiting brackishwater and freshwater lagoons and watercourses in west Africa, ranging from Sénégal to the Democratic Republic of Congo. It is widely exploited by poor fishers using a variety of fishing gear and traditional methods of fishing, e.g., 'brushparks'. It is also a promising species for aquaculture in brackishwater and freshwater and its development for this purpose will obviate the need for the introduction of exotic species for aquaculture and their possible adverse environmental impacts.

*S. melanotheron* is a suitable species for the study of the potential of combining the conservation of the genetic resources of a species with its sustainable and equitable use by humans. This is a question that needs to be answered for many exploited fishes. *S. melanotheron* has several attributes that qualify it as a choice for such a case study: (i) it provides food for poor coastal dwellers and employment opportunities in capture and enhanced fisheries and has a 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; (ii) 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, to characterize and evaluate fish genetic resources; (iii) its populations are threatened by human pressures like overfishing, habitat degradation, pollution, introduction of exotic species, etc.; and (iv) the indigenous knowledge and the traditional management practices that were established to conserve its populations for sustainable use are breaking down as human population increases and natural resources and habitats are degraded.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | H | Systems Approach | M |
| Gender | M | Anticipatory Research | H |

**Current Status**

Work continued on the development of primers for a variety of alpha-globin chain genes, to allow complete sequence comparisons between the alpha-globin chain genes of *S. melanotheron*. This will enable a more detailed analysis of the phylogeny and biogeography of *S. melanotheron* spp. The same primers will probably be useful for other tilapiine species.

The standardization of allozyme data (for use in databases) was continued using molecular weights to allow direct comparisons among different laboratories. This enables the identification of alleles without the use of reference samples (only molecular weight markers are required).

Species-specific markers were identified for *S. melanotheron* based on hemoglobins, parvalbumins and immunological reactions.

The protein components of the erythrocyte membranes of different tilapiine species, including *S. melanotheron*, were compared.

A revision of *S. melanotheron* spp. appears necessary from the project's new data: *S.m. paludinosus* appears synonymous with *S.m. heudelotii* and the validity of *S.m. leonensis* is doubtful.

Phylogenetically, allozyme studies suggest a sister group relationship between *S.m. nigripinnis* and all other populations investigated and a close relationship between populations of *S.m. melanotheron* in Côte d'Ivoire, Ghana, Togo and Benin and *S.m. nigripinnis* in the Congo. Populations from Sénégal (*S.m. heudelotii*) share a high number of more derived character states. Consequently, we propose a Congolese origin for *S. melanotheron* as these populations have colonized coastal basins west and north to the mouth of the Sénégal river, possibly facilitated through former connections between waterbodies and fluctuating sea levels.

Phylogenetic reconstructions, based upon parvalbumin analyses and globin chain data, show a clustering of species by genus, confirming the genera proposed by Trewavas in 1983. Moreover, they support the hypothesis that all the mouthbrooding tilapias had a monophyletic origin (from substrate spawners) and argue against multiple speciation events. However, *S. melanotheron* clusters with the *Oreochromis* group and not with *S. galilaeus*. This result agrees with allozyme studies of Pouyaud and Agnèse in 1995.

The Amisa lagoon population of *S. melanotheron*, Ghana, was identified as the most promising Ghanaian population for aquaculture, showing significantly higher heterozygosity and polymorphism compared to other populations studied. Culture trials of genetically determined Ghanaian *S. melanotheron* populations have been done and results are being evaluated.

**Activities Planned for 2000**

Complete the collection of samples from *S. melanotheron* populations in its western range (Gambia, Guinea, Sierra Leone, Côte d'Ivoire) and collect more samples in its eastern range (Ghana, Togo, Benin, Nigeria and Cameroon and, possibly, Equatorial Guinea, Gabon and Congo).

Continue biochemical genetic characterization of *S. melanotheron* populations (at ZIM/UH and WRI) and their morphological characterization (at MRAC).

Continue *S. melanotheron* culture trials (at WRI).

Start testing methods for identification of tilapia species and hybrids (in Ghana).

Hold project team meetings (at ZIM/UH and WRI) and prepare for an international workshop.

## Project 1.4
## Genetic Diversity of the Silver Barb *Barbodes gonionotus* (Bleeker) in Southeast Asia

**ICLARM Staff**

Dr. Grant Stewart; Ms. Christine Marie V. Casal

**Collaborating Institution**

*UK:* University of Wales, Swansea

**Donor :** DFID

**Duration :** October 1997 - September 2000

**Objectives**

- Identify the center(s) of genetic diversity of *B. gonionotus* across its natural range and make recommendations for the management of these genetic resources.
- 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.
- Gain experience in and develop methods for genetic diversity research that could be applied to other species.

**Background and Justification**

*Barbodes gonionotus* (Bleeker) or 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 the Mekong from Indonesia. The species has now been introduced throughout much of tropical and subtropical Asia, e.g., Bangladesh, China, India and Malaysia.

Knowledge of the genetic diversity and population structure of this species is vital to the future management of farmed and wild populations. A recent preliminary study on the selection of *B. 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 essential that the most important wild populations (i.e., those having the highest levels and most unique genetic variation) must be identified and given priority in terms of conservation. This information can be used for the further domestication of the species. There is presently very little information available on the population genetics of *B. gonionotus*, a gap which this project will start to fill.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | M | Systems Approach | L |
| Gender | L | Anticipatory Research | H |

**Current Status**

Genetic variation in the mtDNA control region was surveyed in four populations of *B. gonionotus* from Java, Indonesia, and two populations from Vietnam.

A rapid method for assessing genetic diversity in mtDNA fragments was optimized, enabling large population samples to be surveyed with minimal sequencing costs.

Fixed sequence differences were identified to discriminate between Vietnamese and Javanese populations of *B. gonionotus*.

Investigations were started on the genetic diversity of three Javanese populations of another species (*B. balleroides).*

Sixty-two clones that give a positive signal when hybridized to microsatellite probes were isolated.

Surveying of genetic variation was started, using the microsatellite loci already available.

**Activities Planned for 2000**

Continue survey of genetic variation in the mtDNA control region.

Sequence the positive microsatellite clones isolated and develop new microsatellite loci.

Complete collection of taxonomic data from museum samples.

Optimize techniques for morphometric analyses of fish, based on scanned slide photographs.

## GERMPLASM ENHANCEMENT AND BREEDING

### Project 1.5

### Genetic Improvement of Carp Species in Asia

**ICLARM Staff**

Dr. Madan Mohan Dey (Project Leader); Dr. Modadugu V. Gupta; Ms. Florabelle Gagalac

**Collaborating Institutions**

*Bangladesh*: Bangladesh Fisheries Research Institute; Department of Agricultural Finance, Bangladesh Agricultural University
*China*: Freshwater Fisheries Research Center; Shanghai Fisheries University

*India*: Central Institute of Freshwater Aquaculture; National Bureau of Fish Genetic Resources
*Indonesia*: Research Institute for Freshwater Fisheries; Universitas Hasanuddin
*Thailand*: Asian Institute of Technology; National Aquaculture Genetics Research Institute
*Vietnam*: Research Institute for Aquaculture Nos. 1 & 2

**Donors** : ADB; ICLARM core funds

**Duration** : Phase I, 1997 - 1999

**Objectives**

- Document carp genetic resources in Asia.
- Document genetic improvement of carps in Asia.
- Conduct baseline surveys to understand the existing farming practices, marketing and consumption patterns.
- Identify constraints to carp productivity improvement in different ecological and socioeconomic environments.
- Prioritize selection of carp species, choice of farming systems and selection of traits for research.
- Genetically improve carp for aquaculture.
- Transfer technology to collaborating country scientists and to farmers.

**Background and Justification**

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 could 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 on increased protein production, efficiency, equity, sustainability and environmental issues.

The study is being 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. Carps constitute about 50% of the total aquaculture production in these countries.

The project has three related components: (i) documentation of carp genetic resources and improvement; (ii) socioeconomic and research prioritization; and (iii) carp genetic enhancement research.

In formulating priorities for carp genetic research, we are considering both the demand for and supply of research. In determining the demand of carp genetic research, the following aspects are being considered: (i) assessment of how and to what extent existing carp species/strains are valued by different groups of society (farmers, consumers, agents, etc.); (ii) estimation of future demand for various carp species by income groups; (iii) analysis of present and future importance of various carp-based farming systems, including problems and opportunities for increasing production in these environments; (iv) assessment of the 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 analyses are based on field surveys for carp producers, consumers and traders, and on secondary information available in the participating countries. This demand analysis will help identify research areas that focus on increasing biological efficiency (productivity), reducing production costs and improving quality.

On the supply side, we are considering: (i) alternative research techniques/tools to resolve research problems; (ii) probability of research success for different research techniques; and (iii) time and resources required to solve various research problems through alternative research tools. The analysis of the supply side of research will be based on surveys of experienced research scientists.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | M |
| Gender | H | Anticipatory Research | H |

**Current Status**

*Documentation of Carp Genetic Resources and Improvement*: Substantial information on carp genetic resources was collected and compiled in each of the six countries. The information collected by the national partners is being processed at ICLARM. Some of the papers from China, Thailand and Vietnam need to be translated into English and translations are currently in progress. A document on carp genetic resources in Asia has been drafted. It will be further updated, revised and expanded as more information comes in. It will be a valuable resource for designing a genetic research pro-

gram in these countries that is appropriate to the existing fish biodiversity. Full completion of the documentation is expected by September 2000.

*Socioeconomic and Research Prioritization*: Extensive socioeconomic surveys are being carried out in the six countries of carp producers, consumers and hatchery operators. Substantial data and information have already been collected by national research teams and have been encoded for analysis.

In analyzing priorities for carp genetic research, the following aspects are being considered: (i) assessment of how and to what extent existing carp species/strains are valued by different groups of society (farmers, consumers, agents, etc.); (ii) estimation of future demand for various carp species by income groups; (iii) analysis of the present and future importance of various carp-based farming systems, including problems and opportunities for increasing production in these environments; (iv) assessment of the relative economic importance of various traits (e.g., growth, disease resistance, resistance to abiotic stresses, soil and water conditions, etc.).

Producer, household consumption and fish species prioritization surveys have been completed in all the countries. Preliminary analyses have been made. Estimation of statistical and econometric parameters is in progress in all collaborating institutions. A draft of the results will be discussed during a training workshop to be held in Penang from 21 March to 8 April 2000.

In China, both polyculture and monoculture are practiced by most farmers. More than 70% of the fish farmers culture silver carp, grass carp and bighead carp. In India, most farmers (approximately 97%) practice polyculture. Most of the farms are owned by the farmers. The highest returns are from the production of catla, common carp and rohu. The estimated profitability of carp farming, in terms of gross and net profits, payback period and internal rate of return, indicated that carp farming is a remunerative enterprise and has a potential for increasing investment and incomes in rural areas. In Thailand, consumers prefer the Thai silver barb because of its flavor, high fat content, good body shape and color.

Preliminary analysis indicates that growth rate, disease-resistance, high survival rate, and resistance to a low-dissolved-oxygen environment are the traits most commonly identified for carp genetic research in these countries. Better morphological characteristics (color, body shape, eye shape) are considered important traits for the common carp in Indonesia and meat quality for the common carp in China.

*Genetic Enhancement*: In Bangladesh, research for genetic improvement has been initiated for two carp species: silver barb (*Puntius gonionotus*) and catla (*Catla catla*). The first generation of selection for silver barb produced an 8% increase in body weight. The experiments for the third generation of selection are in progress. Detailed analysis of experimental data is ongoing.

In China, comparisons of growth of silver carp from two rivers, Changjiang and Shujiang, was conducted. Results show that the Changjiang river strain grows faster than the Shujiang river strain. Growth performance of the artificial multiple triploid carp (AMTC), introduced in March 1999 from the Institute of Hydrobiology, Academia Sinica, Wuham, was compared with Jian carp and hybrid Jianhuang of similar size in the same pond. Results showed that AMTC grew slower than Jian carp and Jianhuang carp. In the monoculture carp growth trial, the hybrid Jian carp X Huanghe carp has a 11.7% and 31.8% higher body weight compared to the parents, Jian carp and Huanghe carp, respectively. The hybrid Jian carp X Hebao has a 9.8% and 23.1% higher body weight compared to the respective parents. The offsprings of the hybrid Jian carp x Hebao are shorter. The nutritive compositions of Jian carp, Huanghe carp, AMTC and the hybrid Jianhuang (Jian X Huanghe) and Jianhe (Jian X Hebao) were compared. Among the six strains, AMTC possessed the highest indices of protein content (18.3%), total amounts of amino acids (17.6 g/100 g), human essential amino acids (8.6 g/100 g) and tasty amino acids (6.9 g/100 g). Thus, the triploid common carp can improve meat quality. Selection and crossing are less important in the improvement of meat.

In India, growth trials of *Labeo rohito* were initiated between crosses and pure lines in polyculture and monoculture systems. Growth performance comparisons of triploid fish and the control fish were initiated in different locations. Experiments in producing monosex populations of carp were conducted. Results show that the maximun male population can be obtained from 50 days old fish. Three stocks of common carp are currently avail-

able and some more stocks will be added in 2000 to make a broader base population for future breeding.

In Thailand, monosex female silver barb have been developed. These have improved growth, survival and edible flesh.

In North Vietnam, family selection was used in choosing the best performers from the first generation of fish. Among 12 families, three were chosen for the best growth and survival rates. Induced breeding of the families chosen in the first generation will be implemented in 2000. Genetic parameters will be computed. Selection of families in the second generation will also be done in 2000.

In South Vietnam, evaluation of six groups of pure breeds and three groups of reciprocal crosses was done. Comparison in different environments (farm and station) and strain by environment interaction analysis are ongoing. Statistical analysis of the experimental data is in progress.

**Activities Planned for 2000**
Report on the analysis of carp genetic research priorities.

Report on carp genetic resources in Asia.

Report on status of carp genetic improvement programs in Asia.

Organize final workshop.

Finalize project report and publish project results.

## Project 1.6
## Genetic Improvement of Tilapias

**ICLARM Staff**
Team Leader (to be identified); Mr. Mahmoud Rezk; Mr. Abdel-Rahaman El-Gamal; Ms. Florabelle Gagalac

**Collaborating Institutions**
*Philippines*: Freshwater Aquaculture Center/Central Luzon State University; GIFT Foundation International, Inc.
*UK*: University College of Swansea; University of Stirling
*USA*: Auburn University

**Donors** : DFID; ICLARM core funds; IDRC; UNDP; USAID

**Duration** : 5-10 years

**Objectives**
- Develop improved breeds of tilapia and provide these to national testing programs and thence to fish farmers.
- Develop breeding plans for tilapia genetic enhancement in Africa and Asia.

**Background and Justification**
Tilapia is a major aquaculture species in Asia and Africa. It is a suitable species for increasing protein production, profits and the quality of nutrition of poor fish farmers and consumers. Previous research indicates great potential for the genetic improvement of this species for aquaculture. Our aim is to develop additional programs of research and to secure funding to strengthen tilapia genetic improvement programs in Africa and Asia.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
*Tilapia Genetic Enhancement in Egypt*: *Oreochromis niloticus, O. aureus, Tilapia zilli* and *T. galilaeus* were compared for aquaculture performance in Egypt. *T. zilli* and *T. galilaeus* spawned earlier and at cooler temperatures. Fry from these two species were larger than those of *O. niloticus* and *O. aureus* at the initiation of a growth experiment because of the early spawning. However, *O. niloticus* and *O. aureus* rapidly grew to larger sizes than *T. zilli* and *T. galilaeus,* despite the size advantage of the latter two.

Three strains of *O. niloticus* from Egypt were included in the comparison, and strain differences were evident. During warm weather, two strains of *O. niloticus* grew faster than *O. aureus*, but the third strain grew slower. This illustrates the importance of strain effects.

*USAID-funded Genetic Enhancement of Tilapia in Africa by Combined Selection, QTL Mapping and Marker-Assisted Collection:* Auburn University scientists have completed a tilapia microsatellite library. Sixty to 100 microsatellites are available for the QTL mapping from previous research. Five

thousand clones have been picked and the screening process initiated. Channel catfish have been tested as a control to determine the utility of markers with other species. Ninety percent were successfully used for the closely related blue catfish; 50% for more distantly related species such as white catfish; and only 5-10% were useful and could be used in tilapia and common carp.

Map Manager software is set up and ready (in Macintosh version).

At ICLARM Abbassa, tilapia germplasm is being obtained from various African countries; production of defined tilapia families for testing is underway; training ICLARM staff in using Map Manager software for QTL mapping is being planned; a menu-driven SAS program application is underway in computing heritabilities, genetic correlations and other genetic parameters.

**Activities Planned for 2000**
???

## Project 1.7
## Production, Accessibility and Consumption Patterns of Aquaculture Products

**ICLARM Staff**
Dr. Madan Mohan Dey (Project Leader); Ms. Florabelle Gagalac; Mr. Ferdinand Paraguas

**Collaborating Institutions**
*Bangladesh*: Department of Cooperation and Marketing, Bangladesh Agricultural University
*China*: Center for Chinese Agricultural Policy, Chinese Academy of Agricultural Sciences
*India*: Department of Fisheries Economics, University of Agricultural Sciences
*Philippines*: Bureau of Agricultural Statistics
*Thailand*: Department of Fisheries
*Vietnam*: Department of Mariculture, Cantho University

**Donor** : FAO

**Duration** : 1 December 1998 - June 2000

**Objective**
- Complement ICLARM's ongoing study of fish consumption in five Asian countries.

**Background and Justification**
Aquaculture production has increased dramatically in most Asian countries. Thus, it is important to assess its accessibility by people belonging to different income classes. It is also useful to study changing consumption patterns for various species by different social classes.

Because of the importance of intra-household allocation of different fish species, it is necessary to monitor the consumption patterns of all members of the household. A sample survey of household in each country will be complemented by macrolevel analyses focusing on production, consumption, trade and price of freshwater fish by species.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | M |
| Gender | H | Anticipatory Research | H |

**Current Status**
The research has been completed in all the five countries. Draft papers are being prepared.

**Activities Planned for 2000**
Finalization of country reports and preparation of a synthesis report.

Publication of a FAO technical series report, jointly published by FAO and ICLARM.

## Project 1.8
## Transfer of Selective Breeding (GIFT) Technology for Aquaculture Improvement from the Philippines to Sub-Saharan Africa and Egypt

**ICLARM Staff**
Team Leader (to be identified); Ms. Florabelle Gagalac

**Collaborating Institutions**
*Philippines*: GIFT Foundation International, Inc.
*Egypt*: ICLARM's Regional Center for Africa and West Asia; Central Laboratory for Aquaculture Research
*Côte d'Ivoire*: Centre National de Recherché Agronomique
*Ghana*: Water Research Institute, Accra
*Malati*: University of Malati

**Donor** : Technical Cooperation among Developing Countries of the UNDP

**Duration** : 2 years

**Objectives**
GENERAL
- Make genetically improved tilapia available to poor farmers in subSaharan Africa.
- Help many poor fish farmers in Ghana, Côte d'Ivoire and Malati to practice productive tilapia aquaculture.
- Increase income of tilapia fish farmers .
- Improve nutritional status of fish consuming population in Ghana, Côte d'Ivoire and Malati.
- Improve food security and quality of life in subSaharan Africa.

SPECIFIC
- Help fisheries institutions in Ghana, Côte d'Ivoire and Malati to successfully adopt productive tilapia aquaculture technologies, including breeding.

**Background and Justification**
ICLARM has developed a successful technology of selective breeding of fish. Through this project, this technology will be transferred from the Philippines to Africa to improve the productivity of aquaculture. This will be accomplished through the establishment of a Regional Tilapia Genetic Enhancement Center in Egypt; training of Egyptian and other African scientists by Philippine scientists; and scientific exchange among Egypt, Philippines and other regions of Africa. The focus will initially be on Ghana, Côte d'Ivoire and Malati, to be expanded to include other African countries later.

The beneficiaries of the proposed project are the national fisheries and aquaculture services of Africa and Egypt and their client farmers who are currently using poor performing tilapia. After this technology is successfully implanted and thriving, ICLARM will continue to facilitate interchange among Africa and the Philippines, Thailand, Vietnam, China, Indonesia and Bangladesh to maintain early gains.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
The project has been initiated. Contacts with collaborating institutions are being established.

**Activities Planned for 2000**
In 2000, the project will: organize workshop and training programs; prepare training manuals; train African scientists in GIFT selection technology on site at the GIFT Foundation, Inc., Muñoz, Nueva Ecija, Philippines; and initiate a selection program for tilapia in African countries

In 2001, the project will: disseminate technology; train African scientists through International Network of Genetic Aquaculture (INGA) activities; train and follow-up ICLARM's regional center by Philippine scientists; further select tilapia; analyze data; report progress to INGA; prepare training manuals for use after the project; prepare report for United Nations Development Programme (UNDP); promote public awareness of these activities, including recognition of UNDP's and donor's contribution to this technology transfer and the success of the transfer.

Post-project activities:

Continue to disseminate technology and training to African scientists.

Initiate selective breeding program for tilapia species in selected African countries.

Improve production of tilapia in Africa and Egypt.

Initiate selective breeding programs for other aquaculture species.

Disseminate training materials.

Develop a proposal to study the impact of the technology transfer.

Develop and disseminate genetically enhanced tilapia.

# 2. COASTAL AND MARINE RESOURCES RESEARCH PROGRAM (CMRRP)

## COASTAL AQUACULTURE AND STOCK ENHANCEMENT

### Project 2.1
Village Farming and Restocking of Giant Clams

**ICLARM Staff**
Dr. Johann Bell (Project Leader); Mr. Rayner Pitt; Mr. Idris Lane; Mr. Cletus Oengpepa; Mr. Hugo Tafea; Mr. Feral Lasi; Ms. A. Grice; Ms. L. Kumar; Mr. T. Barcelona

**Collaborating Institutions**
*Australia*: James Cook University (JCU); Australian Institute of Marine Science (AIMS)
*Fiji*: University of the South Pacific
*Solomon Islands*: Ministry of Agriculture and Fisheries; US Peace Corps; Overseas Fishery Cooperation Foundation of Japan

**Donors** : ACIAR; ESCAP; EU; FAO

**Duration** : Operational since 1987. Current phase, mid-1995 - December 1999

**Objectives**
GENERAL
- Train village farmers and key fisheries personnel in the efficient and profitable culture of giant clams.
- Develop markets for giant clams in the seafood trade and aquarium industry.
- Maintain genetically diverse F1 broodstock of several species of giant clams for development of hatcheries in the Asia-Pacific region.
- Supply giant clam larvae and training in the rearing of giant clams to areas in the region where they have been overfished or extinguished.
- Transfer methods for propagating and growing of giant clams to the private sector in the Pacific.
- Develop cost-effective methods for restocking of giant clams.

SPECIFIC
- Identify the environmental factors that affect mantle color in giant clams.
- Assess the potential for polyculture of giant clams and trochus, and ways of reducing the labor required to rear giant clams and trochus to the size where they are no longer vulnerable to predation and are suitable for release in stock enhancement programs.

**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. The farming of giant clams is one option. Past research by the Micronesian Mariculture Development Center, JCU, the University of the Philippines and ICLARM's Coastal Aquaculture Centre (CAC) in the Solomon Islands, resulted in the development of reliable methods for the spawning and land-based larval rearing of giant clams. More recently, research by ICLARM identified the average rate of growth and survival of five species of giant clams across a broad range of village sites in Solomon Islands and demonstrated that growout of these species by coastal villagers for the marine aquarium market was profitable. The CAC is now completing the research on farming and restocking of giant clams by developing methods to reduce the cost of producing seed clams in hatcheries, adding value to cultured products, improving the survival of clams during growout and developing cost-effective ways for linking the restocking of giant clams to the farming industry.

This project will provide a firm basis for a sustainable increase in the productivity of giant clams. It will also yield robust information on the commercial viability of small-scale village farms for these large autotrophic bivalves. 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 as well as the costs and benefits associated with farming and restocking.

The maintenance of adequate broodstock and the delivery of larvae and growout technology to a number of countries will facilitate the continuation and expansion of giant clam farming and the re-establishment of wild stocks throughout the Asia-Pacific region.

Giant clam farming is particularly suitable for 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 and 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 is a market for giant clams for aquaria, food and shellcraft.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**

In 1999, the project focused on: (i) re-establishing the supply of seed clams for village farmers in the wake of the collapse of the private hatchery; (ii) assessing whether the rearing environment affects mantle color in giant clams; and (iii) using trochus to graze epiphytic algae in tanks and cages to reduce the labor required to rear clams.

The three species most valued by the aquarium trade (*Tridacna crocea, T. maxima and T. squamosa*) were produced in the land-based nursery at CAC. A total of 14,000 *T. crocea*, 13,000 *T. maxima* and 22,000 *T. squamosa* were ready for distribution to village farmers at the end of 1999.

Two experiments were initiated to build on the results of previous research which showed that heavy shading of *T. maxima* in land-based tanks and the addition of higher levels of the fertilizer ammonium sulfate induced drab-colored clams to switch to more desirable hues. However, the clams that did change color had a very high rate of mortality.

One of the experiments was done in 60-liter aquaria and involved lower levels of shading (none, 25%, 40% shadecloth) and the optimal level of nutrient addition (50 mm three times per week vs 0 mm). There were 4 replicate tanks for each of the six experimental treatments. Prior to the experiment, 10 of the 18 clams stocked in each tank were photographed digitally under constant lighting conditions. Variation in mantle color within and between clams was best estimated using six quadrats of 15 x 15 pixels per clam. Plans to photograph the clams at monthly intervals for four months to assess differences in the red and green levels among treatment over time were thwarted by the ethnic tension problems in the Solomon Islands. Instead, the clams were photographed after four months. Samples to assess any differences in size and the concentration of zooxanthellae among treatments were also collected after four months.

In the second experiment, clams were kept in the sea at different depths (1, 3.5 and 7 m) to subject them to different levels of light. No application of nutrients was possible in this experiment. Differences in the light regime at each depth were recorded with dataloggers. After four months, the clams were photographed and zooxanthellae from each clam were extracted for subsequent analysis.

Although there was some change in mantle color, particularly for clams held in the sea at a depth of 7 m, none of the clams were particularly attractive at the end of four months, i.e., none had the brilliant iridescent colors preferred by the aquarium trade.

To examine whether such colors are related to the type or proportions of zooxanthellae in the clams, we are initiating a third experiment in collaboration with Dr. John Benzie at AIMS. In this experiment, we will analyze the DNA of the zooxanthellae in brightly colored and drab-colored *T. maxima*, together with the DNA of the host clams. Up to 12 DNA probes have been developed for zooxanthellae, so we should be able to determine whether there are different strains, or different proportions of the same strains, of DNA among bright and dull-colored clams. If such variation is large compared to genetic variation among the host clams, we will then extract the zooxanthellae from brightly colored clams and add them to tanks (n = 8) containing dull clams. Several brightly colored clams will also be placed in tanks containing dull clams to provide a continual supply of zooxanthellae. Control tanks (n = 8) will not be treated with zooxanthellae and will hold dull clams alone.

In the experiments on polyculture of trochus and giant clams, trochus of 5.7 mm ± 0.2 SE mm shell diameter were placed in 4,000 l concrete tanks with juvenile giant clams to graze epiphytic algae, with the aim of reducing the effort required to clean

the tanks. Within five months, they had reached a size of 28.8 mm ± 0.2SE mm diameter, whereas those in the conventional rearing system using vertical plates had a mean size of 20.9 mm ± 0.8 SE mm. The trochus were then removed from the concrete tanks and used in an experiment to see whether they were effective at cleaning algae from giant clam cages placed in the sea, without affecting the growth and survival of the giant clams. Trochus were stocked into the cages at a size of 30.5 mm ± 0.04 SE. After one month, the trochus had grown to a mean size of 35.0 mm ± 0.07 SE and there was no difference in the growth and survival of trochus placed at densities of 5 and 10 per cage. Similarly, there was no difference in the survival of the giant clams in cages with and without trochus. Differences in the level of fouling algae among treatments is being assessed with digital photography: after one month, there was no significant difference among treatments. The polyculture of trochus and giant clams promises to reduce the time and expense needed to rear trochus to the size suitable for release in the wild (40 mm), and reduce the labor necessary to keep giant clam growout cages free of fouling algae.

A project proposal for the restocking of giant clams by village farmers has been prepared. Funding is being requested from the European Union through the National Indicative Program of the Solomon Islands.

**Activities Planned for 2000**

Perform experiments to monitor the survival of trochus reared in polyculture with giant clams, once they are released in the wild.

Continue supply of seed clams to village farmers in the Solomon Islands.

Continue efforts to expand the markets for cultured giant clams by promoting them in the live seafood markets of Asia.

Transfer methods for village farming of giant clams to Tonga.

Prepare publications on the factors affecting mantle color in *Tridacna maxima* and the polyculture of trochus and giant clams.

Present a paper on polyculture of trochus and giant clams at the World Aquaculture Society Conference.

Initiate a major project with external funding to restock giant clams at several places in the Solomon Islands through linking restocking to the farming of clams at village sites (pending success of the proposal to EU).

## Project 2.2
## Development of Village Farms for Blacklip Pearl Oysters in Solomon Islands

**ICLARM Staff**

Dr. Johann Bell (Project Leader); Mr. Idris Lane; Mr. K. Friedman; Ms. Susan Dance

**Collaborating Institutions**

*Australia*: James Cook University (JCU)
*Fiji*: Fisheries Division
*Solomon Islands*: Ministry of Agriculture and Fisheries (MAF)

**Donor** : ACIAR

**Duration** : Operational since 1993. Current phase, early 1998 - December 2001

**Objectives**

GENERAL

- Develop systems for collecting spat of the blacklip pearl oyster suitable for use in the western Pacific.
- Develop methods for maximizing the survival of oysters in the juvenile growout phase.
- Investigate the comparative advantages of wild spat and hatchery-reared spat for the development of pearl farming.
- Produce the biological data needed to make a thorough analysis of potential returns to farming of black pearls in the western Pacific.

SPECIFIC

- Maintain a small-scale pearl farm using oysters derived from wild spat and successively improve pearl quality.
- Produce blacklip pearl oysters in ICLARM's hatchery in the Solomon Islands.
- Compare the growth and survival of cultured and wild spat, and the quality of pearls derived from these two types of oysters.
- Transfer methods for collection of spat and growout of juvenile oysters toTonga.

**Background and Justification**

The culture of pearls from blacklip pearl oysters (*Pinctada margaritifera*) has brought substantial economic benefits to coastal communities in French Polynesia and the Cook Islands. Despite intensive fishing of the species throughout the Pacific earlier this century, these countries managed to establish pearl farming industries due to their closed coral atoll lagoons. Remnant populations trapped within the lagoons are collected and used for pearl farming operations.

The blacklip pearl oyster also occurs throughout 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. The emphasis is on transferring the methods developed to other countries in the region; encouraging the commercial sector to apply the technology; and assessing the practical potential of using hatchery-reared spat to culture pearls.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | M |
| Gender | M | Anticipatory Research | H |

**Current Status**

The first crop of pearls was harvested from the demonstration pearl farm at the Nusa Tupe field station in April 1999. Approximately 900 pearls were harvested from 1,800 oysters seeded 20 months earlier. The color and luster of the pearls was typical of those produced in French Polynesia and Cook Islands. About 20% of the pearls were round or near round. Although the percentage of such pearls was lower than in French Polynesia, the crop was encouraging. With improved seeding techniques, there is every reason to believe that oysters from the western Pacific will yield high quality pearls. The cost of producing pearls in the Solomon Islands is much lower than elsewhere in the region. This indicates that once the percentage of clean round pearls is improved, pearl farming will be profitable.

A second batch of oysters was seeded in April 1999. The seeding was done in a way that will enable us to determine whether the red mantle tissue typical of 50% of oysters in the Solomon Islands affects pearl quality (shells with red mantles are rare in French Polynesia and Cook Islands). In this experiment, red mantle tissue was used to seed oysters with red and black mantles. Reciprocally, black mantle tissue was also used to seed both types of shell. There were > 220 oysters in each of the four different combinations. At harvest, the shape, color, luster and surface texture of the pearls from each group will be compared to see if any particular combination of donor mantle tissue and recipient oyster type produces better pearls.

There was little variation in the rate at which the four groups of oysters retained the nucleus after seeding: five weeks after implantation, the percentage retention ranged from 73.5% to 79.2% for all the four groups. Of the original batch of oysters, 695 were reseeded during April 1999. The retention rate for these shells was 88.2%.

Spat of the blacklip pearl oyster were reared successfully in the hatchery at the CAC for the first time. More than 800 spat, with an average size of 15 mm shell height, were used in an experiment to compare growth and survival of wild and hatchery-reared spat. The experiment was run in plastic trays in the ocean at the Nusa Tupe fieldstation using methods developed in 1997. Wild and hatchery-reared spat were either glued or settled into the trays at a stocking density of 25 individuals per tray. The hatchery-reared spat were also used in another experiment to compare the effects of different stocking densities (25, 50, 75) of glued spat. After seven weeks, the survival of glued hatchery-reared spat was significantly greater than the glued wild spat (73% ± 4.8 SE vs 35% ± 2.25 SE). There was no significant effect of gluing vs. settling the spat in trays. Stocking density also had no significant effect on the survival of the hatchery-reared spat (mean survival ranged from 73% to 81% for the three treatments). The low survival of wild spat was unexpected because survival of wild oysters had averaged 80% in previous years. The low survival was probably due to undue handling stress during the experiments. The important point, however, is that survival of the hatchery-reared spat was comparable to the best rates previously recorded for wild spat. The hatchery-reared spat will be raised until they are large enough to seed. The pearls produced from the hatchery shell will then be compared with those harvested from oysters grown from wild spat.

The transfer of technology for the collection of wild spat to Fiji was completed in April 1999. Staff of the Fisheries Division were also trained in the growout of spat. The transfer of the technology was highly successful: rates of spat collection in Fiji averaged about 10 per collector and growth of the oysters was as fast as in the Solomon Islands. The result is that Fiji is now in a strong position to establish a black pearl industry based on the collection of wild spat. The government has allocated resources to the development of the industry and expects to grow 8,000 oysters for seeding in 2000.

During 1999, information was supplied to MAF of the Government of the Solomon Islands and the Asian Development Bank for a memorandum of understanding between the two organizations to develop the fisheries sector. This arrangement will provide funding for the construction of a specialized pearl oyster hatchery at ICLARM's facilities in and the upgrading of the Nusa Tupe fieldstation.

**Activities Planned for 2000**

Marketing and sale of the first batch of cultured pearls from the Solomon Islands to assist the Government to attract investors for the industry.

Recruitment of a Canadian scientist to manage the pearl farm at the Nusa Tupe field station.

Reseeding/seeding of ~3,500 oysters to improve pearl quality (in collaboration with JCU).

Publications on the effects of predation on the survival of spat, improved methods for collecting spat, and comparative rates of growth and survival of wild and hatchery-reared spat.

Training of staff from the Fisheries Department in Tonga in the collection of spat and husbandry of juvenile oysters.

Report on the potential for collecting spat of blacklip pearl oysters in Tonga.

Construction of a specialized hatchery for the production of pearl oysters and routine production of spat in the hatchery.

## Project 2.3
## Development of Methods for the Mass Rearing of Tropical Sea Cucumbers for the Purpose of Enhancing Wild Stocks

**ICLARM Staff**

Dr. Johann Bell (Project Leader); Dr. Stephen Battaglene; Dr. Annie Mercier; Dr. J.-F. Hamel; Ms. Evizel Seymour; Mr. Christian Ramofafia

**Collaborating Institutions**

*Australia*: Advisory Panel from Advanced Scientific Institutions in Australia; Australian Centre for International Aquaculture Research (ACIAR); University of Sydney

*Solomon Islands*: Ministry of Agriculture and Fisheries

**Donors** : ACIAR; CIDA

**Duration** : Operational since 1993. Current phase, January 1995 - July 2000

**Objectives**

GENERAL

- Assess the potential for using restocking and stock enhancement to manage fisheries for tropical sea cucumbers.

SPECIFIC

- Develop reliable methods for inducing tropical species of sea cucumbers to spawn.
- Develop repeatable, cost-effective methods for rearing the larvae of tropical sea cucumbers, and growing out the juveniles to the stage where they are robust enough for release into coral reef habitats.
- 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 region 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 in 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 the recent level of catches throughout the tropical Asia-Pacific is not sustainable.

The ability to rebuild populations of sea cucumbers through restocking would be a valuable tool for managers. There are several reasons why sea cucumbers appear to be well suited to restocking: most species are restricted to particular inshore habitats; sea cucumbers are low on the food chain, so impact on other species is unlikely to be a major limiting factor; and sea cucumbers are conspicuous and slow moving and, therefore, easy to harvest.

The potential of restocking sea cucumber fisheries in the region cannot be assessed until four pieces of research have been completed: (i) development of cost-effective methods for producing larvae en masse; (ii) description of the ecology of wild juvenile sea cucumbers; (iii) identification of strategies for maximizing the survival of released juveniles; and (iv) evaluation of the profitability of large-scale release of juveniles to existing fisheries. ICLARM is currently addressing the first task with funds from ACIAR and the second one with support from CIDA.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | M |
| Gender | M | Anticipatory Research | H |

**Current Status**

In 1999, work on this project was limited to the analysis of samples collected from the field, write-up of publications and preparation of proposals for funding. The results stemming from this work are summarized below.

*Settlement of* Holothuria scabra: In laboratory experiments in which the settling pentactula larvae of *H. scabra* were presented with a wide range of substrata, the greatest rates of settlement (4.8 to 10.5%) occurred on leaves of the seagrass *Thalassia hemprichii*. This species of seagrass was preferred as a settlement substrate over sand, crushed coral, several other plant species and artificial seagrass leaves with or without a bio-film. Only settlement on another seagrass, *Enhalus acoroides*, was similar to that recorded for *T. hemprichii*. The pentactulae found on sand, coral and in bare containers were 10-35% smaller than those on *T. hemprichii* leaves. Soluble extracts from *T. hemprichii* and *E. acoroides* successfully induced metamorphosis and settlement on clean plastic surfaces. Newly settled juveniles remained on the seagrass leaves for 4-5 weeks before migrating to sand at around 6 mm in length and becoming deposit-feeders.

*The function of Cuvierian tubules in tropical holothurians*: The release of Cuvierian tubules by *Holothuria leucospilota, Bohadschia argus* and *B. marmorata* appears to be a proficient and readily used defence mechanism against predation. Surveys showed that 2-6% of *H. leucospilota* observed in the field presented signs of having recently used their Cuvierian tubules. Laboratory experiments revealed that *H. leucospilota, B. argus* and *B. marmorata* were highly sensitive to mechanical stimulations, the amount of tubules released being proportional to the intensity of the stimulation. The three species tested were able to target the stimulated area with variable success depending on the location of the stimulus. *H. leucospilota* also reacted to a variety of natural aggressors by releasing Cuvierian tubules.

*The structure and function of ossicles in* Holothuria scabra: Several features of the ossicles found in early juveniles of *H. scabra* were unique to the species and have been instrumental in the positive identification of small individuals found on the surface of seagrass leaves. The experiments on settlement preferences described above and the examination of ossicles, have enabled us to say with confidence that seagrasses are an important settlement habitat for *H. scabra*.

At its final meeting, the advisory panel for the first stage of the project commended the achievements of the project team and was unanimous in recommending the continuation of the research to the next stage. A proposal (Phase 1) was submitted to ACIAR for the development of optimal release strategies for cultured, juvenile *H. scabra*.

**Activities Planned for 2000**

Recruit project staff for the next stage of the research (contingent on restricted core funding from ACIAR).

Produce sufficient cultured juvenile *H. scabra* to initiate field experiments on optimal release strategies.

Produce scientific manuscripts on protocols for larval rearing of *H. scabra* and the ecology of the juveniles.

Make a major review on the biology, aquaculture and fisheries management of *H. scabra*.

Submit final report on the first stage of the project to ACIAR.

First release of juvenile *H. scabra* in large-scale experiments to identify optimal release strategies.

## Project 2.4
## Development of New Artisanal Fisheries Based on the Capture and Culture of Postlarval Coral Reef Fish

**ICLARM Staff**
Dr. Johann Bell (Project Leader); Ms. Cathy Hair; Mr. Idris Lane; Mr. Rayner Pitt

**Collaborating Institutions**
*Australia*: Australian Institute of Marine Science (AIMS); Queensland Department of Primary Industry
*Solomon Islands*: Ministry of Agriculture and Fisheries

**Donor** : ACIAR

**Duration** : January 1999 - January 2002

**Objectives**
GENERAL
- Assess the potential for creating new artisanal fisheries based on the capture and culture of postlarval coral reef fish.

SPECIFIC
- Investigate temporal variation in the availability of postlarval reef fish near Gizo in the Western Province of the Solomon Islands.
- Compare the species composition of catches of postlarval fish made using light traps and crest nets and determine the effectiveness of the two techniques in providing juveniles fit for aquaculture.
- Develop methods for village-based growout of selected species of postlarval reef fish.

**Background and Justification**
In the past decade, there has been a rapid expansion of two fisheries associated with coral reefs - the collection of tropical marine fish for the aquarium trade and the harvesting of groupers (Serranidae), snappers (Lutjanidae) and the napolean wrasse (*Cheilinus undulatus*) for the live reef fish trade.

The markets for tropical marine aquarium fish and live reef fish are of major interest to coastal communities in the South Pacific and Southeast Asia. Villagers have easy access to the resource, prices are high, and networks for sale and distribution are in place. In some countries, however, the high demand for coral reef fish has led to overexploitation and the use of destructive fishing methods.

Several NGOs are now playing an important role in the sustainable management of groupers and snappers by assisting countries in Southeast Asia to produce a regular supply of juveniles through intensive aquaculture. However, large-scale production through intensive aquaculture, as an alternative to wild harvest, will depend on solving problems with larval rearing and nutrition of juveniles.

This project seeks to develop an additional way of supplying coral reef fish for the marine aquarium and live reef fish trades by assessing the potential for capturing a sustainable quantity of postlarvae as they settle from the plankton and rearing them to marketable size.

Provided the cost of catching and rearing the postlarvae can be kept low, villagers in the South Pacific and Southeast Asia will have at least three options to derive income from the capture and culture of postlarval fish: they can sell species of high value to the aquarium market through local dealers; export juvenile groupers to growers of live reef fish in Asia; or sell juvenile groupers to local growers who have access to a supply of fishmeal or trash fish. Juvenile fish that have been nursed through a survival gate could also be released onto protected reefs, e.g., those under customary marine tenure in the South Pacific, to enhance natural spawning stocks or for subsequent harvest.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | M |
| Gender | M | Anticipatory Research | H |

**Current Status**

Fieldwork for this project started in May 1999 with the monthly deployment of four replicate light traps at six sites. Trapping was conducted for a period of three days before and after the new moon. Traps were deployed around sunset each evening and retrieved soon after sunrise the following morning.

By July, a total of 14,957 fish from 222 species in 43 families had been collected. Of these, four families contributed almost 85% of total fish abundance (Clupeidae 44%, Apogonidae 23%, Gobiidae 9% and Pomacentridae 7%).

About 1,200 individuals from 62 species were of value to the aquarium trade. These fishes were mainly from the families: Pomacanthidae (Angelfish), Chaetodontidae (Butterflyfish), Pomacentridae (Damselfish), Acanthuridae (Surgeonfish) and Pseudochromidae (Dottybacks). The collections included few individuals of value to the live reef fish trade.

In general, catches of potentially valuable species during May, June and July were low and variable among sites and months. This is not surprising considering that catches from light traps on the Great Barrier Reef are typically low during those months. Catches are expected to increase greatly from September/October onwards. At that time, collaborators from AIMS will assist with the fieldwork and crest nets will be deployed for the first time. We will also conduct experiments to determine whether trapping is more effective at certain times of the night. This experiment will compare catches from four, 3-hourly periods between 1800 hrs and 0600 hrs at several sites over at least two nights. It will indicate whether traps have to be deployed all night or for shorter periods. The latter would be an advantage as there has been a high incidence of gear malfunction (failure of the lights) when traps are deployed all night. Survival of species may also be improved if they are in the trap for shorter periods.

**Activities Planned for 2000**

Monthly sampling of postlarval fish with light traps and crest nets.

Present a paper at the Ninth International Coral Reef Symposium.

Implement growout trials for selected species.

Train a Scientific Officer from the Division of Fisheries, Solomon Islands, in the use of light traps and crest nets, and the culture of juvenile fish.

Document temporal variability of postlarval coral reef fishes caught by light traps and crest nets.

Evaluate the best method (light traps vs crest nets) for capturing fish for culture.

Identify species amenable to culture.

Submit first annual report to ACIAR.

## Project 2.5
## Effects of Alternative Logging Operations on Inshore Marine Ecosystems in the Tropical Western Pacific

**ICLARM Staff**

Dr. Johann Bell (Project Leader); Dr. D. Morrisey; Dr. M. Lincoln Smith; Mr. Rayner Pitt; Mr. Idris Lane; Mr. P. Clarke

**Collaborating Institutions**

*New Zealand*: National Institute of Water and Atmospheric Research

*Solomon Islands*: Kolombangara Forest Products Limited (KFPL); Ministry of Agriculture and Fisheries (MAF); Ministry of Forests, Environment and Conservation (MFEC)

**Donor** : Government of New Zealand

**Duration** : October 1998 - October 2003

**Objectives**

GENERAL

- Work with coastal communities, governments and industry to collect data on the effects of logging on aquatic habitats and biota.
- Quantify the effects of logging on aquatic habitats and biota by comparing previously logged, actively logged and unlogged areas.

- Compare the effects of logging, as outlined above, on virgin forests and on mature plantations.
- Transfer information on the effects of different types of logging on aquatic habitats and biota to coastal communities so that they can make informed decisions about logging operations in virgin forests, and the reforestation of areas logged previously.
- Disseminate the findings of the research to countries in the South Pacific region.

SPECIFIC

- Conduct pilot sampling at the sites selected in 1998 to determine the most appropriate methods for quantifying the diversity and abundance of freshwater fish and invertebrates in the lower reaches of streams, and the infauna of soft sediment, corals and coral reef fishes in the receiving waters of catchments.
- Determine the most cost-effective distribution of sampling effort within and among the study sites to assess any effects of runoff from logging operations.

**Background and Justification**

The export of whole round logs from virgin tropical rainforests has been a major source of foreign earnings for developing island nations in the western Pacific, particularly Vanuatu, Papua New Guinea and the Solomon Islands. However, the economic benefits that stem from exploitation of this natural resource are tempered by risks to the catchments and inshore receiving waters, and therefore to the well-being of coastal communities.

The risks associated with logging in the western Pacific arise because of the steep, volcanic nature of the islands. If too much vegetation is removed carelessly, heavy rains increase the erosion of topsoil and transport sediment to inshore marine habitats via freshwater streams. The effects attributed to excessive removal of trees and destruction of undergrowth by machinery include: reduced biodiversity of forest plants and associated fauna; destruction of areas suitable for production of food by gardening; loss of pools and riffle habitats in freshwater streams due to sedimentation; deterioration in the quality of water used for drinking; and reduced productivity of inshore fisheries. The latter effect is attributed to loss of, or damage to, coral reefs due to smothering by sediment and reduced light penetration resulting from increased turbidity. Such effects limit the ability of coastal people to obtain a balanced diet, maintain hygienic living conditions and earn an income.

A solution to these problems is to equip the resource owners with knowledge about the consequences of different forms of logging. They can then decide what type of logging they will approve on their land and determine whether it is being carried out within the specified guidelines.

This project is designed to determine the effects of two types of logging operations on freshwater, inshore and coral reef habitats in areas of the Solomon Islands that are typical of the forested volcanic islands of the western Pacific. The two types of operations are the rapid removal of trees from virgin forest and the controlled harvesting of logs from a plantation.

This project is expected to contribute to lasting improvements in the well-being of coastal communities in the western Pacific by empowering them to decide whether proposals to harvest their forests are compatible with the protection of freshwater streams and coral reefs, and the maintenance of fisheries supported by these habitats. For each type of operation, the effects of logging will be determined by comparing the diversity and abundance of fauna associated with freshwater, inshore and coral reef habitats for three types of catchments - those where logging has been completed, those where logging is still underway and those where logging has not occurred.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

The island of Kolombangara, where KFPL operates a large plantation, was chosen for assessing the effects of controlled harvesting of trees and Vangunu island was chosen for the investigation of the effects of removal of trees from virgin forests. Both islands are in the Western Province of the Solomon Islands. On each island, it was possible to find two replicate catchments in each of the three categories described above. The project involves the receiving waters from a total of 12 catchments.

Sites were selected in consultation with the MFEC, the Government of the Western Province, KFPL and the land and reef owners. In each case, the communities with customary ownership of the catchments and reefs have given permission for sampling of the fauna and are interested in participating in the project.

The pilot sampling was done in May and June, and involved four of the six catchments on each island: two actively logged and two unlogged catchments. In each catchment, freshwater fish were sampled using baited traps, seine nets and electrofishing at three sites (n = four replicates). Freshwater invertebrates were collected at four sites in each river by removing them at random from rocks of approximately equal size.

In the marine receiving waters, the infauna of soft sediments were sampled using cores at depths of 1, 4 and 8 m (n = 4). At two of these areas on Kolombangara, comparisons were also made for the fauna retained on 0.5 and 1.0 mm sieves. Corals were sampled along (n = 4) transects at inner and outer reefs on each side of the river mouth. Coral reef fish were counted using the same sampling design, except that the size of the transect was larger. In addition, locations were selected at each river mouth for the deployment of dataloggers to record variation in turbidity and water temperature. After the variation has been quantified to allow measurements at all sites to be standardized, they will be deployed in fixed positions.

The data from the pilot study are currently being analyzed by the consultants to the project. A draft report on the results of the analysis will be complete by the end of 1999.

One of the difficulties to be overcome in this type of project is the natural variation in diversity and abundance of fauna among catchments. For example, it appears that the receiving waters for some of the previously logged areas have a greater potential for recovery than other areas because they are more exposed to the ocean and receive a greater supply of propagules. Thus we might expect previously logged areas to accumulate more species than the unlogged areas. If so, abundance and diversity of fauna may not be the best measures of the effects of logging. Some measures of the effects of runoff on the survival of species would be better. We propose to estimate the effects of runoff on survival of fauna by using sentinel species. Corals that are normally found in the vicinity of river mouths are the most promising sentinel species because they provide habitat for other species and they can be cultured from the same genetic stock through budding. The species used will be tolerant to turbidity, amenable to culture, relatively fast growing and occur in sites where we are working. The coral species will be chosen in consultation with Dr. Terry Hughes from James Cook University.

A similar approach will be used to measure the effects of runoff on freshwater invertebrates, except that we will provide a constant habitat for colonization of the invertebrates. The emphasis here will be to remove the differences in habitat structure among streams, which affects the collection of invertebrates in a uniform way. Nylon pot scourers have been used effectively for this purpose in other studies and will be trialed as a suitable artificial habitat for insect larvae and crustaceans. They also have potential as collectors of sediment deposited by runoff.

**Activities Planned for 2000**

Recruit a national scientist to: collect information on water turbidity and temperature; establish and monitor the experiments using marine sentinel species and uniform habitats for freshwater invertebrates; and coordinate the participation of resource owners in the project.

First full sampling of all study sites using the optimum suite of sampling methods and replicates determined by the pilot study. Report on the first full sampling of all study sites.

Present the purpose of the study and the results of the pilot sampling at the Ninth International Coral Reef Symposium.

Make a final report of the pilot sampling with recommendations for the best methods and distribution of sampling effort.

## AQUATIC ENVIRONMENTS

### Project 2.6
ReefBase

**ICLARM Staff**

Dr. John W. McManus; Ms. Sheila G. Vergara;

Mr. Lambert A.B. Meñez; Mr. Ronald C. Evangelista; Ms. Kathleen K. Reyes; Ms. Audrey Marie B. Serrano and Ms. Rosenne Z. Funk

**Collaborating Institutions**
*International/Regional:* Global Coral Reef Monitoring Network (GCRMN); World Conservation Monitoring Centre
*China:* Reef Check Program
*USA:* Earth Observations Program, NASA-Johnson Space Center; National Center for Atmospheric Research; University of Rhode Island; World Resources Institute
*Others:* Institutions and individuals contributing data and pictures to the database

**Donors** : ICLARM core funds; SIDA

**Duration** : January 1999 - March 2001

**Objectives**
- 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 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.
- Serve as the central repository for data of the GCRMN.
- Define criteria for reef health and use them to refine procedures for coral reef assessments and to determine coral reef status at the regional and global levels.
- Determine the relationships among coral reef health, fishery production and the quality of life of people dependent on reefs.

**Background and Justification**
A great part of the coral reef resources in the world are in danger of destruction due to overexploitation, degradation of habitat and, possibly, changes in global climate. Globally, the loss in income from fisheries is estimated to be billions of dollars a year and affects 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 nonextractive uses of reefs (such as tourism). Sophisticated methods to quantify the deterioration of coral reefs have been initiated in some areas, while hardly any assessment or monitoring activities exist in others. 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.

ReefBase is an effort to gather the available knowledge about coral reefs into one information repository. The information in ReefBase is intended to facilitate analyses and monitoring of coral reef health and the quality of life of reef-dependent people and to support informed decisions about 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 United States 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 the GCRMN and directly addresses priority actions of ICRI, now endorsed by 80 governments.

In order to expand the range of survey contributions to the database, the ReefBase Aquanaut Survey Method for coral reefs was developed by ICLARM. It allows quick and efficient monitoring of a broad geographical area. 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 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 with the data gathered using the standard method of GCRMN.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**

THE DATABASE

Over 700 ReefBase 3.0 CD-ROMs have been distributed worldwide to coral reef managers and scientists, NARS, libraries and others.

A total of 9,136 reefs have been identified and located, and 7,775 references are now logged into the database. The references were used to reinforce data holdings in ReefBase and were added to the reference search system to aid other researchers.

Over 700 images of coral reefs have been acquired from the NASA Space Shuttle Program. A paper is being prepared jointly with NASA describing the use of space shuttles in support of reef management.

A GIS-oriented Internet version of ReefBase is being designed in collaboration with several related international efforts, including an information and training system on reef management being set up by the World Bank; a dialogue and data acquisition system of the Reef Health Program of National Oceanic and Atmospheric Administration (NOAA), the NOAA National Data Center's plans for expansion into reef data, and United Nations Environment Programme systems including GRID and the Biodiversity Clearing House.

An additional table was designed and information on economic values was collected as a result of coordination with the Policy Research and Impact Assessment Program of ICLARM.

RESEARCH

Studies are continuing on ecosystem health indicators for coral reefs based on data in ReefBase. Multivariate analyses have indicated significant differences among reefs in Australia, Indonesia and the Philippines. Reefs in central Indonesia tend to have less coral. Other differences related to ambiguous variables have significant implications for the design of future monitoring.

A coral reef model is currently being developed to determine optimal sampling strategies for various characteristics of reefs and to elucidate principles of resilience in the benthic community.

The ReefBase team is currently examining data that would validate the Aquanaut method against the Line Intercept Transect method.

NETWORKING

Collaboration with CRIOBE in French Polynesia has resulted in a commitment to contribute data in ReefBase. The success of this coordination will form the basis of developing the mechanics of future collaboration.

There is a continuous collaboration between ReefBase and GCRMN. ReefBase is continuously apprised of the GCRMN members who are potential data contributors.

Indications of collaboration were also received from the National Aquatic Resources Research and Development Agency of Sri Lanka and the Sultan Qaboos University College of Agriculture. A global model of potential coral reef distribution at much higher resolution than the existing Kleypas model is being developed in collaboration with Kansas State University.

WORKSHOPS

An International Workshop on Remote Sensing Needs for Coral Reef Management was organized by ICLARM and NOAA in Hawaii, USA from 7 to 11 June 1999. It resulted in recommendations to make remotely sensed data available for distribution via the Internet and ReefBase.

ReefBase hosted the Expert Consultation on Coral Bleaching at ICLARM, Philippines, from 11 to 13 October 1999. This initiative was to provide material to the Fifth Meeting of the Conference of Parties to be held in Nairobi, Kenya, in May 2000.

THE REEFBASE AQUANAUT SURVEY METHOD

A meeting held among ReefBase aquanauts and the first batch of instructors resulted in a recommendation for the revision of the Aquanaut manual. Comments from the new trainees and experts in the field of coral reef monitoring were likewise incorporated. Funds are being sought for the second version.

ReefBase provided Aquanaut training for four ICLARM staff in February 1999 in Anilao, Batangas, Philippines.

Ten Aquanaut master instructors were certified in Puerto Galera, Philippines. The Aquanaut Network

now has registered 27 Aquanauts, 18 Aquanaut Master Instructors, seven Trainers and one Core Instructor. A large volume of Aquanaut data was received from the central Philippines.

Answers to Frequently Asked Questions (FAQs) on the Aquanaut have been developed for input into the ReefBase webpage.

## Project 2.7
## Application of Rapid Assessment of Management Parameters (RAMP) in ReefBase

**ICLARM Staff**
Ms. Rosenne Z. Funk; Ms. Audrey Marie B. Serrano

**Collaborating Institution**
*USA:* University of Rhode Island

**Donors** : USAID; SIDA

**Duration** : November 1997 - March 2001

**Objectives**
- Increase the number of reefs in ReefBase that have associated RAMP data so as to make crucial management information widely available for summary analysis and use in management implementation.
- Determine interrelationships between the coral reef related human variables included in RAMP and ReefBase and selected indicators of coral reef status.
- Further demonstrate the feasibility of quantitative analysis of ReefBase data.

**Background and Justification**
ReefBase is a worldwide database on coral reefs that includes benthic components of reef areas, associated fish communities, human and natural stresses, coastal tourism, amounts of fish harvested by reef, associated mariculture activities and management information. RAMP is a data set associated with each reef in ReefBase. It includes a select set of indicators directed at providing information on coral reef related human activities as well as political, socioeconomic and cultural variables which can be used to assess, predict and potentially manage these activities.

Much of the existing literature does not include information on all variables included in RAMP, and information provided may be at different levels of measurement (e.g., metric, ordinal and nominal). RAMP allows information from diverse sources to be used. This facilitates accumulation of sufficient observations for statistical analysis of relationships between selected human and reef variables. At present, however, very little information has been entered in the RAMP component of ReefBase and only preliminary analyses have been conducted on relating human and reef variables.

The research is significant for several reasons: (i) the additional data entered into ReefBase/RAMP will be useful for analysis by coral reef scientists worldwide; (ii) the analysis conducted as a part of the research will provide a model and questions for further research using ReefBase/RAMP; (iii) the analysis will provide information concerning links between coral reef status indicators and coral reef related human activities as well as political, socioeconomic and cultural variables that can be used to assess, predict and potentially manage these activities. In particular, the research is addressing two major hypotheses: (i) that there is a predictable relationship such that coastal crowding and poverty lead to coral reef degradation; and (ii) that migration tends to be towards healthy, productive reefs, and that degradation ensues secondarily to the in-migration. Analyses to date tend to support the two hypotheses. A paper on the subject is under preparation.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | n/a |
| Equity | H | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**
The report on Integrated Biosocioeconomic Indicators in Coral Reef Fisheries: ReefBase/RAMP Applied was published in January 1999. It illustrates the analytical potential of a data set of ReefBase and RAMP indicators in associating land-based human activities with coral reef health.

**Activities Planned for 2000**
Increase RAMP data in ReefBase.

Normalize RAMP data structure to facilitate efficiency for the database and remove data redundancies.

## Project 2.8
Population Interdependencies in the South China Sea Ecosystems (PISCES)

**ICLARM Staff**
Dr. John W. McManus; Ms. Ma. Carmen Ablan-Lagman

**Collaborating Institutions**
*Malaysia:* Borneo Marine Research Unit, University of Malaysia
*Solomon Islands:* ICLARM Coastal Aquaculture Centre
*Taiwan:* Institute of Zoology, Academia Sinica
*Vietnam:* Institute of Oceanography, Department of Marine Living Resources

**Donors** : ICLARM core funds; UNFIP

**Duration** : January 1998 - June 2000

**Objectives**
- Study the genetic variation of several organisms at selected reefs in six countries in the South China Sea (SCS).
- Develop a model of the degree of interdependencies among reefs, based on genetic markers.
- Quantify the exchange of organisms among reefs, based on species in the study.
- Facilitate the development of improved management strategies by providing information on the interconnections among reef populations.
- Initiate/strengthen collaboration among scientists in the SCS area.

**Background and Justification**
PISCES is an initiative to investigate the degree of connectivity among selected reefs in the Philippines, Vietnam, Indonesia, Malaysia (Sabah), Taiwan and Solomon Islands by evaluating genetic variation based on isozyme and DNA markers. Much of the work on stock identification in both capture and culture species is done using genetic markers. This project is an attempt to apply the theory and technology of genetic markers to the evaluation of interconnection among coral reef resources in the region.

This study was prompted by the need for a knowledge base for managing reefs. On the average, more than 60% of the larvae from organisms in coral reefs remain in the pelagic phase for at least 21 days before they recruit into an existing population. Given the magnitude and direction of the surface current patterns, this period may allow for transport of juveniles across country boundaries. The extent and direction of movement are not very clear. Information on the dynamics of larval transport can be important.

The model of reef interdependencies from this project will be based on genetic variation displayed by populations of three species of reef fish *Heniochus acuminatus, Thalassoma hardwicki* and *Dascyllus trimaculatus* and the starfish *Linckiai laevigata*. These species were chosen based on their common occurrence and abundance in the area covered by the study.

A modest laboratory for genetic marker studies was established at ICLARM headquarters. DNA work is in progress at the Academia Sinica in Taiwan, under the leadership of Dr. Kwang Tsao-Shao.

The project also provides an opportunity for the participating institutions to relate their current research on these reefs (e.g., investigations on recruitment, population ecology, marine pollution, and environment gradients) with the results from PISCES. The project is a venue for training research staff in techniques for work with genetic markers. Though very limited in its scope and participation, the project is a major step towards regional cooperation on management of coral reef resources.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**
Data sufficient to produce a preliminary model of interdependencies were successfully gathered in 1999.

A meeting of PISCES collaborators was held in August at the Institute of Zoology, Academia Sinica. They discussed the preliminary model which was based on genetic markers from proteins of four reef species, and variable number of tandem repeats (VNTR) of the mtDNA control region of two of the fish species.

No significant genetic structure was displayed by populations of the blue starfish *L. laevigata* (Fst = 0.003) implying the existence of extensive dispersal,

rapid expansion of the species in the recent past and/or the absence of major events in geologic time which may cause a pronounced pattern due to isolation. However, genetic structuring is apparent in the domino damselfish, *D. trimaculatus*, a species with approximately the same larval duration as the starfish (Fst = 0.025, $p < 0.01$). *D. trimaculatus* and fish populations of *H. acuminatus* as well as *T. hardwicki* displayed varying levels of affinity. However, the linkages drawn from the data for all three fish species are generally concordant with surface circulation patterns.

Concurrent results on the degree of exchange among reefs were obtained from cluster analysis of Nei's genetic distance values (D) for the isozyme data as well as AMOVA analysis of mtDNA VNTR.

A satellite study that investigated the possible differences in allozyme markers between large and small *D. trimaculatus* was necessary since samples from some areas in Vietnam, Solomon Islands and Malaysia were mainly large individuals. There were major differences in their isozyme patterns. A more extensive analysis of isozyme data from small and large *D. trimaculatus* for a greater number of fish in populations in the Solomon Islands showed no significant difference in expression of markers between the two groups. Differences in banding patterns were also not apparent in the RAPD markers.

**Activities Planned for 2000**
Sampling activities in Malaysia and Indonesia were completed by the end of 1999. Collaborators have suggested the inclusion of samples from Northern Taiwan and perhaps the Spratly Island to produce a more complete model of reef linkages in the area. Analysis of these samples at ICLARM and at the Academia Sinica will be done in 2000. Manuscripts for publication will also be prepared.

## Project 2.9
## Coastal Management Training Program

**ICLARM Staff**
Ms. Sheila G. Vergara; Ms. Audrey Marie B. Serrano

**Organizing Committee**
Department of Environment and Natural Resources; ICLARM; Department of Agriculture-Bureau of Fisheries and Aquatic Resources; Haribon Foundation; International Institute for Rural Reconstruction; Philippine Council for Aquatic and Marine Research and Development

**Collaborating Institutions**
*Indonesia*: Pusat Kajian Sumberdaya Pesisir dan Lautan, Institut Pertanian Bogor
*Philippines*: Local Government Academy
*Vietnam*: Cantho University

**Donor** : Rockefeller Brothers Fund

**Duration** : Five years from 1997

**Objectives**
- Initiate collaboration and networking activities in South and Southeast Asia in the context of coastal management.
- Develop a pool of coastal managers who will champion integrated coastal management (ICM) in the Asian region, starting in Vietnam, Malaysia, Indonesia and Sri Lanka.
- Adapt the National Course on Integrated Coastal Management (NCICM) and the experience acquired from it for the development of national ICM courses in other Asian countries.
- Adapt the NCICM to fit the needs of local government units in the Philippines.

**Background and Justification**
Developing nations in Southeast Asia are experiencing similar problems with their nearshore coastal resources. Issues common to these countries are the lack of comprehensive information on their coastal zones, increasing populations, limited ability to ensure a sustainable level of resource use (e.g., deforestation, coastal erosion, destructive harvesting practices), urbanization, lack of investment on environmental management and lack of a management plan, among others.

Several international institutions are providing assistance in the form of policy development, technical assistance, preparation of master plans, provision of environmental quality criteria, coastal erosion abatement, etc. These assistance packages are based on externally commissioned reviews and needs assessment.

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | ? | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

The last Ninth NCICM Training Program was conducted in Zamboanga for Region 9 and the Autonomous Region for Moslem Mindanao in the Philippines. Twenty-seven government and nongovernment personnel were trained in the principles of ICM.

A proposal entitled Integrated Coastal Zone Management Training for Indonesia, Malaysia, Vietnam and Sri Lanka was prepared for endorsement to donors: Rockefeller Brothers Fund; MacArthur Foundation; and DANCED.

Publication of the Philippine version of the NCICM manual was arranged with BookMark Inc. on a no-cost basis.

Partners conducted training needs assessment (TNA) of local government units.

**Activities Planned for 2000**

*Country-based Training Needs Analysis*: Assess gaps in the extant in-country skills, knowledge and attitudes required for ICM through TNA.

*Curriculum Development*: Based on the recommendations from TNA, a framework for the country specific curriculum will be developed. Consultation with national experts and stakeholders will continue, through government organizations, NGOs and the private sector, for preparing the ICM training design. External reviews will be solicited to ensure relevance and maintain standards.

*Training Courses:* for local government units.

*Institutionalization:* of ICM approaches in Philippine government organizations.

## Project 2.10
Population, Consumption and Environment (PCE) Coordination

**ICLARM Staff**

Dr. John W. McManus; Ms. Rosenne Z. Funk

**Collaborating Institutions**

*Ecuador*: Fundacion Natura; The Nature Conservancy
*El Salvador*: Center for Environmental and Social Studies on Sustainable Development
*Federated States of Micronesia:* Department of Agriculture and Land
*Gabon*: World Wildlife Fund - Central Africa Region Office
*Ghana*: Marine Fisheries Research Division, University of Ghana
*Hong Kong*: World Wide Fund for Nature, University of Hong Kong
*Honduras*: Committee for the Defense and Development of the Flora and Fauna in the Gulf of Fonseca
*India*: Tata Energy Research Institute
*Indonesia*: Bogor Agricultural University; Indonesian Institute of Science; University of Indonesia
*Madagascar*: Madagascar University Museum; Universite d'Antananarivo
*Norway*: Christian Michelsen Institute
*Philippines*: University of the Philippines
*Thailand*: Institute of Social and Economic Policy; Kasetsart University
*UK*: University of East Anglia; University of York
*USA*: Duke University; International Center for Research on Women; Princeton University; Stanford University; The Nature Conservancy - Latin America and Carribean Division; University of Connecticut; University of Rhode Island; Forest Service - US Department of Agriculture
*Vietnam*: Center for Environmental Research and Education
*Zambia*: Ministry of Agriculture, Food and Fisheries
*Zimbabwe*: Center for Applied Social Sciences, University of Zimbabwe

**Donor** : John D. and Catherine T. MacArthur Foundation

**Duration** : January 1998 - December 2000

**Objectives**

GENERAL

- The PCE Initiative of the MacArthur Foundation seeks to foster research and dialogue on the effects of human population shifts and consumer demand on tropical coastal and marine ecosystems. There are now 13 research projects funded by the Foundation under its PCE Program. ICLARM will coordinate the collaboration among research groups to consolidate and synthesize their studies into one cohesive set of results.

SPECIFIC

- Conduct three annual workshops to improve the comparative and complementary aspects of the studies and, where possible, standardize data collection.
- Assist the advisory group and the leaders of the PCE program studies to further develop and adapt plans to fit the overall research framework.
- Assist communication among scientists from different studies and the donor Foundation.
- Develop links between the PCE Program and ongoing ICLARM projects, as appropriate.
- Assist in the publication of the synthesized results of the studies.

**Background and Justification**

This project represents a novel approach to optimizing ICLARM's role as a catalyst and coordinator in global strategic research. Coordination at critical points of inception, implementation and analysis will maximize the benefit from the 13 projects under the MacArthur Foundation's PCE Program for research into coastal resources management.

ICLARM has more than 20 years of experience in tropical fisheries, aquaculture, coastal resources and aquatic conservation research. It specializes in research to benefit low-income people in developing countries and works with a range of partners from other research institutes, government and non-governmental agencies. In addition, ICLARM has a well established publishing program with several publication series, including conference proceedings, technical reports and manuals of research methods. ICLARM scientists also publish widely in mainstream scientific literature. The Director General of ICLARM, Dr. Meryl J. Williams, is a member of the advisory committee for the PCE Program.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

The Second Annual PCE Workshop was held on 1-5 March 1999 in the Philippines. This activity brought together representatives/collaborators from the first and second sets of grantees of the PCE Program.

The purpose of the workshop was to develop conceptual models for understanding PCE problems in each research study site. A common terminology was defined to set a standard for illustrating migration and resource degradation linkages at each site. The development of the conceptual framework began with establishing a common set of migration-mechanism-resource linkages. Given the complexities and variations in each site, several sets of relationships were developed to further demonstrate the dynamics of intervening mechanisms within a research frame, particularly of how indirect threats lead to direct threats.

In the process of developing an overall conceptual framework, the group reached a consensus to collect comparable data.The development of the conceptual framework and the delineation of comparable data needs were documented in a draft workshop report prepared by the resource person - Dr. Sara Curran of Princeton University. This report was disseminated to all grantees and the Technical Advisory Committee of the PCE program.

As a result of the need for a more dynamic exchange of information, ICLARM has opened its information and publication services to the grantees. The Foundation representatives, members of the Technical Advisory Committee and grantees will receive six issues of the ICLARM scientific magazine, *Naga*, from the second quarter of 1999 to the last quarter of 2000. They have also been included in the ICLARM Library's distribution list for announcements of 'New Acquisitions'.

ICLARM has also identified and circulated a bibliography related to PCE. To further improve the communication links among the grantees, a listserver has just been finalized with the assistance of the CGNET.

One of the complex subjects discussed during the second annual workshop was property rights. The

MacArthur Foundation and ICLARM convened an e-mail conference on 'Property Rights, Devolution and Compliance in Natural Resource Management in Developing Countries' from 8 to 25 November 1999. The purpose of this conference was to improve the understanding of aspects of property as applied to land and sea and as a factor in migration and village-level natural resource management. The issues that emerged were:

- What actually are property rights?
- How does legitimacy come about? What is the role of community participation in enhancing legitimacy and how does the diversity of the community affect the legitimacy of rule-making institutions?
- Is compliance stable or likely to break down as institutions evolve?
- How can government develop rules that deal with specific ecosystems and also account for divergent cultures and governance systems?

**Activities Planned for 2000**

Coordinate the organization of the last workshop for the 26 collaborators.

Assist in synthesizing the results of the studies made by the collaborators and coordinate the publication of the results of these studies.

## Project 2.11
International Coral Reef Action Network (ICRAN)

**ICLARM Staff**

Dr. John W. McManus; Ms. Sheila Vergara; Ms. Ma. Carmen Ablan-Lagman; Ms. Melody Ovenden; others to be appointed

**Collaborating Institutions**

*International:* Coral Reef Alliance; Global Coral Reef Monitoring Network; International Coral Reef Initiative-Coordinating and Planning Committee; World Conservation Monitoring Centre; World Resource Institute (WRI); United Nations Environment Programme (UNEP)

**Donor** : UNFIP

**Duration** : June 2000 - June 2004

**Objectives**

GENERAL

- ICRAN consists of a collaboration among seven international agencies to reverse the degradation of the world's coral reefs through an integrated set of actions in the areas of assessment, communications and implementation. Under ICRAN, ICLARM will provide overall leadership in partnership with UNEP, and its activities will focus on global research and training.

SPECIFIC

- Country-by-country analyses, presented in atlas reports of coral reef locations, status, threats and management priorities; economic and social values of coral reefs; production and employment associated with coral reef fisheries and mariculture; and policy changes necessary to ensure the future of coral reefs.
- ReefBase on CD-ROM and the Internet providing access to all information assembled and generated under the ICRAN, along with the bulk of available information on coral reefs gleaned from reports and project databases.
- Guidelines for analyses of coral reef health and the quality of life of reef-dependent people, based on ReefBase data.
- Training materials for coral reef managers in all regions, and a global network of trained coastal management trainers.

**Background and Justification**

ICRAN is an umbrella project designed to reduce coral reef degradation through a set of complementary global and regional activities. The project will consist of a one-year startup phase, followed by a four-year action phase. It will bring together global research and assessment with training and communications, and a tie-up with coastal management activities of the UNEP Regional Seas Programme. This vision has evolved based on a careful matching of global needs with the funding priorities of the initial sponsoring agencies. Flexibility will be maintained to permit responses to further discussions with potential partners and funding agencies, particularly with respect to the action phase. While funds are guaranteed for the first year startup phase, the action phase is dependent on mobilization of additional funds.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**
ICLARM will be assisting WRI in conducting a regional Reefs at Risk analysis within the east Asian seas region. The study will be coordinated with UNEP's East Asian Seas Regional Coordination Unit. The purpose of the regional analysis is to make a risk analysis and assessment using local information.

A comprehensive strategic plan was outlined, including technical and financial guidelines, to carry out all objectives under the ICRAN project. A draft has been submitted to the United Nations Foundation (UNF) and associated reviewers.

**Activities Planned for 2000**
The start-up year will result in a comprehensive Strategic Action Plan for the action phase scheduled from June 2000 to June 2004. A plan for raising matching funds for ICRAN will be developed for approval by UNF. Progress will be made on the Reefs at Risk study in Southeast Asia that will result in specific management advice for the region in a GIS and map-based format. This study will serve as the model for similar studies to be conducted in seven other regions over the subsequent four years.

## FISHERIES RESOURCES ASSESSMENT AND MANAGEMENT

### Project 2.12
Tropical Fish Stock Assessment

**ICLARM Staff**
Mr. Geronimo T. Silvestre (Project Leader); Mr. Francisco S.B. Torres, Jr.

**Collaborating Institutions**
Predominantly in-house, with informal linkages with various research institutions

**Donor** : ICLARM core funds

**Duration** : Indefinite

**Objectives**
- Increase understanding of the dynamics of exploited tropical/subtropical fish communities.
- Develop stock assessment methods that are straightforward and readily applicable to tropical and subtropical stocks.
- Implement and disseminate these methods in the form of widely usable software for research and training.

**Background and Justification**
Stock assessment methods used in temperate areas were traditionally based on age structured information. Such information is difficult and expensive to obtain. ICLARM has developed length-frequency based methods and made them available to tropical developing countriess. ICLARM's prominent role in stock assessment of tropical fisheries based on collaborations with fisheries scientists dates back to 1978.

Since its inception, this project has supplied national aquatic research systems with conceptual and methodological advances to understand and manage aquatic resource systems. New techniques have been distributed through computer program routines. These are now widely used by fisheries researchers in developing countries and, increasingly, in developed countries as well. One such product is the ELEFAN software.

In 1989, it was decided that a single software be developed that merges the routines in the ELEFAN and Length-Frequency Stock Assessment (LFSA) packages. This would become the basic training tool for FAO and ICLARM courses in stock assessment. The 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 has developed new models appropriate to tropical situations. For example, for cases where length-weight data pairs are lacking, a new model was developed to estimate the coefficients of the length-weight relationship from length frequencies and sample weights only. This is incorporated in the software product ABee.

To further facilitate the use of 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 interpretation of the outputs. An important component of this will be the management and detailed analyses of files resulting from scientific trawl survey data that tend to be underutilized although they are extremely expensive to obtain (see Project 2.14).

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
Distribution of the FiSAT package (software, user's guide and reference manual) will continue. A module has been developed to allow the import/export of data to FiSAT to work with the Fisheries Resources Information System and Tools (FiRST) package, based on Microsoft Windows 98 and distributed through that system and the ICLARM web pages.

**Activities Planned for 2000**
Continuously maintain the software for distribution.

Develop a biomass estimation module/analysis in relation to Project 2.15.

## Project 2.13
Modeling of Multispecies Fisheries

**ICLARM Staff**
To be appointed

**Collaborating Institutions**
*Canada:* Fisheries Centre, University of British Columbia (UBC)
*Denmark:* North Sea Centre

**Donors** : DANIDA; ICLARM core funds

**Duration** : Continuous since February 1990

**Objectives**
- Develop modeling approaches for management of ecosystems and multispecies fisheries incorporating biological interaction.
- Make the methods available to, and develop them further in cooperation with, scientists in national institutions.

**Background and Justification**
A method for ecosystem analysis was developed at ICLARM over the last decade based on an approach originally conceived by a US scientist, Dr. J.J. Polovina. This led to the Ecopath with Ecosim software system which is now widely distributed (1,600 registered users in 94 countries) and used for description of more than 100 ecosystems, and regular course work at universities, thesis work, etc. Interest is now growing in its potential for ecosystem management.

New methodologies (Ecosim and Ecospace) describing ecosystem time and spatial dynamics were developed by Prof. Carl Walters, UBC, Canada, in cooperation with Dr. Daniel Pauly and Dr. Villy Christensen. Ecospace is now integrated in Ecopath with Ecosim. Ecosim makes it possible to simulate the impact of changes in fishing pressure on ecosystems, while Ecospace addresses spatial dynamics, including studies of the effects of protected areas.

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

**Scores Against Principles**

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|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | n/a | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**
During the first half of 1999, major effort was allocated to considering comments from the tests of the Ecopath with Ecosim Alpha version following a series of international workshops conducted in 1998. These were used to add a number of new features to the underlying database and to improve the programming structure of the software. The programs were also transferred to the new version 6.0 of Visual Basic Enterprise, and the help system was updated. The updated version was tested with good results at the Regional Ecosystem Modeling Workshop held at ICLARM, Manila, Philippines, 7-11 June 1999. Updating of the flowchart program by a consultant is in progress. A recent development opens the way for simulation of indirect effects in Ecosim, e.g., through habitat alterations. The Beta version of Ecopath with Ecosim has been completed along with a new manual.

The Project Leader participated in the FAO/Australia Technical Consultation on the Use of Indicators of Sustainable Fisheries Development, Sydney, Australia, 18-22 January 1999, and in the WWF/Charles Darwin Foundation for the Galápagos Islands Biodiversity Workshop, Galápagos, 25-28 May 1999.

A review describing the present status of the Ecopath with Ecosim approach was presented in a keynote to the ICES/SCOR Conference on Ecosystem Effects of Fishing in Montpellier, France, March 1999. The conference marked the role Ecopath has come to play in introducing ecological considerations into fisheries management. More than 20 publications at the conference utilized or referenced Ecopath as did 20 of the presentations.

**Activities Planned for 2000**
Official release of Ecopath with Ecosim 4.0 by the end of the year.

## Project 2.14
## Sustainable Management of Coastal Fish Stocks in Asia

**ICLARM Staff**
Mr. Geronimo T. Silvestre (Project Leader); Dr. Daniel Pauly (Consultant); Dr. Mahfuzuddin Ahmed; Dr. John McManus; Mr. Len R. Garces; Ms. Lualhati Lachica-Aliño; Ms. Rowena Andrea V. Santos; Mr. Fredelito C. Valdez; Mr. Francisco S.B. Torres, Jr.; Ms. Kristine F. Santos

**Collaborating Institutions**
*Bangladesh:* Bangladesh Fisheries Research Institute; Department of Fisheries (DOF); University of Chittagong
*India:* Central Marine Fisheries Research Institute; Indian Council for Agricultural Research
*Indonesia:* Central Research Institute for Fisheries; Directorate of Fisheries Resource Management
*Malaysia:* DOF; 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
*Thailand:* DOF; Southern Marine Fisheries Development Center
*Vietnam:* Ministry of Fisheries; Research Institute for Marine Products

**Donor** : ADB

**Duration** : 1998 - 2001

**Objectives**
GENERAL
- Provide selected developing countries with tools and strategies to improve management and sustainable utilization of their coastal fisheries and related ecological systems.

SPECIFIC
- Develop a fisheries resource information system that relates environmental and socioeconomic factors to resource management needs.
- Develop appropriate strategies and action plans to assist in rehabilitating coastal stocks and sustaining the benefits.
- Strengthen the capabilities of selected institutions in coastal fisheries assessment and management.

**Background and Justification**
The project under Sustainable Exploitation of Tropical Coastal Fish Stocks in Asia (ADB RETA No. 5651) identified the issues impacting coastal fisheries in the region that require action on a broad front. Success in dealing with these issues will depend on the institutional capabilities and resource mobilization in these countries. Regional collaboration can be focused on key elements that will assist them to deal successfully with these issues.

Regional cooperation will be cost effective in addressing common issues in the management of coastal fish stocks. It will contribute to scientific advances in stock assessment and development of fisheries resource databases, that can be applied extensively for improved management and sustainable utilization of coastal fisheries resources.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | M |
| Gender | M | Anticipatory Research | H |

**Current Status**
The Annual Technical Progress Report and Audited Financial Report (covering the period 15 March 1998 - 15 March 1999) have been submitted to the ADB, respectively. Since its initiation on 15 March 1998, the project accomplished the following: (i) completion of startup activities; (ii) preparation and submission of inception report; (iii) signing of memorandum of agreement between ICLARM and eight participating countries; (iv) development of protocol/format for the Fisheries Resource Information System; (v) development of Fisheries Resource Information System and release of the 1998 version; (vi) initiation of data collection on trawl surveys; (vii) compilation of available socioeconomic information; (viii) initiation of review and evaluation of existing policy, strategy

and development plans on fisheries resources management; and (ix) organization of regional training and workshops on the use of the database system, fish stock assessment, community/ecological analysis, socioeconomics, and management/policy planning.

The progress of these activities is documented in the Semi-Annual Progress Report submitted to ADB in September 1999.

On 7-11 June 1999, the project held a Regional Workshop on Ecosystem Analysis (Ecopath Modeling). The workshop aimed to assist project partners to construct a preliminary ecosystem model in a selected coastal area (with trawl survey data/information) and refine technical elements of the paper outputs. The workshop also gave ICLARM an opportunity to review the progress of work, particularly on the resource analysis component of the project, with country representatives.

An updated version of FiRST was released during the workshop. Data compilation and inputting of national and regional data are in progress. The project's webpage is regularly updated to serve as a venue for communication and information exchange among the participating countries.

Research partners are given assistance in the proper installation of database systems and encoding of trawl data as well as in data analysis and preparation of technical reports of the various research components at the country level.

**Activities Planned for 2000**
Continue data and policy analyses.

Further develop the Fisheries Resource Information System and release of 1999 version and related documentation.

Prepare and submit draft technical reports.

Organize and conduct national/regional fisheries resource management strategic planning workshops.

Formulate national development strategies and action plans.

Organize regional consultative planning and technical workshop.

## Project 2.15
## Testing the Use of Marine Protected Areas to Manage Fisheries for Tropical Coral Reef Invertebrates in the Arnavon Islands

**ICLARM Staff**
Dr. Johann Bell (Project Leader); Mr. Marcus Lincoln-Smith (Consultant); Mr. Peter Ramohia; Mr. Rayner Pitt; Mr. Idris Lane

**Collaborating Institutions**
*Australia:* Great Barrier Reef Marine Park Authority (GBRMPA)
*Solomon Islands:* Ministry of Agriculture and Fisheries; Ministry of Forests, Environment and Conservation
*USA:* The Nature Conservancy

**Donor** : ACIAR

**Duration** : October 1994 - September 1999

**Objective**
- 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 size of individuals in the reserves will be greater than those in fished areas.

**Background and Justification**
Fisheries managers in developing countries are looking for affordable ways of achieving sustainable harvests. One such method is to use marine protected areas (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.

Firstly, the prevention of fishing allows fish to accumulate and grow in size. The protected fish then produce a far greater number of eggs because there is an exponential increase in fecundity with increasing body size. Secondly, 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 fish-

ing, populations in the refuge should contribute an increased number of juveniles to the fishery.

ICLARM tested 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 negotiated a three-year closure to fishing in the MCA for trochus, sea cucumbers and giant clams with the traditional users. GBRMPA provided assistance for 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 was estimated from six transects at each of four sites at two islands within three 'external reference' areas and within the MCA. Such estimates were made three times prior to dedication of the MCA (in August 1995), and once each in 1996 and in 1997. Three estimates were also made between late 1998 and early 1999.

ICLARM regularly attended 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 among traditional users of the area and in the Fisheries Division, of the potential value of MPA in the management of coral reef fisheries.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**

The last of the three independent samples to be taken three years after declaration of the Arnavon Islands MCA was completed in May 1999. The consultant completed the final report for the project in November. Preliminary analysis shows that there has been substantial increase in the abundance of trochus in the MCA relative to the three areas outside the MCA that remain open to fishing. Regrettably, increases in trochus at some of the eight sites monitored within the MCA have not been as great as they should have been, due to poaching.

The culprits have recently been prosecuted. The response of other species (sea cucumbers, giant clams) to protection from fishing has been negligible over the three-year closure, indicating that far greater periods of protection are needed for recovery.

ACIAR has indicated that it is prepared to continue the monitoring of the MCA for another three years, in the first instance, to assess the time needed for recovery of sea cucumbers.

**Activities Planned for 2000**

Write papers for *Naga* and scientific journals about the project and the effects of the fishing closure for three years.

Prepare a proposal to continue the monitoring of the MCA in collaboration with a consultant scientist.

Make estimates of abundances of invertebrates four years after closure (September 1999).

## Project 2.16

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

**ICLARM Staff**

Dr. John L. Munro (Principal Scientist); Dr. Marguerite Watson; Ms. Fiona Gell; Mr. Robert Power; Mrs. Moana Murray; Mr. John Samuels

**Collaborating Institutions**

*British Virgin Islands (BVI):* Conservation and Fisheries Department, Tortola, British Virgin Islands; McLean Marine Science Center, University of the Virgin Islands (UVI); St. Thomas Department of Marine Studies, H. Lavity Stoutt Community College

*Jamaica:* Centre for Marine Sciences, University of the West Indies (CMS-UWI)

**Donor** : DFID-BVI and Government of Jamaica

**Duration** : January 1999 - December 2001

**Objectives**

GENERAL

- Develop scientifically validated criteria for the establishment of marine protected areas (MPA) as fishery reserves through large-scale experimental studies of lightly fished reefs (BVI) and heavily exploited reefs (Jamaica).

- Establish criteria for identifying optimal locations for MPA and to provide a basis for the implementation of management strategies based on sound social, economic and ecological evaluations.

SPECIFIC

- Develop trophic interaction models of pristine and heavily impacted coral reef resource systems in order to develop management strategies for fisheries in such ecosystems, with particular reference to the design and management of MPA as fishery reserves.
- Understand the recruitment patterns of commercially important coral reef fish in relatively pristine areas in comparison with heavily exploited areas within the Caribbean Large Marine Ecosystem.
- Determine expected rates of recruitment into newly established marine fishery reserves and develop technologically simple and sustainable methods for rearing selected reef fish post-larvae for stock enhancement in depleted marine fisheries.
- Explore strategies for management and rehabilitation of Caribbean reef fish stocks.

**Background and Justification**

This is a follow-on to an earlier project that developed scientifically validated criteria for the establishment of MPA. It also established methods for identifying optimal locations for MPA and for the management strategies based on sound social, economic and ecological evaluations.

Reef fisheries are in a state of decline in most parts of the Caribbean, either because of overfishing or environmental degradation. Large apex predators such as groupers and snappers have become virtually extinct in many fisheries and the composition of the catch has shifted steadily towards herbivorous species.

In one of the worst cases known, massive algal overgrowth of the coral reefs on the north coast of Jamaica has resulted in a severe loss of biodiversity and disruption of the ecosystem. This appears to have been triggered by the Caribbean-wide die-off of the herbivorous long-spined sea urchin (*Diadema antillarum*) in 1984. The biomass of herbivorous fishes in Jamaica was too low to control the algae. This did not occur elsewhere in the Caribbean where fisheries were less intense. There is some evidence that stocks of *D. antillarum* are starting to recover at various locations in the Caribbean, including Jamaica. This might lead to a recovery, at least in part, of the coral reefs in Jamaica. However, data collected in Jamaica during the past few years show drastic declines in the biodiversity of the fish community. This is attributed to the collapse in recruitment of some species and the loss of habitat for others. Without active management, recovery would be very slow.

The first phase of this project focused on: (i) establishing rates of settlement and recruitment of commercially important coral reef fishes in the lightly fished waters of the BVI, in comparison with the heavily exploited reef fisheries in Jamaica; and (ii) exploring some of the socioeconomic factors influencing fisheries in BVI and Jamaica. Light traps, constructed and operated during the earlier project, were confirmed to be effective in capturing a wide range of pre-settlement coral reef fishes, with the notable exception of grunts and parrotfish. Likewise, small-meshed fish traps have given a valuable insight into the relative abundance of post-settlement reef fishes. Comparisons with Discovery Bay, on the north coast of Jamaica, have shown that abundances of pre-settlement and pre-recruitment reef fish are orders of magnitude greater in BVI waters and that the number of species captured is also much larger.

Preliminary trials of floating net cages, illuminated at night with automatic solar-powered lights, have shown that the post-settlement stages of reef fishes captured in light traps could be easily reared. The fish that feed on plankton were attracted to the lights. This raises the possibility of using such a system to artificially boost recruitment in newly created marine fisheries reserves or as a form of small-scale aquaculture (particularly in the aquarium fish industry, where development of sustainable collection techniques is an international concern). If successfully developed, such techniques would have global applicability.

The recently released Ecopath II, Ver. 4, by ICLARM and collaborators incorporates a number of very important subprograms that enhance its usefulness. These include Ecoranger, a Monte-Carlo routine that permits the incorporation of probabilities into estimates of parameters and the Ecosim routine, which permits the effects of changes in the ecosystem (such as a change in the fishery, clearance of an area of seagrass, artificial enhancement of recruitment and almost any other

measurable change) to be accurately simulated and the outcome predicted. A third routine, Ecospace, is based on maps of the habitats in an ecosystem. It enables modelling of the impact of the creation of fishery reserves on the fisheries in adjacent areas (as a result of outmigration) and the rates of biomass increase in the reserves (and hence the buildup of spawning stocks). The essential data for the Ecopath model can be collected relatively inexpensively and will pave the way for the management of ecosystems as whole entities rather than by piecemeal attempts to manage the component parts.

Ecopath assessments can be accompanied by conventional single species assessments for important species of fishes and these assessments can then be used to decide on changes to the important fishery parameters in the Ecopath model, such as changes in size at first capture or in fishing mortality rates.

Conventional assessments of Caribbean coral reef trap fisheries have shown that harvests would be increased by adopting larger mesh sizes, instead of the commonly used 1" to 2" hexagonal mesh sizes in which galvanized chicken wire is used. This would reduce growth overfishing for most species and also contribute to the reduction of recruitment overfishing, However, even the largest conventional mesh sizes will capture deep-bodied fish such as surgeon fish, angel fish, porgies, spadefish, hogfish and many species of jacks at unduly small sizes, while releasing elongate-bodied fish such as goatfish, yellowtail and bar jacks. It is postulated that rectangular escape gaps in fish traps would substantially improve harvests by allowing growth of deep bodied fish to larger sizes, and possibly to maturity, while still retaining catches of elongate-bodied species.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

In the earlier project, a total of 6,949 fish were marked and released within the Fishery Reserve at Discovery Bay, Jamaica, between December 1996 and April 1998. There were a total of 6,957 recaptures (including multiple recaptures of the same individuals), of which 5,662 were recaptured (and again released) by the project's traps in the Fishery Reserve and 295 were returned by 72 fishers. These returns yielded excellent data on growth and migration rates and other population parameters. The trapping program yielded a substantial body of data on length-frequencies and relative abundances, including seasonality.

A questionnaire for fishers was developed concerning catch rates and fishing grounds and other socioeconomic data in BVI. Out of a known total of 174 fishers, 109 were interviewed with the assistance and collaboration of the BVI Conservation and Fisheries Department. A substantial report was assembled. The value of the fishery in 1998 was estimated at $6.65 million. The average gross annual income per fisher (45% are part-time operators) was in excess of $38,000, less operating costs of $7,300 and depreciation of equipment. Depreciation was not estimated in the survey but would probably be around $1,500/year. These figures are illustrative of the value of a fishery that is not greatly overexploited, and can be contrasted with the situation in Jamaica where the average trap fisher earns about $1,900/year.

A similar study is planned for the fishery at Discovery Bay, Jamaica, probably in collaboration with the CMS-UWI Fisheries Improvement Project. A significant development at Discovery Bay is that the fishing community has recently recommended that the present 27 ha fishery reserve should be extended to cover all of the shallows of Discovery Bay, to a depth of 20 m. This recommendation has been put to the government to incorporate into the Fisheries Law. Irrespective of government action, it appears that fishing will cease within the bay with immediate effect.

The program for gathering data for use in developing Ecopath models of Hans Creek in BVI and Discovery Bay in Jamaica is well underway. Aerial photographs of Hans Creek have permitted the area to be mapped with accuracy. Discovery Bay is quite well studied and relatively good maps are available of the reef system and adjacent areas. Transect sites and sampling sites for monitoring biomasses of fishes and invertebrates have been established in both areas and the first (summer) set of observations completed. Inventories of biomasses will be made each quarter.

Routine recruitment monitoring using minitraps has continued since August 1996 in Jamaica and April 1997 in BVI. Significant seasonality is now apparent in the records for a number of species. All

minitrap data have been entered into the project's databases. In the interests of efficiency, the more distant sites in BVI were abandoned in favor of accessible sites adjacent to the field station and the Hans Creek study area.

Light trapping was resumed in April with traps set each night for ten days around new moon. Crest nets for sampling reef fish at the time of settlement from the plankton were purchased and will be tested as soon as possible, with a particular view to obtaining large numbers of fish for cage culture trials. Collaborators at UVI have adopted our light trap designs and are doing comparative assessments of settlement rates.

Cage culture resumed as soon as the light trap program produced an adequate number of fish. Yellowtail snapper, *Ocyurus chrysurus*, and Lane snapper, *Lutjanus synagris*, have been successfully reared and show good growth rates. Preliminary evidence seems to indicate that mortality in cages is not density dependent. A fairly constant percentage appears to die initially, possibly due to handling stress, after which mortality rates decline.

In order to evaluate the possibility of using rectangular escape gaps in traps, work has started on gathering a comprehensive set of morphometric data using fish captured by the project. Lengths, weights, body depths and widths are the principal parameters of interest. Trials are being undertaken with traps fitted with escape gaps to investigate the degree to which other factors influence the size selectivity of the traps. For example, catch rates of some species might be adversely affected by the escape gaps because small-meshed traps are, to a degree, self-baiting when larger predators are attracted to small fish in the traps.

**Activities Planned for 2000**

By the middle of 2000, sufficient data will have been gathered to develop preliminary Ecopath models of the ecosystems at Hans Creek, BVI, and Discovery Bay, Jamaica. These data will include estimates of biomasses of system components at quarterly intervals, estimates of growth and mortality rates of principal species, catch data and trophic interrelationships. Data collection will then focus on refining parameter estimates.

Tests of the efficacy of escape gaps in fish traps will continue, as will the collection of morphometric data from a wide variety of sources. Preliminary models of the effects of escape gaps will be developed by the end of the year.

Work on improving light trap designs will continue and refinements to cage culture techniques will aim at improving productivity and reducing costs.

The reef fish monitoring program in Jamaica will be expanded in order to measure the effects of the expansion of the Discovery Bay fishery reserve and a catch sampling strategy developed to estimate the effects of the reserve on the catch rates of fishers.

As part of our collaborative relationship with CMS-UWI, Ms. Gale Persad will study the neritic pelagic ecosystem at Discovery Bay as part of a Ph.D. program.

# 3. FRESHWATER RESOURCES RESEARCH PROGRAM (FRRP)

## Project 3.1
Review of Inland Aquatic Resource Systems

**ICLARM Staff**
To be appointed

**Collaborating Institution**
*UK*: Imperial College, London; others to be identified

**Donors** : To be identified

**Duration** : 2000 - 2002

**Objective**
- Define strategic research agendas (and ICLARM's possible future contributions to these) for aquaculture and fisheries development in inland aquatic resource systems, other than ponds and rice floodwaters. The systems to be reviewed include reservoirs, small lakes, floodplains and wastewaters.

**Background and Justification**
For the 1994-1998 period, ICLARM chose to focus the work of its inland aquatic resource systems programs on the systems for which the most pressing needs and opportunities could be seen with respect to poor farmers, i.e., ponds and rice floodwaters. This was based upon the priorities set in ICLARM's strategic plan. However, other inland aquatic resource systems (reservoirs, small lakes, floodplains and wastewaters) have a potential for fish production and livelihood opportunities, and strategic research agendas are needed for this. This can be done through commissioned reviews.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | L |
| Equity | H | Systems Approach | H |
| Gender | L | Anticipatory Research | H |

**Current Status**
Discussions are continuing with a number of potential partners and donors.

**Activities Planned for 2000**
Prepare proposals for donors to fund commissioned reviews on one of the aquatic resource systems listed above. Reservoirs will be the priority.

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

**ICLARM Staff**
Dr. Mark Prein (Project Leader); Ms. Teresita S. Lopez; Mr. Ferdinand Paraguas

**Collaborating Institutions**
*Bangladesh*: national collaborators
*Malati*: national collaborators

**Donor** : ICLARM core funds

**Duration** : 1991 - 1999

**Objectives**
- Improve the way farmers manage their land and water resources through integration of aquaculture and agriculture.
- Develop participatory research procedures for farmers to integrate aquaculture into their farming systems.
- Develop participatory research methods for enhancing farmers' natural resource management skills.
- 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 aquaculture-agriculture (IAA) farming systems has progressed over the past decade. Much has been learned and development imperatives have changed. Exploring sustainable management of natural resources has taken precedence over the pursuit of maximum commodity yields. The focus has moved from systems

developed on research stations to farmer participation in technology development on their farms.

Resource-poor farmers are the target beneficiaries and very few of them culture fish. Methods 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 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**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**

The Research Tool for Natural Resource Management, Monitoring and Evaluation (RESTORE) package was externally reviewed. Refinements were made in the software and manuals. The release of the package is being finalized.

Demonstrations of the package were given to numerous visitors and updated versions of the software, including manuals, were sent to persons or institutions that had received previous versions and those requesting copies for the first time. The total recipients of RESTORE are 150.

**Activities Planned for 2000**

Release of RESTORE version 1.0 along with a revised User Manual and Field Guide.

Establish further working relationships with ongoing projects, to further test and evaluate the RESTORE process and software.

Publications on the potential applications of RESTORE and an information brochure on RESTORE.

Conduct RESTORE training courses at sites that request them.

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

**ICLARM Staff**

Dr. Mark Prein (Project Leader)

**Collaborating Institutions**

*Germany*: University of Kassel (GHK)
*Philippines*: national institutions
*Others*: national collaborators

**Donor** : BMZ/GTZ

**Duration** : October 1994 - June 1999

**Objectives**

- Develop and test a set of sustainability indicators for evaluating the performance of integrated aquaculture-agriculture (IAA) on small farms.
- Formulate a range of simulation models of IAA systems at different levels of integration.
- Disseminate results through workshops, ICLARM publications and peer reviewed journals.
- Train national and project staff in collaborating countries in the application of tools for participatory monitoring and evaluation of integrated systems.

**Background and Justification**

Farm activities can be integrated such that some activities can provide nutrient inputs or ecological services for others. Such integration has the 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 are required to control the development process.

In collaboration with scientists from GHK, indicators of sustainability on IAA smallholder farms need to be formulated and evaluated. Multivariate statistical analyses of farm datasets and indicators will identify key relationships and governing variables. Dynamic simulation models of

representative farms will enable testing and characterization of the indicators in terms of sensitivity and precision.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | H |
| Gender | L | Anticipatory Research | H |

**Current Status**

Based on data from the Philippine worksite, staff of GHK refined a model characterizing a rice-fish culture system under subsistence level rice and fish production. This dynamic simulation model is available within the STELLA modeling environment. A set of higher level indicators was formulated, together with a framework for defining and identifying indicators based on several criteria founded on the Orientors approach developed for this purpose at the Environmental Systems Research Center at GHK.

**Activities Planned for 2000**

Publish project results. Project completed in June 1999.

## Project 3.4
## Research for the Development of Sustainable Aquaculture Practices

**ICLARM Staff**

Dr. John Grover (Project Leader); Mr. Debashish Mazumder (Research Associate); Dr. Aminul Islam (Consultant), Dr. Wajed Shah (Consultant)

**Collaborating Institutions**

*Bangladesh*: Bangladesh Fisheries Research Institute (BFRI); nine local nongovernmental organizations (NGOs)

**Donor** : USAID

**Duration** : June 1993 - September 2000

**Objectives**

- Develop sustainable, low-external input integrated aquaculture-agriculture practices that fit into farming systems of Bangladesh, in collaboration with national aquatic research systems.
- Disseminate the improved technologies to a large number of smallholder farm households and monitor the efficiency of this process in collaboration with local NGOs.
- Monitor the impact of the adoption of integrated aquaculture on household income and fish supply.

**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 underutilized or unutilized. Capital intensive aquaculture technologies are not suitable for adoption by resource-poor farmers. The project has been assisting the national research and development institutions and a number of NGOs in developing low external input, low-cost, integrated aquaculture-agriculture (IAA) practices that can be adopted by the rural poor, using mostly on-farm resources.

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

Dissemination of results is done through a technology transfer process in collaboration with NGOs. This provides feedback from different agroecological regions. The project also addresses gender issues through the involvement of women in pond aquaculture. This enables women to contribute to household income, resulting in their empowerment. The 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.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

Dr. John Grover was appointed Project Leader in March 1999.

An on-farm weed research trial was initiated with farmers in the Mymensingh area, in collaboration with BFRI. This initiative is the result of previous experience indicating that the system of gathering and feeding ponds with locally grown weeds and grasses, though resulting in increased fish yields, often meant more work than the farmers were will-

ing to put in, particularly as vegetation became scarce in the dry season. Currently, a trial involving 47 ponds is in progress using three different feeding practices and three different stocking schemes, centered around grass carp as the primary consumer of vegetation added to the ponds. Weed supplementation with azolla, a nutritious floating aquatic plant grown in ponds, is being evaluated as a way to reduce the requirement of weeds to sustain fish growth. A brief training program was held for participating farmers, pond sites were visited and measured, and a field record-keeping system is put in place.

A new initiative on pen culture of grass carp is under development with a United States Agency International Development (USAID)-sponsored project for floodplain fisheries. It will be an exploratory trial of the poduction of grass carp in small cages. The area selected is Hail Haor, a large, seasonally flooded area in northeastern Bangladesh. Aquatic vegetation will be harvested to feed the grass carp.

*NGO Support*: USAID required that production technologies developed be widely promoted around the country. It was agreed that NGO had the best grassroots support systems to work with rural people. Following a screening and negotiation process, memoranda of agreement were signed with seven NGOs to provide training in fish production methods to low income people in their respective target areas. ICLARM supported the NGOs in this effort by training of trainers and support and monitoring of their subsequent activities. Demonstrations on rice-fish or taro-fish production systems have been carried out with two additional NGOs.

Two full-time consultants were hired by ICLARM to assist in this work with the NGOs. To assist in the training of trainers with the NGOs, a training manual was developed that outlines the principles of aquaculture and explains nine different approaches to aquaculture that might be adopted by pond operators. The training phase of ICLARM's effort is now completed (151 NGO trainers trained) and implementation by the NGOs is in progress.

The NGO effort was spread over much of the country. Six thousand pond operators received training and conducted aquaculture demonstrations as a result of project support. In turn, these cooperating farmers, through their production demonstrations and field days, are expected to reach nearly 175,000 co-farmers, almost half of whom are women. In the 1,700 acres of demonstration ponds, if yields are increased by 1,000 lb/acre (ca. 1,000 kg/ha) on the average, there would be a net increase of about 1,700,000 lb (770,000 kg) of fish. The potential benefits from expanded adoption and repeated application of these improved production methods are substantial.

Our monitoring and feedback information system will give us specific information about the benefits to rural communities. A total of 7,000 individual pond record books have been printed and distributed as the core resource in evaluating the actual aquaculture practices adopted and their impact on participating pond operators and their families. We also hope to gain insights into the effectiveness of different NGO approaches in disseminating this technology. Besides the production and individual benefits that should come from this effort, we regard the process as a laboratory in which useful information will be generated to guide future research and outreach programs.

*Other Activities*: The quarterly ICLARM publication *Naga*, is now sent to more than 270 agencies, libraries and fishery workers in Bangladesh using a distribution list maintained by the project.

Data on the geographic distribution of various NGO efforts have been shared with the Cooperative for Assistance and Relief Everywhere, Inc.-Geographical Information System Project to be included in their database maintained to provide information on the overall economic growth and agricultural development activities to USAID.

USAID has a continuous feedback on our work through their observer on training and monitoring activities.

**Activities Planned for 2000**

Continue linkages with government organizations and maintain an active network of collaborating NGOs for training in IAA technology and in RESTORE.

Monitor the NGO outreach efforts and continue field demonstrations. As all the results from pond harvests were not available in time to complete a review of the socioeconomic impact before the end of 1999 and the current funding authorization, a nine-month project extension to September 2000 was approved. This will provide for a thorough analysis of the results, further adoptive research, another round of NGO participation, and a period to formulate a new project.

## Project 3.5
Aquaculture Research and Development for Smallholder Farms in Southern Africa

**ICLARM Staff**
Dr. Daniel Jamu (Project Leader); Dr. Randall E. Brummett; Mr. Issa Jaffali; Mr. Francis Kachala, Mr. Foster Makuwa; Mr. Alim Monjeza

**Collaborating Institutions**
*International/Regional*: Aquaculture for Local Community Development Programme, Food and Agriculture Organization (FAO)
*Malati*: Department of Fisheries (DOF); Ministry of Agriculture and Livestock Development; University of Malati

**Donors** : DANIDA; USAID; ICLARM core funds

**Duration** : 1996 - 2000

**Objectives**
- Study integrated aquaculture-agriculture (IAA) technology adoption and dissemination, and measure the impact on smallholdings.
- Develop sustainable management practices for enhanced aquatic productivity within the context of rural subSaharan Africa.
- Strengthen national capacity to develop and disseminate sustainable aquaculture technology.
- Study the aquaculture development process and advise policymakers on how to maximize the impact of development efforts.

**Background and Justification**
The agricultural economy of the subSaharan region is dominated by smallholder farmers who operate at close to subsistence level. With a growing population, the productivity of these farming systems is increasingly unable to meet food security needs. At the same time, fertilizer and other subsidies to agriculture in the region are being withdrawn as the governments adopt structural adjustment. With inadequate capital to purchase more expensive fertilizer, smallholder farmers must rely on integrated resource management (IRM) within the farming system itself in order to maximize the use of available nutrients.

IRM's theoretical capability to improve productivity, increase sustainability and decrease waste has been accepted as a realistic approach to reducing rural poverty and improving food security in subSaharan Africa. Proponents of this approach claim that integrated farming can improve productivity and sustainability and even rehabilitate degraded rural landscapes. Unfortunately, farm level field data which support this premise are restricted to a few case studies involving a relatively small number of farmers.

IRM must be adopted by a large number of small farmers if its impact is to be widely felt. Current thinking is that the involvement of farmers from the beginning of the technology development process will help in overcoming problems of adoption. Evidence exists that the approach is useful if it can be adapted to accommodate the wide diversity of small farming systems.

ICLARM has been studying the potential of, and problems associated with, the farmer participatory introduction of aquaculture into existing farming systems, based on an IRM approach in Malati and Ghana for more than 10 years. This has been done with a view to establishing the criteria upon which a transition from destructive to sustainable agriculture can be made. Through dozens of on-farm research projects, approaches to technology development, farmer participation and impact analysis have been identified. Collectively, these components form a methodology which can now be tested for its effectiveness as a farmer participatory technology development and transmission mechanism.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
Dr. Daniel Jamu was appointed Project Leader and Officer-in-charge in January 1999.

*Research Extension Teams (RET) for IAA*: The new technology development and transfer approach involving farmer-led research was initiated at the Malati National Aquaculture Center (NAC). Two trials on fingerling production techniques and inputs have so far been implemented. Discussions to identify other research topics with eight farmers are underway. Monitoring of impact among participating farmers using the RESTORE software is under progress. Concepts for posters and slide

shows to complement the RET activities are currently being developed. A newsletter (NACNews) was launched to widely disseminate results from RET activities. The newsletter has 120 subscribers in the Southern African Development Community (SADC) region and is produced quarterly by NAC with technical and financial support from ICLARM. Links have been established with the World Aquaculture Society so that World Aquaculture Magazine articles relevant to the mission of the newsletter can be reproduced in the NACNews without seeking copyright permission from WAS.

*Integrated Watershed Management*: A study to investigate the relationship between fish (*Barbus paludinosus* and *Barbus trimaculatus*) reproduction success in Lake Chilwa and the status of its watershed was conducted between January and June 1999. Baseline data on *Barbus* migratory patterns, reproductive success and stream water quality in two influent streams draining farmland and an urban area were collected during the study period. The results showed that there were differences in water quality and in the composition of *Barbus* species between the two influent streams. The influent stream draining the urban environment had lower water quality and consisted predominantly of *B. paludinosus*, a species more resistant to poor water quality. *B. trimaculatus*, a species less resistant to poor water quality, was dominant in the influent stream draining the typical farmland. The results further showed that changes in electrical conductivity, total suspended solids and, to a smaller extent, dissolved oxygen concentrations were the major cues triggering spawning and migration of *Barbus*. Results from this study and other studies commissioned by the Danish International Development Assistance (DANIDA) under the Lake Chilwa Wetland and Catchment Project will be synthesized to produce a State of the Environment report on Lake Chilwa and its watershed. A draft report titled Fish Reproduction in Lake Chilwa with Special Emphasis on *B. paludinosus* and Status of the Watershed was presented to the Lake Chilwa Wetland and Catchment Project and a second version of this paper is under preparation for submission to a peer-reviewed publication.

*Mbowe Sustainable Ecofarming Project (MSEP) Monitoring and Evaluation*: Monitoring of the impact of MSEP ecological farming training center on improvements in farm productivity and sustainability (economic and ecological) was initiated in January 1999. Twelve farmers who participated in the first training course organized by MSEP are currently being monitored using RESTORE. To acquaint MSEP trainees with IAA technology, a study tour organized by ICLARM and funded by DANIDA was conducted in southern Malati. The tour consisted of 21 farmers. Three of the 12 farmers participating in the RESTORE monitoring program incorporated fishponds in their farm system upon return from the study tour and four other farmers have requested technical help on pond construction. Initial results in the first half of 1999 show that all farmers being monitored expanded their landholdings by cultivating virgin forests. Results from demonstration plots comparing the performance of maize in no input controls, inorganically and organically fertilized plots showed that there were significant differences in maize yield between no input control, inorganically fertilized and organically fertilized fields (organically fertilized maize > inorganically fertilized maize > no input control). Monitoring was expanded to include 20 farmers who participated in a second training course at the end of July 1999. A proposal to extend the monitoring and evaluation exercise was accepted and DANIDA will provide support to MSEP and ICLARM for another year.

*Information/Outreach*: Work on linking the NAC information center with other similar facilities in SADC is continuing. This work is being done in collaboration with the Icelandic International Development Agency, FAO, Malati DOF and the Bunda College of Agriculture, University of Malati, which is the lead institution for aquaculture training in the region.

**Activities Planned for 2000**

Expand the pilot phase on the implementation of RET approach to cover 300 farmers in the southern region of Malati.

Continue monitoring activities at MSEP and initiate these for the Lake Chilwa Wetland and Catchment Management Project.

Prepare a technical report on MSEP and submit a manuscript on fish reproduction in Lake Chilwa to a peer-reviewed journal.

Conduct an IAA technology study on the identification of factors regulating nitrogen retention in IAA systems.

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

**ICLARM Staff**
Dr. Mark Prein (Project Leader); Ms. Teresita S. Lopez

**Collaborating Institutions**
*Philippines*: Community Forestry Project-Quirino (CFPQ); Department of Environment and Natural Resources; Peoples Organizations of barangays Baguio Village and Don Mariano Perez

**Donors** : BMZ/GTZ; Philippine/Germany CFPQ

**Duration** : July 1996 - December 1999

**Objectives**
- Conduct a rigorous assessment of the usefulness of farm ponds for aquaculture and the potential for integration of ponds and ricefields into existing farming systems within the forest border zone management efforts of CFPQ.
- Study the gender impact of integrated aquaculture-agriculture (IAA) on adopting and non-adopting households in the CFPQ project area.

**Background and Justification**
The CFPQ is a development project of bilateral cooperation between the Philippines and Germany. Its aims are to contribute to the sustainable management of 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 area and to safeguard the livelihoods of the upland population. The project operates under the premise that small communities can independently conserve and manage their local resources and benefit from them. The project operates in five barangays in the municipalities of Diffun, Maddel and Nagtipunan. The project area covers 23,700 hectares, of which 19,300 are still thickly forested, with a population of 3,500 persons in 660 households.

In 1993, CFPQ promoted the establishment of small farm reservoirs above terraced ricefields. This 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 now depend on this source for fish for home consumption, with the surplus given to neighbors. Few nutrients are added to the ponds. These are mainly leaves and rice hulls fed directly to the fish.

Existing operations can be improved for enhanced production from existing farm ponds (mini reservoirs) through better management and use of on-farm residues as nutrients. A 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 performance and benefits.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
Analysis of data of 30 farm households in two barangays was completed over two project years and one pre-project recall year. A final report was prepared and submitted to CFPQ/GTZ management.

Although the net cash income per farm from fishponds was only PhP* 114 on average, representing only 0.5% of whole-farm income in 1997/98, this can be improved with an assured water supply. Net cash income from the fishpond improved in the third year of the monitoring period, i.e., it turned positive from the negative net cash incomes registered in the first and second years. The negative income in the initial years was due to the cost of constructing or rehabilitating the fish pond. Once the infrastructure was in place, the returns from fish production offset the operational costs.

A large proportion of fish production was valued as non-cash income during the three-year monitoring period. In the first and second years, around 86% of fish harvested was consumed by the farm household. In the third monitoring year, 76% of the fish harvested was given away. Fish carried a high cultural value for the villagers in upland com-

*April 2000: US$1 = PhP40.

munities being used for feast days and payment for labor.

It can be concluded that farmers have internalized the benefits of bioresource recycling. The total recycling counts of the 30 farmers increased from 44 to 142 over the three-year monitoring period. Before the project, less than half of these farmers practiced recycling. Moreover, in the last year farmers utilized as many as 18 types of on-farm materials for recycling, compared to only eight types before the project. The use of on-farm materials reduced the need for chemical fertilizers for agricultural crops.

There is a need to further reinforce aquaculture activities in the area. This should include training in fish culture and farm production monitoring as systems can be improved further. More training in hatchery and culture methods is needed.

Since fish culture is only one aspect in the farming systems of upland farmers, there is a need to examine how fish culture and IAA practices integrate with other development initiatives in the area.

Recommendations on further researchable issues are: improvement of pond productivity; hatchery and local fry production; addition of other species; biodiversity issues; rice-fish culture; water use budgets; assessment of the importance of the proximity of the pond to the homestead; adaptation of the aquaculture system to other farming systems, assessment of the farmers' learning curve; studies on the possible transitional pathways to market orientation; farmer perception on fishpond value and on risk aversion; and an analysis of the effects of IAA introduction on traditional gender roles, sharing of labor inputs and its benefits.

Several publications in peer-reviewed journals and books are in preparation.

A study on the gender impact of IAA among adopters and non-adopters in the project area is being conducted as part of a Ph.D. thesis with the University of the Philippines in Los Baños. Data collection on 30 adopter and 30 non-adopter households (control group) was completed in November 1999.

**Activities Planned for 2000**

Publish a technical report and articles for journals and newsletters.

Complete a Ph.D. thesis on gender analysis of IAA and prepare it for publication.

## Project 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; Mr. Ferdinand Paraguas

**Collaborating Institutions**

*International/Regional*: International Rice Research Institute

*Bangladesh*: Bangladesh Fisheries Research Institute; Bangladesh Rice Research Institute; Proshika Manobik Unnayan Kendra (PMUK)

*Vietnam*: Research Institute for Aquaculture Nos. 1 & 2; Vietnam Agricultural Science Institute

**Donors** : IFAD; Ford Foundation

**Duration** : June 1997 - May 2000

**Objectives**

GENERAL

- Develop a sustainable resource management system for 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 to increase the incomes of rice farmers.

SPECIFIC

- Make a comparative analysis of alternative resource management strategies in flood-prone ecosystems.
- Develop, using participatory approach, viable income-generating technical options and their field-testing and validation.
- 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**

Subsistence rice farmers are among the poorest socioeconomic 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 ecologically sustainable farming systems, at its present low yield level the flood-prone ecosystem cannot supply adequate food to meet the growing demand. As a result, farmers are compelled to look for additional sources for increasing food availability. Some of their activities have adversely affected the environment. There is an urgent need to identify high yielding, yet sustainable, technological and resource management options for the flood-prone ecosystems to improve the livelihood of people dependent on them.

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

The flood-prone ecosystem has considerable potential for increased food production through the integration of fish culture with deepwater rice farming. Preliminary research has shown that fish production in deepwater ricefields is 1-2 t/ha/year compared to 50-200 kg/ha/year in irrigated fields. This is because of higher stocking densities, the abundance of natural food, the better quality of water and the absence of pesticides and herbicides associated with the cultivation of high-yielding rice varieties. The flood-prone areas remain submerged for four to six months of the year. The vast waterbodies and the rice canopies that result provide natural habitats for various aquatic resources including wild fish and shrimp. The periodic deposit of silt and decomposition of organic matter favor the growth of flora and fauna. The abundance of natural organisms favors the cultivation of fish for four to five months of the year.

During the dry season, land ownership is fixed according to tenure arrangements. At times of floods and where land is not bounded, fish are a community property. Poor communities should sustainably manage common property resources over which they have effective control.

Resource management approaches, such as IRM 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 and 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.

These 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 ecosystems of Bangladesh and Vietnam.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

In Bangladesh, rice-fish experiments are ongoing in five sites in the three selected areas representing major floodplains (Meghna, Brahmaputra and Ganges rivers), and are implemented mainly through our NGO partner, PMUK.

Institutional arrangements for community-based rice-fish culture for the three project sites were developed and are being tested at new sites with new communities. The management groups contain both land-owning farmers and landless farmers/fishers who used common property fishing prior to the initiation of the experiment. The institutional arrangements in the previous trials worked well, and there were no social conflicts arising directly from the activities introduced by the project.

In Vietnam, experiments are being conducted in several sites in the Red river delta, and in one site in the Mekong delta. In the Red river delta, the fish yield (cultured concurrent with rice) in the previous year's trial was about 600 kg/ha in one site and about 1,150 kg/ha in another site, and the profit obtained from rice-fish culture was double that of single rice culture. In the Mekong delta, fish yield, cultured between two rice crops, was low (about 200 kg/ha), but the profitability was high. Institutional arrangements worked well in all the sites in the Red river delta, whereas

farmers in the Mekong delta have strong reservations about communal sharing arrangements.

The 1999 Interim Project Review Workshop was held in Hanoi, Vietnam, from 12 to 15 October, with participants from ICLARM and the International Fund for Agricultural Development.

**Activities Planned for 2000**

Complete second-year trials in all sites.

Analyze survey and experiment production data.

Analyze institutional and organizational arrangements in Bangladesh and Vietnam.

Hold a concluding workshop in Bangladesh, synthesizing project results and presenting recommendations.

# 4. POLICY RESEARCH AND IMPACT ASSESSMENT PROGRAM (PRIAP)

## ECONOMIC MONITORING AND EVALUATION OF DEVELOPING COUNTRY FISHERIES

### Project 4.1
Valuation and Policy Analysis for Sustainable Management of Coral Reefs

**ICLARM Staff**
Dr. Mahfuzuddin Ahmed (Project Leader); Ms. Gloria Magnayon-Umali; Ms.Mary France Rull

**Collaborating Institutions**
None

**Donors** : ICLARM core funds; SIDA

**Duration** : October 1998 - December 2000

**Objectives**
- Review and assess valuation techniques that are potentially applicable to valuing coral reef systems.
- Compile related valuation studies and collect information on values estimated through nonmarket techniques.
- Identify goods and services provided by coral reefs and classify them according to the type of benefit they provide.
- Obtain values for coral reef systems through demand estimation using nonmarket valuation techniques and/or benefit transfer analysis.
- Analyze alternative management and policy scenarios, based on the full range of benefits provided by the coral reef system.
- Enhance the scope of ReefBase by incorporating nonmarket values into the existing database.

**Background and Justification**
Economic valuation has emerged as a recognized tool for resource allocation that promotes sustainable resource management. While the value of marketed goods and services is easily measured in monetary terms, nonmarket valuation techniques are used to estimate the value of benefits such as habitat protection and resource conservation.

Many human activities cause coral reef degradation. Destruction of coral reefs due to sediment and nutrient pollution, destructive fishing methods, coral mining and other human activities are continuing unabated in many parts of the world. Open access to the resource and the lack of collective responsibility among users invariably result in resource overexploitation and environmental degradation.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
The University of the Philippines in the Visayas and ICLARM completed a collaborative research that documents the benefits provided by the coral reefs of the Taklong Island National Marine Reserve. The study estimates nonmarket values and analyzes management alternatives based on the full range of benefits provided by the coral reefs.

Collection of literature on valuation of coral reefs done elsewhere is continuing. The methods in the studies will be used as a basis for reviewing nonmarket valuation techniques for coral reefs. Economic values estimated by the individual studies will constitute the socioeconomic module of ReefBase.

**Activities Planned for 2000**
Continue the review of valuation techniques.

Produce a technical report on the application of nonmarket valuation techniques and benefit transfer analysis in the estimation of benefits from coral reef systems, including results of the Taklong Island study.

### Project 4.2
Database for the Assessment of Developing Country Fisheries

**ICLARM Staff**
Dr. Mahfuzuddin Ahmed (Project Leader); Ms. Rowena Andrea V. Santos

**Collaborating Institutions**
*International/Regional*: Food and Agriculture Organization of the United Nations (FAO); Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in Asia and Pacific Region (INFOFISH); Network of Aquaculture Centres in Asia-Pacific (NACA)
*Others*: to be identified

**Donor** : ICLARM core funds

**Duration** : 1997 - 2000

**Objectives**
GENERAL
- Establish and maintain a database for analyses of policies, technological developments, market movements and institutional changes in developing country fisheries.

SPECIFIC
- Develop and adapt databases for impact assessment and research priority setting.
- Create, maintain and update a secondary database combining biophysical and socioeconomic information on world fisheries with special reference to developing country fisheries.
- Make projections of and forecast trends in the fisheries sector in order to formulate research and development priorities.

**Background and Justification**
Impact assessment and policy analyses require a wide range of historical and comparative data. Data are needed for assessment of developing country fisheries and to guide policy measures, technological development and institutional change.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | L |
| Equity | L | Systems Approach | H |
| Gender | L | Anticipatory Research | H |

**Current Status**
Fisheries and aquaculture production statistics were compiled using FAO's State of the World Fisheries, Aquaculture, FishStat Plus, AquaStat and other related literature. A secondary database was created and the data downloaded and encoded in some cases. The data were categorized by country and aquatic system, i.e., inland and marine systems. These datasets have been extensively used for ICLARM's Strategic Plan 2000-2020.

A collaboration with INFOFISH on the project Database on Prices and Market for Fish and Seafood Products in Developing Countries was initiated on 1 November 1999, to run until 30 June 2000. This project will strengthen collaboration between the two institutions on sharing and disseminating information about fish species and products. Classification by price, market and market share will benefit small-scale suppliers and producers of various fish and seafood products in developing countries.

Two proposals have been prepared and submitted to potential donors. These are Assessment and Monitoring of Supply and Demand for Fish and Seafood Products in Asia submitted to the Asian Development Bank (ADB) and Assessment and Monitoring of Supply and Demand for Fish and Seafood Products in Africa submitted to the African Development Bank.

Discussions were held with the International Food Policy Research Institute (IFPRI) on strategies and workplans for integrating fish into the world food model, IMPACT. Discussions were also held with FAO on the possibility of collaboration on this. Collaboration with both IFPRI and FAO is anticipated in 2000.

**Activities Planned for 2000**
Continue compilation of fishery statistics data from existing literature.

Continue interaction with INFOFISH for data gathering and updating.

Present submission (by INFOFISH) of project terminal report by mid 2000.

Report preliminary model results for fisheries.

Gather data and derive parameters for the IMPACT model jointly with IFPRI and in collaboration with FAO and INFOFISH.

## Project 4.3
## Socioeconomic and Bioeconomic Analysis of Coastal Fish Stocks in Asia

**ICLARM Staff**
Dr. Mahfuzuddin Ahmed; Ms. Rowena Andrea V. Santos

**Collaborating Institutions**
*Bangladesh*: University of Chittagong
*India*: Central Marine Fisheries Research Institute
*Indonesia*: Directorate of Fisheries Resource Management
*Malaysia*: Department of Fisheries
*Philippines*: University of the Philippines in the Visayas
*Sri Lanka*: Ministry of Fisheries and Aquatic Resources Development
*Thailand*: Department of Fisheries; Southern Marine Fisheries Development Center
*Vietnam*: Research Institute for Marine Products

**Donor** : ADB

**Duration** : 1998 - 2001

**Objectives**
- Provide socioeconomic information for developing strategies and action plans for sustainable utilization of coastal fish stocks in Asia.
- Present an overview of the socioeconomic status of coastal fisheries and analyze the importance of the fisheries sector to national economies.
- Analyze the socioeconomic condition of the small-scale fishery sector and recommend policies for economic advancement.
- Analyze the productivity, cost efficiency and economic viability of both small-scale fisheries and commercial fisheries, and indicate a better fleet composition in relation to available fishery resources.
- Analyze the relationship between catch and fishing effort (or revenue and costs).
- Identify a set of socioeconomic variables for integration into the database to be developed under the project on Sustainable Management of Coastal Fish Stocks in Asia.

**Background and Justification**
This project is part of the project on Sustainable Management of Coastal Fish Stocks in Asia (Project 2.14) in which several components on biophysical analysis of coastal fish stocks are conducted by ICLARM. The project covers Bangladesh, Indonesia, India, Malaysia, Philippines, Sri Lanka, Thailand and Vietnam.

An adequate information base on the economics of the fishing industry is as crucial as information on ecological processes and biological characteristics of fish populations. It is necessary to analyze the interaction between fish stocks and the fishing industry, as the management of fisheries is primarily a management of the industry rather than of the fish stock itself. This will lead to management decisions that are not only biologically sustainable but also economically efficient.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Gender | M | Systems Approach | M |
| Equity | H | Anticipatory Research | H |

**Current Status**
The proceedings for the Regional Workshop on Fisheries Economics and Management held from 24 November to 1 December 1998 in Hat Yai, Thailand, were finalized and submitted to the Asian Development Bank. This report is part of the semi-annual reporting of the project.

Visits were made to each of the eight countries. Supervision was provided on data collection and analysis. These include information on socioeconomics, fleet operational dynamics and bioeconomic modeling from each country. The data collected are being analyzed and summarized for technical reports. The schedule of reports submitted in 1999 by the collaborators is given below.

A paper on the dependence of Asian economies on fisheries is under preparation.

Inputs on the socioeconomic component were provided to the Fisheries Resource Information System and Tools.

Schedule of reports submitted by collaborators in 1999.

| Countries | Socioeconomic profile | Fleet operational dynamics | Bioeconomic modeling |
|---|---|---|---|
| Bangladesh | 31 October | 31 October | 30 November |
| India | 15 October | 31 October | 31 October |
| Indonesia | 31 October | 31 October | 31 October |
| Malaysia | 15 November | 30 November | 30 November |
| Philippines | 30 November | 30 November | 30 November |
| Sri Lanka | 30 October | 30 November | 30 October |
| Thailand | 30 September | 30 October | 15 November |
| Vietnam | 15 October | 15 October | 15 November |

**Activities Planned for 2000**

Prepare a paper on The Increasing Dependence of Developing Asian Economies on Fisheries. This will use the information provided by collaborators.

Provide technical assistance in organizing a regional consultative planning and technical workshop tentatively set for September/October 2000 in Penang, Malaysia.

Provide technical inputs to national and regional fisheries resources management and planning, and to the formulation of national development strategies and action plans.

Start the preparation of the terminal socioeconomic report as part of the final project report, for submission to the donor by 2001.

## Project 4.4
## Assessment of the Contribution of Aquatic Resources in the Mekong River Basin to Food and Nutritional Security of the Fishing and Farming Population

**ICLARM Staff**

Dr. Mahfuzuddin Ahmed (Project Leader); Ms. Gloria Magnayon-Umali; Ms. Rowena Andrea V. Santos

**Collaborating Institutions**

*International/Regional*: International Institute of Rural Reconstruction (IIRR)
*USA*: Institute for Development Anthropology
*Vietnam*: Cantho University (CTU)

**Donor** : Oxfam America-SEARO

**Duration** : May 1998 - October 1999

**Objectives**

GENERAL

- Provide baseline data on the current state of fisheries resources and their role in household food security. Assess and monitor effects of local, national and transnational intervention on fisheries in the Mekong basin and the consequent impact on people/communities that are dependent on these resources.

SPECIFIC

- Assess the value of aquatic resources in ecological, social and economic terms.
- Provide extensive and in-depth baseline information on the contribution of aquatic resources to the food security and livelihood of the farming and fishing population.
- Estimate household benefits and consumption patterns for fish and other aquatic resources.
- Build national and regional capacity to assess and monitor the economic, social and ecological values of resources through hands-on training.

**Background and Justification**

As the largest freshwater source in the region, the Mekong river provides food, water and economic sustenance to more than 50 million people. Infrastructure development and planning has emphasized construction projects without assessment of their impact on livelihoods, community life and the environment. For example, the Mekong Basin Development Plan Insight Workshop (April 1996) focused on the technical aspects of plans with little consideration of the social and environmental impacts. There is evidence of the deleterious impact of other development activities on fish production and farming.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

A report entitled Reconnaissance of Two Hamlets in the Mekong Delta of Vietnam was submitted to the donor and collaborators in May 1999. It provides a description of the two project sites, Loi Du-B, Cantho province and Binh An-Thanh Loi, An Giang province in the Mekong delta. It is based on results from agroecosystem mapping and informant surveys (on institutional and management systems and market attributes) conducted in July and October 1998.

Results of the household surveys from Loi Du-B and Binh An-Thanh Loi were encoded and compiled. Data are being processed for analysis. Preparations for the project terminal report have been initiated.

Training of CTU staff on socioeconomic research and database management was conducted from 16 to 26 March 1999 in IIRR, Philippines. The objective was to review and discuss methodologies for socioeconomic research and commonly used statistical tools, such as SAS, and to provide hands-on training on data encoding and analysis.

The Third Partners' Meeting was held from 20 to 22 October 1999 in Cantho University. Preliminary results of data gathered from the household survey were presented. Past and future activities of the project were also discussed. A project proposal for the resources, ecology and socioeconomic assessment of one village in the Mekong delta was conceptualized. This is to commence by the second quarter of 2000, upon approval by the donor.

**Activities Planned for 2000**

Complete data processing and database management.

Finalize project terminal report and recommendations.

Submit project proposal entitled Community Assessment, Management and Monitoring of Local Aquatic Resources for Improved Food Security in the Mekong Basin - Mekong River Basin Research and Capacity Building Initiative - Phase 2 by the first quarter of 2000.

## AQUATIC RESOURCES PLANNING AND IMPACT ASSESSMENT

### Project 4.5
Impact of Giant Clam Productivity Enhancement Research

**ICLARM Staff**

Dr. Mahfuzuddin Ahmed

**Collaborating Institutions**

*Australia*: Department of Agricultural and Resource Economics, University of New England

**Donor** : ICLARM core funds

**Duration** : 1997 - 1999

**Objectives**

GENERAL

- Assess the impact of research and technology development for giant clam mariculture in the Indo-Pacific region.

SPECIFIC

- Estimate the effects of giant clam breeding and stock enhancement research on income and output stabilization; productivity of marine and coral reef systems; and risks to a stable supply of food and income for coastal communities.
- Provide a framework for monitoring farming trials of *Tridacna derasa*, determine its potential for adoption, and provide *ex ante* assessment of productivity, income and marketing.
- Develop a biological model that captures the relationships inherent in the marine production system for cultured giant clams.
- Develop a bioeconomic model that links the biological model to market conditions.
- Identify and demonstrate the possible applications of the bioeconomic model in the evaluation of:
  - optimal management strategy for the village farmer facing three different markets.
  - effects of marketing, extension and biological research on the profitability of village farms.
  - possible losses to the village farm due to third party activities.
- Investigate the factors affecting the rate of adoption of giant clam mariculture by village farmers.

**Background and Justification**
Giant clams were listed under the Convention on International Trade in Endangered Species in 1983, prohibiting international trade in giant clam products obtained from wild stocks. ICLARM has devoted significant resources over the last decade to developing breeding and farming technologies for enhancement of production of giant clams in the South Pacific region. Initially, the objective of the research was to develop aquaculture techniques to restock reefs where giant clams had become extinct, thereby providing coastal communities with giant clam stocks sufficient for their subsistence needs. However, the interest in and prospects for commercial giant clam aquaculture were greater than for subsistence aquaculture. The objective has expanded to include the development of commercially viable giant clam aquaculture. However, despite favorable research results, commercial giant clam aquaculture has not yet been well adopted by village farmers. There is a need to assess the impact of this research and development investment to determine the research benefits as well as to provide guidelines for future research and development initiatives.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | H | Systems Approach | M |
| Gender | H | Anticipatory Research | M |

**Current Status**
Recent work on this project has concentrated on applying the bioeconomic model developed for giant clam farming in the Solomon Islands to problems of research interest.

Technical papers on the application of the model for submission to the International Journal of Aquaculture Economics and Management are in preparation.

A paper by Hean et al. titled The Potential Emergence of Commercial Giant Clam Mariculture and the Need for Policy Analysis has been prepared for publication in a scientific journal.

Two papers were presented in international conferences in 1999: (i) Management Strategies for Giant Clam Mariculture in Solomon Islands, presented at the 43rd Annual Conference of the Australian Agricultural and Resource Economics Society in Christchurch, New Zealand, 22 January 1999; and (ii) Giant Clam Farming and the Effect of Seawater Turbidity on Village Farmer Profits, presented at the World Aquaculture Society Conference in Sydney, Australia, 27 April 1999.

**Activities Planned for 2000**
Present a third application of the model, entitled Evaluating Returns to Research and Development of Giant Clam Farming.

Summarize technical project reports into an article for submission to a scientific journal.

## Project 4.6
## Developing an Appropriate Fishery Extension System for Transfer of Technology Based on Evaluation of Existing Alternative Extension Approaches

**ICLARM Staff**
Dr. Paul Thompson (Project Leader); Dr. Parvin Sultana; Mr. Nuruzzaman; Mr. A.K.M. Firoz Khan; Mr. Hasib Khandler Mahbub; Mr. Sabinoy Chakma; Dr. Mahfuzuddin Ahmed

**Collaborating Institution**
*Bangladesh*: Department of Fisheries (DOF)

**Donor** : IFAD

**Duration** : October 1997 - September 1999 (extended to June 2000)

**Objectives**
- Evaluate the sustainability of fish culture based on technology transfer and extension efforts.
- Make a comparative study of the efficacy of extension services with and without credit availability.
- Compare the above with the extension approaches and impacts of other pond fish culture programs in Bangladesh.
- Make recommendations on extension methods based on these comparisons.
- Make a whole-farm analysis of fish culture input-output relationships.

**Background and Justification**
In collaboration with the Government of Bangladesh, ICLARM carried out a project on the Socioeconomic Impact of Fish Culture Extension Program on the Farming Systems of Bangladesh

in the Gazipur district of Bangladesh during 1990-1994.

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 extension project and an impact survey near the end, to measure relative changes with and without the extension program. The impact survey showed a substantial increase in production of carp and tilapia in the 215 ponds where the technology was adopted. It also indicated a return on investment (ratio of net income to total cost) for disease-free carp polyculture of 500%.

The project successfully introduced low-cost fish culture technology. 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 effort. This study is designed to assess the long-term sustainability of the technologies introduced and the extension approach adopted, three years after the intensive extension effort ended. It covers the Mymensingh Aquaculture Extension Project, which has a higher input approach to promotion of aquaculture, and the original control areas in Sreepur to provide a comparison with the standard DOF extension programs. These are compared to the standard DOF extension programs in operation through the trickle-down approach to fish culture extension at the thana level, and enhanced extension systems through intensive training under the Northwest Aquaculture Development Project. Recommendations for extension assessment methodologies will be developed for the DOF and others involved in fish culture projects. Whole-farm models including aquaculture will be refined. This will expand existing models and involve detailed farm household surveys. It will also involve monitoring of inputs and outputs, nutritional changes and employment and income by gender.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | M |

**Current Status**

Regular monitoring of a sample of 69 pond-operating farm households and their fish consumption in Kapasia has been completed. In the same area, traders from 15 fish markets were surveyed for comparison with an earlier survey conducted in 1991.

A series of case studies was undertaken to investigate the sustainability of other aquaculture technologies in Kapasia.

In the Mymensingh Aquaculture Extension Project area, 120 pond operators were surveyed. The objective of the survey was to assess the extent and continuity of the aquaculture technologies introduced by the project to the operators.

In two other areas, Brahman Baria and Barisal districts, 180 pond operators were surveyed to assess the continued use of aquaculture technologies introduced under the Thana Level Fisheries Extension Project.

In the Northwest Fisheries Extension Project area, 30 fry traders (trained as local extension agents), 30 of their clients, 30 pond operators in model villages and 30 control pond operators were surveyed.

Initial analysis indicates that in Kapasia and Sreepur, most pond operators own more than one hectare of land. Participants in previous ICLARM projects did not differ from nonparticipants in landholding size or in house structure. Most ponds were operated and owned by one household, though about 30% of ponds larger than 0.06 ha were operated by more than one household. The percentage of ponds stocked in 1998 had increased, compared with 1990. The increase did not differ significantly between previous participants (61% to 90%) and the two comparison samples of neighboring pond operators in Kapasia (61% to 89%) and pond operators in the control area of Sreepur (70% to 85%). By 1998 fish culture had become widespread in the project area, but it had also developed in the control area without any specific extension effort. The project brought fish farming a few years earlier to Kapasia but has not resulted in a higher incidence of aquaculture.

It was expected that the main technologies introduced - carp polyculture and silver barb monoculture - would yield 3.7 t/ha and 2.0 t/ha of fish, respectively, compared with an average of 0.5 t/ha in both Kapasia and Sreepur in 1990. The actual achievement in 1992 was 2 t/ha and 1.1 t/ha, respectively. In 1997-1998, the previous ICLARM participants reported an average production of 1.8 t/ha, compared with 1.5 t/ha for other pond operators in Kapasia ($p < 0.1$, t-test) and significantly more than the average production in Sreepur of

1.1 t/ha ($p < 0.001$, t-test). Smaller ponds were more densely stocked and achieved significantly higher production than larger ponds, both among previous participants and nonparticipants. For example, production of past ICLARM participants' ponds of under 0.06 ha was 2.4 t/ha compared with 1.3 t/ha for ponds over 0.06 ha. Although nonparticipants stock fish in their ponds, they have not followed best practices (in particular they adopted significantly higher stocking densities) and this has resulted in lower production levels. The past recipients of extension have maintained the same production level as in the first year of extension and have adopted polyculture, but they have not been able to improve production to the target level. Farmer-farmer contact, radio and TV have been the main sources of information on aquaculture for nonparticipants of the earlier extension.

The pond operators have much higher incomes than the average household in Bangladesh, consequently they eat fish frequently. Among the monitored households, small pond owners averaged fish consumption of 69 g/person/day and medium and large pond owners averaged 164 g/person/day during August 1998-January 1999 (the national average is 22 g/person/day), and 18% and 10%, respectively, of this fish came from their own ponds. Most fish consumed in this period (which was a high flood) was purchased from or was caught in flooded fields, and comprised mainly small fish. Fish stocked and cultivated in ponds are mostly sold.

Related aquaculture technologies introduced by the earlier project in Kapasia consisted of: nursery ponds to raise fingerlings, hatchery, beel stocking, rice-fish culture and poultry-fish culture. Case studies of the past extension participants revealed that the nursery operators only continued this for 1-2 years before they converted to carp polyculture (due to high operating costs and competition from suppliers of lower quality fingerlings). Only one person set up a hatchery based on information obtained from the project, but has faced technical problems since. Rice-fish culture was continued by the people trained by the project as the returns in normal years were good, but experience in 1998 confirmed the risk from flooding. Beel stocking spread widely in small private beels after the earlier project introduced the idea. However, the main constraint has been disputes among shareholders and landowners about ownership of these beels. These conflicts appear to reduce returns over time as there is less incentive to invest or guard fish when mistrust among the cultivators/owners arises. It also results in a profitable activity being abandoned.

**Activities Planned for 2000**

Complete analysis of survey data.

Hold a local workshop with farmers monitored in Kapasia to assess the results of monitoring and the potential to improve their farming systems, including aquaculture.

Hold a national workshop on the sustainability of aquaculture and the assessment of extension approaches.

Complete project report.

## LEGAL AND INSTITUTIONAL ANALYSIS FOR FISHERIES MANAGEMENT

### Project 4.7

Legal and Institutional Frameworks and Economic Valuation of Resources and Environment in the Mekong River Region - A Wetlands Approach

**ICLARM Staff**

Dr. Magnus Torell (Project Leader); Dr. Mahfuzuddin Ahmed; Mr. Albert Salamanca; Ms. Gloria Magnayon-Umali; Ms. Rowena Andrea V. Santos

**Collaborating Institutions**

*International/Regional*: Asian Institute of Technology (AIT); Mekong River Commission (MRC) Secretariat; International Union for Conservation of Nature

*Cambodia*: Department of Fisheries, and others to be specified

*Lao PDR*: Department of Livestock and Fisheries through the Regional Development Centre; others to be specified

*Sweden*: University of Gothenburg

*Thailand*: Department of Fisheries, through the Office of Environmental Policy and Planning; Coastal Resources Institute of the Prince of Songkla University; others to be specified

*Vietnam*: College of Agriculture and Forestry; others to be specified

**Donor** : SIDA

**Duration** : Preparatory phase, October 1998 - March 1999; Implementation phase, October 1999 - October 2001

**Objectives**

PREPARATORY PHASE

- Develop a project framework and workplan for submission to the Swedish International Development Cooperation Agency (SIDA) by the first quarter of 1999.
- Define specific objectives for the implementation phase.

IMPLEMENTATION PHASE

- Enhance the quality of life of people in the Mekong river region by supporting environmentally sound development and by improving the awareness of the value and functions of wetlands in the Mekong river region.
- Improve the national legal and institutional frameworks and increase local capacity to manage the wetlands and their resources.

**Background and Justification**

Jurisdiction and authority over forests, fisheries and other natural resources including lakes, rivers, coastal zones and other wetlands, tend to be fragmented and overlapping. The authorities lack the capacity to monitor resource use or to enforce regulations.

The actual availability and value of fish and other aquatic products (such as frogs, eels, snails, crabs, etc.) that are found in commons like wetlands, floodplains, etc., are grossly underestimated and not well documented. These resources are crucial throughout the Mekong river basin, especially for the rural poor and those with limited access to (productive) land. They are threatened by increasing encroachment, overexploitation, destructive practices, pollution and environmental degradation. Because of lack of information, environmental and social impact assessments are often based on untested assumptions.

The project will focus on the analysis and dissemination of information on legal and institutional aspects, as well as on the economic value of aquatic resources in the wetlands of the Mekong river region through links with relevant national, regional and international agencies.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**

National workshops were conducted in Cambodia, Lao PDR, Thailand and Vietnam in February and March 1999, to identify issues, problems and options in the management of the wetland resources of the Mekong river region. These workshops dealt with activities which may be carried out in the future to improve the legal and institutional framework for managing wetlands. Several regional organizations such as MRC and AIT-Aqua Outreach, national agencies, nongovernment institutions and universities participated in these workshops.

A regional workshop was held in Khon Kaen, Thailand, on 29-31 March 1999. The main objective was to synthesize the results of the national workshops and to develop a logframe on the issues, problems and options identified. Representatives from the fisheries, water, forestry and environment departments of each country attended the regional workshop. A synthesis document cum project proposal was presented to the participants for their review and comments.

On 31 March 1999, the project proposal was submitted to SIDA. The proposal is currently under appraisal and review.

In light of the collaborative network of the project, contacts were established with the University of Gothenburg in Sweden for research collaboration in the future.

A book entitled Common Property in the Mekong: Issues of Sustainability and Subsistence is being prepared in collaboration with the Australian Mekong Research Center of Sydney University, Australia. The book contains the papers presented in a panel session on Conflicts, Competition and Cooperation in the Mekong Commons: Feeding People and Protecting Natural Resources during the Seventh Conference of the International Association for the Study of Common Property entitled Crossing Boundaries held on 10-14 June 1998 at the University of British Columbia, Canada.

**Activities Planned for 2000**

Strengthen links and framework of collaboration with MRC, AIT, riparian countries and institution(s) in Sweden.

Hold workshops with partners in Thailand, Cambodia, Lao PDR and Vietnam to establish detailed activity plans. Specify year 2000 outputs in rela-

tion to the expected outputs for the whole project.

- Increased understanding of wetland management issues at the local, provincial, national and regional levels
- Improved capacity of riparian countries to promote sustainable wetland and aquatic resources management
- Improved linkages and networks on wetland management among institutions at the national and regional levels
- Improved economic valuation of wetlands and wetland resources
- Strengthened capacity of relevant agencies to involve communities in the sustainable use of wetland resources
- Improved capacity to integrate local management systems into institutional regulatory and planning processes
- Improved institutional and legal frameworks for wetlands and aquatic resources management

## Project 4.8
## Institutional Capacity-Building for Community-Based Fisheries Management (CBFM) in Bangladesh

**ICLARM Staff**
Dr. Paul Thompson (Project Leader), Dr. Mahfuzuddin Ahmed; Dr. Parvin Sultana; Mr. Nurul Islam; Mr. Hasib Khandler Mahbub; Mr. Arif Hossain

**Collaborating Institutions**
*Bangladesh*: Banchte Shekha; Bangladesh Rural Advancement Committee; Caritas; Center for Natural Resources Studies; Center for Resource and Environment Development; Department of Fisheries; Proshika Manobik Unnayan Kendra
*Philippines*: Tambuyog Development Center (TDC)

**Donor** : Ford Foundation

**Duration** : 1 January 1997 - 31 December 1999

**Objectives**

- Provide training for government and nongovernment organization (NGO) personnel.
- Contribute to the establishment of linkages among the Bangladesh government, NGOs and other institutions involved in CBFM activities to strengthen overall fisheries resources management.
- Contribute to the establishment of collaborative research and development activities in CBFM in Asia to improve overall fisheries management and policy.

**Background and Justification**
CBFM in Bangladesh is focused on inland open waters (rivers, beels/lakes and floodplains). The DOF and NGOs are working together to enable local communities, particularly people who depend on fishing for their livelihood, to manage fisheries in a more sustainable way. This includes developing alternative and enhanced sources of income for the lean seasons, and protecting access to fisheries for the many poor households who catch small fish for their own consumption. Training is needed to enhance the capacity of institutions and local communities to assess and analyze existing management systems. It should also help them to undertake participatory rapid appraisal and participatory planning of community-based initiatives (for example, for fish conservation). It will improve their ability to analyze survey results to assess the sustainability and equity implications of fisheries management, and to learn from the experience of CBFM in other countries.

The training and study program will include: (i) custom-designed CBFM training and programs to strengthen the capabilities of government and nongovernment personnel involved in CBFM at specific waterbodies covered by existing projects; and (ii) training programs for policymakers.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**
The bridging period of CBFM activities continued through 1999. Activities supported from this fund are reported under Project 4.11 and include report preparation, continued monitoring and a national workshop.

A manual on CBFM training modules is being drafted by the TDC.

A final report on training and exchanges is expected from TDC.

**Activities Planned for 2000**
Finalize project report and the manual in early 2000.

## Project 4.9
Methods for Consensus Building for Management of Common Property Resources

**ICLARM Staff**
Dr. Paul Thompson; Dr. Parvin Sultana; Mr. Nurul Islam; Mr. Hasib Khandler Mahbub; Mr. Delwar Hossain; Mr. Arif Hossain.

**Collaborating Institutions**
*Bangladesh*: Center for Natural Resources Studies (CNRS); Banchte Shekha; Caritas; Center for Resource and Environment Development
*United Kingdom*: Centre for Land Use and Water Resources Research, University of Newcastle; Department of Anthropology, University of Durham; Centre for the Economics and Management of Aquatic Resources, University of Portsmouth

**Donor** : DFID

**Duration** : January - December 2000

**Objective**
- Improve floodplain resource use by: (i) identifying all the stakeholders in common property resources (CPR) use and management; (ii) highlighting the interdependencies between stakeholders; (iii) facilitating consensus or accommodation for improved CPR management; and (iv) arbitrating in disputes over competing uses of wetlands.

**Background and Justification**
Bangladesh's 50 million landless are not self-sufficient in food. Their livelihood strategies include share-cropping, wage labor and fishing. They subsist below the poverty threshold. Fishing is the primary use of aquatic CPR. About 70% of rural households fish for food or income in the floodplains. Improvements in the management and distribution of benefits from CPR will help the extremely poor in Bangladesh.

A previous Department for International Development (DFID)-supported study on the Investigation of Livelihood Strategies and Resource Use Patterns in Floodplain Production Systems showed that the interplay between terrestrial (private) and aquatic (common-pool) resources results in floodplain stakeholders (landed elite, farmers, sharecroppers, fishers, landless laborers, etc.) having interdependent livelihood strategies that may conflict with or complement each other. However, the social environment is characterized by a multi-tiered hierarchy, wherein local elites can capture resources and manage them in a nonconsensual fashion.

The most significant CPR in Bangladesh are the wetlands. Inland open waters consist of more than 12,000 *jalmohals* for which the government leases out fishing rights. However, other uses (e.g., navigation, extraction of irrigation water) are open and may conflict with the fishery. Powerful local elites generally obtain leases using fisher cooperatives as a front, and collect tolls from or employ fishers. Leases tend to be enforced where fish are concentrated in defined waterbodies. Waterbodies merged under monsoon inundation are open for subsistence fishing.

The current CPR management approach is unsustainable. For fish stocks to recover, limits on fishing may exclude some stakeholders and reduce short-term benefits. This is the constraint to be researched. There needs to be a flexible, replicable method for establishing conflict management or for reaching accommodation that involves conflict management assessment. It must take account of local power relations between multiple stakeholders. It should ensure that issues of governance, management, distribution of benefits and use are dealt with transparently, and result in a sustainable process that communities can adopt.

The project adds value to the Community-based Fisheries Management (CBFM) project, which is shortly expected to expand with DFID funding to CBFM-2.

Newcastle University and CNRS piloted a participatory problem-census/systems workshop process to elucidate stakeholders' multiple perspectives in natural resources management. Through system learning techniques, stakeholders were helped towards agreement from originally divergent perspectives. The project will further develop this method. Analysis showed that deficiency of natural capital was not the primary limiting factor to sustainable livelihood. It was vulnerable to trends and affected by poor access to natural capital due to local institutions.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Activities Planned for 2000**

Hold a project planning meeting with project partners to agree on sites, roles and responsibilities, and establish a project steering group.

Organize a workshop with ICLARM, CNRS, CBFM partner NGOs and DOF to share experiences on consensus building in CPR management, address issues and conflicts between fishers and between fishers and other users, identify their future needs in this area, and agree on modalities for delivering outputs to these target institutions to promote optimum uptake.

Make a synthesis of the stakeholder analysis, community organization, consensus building and conflict management methods used in CBFM projects and other recent and current CPR-oriented projects in Bangladesh (e.g., 3FP, MACH, Oxbow Lakes). In particular, methods will be appraised according to the stakeholder context (fishers only, fishers and farmers, etc), and the type of CPR. This review will lead to the development of a typology of consensus-building methods for CPR management.

Review relevant literature on consensual resource management, stakeholder methods and conflict resolution/conflict management and community management of CPR.

Undertake a stakeholder-based analysis of the constraints to consensual management of CPR at project sites, to understand the distribution of perceived reasons for constraints among stakeholders. These may include: trends, shocks and seasonality; a deficiency of assets, especially natural capital (the CPR itself) and social capital; or change in structures and processes, such as national legislation or local norms for access. This will help elucidate the controls on equitable and sustainable management of the CPR.

Test the system-based workshop method developed by the Land-Water Interface (LWI) I project to facilitate consensus and accommodation in floodplain resources management in seasonal floodplain *beels* and *beels* that contain larger permanent *jalmohals*. This will focus on areas into which the partner NGOs of CBFM-2 will continue and expand their development work.

Modify the method in iterative cycles, based on conflict management assessment, ongoing research at these sites and lessons learned from CBFM experience.

Produce a technical report and hold a final workshop with target institutions (CBFM-2, NGOs and DOF).

## Project 4.10
## Coastal Resource Co-Management Project: A Worldwide Collaborative Research Project (Phase II)

**ICLARM Staff**

Dr. K. Kuperan Viswanathan (Project Leader); Dr. Mahfuzuddin Ahmed; Ms. Rowena Andrea V. Santos

**Collaborating Institutions**

*International/Regional*: Caribbean Community Fisheries Resource Assessment and Management Program; Programme for Integrated Development of Artisanal Fisheries in West Africa; Southeast Asian Fisheries Development Center-Aquaculture Department; Southeast Asian Regional Center for Graduate Study and Research in Agriculture
*Denmark*: Institute of Fisheries Management and Coastal Community Development (IFM); North Sea Centre
*Indonesia*: Directorate General of Fisheries; Indonesian Fisheries Socioeconomic Research Network; Research Institute for Marine Fisheries; Universitas Pattimura Ambon; Yayasan Hualopu, Universitas Diponegoro
*Laos*: Living Aquatic Resources Research Institute
*Malati*: Chancellor College; Department of Fisheries
*Malaysia*: Universiti Putra Malaysia (UPM)
*Mozambique*: Institute for Development of Smallscale Fisheries
*Philippines*: College of Public Administration, University of the Philippines (UP); Department of Environment and Natural Resources; Haribon Foundation; Palawan Council for Sustainable Development; Tambuyog Development Center; UP in the Visayas
*South Africa*: Sea Fisheries Research Institute; University of Cape Town
*Thailand*: Department of Fisheries; Kasetsart University; Prince of Songkla University, Andaman Sea Fisheries Development Center.
*Vietnam*: Cantho University (CTU); Ministry of Fisheries; National Center for Social Sciences
*Zambia*: Department of Fisheries

*Zimbabwe*: Center for Applied Social Sciences, University of Zimbabwe; Lake Kariba Fisheries Research Institute

**Donors** : DANIDA; ICLARM core funds

**Duration** : January 1999 - December 2003

**Objectives**

- Gain practical knowledge and experience in coastal resources co-management.
- Analyze and demonstrate the applicability of co-management as a sustainable, efficient and equitable resource management strategy.
- Contribute to the global development objective of sustainable, efficient and equitable management of fisheries and coastal resources in developing countries to ensure food security and improve the economic and environmental conditions of poor people and the environment.

**Background and Justification**

During 1994-1998, Phase I of the Coastal Resources Co-Management Project conducted research in selected coastal, coral reef, lake, river, floodplain and inland waterbody systems in several countries of Asia and Africa in order to determine whether co-management is a viable management strategy under different conditions (political, social, cultural, economic, biophysical, technological). This has resulted in a body of knowledge on the approaches, methods, processes and impacts of co-management of fisheries. Phase II of the project will continue to focus on fisheries and also include coastal ecosystem and coastal resources management. This broader focus illustrates the increased attention co-management is receiving from managers of other coastal resource systems. The resource systems to be studied will now include fisheries, coastal, coral reefs, mangroves, seagrasses, lakes, rivers, floodplains, wetlands and inland waterbodies. 'Coastal' will be defined to include not just the marine coast but the coast of lakes and inland waterbodies.

The project will not advocate or promote co-management, but systematically document, compare and evaluate the processes and feasibility of co-management implementation at the government and community levels and their impacts. General conditions and factors that facilitate the successful implementation of co-management strategies will be identified. The research will have a strong applied policy focus aimed at strengthening national policies, laws and programs for co-management.

The research activities in Phase II will be conducted through eight components: case studies; hypothesis testing; studies of management systems; legal, policy and institutional analysis; national policy development; technical assistance to co-management initiatives; synthesis of research results; networking/capacity building.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | M |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**

The project has generated insights into the approaches, methods, process and impacts of co-management, and has distilled the key conditions for the successful design, development and implementation of co-management. Overall, the project has documented experiences that attest to co-management as an equitable, efficient and sustainable resource management strategy. Both qualitative and quantitative tools have been used in a number of studies. An awareness of co-management regimes has been made possible through the dissemination of journal articles and project publications, presentation of research results in local, regional and international conferences, interaction with national partners and installation of a co-management web site, among others.

Other project accomplishments include the strengthening of the capacities of research partners to understand the theoretical and conceptual foundations of co-management and to undertake research in this area.

Studies generated by the project have affirmed that resources can be better managed when resource users and other stakeholders are actively involved in management and when use rights are allocated to control resource access. These studies, moreover, have shown that partnerships between the government and the community of resource users/stakeholders can work in diverse biophysical, socioeconomic, cultural and political environments. No single blueprint exists. Partnerships are redefined at various stages in the co-management process. Co-management adjusts to changing conditions and addresses aspects of democratization, empowerment and power sharing.

Success in co-management is not automatic. Often, success is heavily dependent on incentives to collaborate, leadership, existence and enforcement of property rights and rules, empowerment of local organizations, active participation of resource users and stakeholders in planning and implementation and existence of effective conflict resolution mechanisms, among other factors.

Dr. K. Kuperan Viswanathan was appointed on 21 May as Project Leader of the Fisheries Co-Management Project.

The research report on Fisheries Co-Management in Asia (Phase I) was finalized.

The 11th Fisheries Co-Management Steering Committee Meeting was held at ICLARM Headquarters, 29-30 March 1999. The meeting addressed the following: progress reports of ICLARM, IFM and NARS; budget and financial reports; future research and funding principles; Phase II workplan; publications and newsletter; approval of new research proposals; and planning of the International Co-Management Workshop to be held in Penang, Malaysia.

Five new studies proposed by NARS partners in Asia were funded by the co-management research project on: (i) co-management of fisheries in diverse aqua-ecosystems of Southern Laos; (ii) co-management of coastal fisheries in Bangladesh; (iii) an analysis of co-management of fisheries in West Sumatra Province, Indonesia; (iv) a case study of community-based fisheries co-management in Phang-Nga Bay, Thailand; and (v) enforcement and compliance with regulations under community-based projects in Thailand.

Three co-management case studies proposed by NARS partners in Africa were funded by the project: (i) a study of fisheries co-management arrangements at Lake Kariba on the Zimbabwean side; (ii) a study of fisheries co-management arrangements in Angoche District, Nampala Province; and (iii) a study of fisheries co-management arrangements at the Olifants River.

ICLARM and IFM in Hirtshals, Denmark, brought together research partners in Asia and Africa, donor organizations and reviewers to take part in a major Project Workshop on Fisheries Co-Management, 23-28 August 1999. This workshop was organized in collaboration with UPM and DOF, Malaysia. The purpose of the workshop was to wrap up the Phase I activities of the project and discuss the workplan for the second phase.

The 12th Steering Committee Meeting of the project was held on 29 August 1999 in Penang, Malaysia, to discuss updates from April 1999 onwards.

Two research papers were completed: (i) Welfare Impacts and Transaction Costs of Fisheries Co-Management at Ox-bow Lakes in Bangladesh; and (ii) Traditional Organizations in Fishing Communities in Vietnam.

**Activities Planned for 2000**

Build on Phase I research and develop new directions in order to generate more specific information for policy and practical application. Carry out policy analysis and hypothesis testing research in partnership with NARS.

Make new case studies and monitor those in the first phase. Since co-management is a relatively new strategy, long-term monitoring of the process, performance and impacts is required to provide new insights.

Carry out research on hypothesis testing and institutional, policy and legal aspects of co-management approaches to fisheries management.

Hold workshops to disseminate information on the applicability of co-management for policymakers and resource managers.

Provide technical assistance to co-management initiatives of NARS partners.

Publish a policy brief incorporating the key findings from Phase I of the research for circulation to policymakers and researchers. Publish the proceedings of the International Co-Management Workshop.

## Project 4.11
## Community-Based Fisheries Management (CBFM) Policy Research on User-based Management: The Case of Inland Openwater Fisheries of Bangladesh

**ICLARM Staff**
Dr. Paul Thompson (Project Leader); Dr. Mahfuzuddin Ahmed; Dr. Parvin Sultana; Mr. Nurul Islam; Mr. Hasib Khandler Mahbub; Mr. Delwar Hossain; Mr. Arif Hossain.

**Collaborating Institutions**
*Bangladesh*: Banchte Shekha; Bangladesh Rural Advancement Committee (BRAC); Caritas; Center for Resource and Environment Development (CRED); Department of Fisheries (DOF); Proshika Manobik Unnayan Kendra (PMUK)

**Donors** : Ford Foundation; DFID (anticipated)

**Duration** : Phase I: July 1995 - April 2000; Phase II: May 2000 - March 2005

**Objectives**
OVERALL
Develop a framework for user-based fisheries management that would promote equitable distribution of benefits to the poorer sections of the community and ecologically sustainable use of Bangladesh's openwater and floodplain fisheries.

SPECIFIC
- Develop an integrated systems view of the relationship between people and fisheries resources.
- Understand the role of local institutions, traditional practices and ecological knowledge in access to and patterns of exploitation of the fisheries.
- Test alternative models of government-nongovernment organization (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.
- Generate and disseminate relevant information to foster informed debate and the necessary policy changes.

**Background and Justification**
Since the 1970s, the DOF of Bangladesh has argued for managing the country's natural waterbodies with the objectives of sustainable increases in fish production and promoting the welfare of fishing communities. In 1986, the government decided to pursue a New Fisheries Management Policy 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 in a project entitled Improved Management of Openwater Fisheries (IMOF) which focused on strengthening the licensing management by DOF through active participation of four leading NGOs (BRAC, Caritas, PMUK and Friends in Village Development of Bangladesh) with technical assistance from ICLARM.

An external evaluation of the IMOF Project noted that the Bangladesh experience with government-NGO-fisher relationships is valuable and applicable to co-management systems in many other fisheries. The report noted that increasing the participation of local fishers in resource management is required. The Bangladesh project and the ICLARM global research project on fisheries co-management are mutually strengthened through collaboration and networking, with the co-management project providing methodological inputs and the Bangladesh project providing detailed case studies of a range of NGO-led initiatives.

This project has been extended to mid-2000 and has been combined with part of the grant for institutional capacity building for community-based fisheries management (CBFM) in Bangladesh that was earmarked for the transition phase of this project.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | H | Anticipatory Research | H |

**Current Status**
The Government of Bangladesh has given a favorable evaluation of the project. This supported the planned second phase of the project. ICLARM staff assisted the Department for International Development (DFID) in preparing a project memorandum for the appraisal of the proposed larger Phase II. The draft was submitted to DFID.

The project worked in 10 rivers, three open floodplain wetlands (*beels*) and six closed permanent lakes (*beels* and *baors*). Responsibility for the *beels* was vested in DOF for ensuring access by organized fishers. Rivers are open access. The NGO partners organized groups of fishing households, provided training and credit for additional sources of livelihood, and helped the fishers in forming management committees. The committees make rules and decisions to sustain and enhance their fisheries.

Local management committees were developed in each site. In well-defined closed *beels*, groups of fishers have established exclusive control over the area with NGO support.The open access policy in most rivers has resulted in severe competition for fishing access. The local committees, comprising representatives of NGO-organized fishers, other fishers, local leaders, etc., lacked any clear authority in most rivers.

The impact of fishery management undertaken by these committees and training and credit support provided by partner NGOs were assessed by household surveys. The NGOs targeted poorer households that were more dependent on fishing. Respondents' own assessments indicated significant improvements in participation, decisionmaking, influence over fishery decisions and livelihoods of fishers in most *beels*, but such benefits were reported in less than half of the rivers.

In all the *beels*, the fishers and wider community complied with rules limiting fishing seasons, areas (sanctuaries) and type of fishing. This was also true in one river. Because they hold property rights in *beel* fisheries through payment of government revenue, fishers were able to enforce rules and could call on government authority when necessary.

Fishing and fish consumption were monitored for seven days each month for 60 households in one river, one open *beel* and one closed stocked *beel*. Analysis of the data is ongoing.

In 1998, the analysis of fish catches showed that catch diversity increased in three rivers, remained the same in two open beels and decreased in one open beel compared with 1997.

In stocked waterbodies, there has been debate over the possible impacts on catches and diversity of non-stocked indigenous fish species. Moderate stocking levels do not appear to affect the capture fishery, but high stocking levels have some negative impact.

Interactions among fishers and between fishers and other resource users over control of the fishery through leasing, interactions between local administration and fishers, and three-way interactions between fishers, NGO partner and government (DOF) were documented for each waterbody.

In the rivers there were more examples of conflict than of cooperation. Competition was heightened by open access. In the open *beels* cooperation both among fishers and with the wider community was dominant, although there were conflicts over water use and fishing in connecting channels. Though there were as many examples of cooperation as of conflict in each type of interaction in closed *beels* (where defined sets of fishers have exclusive control), there was substantial cooperation among fishers which enabled them to stock, guard and harvest fish collectively.

In Bangladesh fishing rights are determined to a large extent by payment to government for the lease of a given *jalmohal*. It has proved difficult for communities to conserve and enhance the fisheries they depend on when they lack rights recognized by the administration or local government. Secure medium- to long-term rights for fishers would provide an incentive for them to sustain their livelihood.

A two-day Workshop on Community-based Fisheries Management and Future Strategies for Inland Fisheries in Bangladesh was conducted in October 1999, Dhaka, Bangladesh. Nine papers on the results of the project were presented by ICLARM staff, together with project partners. Through the working groups and plenary sessions, government commitments were made to a range of community-based and participatory approaches to sustainable fishery management.

**Activities Planned for 2000**

Continue the monitoring program in CBFM-I sites.

Complete the design of CBFM-II and the approval process with DFID and the Government of Bangladesh.

Design and conduct training in CBFM for all project partner staff.

Design and initiate baseline and monitoring surveys in new project sites and in control sites.

Undertake studies on means of building consensus among different stakeholders in fisheries and wetlands.

# 5. PARTNERSHIPS, INFORMATION AND TRAINING PROGRAM (PITP)

## INTERNATIONAL PARTNERSHIPS

### Project 5.1
International Partnerships

**ICLARM Staff**
Dr. Modadugu V. Gupta; Ms. Belen O. Acosta

**Collaborating Institutions**
National, regional and international research institutions and nongovernmental organizations (NGOs).

**Donor** : ICLARM core funds

**Duration** : Continuous since 1996

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

**Background and Justification**
The need for strong national research systems, better utilization of scarce resources, quicker gains from strategic research and matching of complementary skills of agencies, underscores the importance of ICLARM working in partnership with national systems (government and NGO), 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. In a broad sense, all its activities are serving to strengthen national aquatic research systems. This involves forming productive partnerships for collaborative research on aquatic resources with national research institutions, the private sector and development assistance agencies, as well as undertaking related activities such as workshops, training and advisory services at the national, regional and global level.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | M | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | NA | Anticipatory Research | H |

**Current Status**
COLLABORATION
Activities are continually undertaken for strengthening existing and/or establishing new linkages with national, regional and international institutions.

*NARS Collaboration:* Meetings were held with Philippine NARS, namely: Philippine Council for Aquatic and Marine Research and Development (PCAMRD); Bureau of Fisheries and Aquatic Resources (BFAR); University of the Philippines Marine Science Institute; Freshwater Aquaculture Center-Central Luzon State University; and the University of the Philippines in the Visayas (UPV), to review past collaboration and identify areas of mutual interest for future collaboration. The following were identified as areas of mutual interest: (i) fisheries co-management; (ii) environmental risk assessment; (iii) resource valuation; (iv) coastal fisheries resource assessment; (v) fisheries data collection and analysis (databases); and (vi) regional integrated coastal zone management.

Discussions held with Aquaculture Department of the Southeast Asian Fisheries Development Center led to the preparation of a proposal for collaboration on Dissemination and Extension of Milkfish Aquaculture Technology in the Southeast Asia Region.

Meetings with Malaysian aquatic resources institutions were held to inform them of ICLARM's strategic research interests, to understand the priorities of the Malaysian government and to identify collaborative projects.

*Regional/International Collaboration:* The proceedings of the First Meeting of the Group of Fisheries and Aquatic Research - Asia-Pacific Association of Agricultural Research Institutions (GoFAR-APAARI) held in Korea in 1998 have been published. A brief on GoFAR activities has been sent to the APAARI Secretariat for uploading on the APAARI website.

APAARI, ICLARM and the International Service for National Agricultural Research (ISNAR) have agreed to organize a training workshop on research priority setting for Asia-Pacific NARS. A proposal for funding the workshop and the second GoFAR annual meeting (scheduled for mid-2000) has been developed and sent to donors.

A report of GoFAR activities was presented at the APAARI Sixth General Assembly held in December 1999 in Thailand.

As a result of the APAARI-GoFAR meeting, the Food and Agriculture Organization (FAO) and ICLARM have signed a contract to jointly publish a technical manual on integrated rice-fish farming practices. A draft of the manuscript is being reviewed by FAO and ICLARM.

At the request of African scientists, a proposal has been prepared for starting a Coastal Resources Management Network in Africa.

*Memorandum of Understanding/Memorandum of Agreement (MOU/MOA):* These have been signed with PCAMRD and UPV, respectively. A MOU has also been signed with the Chinese Academy of Fisheries Sciences, China. MOUs have been prepared and sent for signing to the Living Aquatic Resources Research Center (LARReC), Lao, PDR; Economic Resources Division, Bangladesh; and the Japan International Research Center for Agricultural Sciences.

*Partner Database/Survey:* A survey to evaluate the effectiveness of ICLARM's partnerships with various institutions has been initiated. Survey forms have been sent to 184 partner institutions in 65 countries. The results of the survey will be available in 2000.

An information database on ICLARM research partners has been designed and is available through the network server. The database includes information on partner institutions and individuals from the institutions involved in ICLARM's research projects.

NARS CAPACITY BUILDING

As part of ICLARM's mandate to strengthen capacity of national research institutions, the Center has provided NARS scientists with training opportunities on aquatic resources research. In the past, training has included workshops on resources assessment, genetics methods, etc., within the Center, nationally and regionally/internationally. ICLARM Programs have been asked to include positions for partner scientists in their project proposals.

A young scientist from the National Bureau of Fish Genetics Resources, India was trained in FishBase data management and geographical information system (GIS)-based database development in October 1999 at ICLARM Philippines. Two staff from the Chinese Academy of Fisheries Sciences were trained in FishBase data management in October 1999 at ICLARM Philippines.

A scheduled training on the culture of sea cucumbers for a young scientist from UPV at ICLARM outreach office in the Solomon Islands has been postponed due to civil strife.

Training of three Senior Research Managers from the Central Institute of Freshwater Aquaculture (CIFA), India, in strategies for dissemination of genetically improved strains has been planned.

Requests were received from: (i) the Marine Science and Resources Research Center, Aden, Yemen for training of its staff in fisheries and marine biology and ecology; (ii) Caraga Center for Environmental Studies Management (CCESM), Philippines for training in resource and ecological assessment; and (iii) Environmental Study Centre, University of Udayana, Indonesia, for training in fishery database management.

*Visits/Requests for Collaboration:* Requests for possible collaborations in research and related activities have been received and discussed with the following: (i) *India*: CIFA; (ii) *Philippines*: CCESM, Northern Mindanao; (iii) *Bangladesh*: Proshika Manobik Unnayan Kendra; (iv) *Republic of Uganda*: Ministry of Agriculture, Animal Industry and Fisheries; (v) *Pakistan:* National Institute of Oceanography; (vi) FAO; (vii) United States Agency for International Development; (viii) MADECOR International Group based in the Philippines; (ix) Support Unit for International Fisheries and Aquatic Research; and (x) Australian Centre for International Agricultural Research.

Visits and/or briefings were organized for the following visitors to ICLARM: (i) 15 Fisheries Officers from Sri Lanka; (ii) Sri Lankan Ambassador; (iii) Director, Institutional Development and Governance, ISNAR, The Netherlands; (iv) Scientist from the Florida Marine Research Institute; (v) FishBase Regional Training Coordinator for West Africa; (vi) Scientist from the South Australia Research and Development Institute; (vii) Caritas-Bangladesh officials; (viii) LARRI, Lao PDR Director and staff; (ix) Director General and Chair of the Agriculture, Forestry and Fisheries Council, Japan; (x) research team of the Assessment of the Living Marine Resources in Vietnam; (xi) Scientist from the Center of Studies in Resources Engineering, Indian Institute of Technology, India; (xii) Scientist from the University of Hohenheim, Germany; and (xiii) two Scientists from the University of Stirling, United Kingdom.

OTHER ACTIVITIES

The Program Leader has been invited by international organizations in various capacities and has: (i) served as a member of the FAO Asia-Pacific Fisheries Commission Ad Hoc Working Group of Experts on Rural Aquaculture; (ii) joined the editorial board of the Journal of Applied Aquaculture; (iii) reviewed - at the request of Mekong River Commission - aquaculture development project in Cambodia and Vietnam; (iv) reviewed the aquaculture research in Lao, PDR at the request of LARReC; and (v) attended several seminars on the Rural Asia Study organized by the Asian Development Bank.

**Activities Planned for 2000**

Continue strengthening/developing research partnerships with national/regional and international institutions/organizations.

Organize training workshops on research priority setting for Asia-Pacific NARS, subject to availability of funds.

Analyze data from survey of partners and initiate actions for improving partnerships.

Publish: (i) Proceedings of the First Meeting of APAARI; and (ii) Technical Report on Integrated Rice-fish Farming.

Assist NARS scientists in capacity building.

## INTERNATIONAL RESEARCH NETWORKS

### Project 5.2
International Network on Genetics in Aquaculture (INGA)

**ICLARM Staff**

Dr. Modadugu V. Gupta; Ms. Belen O. Acosta

**Collaborating Institutions**

*Bangladesh:* Bangladesh Fisheries Research Institute
*China:* Shanghai Fisheries University; Freshwater Fisheries Research Centre
*Côte d'Ivoire*: Centre National de Recherche Agronomique
*Egypt:* Central Laboratory for Aquaculture Research
*Fiji:* Ministry of Agriculture, Fisheries and Forestry
*Ghana:* Water Research Institute
*India:* Central Institute of Freshwater Aquaculture; National Bureau of Fish Genetic Resources; University of Agricultural Sciences
*Indonesia:* Research Institute for Freshwater Fisheries
*Malati:* University of Malati
*Malaysia:* Universiti Malaya
*Philippines:* Bureau of Fisheries and Aquatic Resources; Freshwater Aquaculture Center/Central Luzon State University
*Thailand:* National Aquaculture Genetics Research Institute
*Vietnam:* Research Institute for Aquaculture No. 1 and No. 2

**Donors** : Government of Norway; IDRC; ICLARM core funds

**Duration** : Continuous since August 1993

**Objectives**

- Contribute to the domestication and sustainable performance of tropical finfish species farmed in developing countries.
- Demonstrate the potential for increasing production through application of genetics and selective breeding.
- Evaluate culture performance of promising lines of tilapia and carp.

- Develop national capabilities through training, exchange of germplasm and methodologies.
- Provide a forum for exchange of information, methods and germplasm.
- Strive for the conservation of biodiversity.

**Background and Justification**

The aquaculture sector, which is expected to contribute significantly to world food production, has made only modest gains from genetic research, particularly in tropical developing countries. Recent studies in Norway and the Philippines have clearly demonstrated the potential for achieving substantial gains in aquaculture production through application of genetics and breeding.

Networking is a well-tested and proven mechanism for fostering international cooperation in seeking solutions to problems of common interests that cut across political boundaries. The inherent advantages of 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 suitable for the aquaculture systems in developing countries.

Strategies include: exchange of methodologies and materials; research planning meetings and workshops; formulation and implementation of collaborative research projects; training; joint site visits; information dissemination; and involvement of national systems in planning and governance.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | M | Participation | H |
| Equity | H | Systems Approach | M |
| Gender | n/a | Anticipatory Research | H |

**Current Status**

*Fifth INGA Steering Committee Meeting:* The INGA Steering Committee, which comprises of scientists from member-countries and ICLARM, meets once a year to review the progress in genetics research in member countries and to formulate plans for future research and related activities. The Fifth Steering Committee Meeting was held in Kuala Lumpur, Malaysia, on 3-5 March 1999. It was hosted by the University of Malaya and the Malaysian Department of Fisheries. The meeting reviewed and discussed the: (i) current status, priorities and future plans in genetics research in member-countries and advanced research institutions; (ii) collaboration among member country institutions and the advanced research institutions; (iii) genetic improvement of tilapia species in Africa and related issues; and (iv) recent international developments in aquatic genetic resources use and conservation. One of the important outputs of the meeting was the establishment of linkages between scientists from developing and developed country institutions to establish future collaboration in fish genetics research. A draft of the proceedings is being edited for publication.

*Requests for Membership in INGA:* INGA currently has a membership of 13 developing countries and 11 advanced scientific institutions from developed countries as associate members. Requests for membership in INGA were received from Ukraine and Cambodia.

*Regional Research:* In Africa, INGA has been coordinating collaborative research program aimed at conserving fish genetic resources and increasing fish production through genetic enhancement of local tilapia strains. Through startup funds provided by IDRC, the first phase of the regional research project Collaborative Research and Training for Documentation and Characterization of Tilapia Genetic Resources for Aquaculture in Africa is being implemented in Côte d'Ivoire, Egypt, Ghana and Malati. In June 1999, ICLARM submitted a technical progress report which covers the period of implementation from April 1997 to March 1999. The highlights of research activities are as follows:

(i) Surveys have been completed or are in progress to gather indigenous knowledge on the distribution, biology and performance of various species/strains of tilapias.

(ii) Stocks of *Oreochromis niloticus* have been collected from different ecological regions in each country and analysis of fish population structures is in progress.

(iii) Studies have been initiated to evaluate the production performance and other genetic parameters of the tilapia strains collected in Egypt, Ghana and Malati. Once evaluation is completed, studies will be initiated for genetic enhancement of selected strains and their crosses.

The INGA Secretariat has assisted in the collection and transfer of germplasm, following strict quarantine protocols and material transfer agreements. At the request of ICLARM Abbassa, the Nile tilapia germplasm of the Bouake (Côte d'Ivoire) and Kenya strains have been transferred to Egypt. Efforts are underway for the transfer of Nile tilapia germplasm (Sénégal strain) to Egypt. These will be used to establish the base population for the tilapia genetic improvement program initiated by ICLARM at its regional center in Abbassa, Egypt. Nile tilapia and blue tilapia (*O. aureus*) were transferred from Egypt to China. Nile tilapia (GIFT strain) was transferred from Vietnam to Lao, PDR. As of August 1999, a total of 31 shipments of tilapia and carp have been made through the network.

*Support to Regional Carp Project in Asia:* The INGA Research Coordinator has provided technical backstopping and all the necessary support to the project on Genetic Improvement of Carp Species in Asia funded by the Asian Development Bank. This includes organizing institutional collaboration among the partner institutions in six countries and technical and logistical support in the organization of the Interim Review Meeting of the Genetic Improvement of Carp Species in Asia, held in Kuala Lumpur, Malaysia, 1-2 March 1999.

*Training:* A two-week training program was organized for four scientists from Fiji, Indonesia and Malaysia to acquaint them with the practical aspects of selective breeding.

*Information Dissemination:* In order to strengthen communication and information exchange among INGA members, the tasks either in progress or accomplished are as follows:

(i) Four issues of INGA News were published in *Naga, the ICLARM Quarterly,* featuring genetics research profiles of the member-countries and news items related to the network.

(ii) The new brochure of INGA has been published. It highlights the history of the network, its objectives, management, membership and genetics research in member-countries and institutions.

(iii) For easy access of information to network members, the INGA web page is being prepared.

(iv) A draft directory of aquaculture geneticists in INGA member-countries was distributed to the members of INGA Steering Committee for comments during the INGA meeting in March 1999. The directory will provide information on human resources in genetics research from each country - a knowledge that can be used to facilitate networking activities. Revision of the draft directory is being made to incorporate the inputs of national partners.

*INGA Technical Report:* With the support provided by the Ministry of Foreign Affairs (MFA), Government of Norway, to INGA from 1996 to 1999, the network was able to initiate its activities. The Final Technical Report of INGA covering the period October 1997 to September 1999 was submitted to MFA.

*INGA Proposal to Norway:* A proposal has been submitted to the Norwegian Agency for Development Cooperation for funding INGA activities for a further period of two years, to assist member-countries in: (i) implementation of national fish breeding programs; (ii) development of strategies and action plans for distribution of improved fish breeds to small-scale farmers; (iii) ecological assessment of the genetically improved and modified organisms; (iv) facilitation of germplasm exchange; (v) enhancement of research capacity in developing country institutions; (vi) setting up of the INGA web page; and (vii) coordination of INGA activities.

**Activities Planned for 2000**

Assist in implementation of national breeding programs in member-countries.

Continue regional research project in Côte d'Ivoire, Egypt, Ghana and Malati.

Further exchange of genetic materials, complying with material transfer agreements and strict quarantine protocols.

Organize a workshop on the development of strategies and action plans for distribution of improved fish breeds to small-scale farmers (subject to availability of funds).

Organize the Third Course on Quantitative Genetics and Selective Breeding (subject to availability of funds).

Establish the INGA web page.

Publish the Proceedings of the Fifth INGA Steering Committee Meeting.

## Project 5.3
## Asian Fisheries Social Science Research Network (AFSSRN)

**ICLARM Staff**
Dr. K. Kuperan Viswanathan

**Collaborating Institutions**
*International/Regional:* Economics Section, Research Division, Southeast Asian Fisheries Development Center-Aquaculture Department
*Indonesia:* Central Research Institute for Fisheries; Faculty of Economics, Universitas Diponegoro; Research Institute for Marine Fisheries
*Malaysia:* Faculty of Economics and Administration, Universiti Malaya; Natural Resource Economics Department, Universiti Putra Malaysia (UPM)
*Philippines:* Bureau of Fisheries and Aquatic Resources; Department of Agricultural Economics, College of Economics and Management, University of the Philippines at Los Baños; Faculty of Arts and Sciences, University of the Philippines in the Visayas (UPV); Freshwater Aquaculture Center/Central Luzon State University
*Thailand:* Coastal Resources Institute, Prince of Songkla University; Department of Agricultural and Resource Economics, Faculty of Economics and Business Administration, Kasetsart University; Fisheries Economics Research Subdivision, Department of Fisheries
*Vietnam:* Cantho University; Ministry of Fisheries

**Donors** : Asian Fisheries Society; ICLARM core funds

**Duration** : Continuous

**Objectives**
- Promote effective interaction and cooperation among scientists involved in socioeconomic research in the fisheries sector.
- Promote investigation and advance knowledge of socioeconomic aspects of fisheries.
- Focus attention on socioeconomic problems by disseminating information on all aspects of living aquatic resources management.
- Disseminate social sciences research methodologies and results in the region.

**Background and Justification**
The AFSSRN was established in 1983 to address the need to enhance research capabilities in socioeconomic research relating to capture fisheries, coastal resources management and aquaculture in Asia. The aims are even more relevant today due to the increasing recognition of social and political factors in achieving sustainable aquatic resources development. The AFSSRN is currently composed of 15 research teams, with more than 80 researchers at universities, research institutions and government fisheries agencies in Indonesia, Malaysia, Thailand, the Philippines and Vietnam. As the founding member institution of the AFSSRN, ICLARM has a lead role to play in its future. Under the new AFSSRN constitution, an ICLARM staff member shall serve as Vice-Chair of the executive committee. ICLARM staff will continue to provide technical guidance to AFSSRN.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | M | Systems Approach | H |
| Gender | n/a | Anticipatory Research | H |

**Current Status**
In 1999, AFSSRN members continued to provide active support for research in the Fisheries Co-Management Project. Four new activities under this project were funded in 1999 and carried out by network members in Indonesia, Bangladesh, Thailand and Laos. They also actively interacted on the co-management list-server FISHCOM, set up on the Internet and devoted specifically to fisheries co-management.

Members met on 26 August 1999 in Penang, Malaysia, and elected Dr. Nik Mustapha Raja Abdullah, Dean, and Dr. Tai Shzee Yew, of the Faculty of Economics and Management, UPM, as the new Chair and Secretary-Treasurer of the AFSSRN, respectively.

**Expected Outputs in 2000**
Hold the annual meeting of the Network at ICLARM, Penang, on 20 October to elect the executive committee.

Conduct the Training Workshop on Impact Assessment of Coastal Management Policies, 16-18 October.

Publish the directory of fisheries and coastal resources social scientists in Asia.

Continue research collaboration of network members in the coastal resources co-management project managed by ICLARM.

Contribute news and articles to the SocScience section in the *Naga, the ICLARM Quarterly.*

## INTERNATONAL INFORMATION NETWORKS

### Project 5.4
Network of Tropical Aquaculture and Fisheries Professionals (NTAFP)

**ICLARM Staff**
Dr. Modadugu V. Gupta; Mr. Geronimo Silvestre

**Donor** : ICLARM core funds

**Duration** : Continuous

**Objectives**
- Enhance communication among fisheries professionals working on the assessment, conservation and management of tropical fish stocks and among aquaculture scientists engaged in fisheries research in the tropics, especially in genetics, integrated agriculture-aquaculture farming systems and coastal aquaculture.
- Enhance the output of these professionals by assisting them in information and database searches, research, manuals, methods, data analysis and interpretation, and by publishing some of their research findings in the Fishbyte (fisheries) and Aquabyte (aquaculture) sections of *Naga, the ICLARM Quarterly*.

**Background**
After functioning as separate entities for more than a decade, the ICLARM-coordinated information networks, the Network of Tropical Fisheries Scientists (NTFS) and the Network of Tropical Aquaculture Scientists (NTAS) were merged in 1998 to form the NTAFP. The merger was designed to consolidate efforts and resources in the management of the networks by ICLARM and to expand its membership by including professionals from the private sector and nongovernment organizations (NGOs) working in tropical aquaculture and fisheries. With the increasing involvement of private individuals and NGOs working on aquaculture and fishery development, be it for sustainable management of resources or for income-generating activities, it is recognized that professionals from these sectors can contribute significantly to information exchange among the members of the network. NTAFP will continue to fulfill the main purpose of NTAS and NTFS which is to create links among fisheries scientists and professionals working in the tropics, especially for those who work in isolation and have difficulty in accessing relevant information.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | n/a | Participation | M |
| Equity | H | Systems Approach | n/a |
| Gender | H | Anticipatory Research | n/a |

**Current Status**
Inputting of members' information into the database of NTAFP members is continuing. Options for setting up a list-server for network members to facilitate information exchange are being evaluated.

Assistance was provided to network members in establishing contacts with other scientists, literature searches and supply of photocopies of publications.

Articles for the Aquabyte and Fishbyte sections of four issues of *Naga, the ICLARM Quarterly* were prepared.

**Expected Outputs in 2000**
Publish articles for the Aquabyte and Fishbyte sections of *Naga* sent in by members.

Provide free computerized literature searches, published materials unobtainable from reprint requests and communication links among research scientists.

Further use modern information technology to facilitate information dissemination.

## INFORMATION AND TRAINING

### Project 5.5
Information and Training

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : Continuous

**Objectives**

- Actively initiate and participate in the dissemination of ICLARM's research outputs.
- Initiate the marketing of ICLARM as a corporate entity with a clearly defined mission.
- Develop the structure and skills where relevant, to achieve these objectives.
- Manage the Publications Unit; Library and Information Services Unit; Public Awareness Unit; and Training Unit.

**Background and Justification**

Dissemination of research results and the marketing of ICLARM are critical for the success of its mission. For the Center's research to have a positive impact on food security and sustainability of fisheries, it is essential that it reaches the target beneficiaries, fisheries scientists and managers, and other organizations committed to promoting these objectives. The increased demand by donors for identification and assessment of the impact of its research further emphasizes this requirement.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | n/a |
| Gender | n/a | Anticipatory Research | H |

**Current Status**

Provides advice on the development of dissemination strategies to be incorporated into ICLARM's research proposals.

Contributes to the Center's activities through provision of advice and suggestions; membership on internal committees; external presentations and reports; and involvement in the Consultative Group on International Agricultural Research meetings.

Directs *Newsplash; Naga, the ICLARM Quarterly; Annual Report; Operational Plan;* and all public awareness materials.

Manages the budgets of the Units.

Directs and monitors ICLARM's home page.

Directed the development and updating of ICLARM's distribution database in 1999.

Developed a communication strategy for the move of ICLARM headquarters to Penang.

**Activities Planned for 2000**

Further develop the use of technology in fulfilling research and information dissemination goals.

Continue management and direction of the Units.

Continue center-level and system-wide involvement.

## Project 5.6
Publications Unit (PU)

**ICLARM Staff**

Ms. Marie Sol Sadorra-Colocado (Manager); Ms. Rita Kapadia; Ms. Sheila Siar; Ms. Ma. Graciela Balleras; Mr. Alan Siegfrid Esquillon; Mr. Rodel Resurreccion

**Collaborating Institutions**

Various external authors contributing manuscripts; internal and external reviewers

**Donor** : ICLARM core funds

**Duration** : Continuous

**Objectives**

- Publish effectively and disseminate efficiently information on ICLARM research and related activities.
- Edit written outputs of the Center that are submitted to external journals and donors or published by ICLARM.
- Produce/publish all public awareness (PA) materials.
- Distribute all publications and PA materials.

**Background and Justification**

The main tool for documenting and disseminating ICLARM's research and development activities are its publications. These take several forms: *Naga, the ICLARM Quarterly*, Technical Reports; Conference Proceedings; software manuals; Education Series; Bibliographies; Studies and Reviews; training manuals; brochures and flyers. These outputs ensure that ICLARM's work reaches the donors, scientific community, fisheries managers, extension workers and, most importantly, the intended beneficiaries.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | n/a | Participation | H |
| Equity | H | Systems Approach | n/a |
| Gender | n/a | Anticipatory Research | n/a |

**Current Status**

*Team Award from Board of Trustees:* In 1999, PU received the Board Award for a Team in the Area of Research Support, the first such award to be given by the Board of Trustees (BOT). The Unit was commended for its efforts in clearing the backlog of five to six years of scientific manuscripts to be published; reducing the publication time significantly; publishing *Naga, the ICLARM Quarterly* on time; and making significant efficiency gains in distribution of publications, among others. These achievements involved implementing a project management system based on a team approach.

*Unit Management and Operations:* Team-style management was further refined through internal training. The workflow charts were cleared and finalized. Use of the work approval forms has been implemented to better monitor and plan the workflow.

An audit of PU was carried out in 1999. Several of the recommendations of the audit have been implemented: improved processing procedures for purchase/printing requirements; all manuscripts submitted to the Unit in electronic form; accomplished staff timesheets for costing activities and forms for monitoring consumption of supplies; recorded time allocation for many projects and activities; and maintained inventory records to monitor movement of publications.

*Forty-two (42) Publications Produced in 1999:*
- 4 issues of *Naga, the ICLARM Quarterly*
- 1 Operational Plan
- 1 Annual Report
- 3 Research Highlights (English, French and Arabic)
- 1 Strategic Plan and a supplemental Databook
- 3 Technical Reports (TR 55, 56 and 57)
- 2 Conference Proceedings (CP 60 and 53, which was reprinted)
- 4 Focus for Research issues
- 4 flyers on *Naga* and new releases
- 1 Abbassa Update issue
- 2 brochures
- 1 booklet entitled *Building for the Future*, about the ICLARM-Penang site
- 11 issues of Newsplash
- 1 CD
- 1 greetings card/calendar
- 1 ICLARM folder.

*Editing:* 68 papers/articles were edited, cleared and recorded in the ICLARM Contribution Series.

*Home Page:* 26 uploadings on the ICLARM home page: These include the Library and Services Unit's monthly selected new acquisitions (9); employment opportunities (4); updated news section (4); abstracts of *Naga* issues (3); publications and software (2); staff list (2) Operational Plan 1999 (1); and the Population, Consumption and the Environment call for proposals (1).

*Development of the* Naga: A meeting of the editorial team was held in March 1999. Among the topics discussed were: defining the market position of the magazine; reviewing the current sections and developing ways to improve their content and presentation. The recommendations are being implemented.

*Publication Distribution and Promotion:* ICLARM publications and information materials were exhibited at nine events: ICLARM External Program and Management Review; BOT Meeting; Inter-institutional Communication Workshop; CGIAR Mid-term Meeting; Policy Workshop on Collective Action, Property Rights and Devolution of Natural Resource Management; International Workshop on Fisheries Co-Management; Malaysian-national aquatic research systems Meeting in Penang; International Day at Tokyo 99; and the Philippine Bookfair. New publications were distributed to local and international libraries and fisheries institutions under the full-free exchange agreement.

*Staff Development:* All staff of the Unit participated in the Inter-institutional Communication Workshop held at the Asian Development Bank on 18 May. Other participating institutions included the International Rice Research Institute, International Institute for Rural Reconstruction, Philippine Council for Agricultural Research and Resources Development and PhilRice. Among the topics discussed were electronic publishing, digital communication, marketing on the web and information management policies.

The Publications Unit Manager attended the 21st Annual Meeting of the Society for Scholarly Publishing in Boston, USA, 9-11 June. Among the topics discussed in the meeting were: developing critical skill sets for today's publishing environment; online peer review; e-journals and e-books; content management and identification for electronic publications; print-on-demand and digital production. These topics will be very useful for the

Unit as it is currently gearing towards electronic publishing.

*Electronic Publishing:* The Unit has acquired electronic publishing equipment with funds from the Office of the Director General.

*Translation and Public Awareness Activities:* The Unit continued to coordinate translation activities of the Center. These include the French and the Arabic versions of the Research Highlights, which were extracted from the ICLARM Annual Report 1998.

For public awareness activities, the Unit prepared various Powerpoint presentations, overhead transparencies, slides and folders. Business cards, conference invitations, programs, certificates and handouts were also made. Photography, videography and other audiovisual requirements were also handled.

*PU Transition Team in the Philippines:* The transition team is planning and implementing the transition process to Malaysia, including digitizing publications, packing, and processing publications in the pipeline and distributing these.

**Activities Planned for 2000**

*Unit Management*:

- ensure smooth transition and setting up of PU in Malaysia
- archive and digitize publications
- document PU procedures
- hire new PU Manager and staff
- orient and train new staff on the functions of the Unit
- develop project management procedures, based on team approach and quality assurance processes
- streamline procedures
- continue to upgrade computer system
- timetable and release publications
- create a pool of contractual staff (i.e., editors, writers, translators and artists) and printers
- initiate and nurture collaboration with relevant professional societies and institutions in Malaysia and elsewhere.

*Publications:* The Unit will produce the following publications:

- ICLARM 2000 Operational Plan
- ICLARM Annual Report (AR) 1999
- AR 1999 Research Highlights in four languages (English, French, Arabic and German)
- 4 issues of *Naga, the ICLARM Quarterly*
- 5 Conference Proceedings (CP)
- 1 Technical Reports (TR)
- 1 Studies and Reviews
- ICLARM capability statement brochure
- ICLARM folder with inserts
- 4 Focus for Research flyers
- 3 Impacts flyers
- 12 issues of ICLARM Newsplash
- 1 CD-ROM user's manual
- updated publications catalogue
- updated 'Publishing at ICLARM'
- flyers on the new publications
- flyers on impacts of ICLARM's work
- ICLARM project brochures
- press releases
- posters
- 2 video complementary booklets
- donor briefs
- season's greetings card
- Training policy brief
- "bestseller" publications reprinted: CP 26, CP 31, CP 45 and TR 46

*Naga:* Amidst the transition activities, the Unit will try its best to release the *Naga* on schedule. A survey on the magazine and its readership will be started. The survey results will be used to further develop *Naga*'s content and presentation. A campaign on publishing and advertising in *Naga* will be initiated. Advertising exchanges will be studied and, when found feasible, will be carried out.

*Contribution Series:* Continue to edit, clear and record contributions.

*Other Services:* Continue to draft figures and graphics; prepare posters, slides, overheads and Powerpoint presentations; assist in proofing corrections to manuscripts and layouts.

*Distribution and Promotion:* These will continue to be made more dynamic. Flyers to promote new publications will be produced. The Internet will be used more to disseminate and distribute publications.

The mailing list will be updated to: eliminate redundancy or duplication; identify key people and institutions; make it accessible to ICLARM staff (read-only); design a faster and more efficient customer-entry system; and create a set of criteria for reviewing it.

More effective and cheaper mailing modes will be sought and negotiated.

*Home Page:* The home page will be expanded and equipped with features that can monitor its effectiveness.

*Communication Workshops*: These will be held with relevant institutions in Malaysia for the professional development of new staff.

*Translation:* Coordination of translation activities (for the 1999 Research Highlights brochures, Annual Report and other inquiry and reply letters) and of some public awareness activities (workshops, bookfairs, CGIAR and fund-raising events) will continue. The pool of commissioned translators will be further developed.

*Electronic Publishing:* The necessary hardware and software have already been purchased. Manuscripts which have been put on hold due to lack of funds will be timetabled for electronic publishing.

## Project 5.7
Library and Information Services Unit (LISU)

**ICLARM Staff**
Ms. Norma Jhocson; Ms. Erlinda Gonzalez; others to be appointed

**Donor** : ICLARM core funds

**Duration** : Continuous

**Objective**
- Promote and effectively provide information services including, but not limited to, identifying, collecting, processing, storing, analyzing and disseminating scientific information to ICLARM management, staff and partners (including donors, researchers, collaborators and other users of the information) worldwide.

**Background and Justification**
In September 1978, the ICLARM Library (the Ian R. Smith Memorial Library and Documentation Center) was set up as a nucleus of information resources. It aims to help implement the Center's goal of providing technical and scientific information required to strengthen research and management of tropical aquatic resources for the benefit of developing countries.

It has grown rapidly with the proliferation of literature on fisheries and aquatic resources both from the developing countries served by ICLARM and 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**

| | | | |
|---|---|---|---|
| Sustainability | n/a | Participation | H |
| Equity | H | Systems Approach | n/a |
| Gender | n/a | Anticipatory Research | n/a |

**Current Status**
INFORMATION DISSEMINATION
*Acquisitions List.* Nine monthly electronic issues (January to September) of *New Acquisitions* and *Selected New Acquisitions* were prepared and disseminated to all ICLARM staff, a mailing list and through the LISU webpage. The 58 members from 18 countries of the Population, Consumption and the Environment (PCE) Initiative Group received the *New Acquisitions* list beginning with the April 1999 issue.

*Serial Contents.* Disseminated 795 pages of table of contents (537 volumes/issues of journals) to ICLARM staff and serviced their requests for 697 articles (7,157 pages).

*Information Department of* Naga. LISU has indexed and provided 700 bibliographic entries for the four 1999 issues of the *Naga* including comprehensive indexes (subject, taxonomic and geographic).

*ASFA Database*. In its fifth year of participation as an international inputting center to the Aquatic Sciences and Fisheries Information System, LISU has indexed and submitted a total of 931 ICLARM publication citations for the *Aquatic Sciences and Fisheries Abstracts* (ASFA) database. Of these, 42 new ICLARM citations were submitted to the ASFA publisher (Cambridge Scientific Abstracts) in March and October 1999. Entries of all ICLARM publications/contributions are fully up-to-date.

*Information and Reference Services to On-site Users/Visitors.* LISU has provided technical information and reference services to 1,309 on-site us-

ers/visitors, mostly university students from Metro Manila, government workers, volunteers, growers, consultants, administrators, policymakers and academic/library personnel. Demonstrations on the use of bibliographic databases, online searching, briefings, and technical advice on library and information services were also provided to 335 users/visitors and to new ICLARM staff.

SERVICES TO OUTREACH SITES

*External Information Service*. The Selective Fisheries Information Service (SFIS) responded to 426 requests from 75 countries. Queries received from January to November 1999 were largely (66%) from the developing countries. The leading countries were Philippines (84), followed by USA (41), India (29), Kenya (25) and Australia (17). Seventy-nine percent of all queries were answered free of charge.

*Collection*. The acquisition of new library materials has again been greatly affected by budget cuts and the increasing costs of books and serial subscriptions. As of November 1999, there were 347 volumes of books added to the collection bringing the total to 14,916 printed volumes. Of these, 83 (53%) volumes were received as gifts, 88 (25%) as exchange and 76 (22%) volumes were charged to the different Programs/Projects. From a total holdings of 1,335 serial titles, 892 are currently being received. A total of 64 journal subscriptions were renewed, 10 of which are through institutional memberships and 54 titles are subscribed direct from publisher and/or through distributor(s).

*Electronic Access to the Library Collection*. Maintained six databases including 54,555 bibliographic citations providing access to the information resources in the Library.

*Electronic Document Delivery System/Service*. The acquisition of Ariel software speeded up LISU's document delivery service to ICLARM staff and external clients. A total of 60 journal articles were received through Ariel, of which 35 were free of charge and 25 were paid (charged to respective Programs/Projects).

*Acquisition of Library Materials*. LISU obtained and sent a total of five books and 55 journal articles to the Coastal Aquaculture Centre, Solomon Islands; two journal articles and two books to the ICLARM Regional Research Center for Africa and West Asia, Egypt; six books to the Bangladesh Office; and two journal articles and two books to the Caribbean/Eastern Pacific Office. Books required by staff which were not available in the ICLARM Library were obtained through interlibrary loans. A total of 24 books and 15 journal titles were borrowed from 12 local libraries. LISU also assisted in the professional growth of staff by obtaining personal copies of books, journals, reprints, etc. A total of 13 books and 18 journal articles were acquired for six HQ staff.

*Document Delivery*. Sent 1,713 contents pages of 1,067 volumes/issues of journals to Egypt, Solomon Islands, Bangladesh, Malati and Caribbean/Eastern Pacific Office, and supplied their requests for 657 articles (9,758 pages).

INFORMATION PROJECTS

*Library Holdings on the Internet*. In spite of no budget allocation for this top priority and long overdue project, the ICLARM Headquarters Library Databases were made available on the Internet by using the WWWISIS system developed and distributed by BIREME/PAHO/WHO. Web programming was handled by Ms. Cristina Carpio of ICLARM Computer Services Unit with technical support from David Storiti of UNESCO.

*Retrospective Conversion Project*. A total of 220 paper-based catalog records for monographs were converted into machine-readable form and subsequently added to LIBRI database as they became available.

*Compilation of ICLARM Contributions Series*. LISU continued to update the compilation of Contributions Series. In June 1998, a total of 208 contributions were found missing from the collection. From January to November 1999, 63 contributions were added to the collection.

*Citation Tracings/Analyses of ICLARM Publications/ Contributions*. Our citation database has a total of 19,790 entries. During 1999, 1,540 records from 576 volumes of citing materials have been added to the database.

*Photos/Slides*. As of end November 1999, the IMAGE database contained 297 bibliographic records from a total of 6,776 slides. Photos held total 5,717.

LINKAGES AND COOPERATION

LISU continued to strengthen its ties with libraries and institutions worldwide through increased co-

operation and assistance. As of November 1999, information/publications exchange agreement had been established with 153 libraries/institutions. An exchange of publications has been established with six institutions: (i) Shanghai Fisheries University, China; (ii) School of Environmental Science and Management, UPLB, Philippines; (iii) Faculty of Agriculture, University of Ruhuna, Sri Lanka; (iv) Japan International Research Center for Agricultural Sciences, Ministry of Agriculture, Forestry and Fisheries, Japan; (v) Journal of Fishery Sciences of China, Beijing; and (vi) Benguela Environment Fisheries Interaction and Training Program, Namibia.

Through the Duplicate Exchange Program of the International Association of Aquatic and Marine Science Libraries and Information Centers, LISU requested and received 11 journal titles with 117 issues from nine libraries.

In April 1999, LISU donated some library duplicates of books and journals to the library of School of Fisheries, Bicol University.

In June 1999, LISU donated library duplicates such as 68 volumes of books and 11 journal titles (71 issues) to the library of Philippine BFAR.

In August 1999, some ICLARM publications were donated to the library of College of Veterinary Medicine, Benguet State University, La Trinidad, Benguet.

On 13-15 September, LISU hosted, arranged and coordinated a visit to ICLARM and meetings with concerned staff for Mr. Vladimir Puentes, M.S. student of the Faculty of Fisheries, Kagoshima University, Japan.

**Activities Planned for 2000**
Hire new LISU staff in Penang, Malaysia.

Train new LISU staff in Penang, Malaysia.

Physical setup of library facilities and resources in Penang, Malaysia.

Continue to adopt and use current information systems and technology in the efficient delivery of information services and for more effective operational activities.

Further promote and develop SFIS worldwide.

Continue the provision of information services to outreach sites and improve services where practical opportunities are identified.

Keep up-to-date the inputting of ICLARM publications to ASFIS.

Continue citation tracing of ICLARM documents to find out the extent to which the Center's publications/contributions have been used by other researchers in various countries.

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.

Continue to monitor and assess the usage of and demands for ICLARM subscriptions to determine a priority listing.

## Project 5.8
## Public Awareness Unit

**ICLARM Staff**
All PU and LISU Staff

**Donor** : Mainly ICLARM core funds

**Duration** : Continuous since 1995

**Objectives**
- Coordinate public awareness (PA) of ICLARM at a corporate level. The 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 research outputs.

**Background and Justification**
Traditional sources of funding for ICLARM and other CGIAR centers have tightened and access has become more competitive. 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 can influence and support ICLARM's future existence.

Recognition of the importance of dissemination of research has increased with the need to show the

impact of 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**

| | | | |
|---|---|---|---|
| Sustainability | n/a | Participation | H |
| Equity | H | Systems Approach | n/a |
| Gender | n/a | Anticipatory Research | H |

**Current Status**

ICLARM conducted a wide variety of PA activities in 1999. Some of the highlights are:

*ICLARM's First PR Strategy:* First draft of (i) an ICLARM PR plan and (ii) a medium-term timetable of PR outputs (products and activities) was presented and submitted to the Director General (DG).

*Developing and Defining ICLARM's Corporate Identity:* For the first time, ICLARM is consciously and methodically formulating its corporate identity. Initially this includes a (re)assessment of its image, key messages, names of the corporate and outreach offices, logo, slogan, corporate designs and themes.

*Assistance in a Smooth Announcement and Management of the Headquarters (HQ) Move:* Developed a HQ communications strategy for the announcement and a crisis management plan.

*Fundraising for the HQ Move:* Produced an HQ fundraising document as well as a complementary photo collection.

*PR Media Work Started in Penang:* Media releases sent out, interviews arranged and successful coverage in Malaysia media achieved. Media contacts in Penang made and collated.

*Fundraising from Private Industry:* Prepared a draft of a (skeleton) strategy and a sponsorship document and research on companies coordinated.

*Promoting and Disseminating Information on Integrated Aquaculture-Agriculture:* Prepared videos of integrated aquaculture-agriculture (IAA) projects in the Philippines and Malati and coordinated with the Canadian International Development Agency for funding. The videos will be released in 2000 and follow up work will be needed to capitalize on the outputs. A *Focus for Research* on IAA has been started. Aquaculture has been chosen as the theme for Germany-ICLARM week in 2000.

*Positive Feedback and New Direction from Partners:* A donor survey was undertaken and results collated. Internal discussions were coordinated to analyze and prepare an action list resulting from the survey.

*Promotion to Donors at Medium-term Meeting (MTM)/International Center's Week (ICW):* A Fisheries in China "display and products" was organized at the MTM in Beijing. A complementary Focus for Research flyer was produced. A new poster was designed for ICW entitled "What does aquatic science look like?"

*New ICLARM Organizational Statement:* Prepared in line with the revised CGIAR mission statement. This was sent around to key staff for comments and discussed at a Research Management Committee meeting before finalizing.

*Formalizing Use of CGIAR and Future Harvest Logos:* Standards are now set for the text and positioning of these logos when used with ICLARM outputs.

*Analyze Direct Marketing:* To determine advantages to ICLARM to be able to customize the information and communication to our partners.

*Presentations by the DG:* Assisted with numerous presentation materials and information.

*Capitalizing on the EPMR Report:* Report was analyzed. A summary of the most positive statements was collated under relevant headings and distributed to key staff for use. Preparations were made for the presentations at MTM. The Newsplash, home page and *Naga* covered the EPMR outcome.

**Activities Planned for 2000**

Complete the fundraising strategy and start to approach private companies for funding.

Finalize a clear definition of the corporate identity and implement the supporting activities.

Develop good host country public relations for the new HQ site.

Launch an information campaign for partners to know and understand the HQ move.

Increase public awareness about ICLARM through the media and other channels.

Increase corporate commitment internally.

Promote the importance of fisheries issues and ICLARM's work through further development and implementation of the PA plan.

Develop an occasional series on *Impacts* of ICLARM's work.

Produce four flyers in the *Focus for Research* series.

## Project 5.9
Training Unit

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : Continuous from 1996

**Objective**
- Institutionalize training activities provided or supported by ICLARM.

**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 ITP in 1996. Without a budget allocation in 1997, discussions on and formulation of a draft training strategy were initiated.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | n/a | Participation | H |
| Equity | H | Systems Approach | n/a |
| Gender | H | Anticipatory Research | H |

**Current Status**
Recommendation made to BOT to employ staff to implement the training strategy.

**Activities Planned for 2000**
Setting up a Training Coordination Unit.

# 6. CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH (CGIAR) SYSTEM-WIDE ACTIVITIES

## Project 6.1
CGIAR System-wide Initiative on Property Rights and Collective Action

**ICLARM Staff**
Dr. Mahfuzuddin Ahmed; Dr. K. Kuperan Viswanathan

**Collaborating Institutions**
*International/Regional*: International Food Policy Research Institute (IFPRI)
*Germany*: German Foundation for International Development/Food and Agriculture Development Centre (DSE/ZEL)

**Donor** : DSE/ZEL

**Duration** : October 1998 - July 1999

**Objective**
- Liaise with IFPRI, DSE/ZEL and other participating groups on planning and hosting an international policy conference on collective action, property rights and devolution.

**Background and Justification**
Property rights and collective action play an important role in how people use natural resources, which in turn shapes the outcomes of production systems. This system-wide initiative examines the formation and effectiveness of community-based organizations and the performance of institutions involved in natural resource management. The overall goal of this initiative is to contribute to policies and practices that alleviate rural poverty by analyzing and disseminating knowledge on how property rights and collective action institutions influence the efficiency, equity and sustainability of natural resource use.

The issues of property rights and collective action are of special concern to the CGIAR because of their effect on technology adoption, natural resources management and poverty alleviation. To address these complex issues requires an interdisciplinary approach, with insights and methodologies from a range of social as well as technical scientists. Through collaboration among CGIAR centers, national research institutions and nongovernment organizations (NGO), the system-wide initiative is able to achieve the necessary complement of researchers to examine the environmental impact of institutional change.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
As part of the activities of the system-wide initiative in 1999, ICLARM, IFPRI and DSE/ZEL held a five-day International Policy Conference on Property Rights, Collective Action and Devolution of Natural Resources Management on 21-25 June 1999 in the Philippines. The conference brought together 57 scientists, researchers, policymakers and practitioners from 19 countries in Asia, Africa, North America and South America. The conference had four guiding objectives: (i) identify the factors that facilitate collective action for resource management; (ii) discuss issues and problems that have emerged in the course of implementing devolution policies; (iii) pinpoint priorities for further research; and (iv) draw up policy recommendations that will hasten effective, sustainable and equitable devolution of natural resource management. Workshop participants reviewed worldwide experiences in fisheries co-management, joint forest management, irrigation management transfer and management of rangelands. This resulted in a rich discourse of various views on the factors that hinder or promote user participation in natural resources management. The field visits provided an opportunity for participants to interact with members of user associations on various resource management arrangements.

During the workshop, there was agreement on the need to sort out the complex interaction of the resource base, institutions and technological forces that determine access to and control of natural resources before any intervention is made. Mechanisms must be set in place to allow for participatory decisionmaking, for defining and rethinking

roles and responsibilities over time, and for resolving conflicts at various levels. Secure rights of tenure/property rights must be provided to resource users, along with incentives to manage their resources. New approaches require changes in the administrative levels of government as well as new laws and policies in support of the new management arrangements.

## Project 6.2
Optimizing the Use of Water for Food Security: Sustaining the Production of Living Aquatic Resources

**ICLARM Staff**
To be appointed

**Collaborating Institutions**
*International:* International Water Management Institute; Mekong River Commission (MRC)
*Regional*: National aquatic research systems in Cambodia, Laos, Thailand and Vietnam

**Donor** : Technical Advisory Committee of CGIAR

**Duration** : 2000 (12 months)

**Background and Justification**
The project will focus on the development of a hydrological model of the Mekong with special reference to the floodplains of the Lower Mekong Basin countries and the hydrological dynamics of the Great Lake of Cambodia. These wetlands support fisheries and other aquatic resource production critical to food security of large numbers of poor in the region. The model will be used to help predict the effects of fluctuations in flow and flooding on aquatic biodiversity and productivity. The outputs will directly support regional requirements and ICLARM's biodiversity and policy program studies. MRC and fisheries experts from the riparian countries will be key collaborators in this work.

## Project 6.3
Gender and Diversity Program

Following the successful gender staffing initiatives of the early 1990s, the CGIAR decided to launch a Program on Gender and Diversity in 1999. This program provides the centers with advice on gender and diversity in the workplace, and designs training and activities to assist centers and their staff to benefit from the opportunities of a diverse and multicultural workforce. The Program is guided by the Gender and Diversity Program Advisory Board, reporting to the Committee of Center Directors. The Director General of ICLARM chairs the Advisory Board. The Program Leader is located at the International Center for Research in Agroforestry in Nairobi, Kenya.

## Project 6.4
Revised CGIAR Accounting Manual Based on the International Accounting Standards

In 1999, ICLARM served on the Steering Committee for revising the CGIAR Acounting Manual to be in conformity with International Accounting Standards (IAS) and relevant provisions of the United States Generally Accepted Accounting Principles. The objective of the manual is to develop a standard set of accounting policies and reporting practices which will address, to the extent possible, the differences in the accounting standards and conventions in the various countries where CGIAR centers operate. By combining relevant IAS and US GAAP provisions in the manual, the newly developed accounting policies and reporting practices aim to eliminate the confusion in the treatment of certain accounts and to clearly define terms.

The revised manual also promotes consistency in the treatment of accounting and segregation of financial accounts from management accounts. ICLARM implemented the revised CGIAR Accounting Manual in 1999 and the audited statements for 1999 were produced based on the revised manual.

## Project 6.5
System-wide Public Awareness Activities

The public awareness activities of CGIAR are designed to inform the public, donors, scientists and academics about the need for and the results and impacts of research activities that the Centers undertake to enhance production and improve the management of agricultural and aquatic resources. ICLARM participates in these activities through meetings, displays, printed materials, etc., at various international fora with other CGIAR centers.

# 7. CORPORATE SERVICES DIVISION (CSD)

## Project 7.1
Office of the Associate Director General (OADG)

**ICLARM Staff**
Mr. Edward N. Sayegh; others to be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 months)

**Functions**

- Provide operational and logistical support to the Center's Programs and Units. 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 the BOT and management in developing appropriate policies, procedures and systems, and in regular reviews of the effectiveness and efficiency of the Division's services so as to indicate areas for improvement and the adaptation of the services to the constantly changing environment.
- Reorganize operations to provide the required services at the new headquarters in Penang. Most of the positions will be recruited in the year 2000 to fully staff the Division.
- Develop a service vision and services strategy for recruiting new staff and creating a new corporate culture based on efficient service and output orientation. This will guide CSD, motivate staff and instill team spirit.
- Manage the Board Secretariat which acts as the custodian of Board records and minutes, and provides support to the Board Chair and members.

**Background and Justification**
CSD SERVICE VISION
Creating and managing a client-oriented culture dedicated to developing seamless and high-value service quality.

CSD SERVICE STRATEGY
To support its vision, the Division is committed to an operating strategy that is built on:

*Operational Excellence*: smoothness, speed, quality, accuracy, consistency and reliability in execution and delivery.

*Client Needs*: carefully targeted services to meet the broad range of internal and external client needs.

*Cost Consciousness*: delivery of services at costs comparable or less than the market

*Superior Human Resources:* strive to attract and maintain excellent human resources that share the vision, strategy and corporate values of ICLARM.

*Flexible Delivery Systems*: systems and processes responsive to the changing environments that rapidly adapt to the constantly changing needs.

**Current Status**
CSD has been structured into six functions under the ADG, with major reduction in support staff. It will follow the decentralized mode of operations.

*Human Resources*: In consultation with clients, develop, implement and administer human resources systems, programs and activities designed to attract, motivate and retain efficient and effective human resources.

*Finance and Management*: Ensure the financial viability and stability of the Center through proper financial management and provide client-oriented financial support services

*Administrative and Operational Services*: Provide client-oriented administrative and infrastructure services, effectively and efficiently at costs equal or lower than the service providers in the open market.

*Information Technology*: Provide an environment for improved quality and efficiency of data processing and ensure the productive use and sharing of computers, applications and systems. Provide clients with speedy and easy access to information resources. Improve sharing and dissemination of information through the Internet and Intranet.

*Planning and Budgeting*: Assist in the formulation, development and management of the budget, including the establishment of databases, systems, procedures and guidelines. Assist in the development of medium-term plans, financing plans and project proposals to donors. Provide assistance in financial and administrative services to the Board, management, Programs and Units to reduce transaction costs.

*Financial and Administrative Systems:* Develop and maintain state-of-the-art computerized integrated financial and administrative systems to serve the institutional and client requirements effectively and efficiently. Modernize and update the computerized financial and administrative applications to respond to constantly changing internal and external client needs.

*Board Secretariat:* Managed by the ADG/CS (who is the Board Secretary) and his Personal Assistant. The Secretariat has four major functions:

- Maintains Board records and files.
- Serves as a source of information regarding the Board to the staff and regarding the Center to the Board.
- Responsible for certain segments of corporate information, i.e., updating ICLARM constitution and maintaining Board-approved policy decisions.
- Oversees and coordinates arrangements necessary for each Board meeting.

From time to time, certain decisions are made by the Board outside the schedule of its meetings. Such decisions are normally conducted by polling either the full Board or the Executive Committee. The Board Secretariat prepares the documentation required for a decision, compiles all responses received and presents a summary to the Chair.

The Board Secretariat organizes visit of individual Trustees to ICLARM's regional and outreach research facilities as part of their ongoing orientation to research activities. Attendance of Trustees to other meetings/conferences are also facilitated.

Major accomplishments of the OADG in 1999 were the: provision of support to the Director General (DG) in the selection of the new headquarters site and playing a key role in negotiating the headquarters agreements. The OADG took the main responsibility for handling and managing all activities related to ICLARM's move from the Philippines to Malaysia.

**Activities Planned for 2000**
Set up operations in Malaysia. Oversee the building program. Recruit staff. Ensure smooth transition to and in the new headquarters.

## Project 7.2
Human Resources Unit (HRU)

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 months)

**Functions**

- Recruit qualified and experienced staff and plan their orientation.
- Develop, implement and administer human resources systems, programs and activities designed to attract, motivate and retain efficient and effective employees, including planning and system design; recruitment and selection; development and evaluation; compensation; and employee relations and assessment.

**Current Status**
The existing Human Resources Information System (HRIS) has been modified and simplified to provide an alternative database for use at the Philippine regional office. It will be used at the new HQ until a new system is adopted. The purchase and implementation of a new system has been postponed due to the move.

The 1999 PMP review process has been finalized and implemented for separated staff. Implementation for the remaining regular staff will be undertaken in early 2000.

The first annual Staff Achievement Awards have been given and are highly regarded by the HQ staff.

The Staff Attitude Survey for 1999 has been completed and the results shared with the Board of Trustees. The survey included the staff to be separated.

In the preparations for the HQ transition, HRU assisted in implementing an Employee Assistance Program to help separated staff find opportunities of employment elsewhere and provide guidance, counseling and training activities for those wishing

to embark upon individual/family/group livelihood enterprises.

Developed regionally recruited staff (RRS) policy manual and salary structure.

Developed Malaysian nationally recruited staff (NRS) policy manual and salary structure.

Revised internationally recruited staff (IRS) policy manual.

Assisted in the preparation of the separation program.

Made insurance arrangements for 1999/2000 (medical, life and accident).

Developed policy and procedures for issuance of contracts (new/renewal).

Updated all Philippine government-mandated benefits records.

Arranged and coordinated for Malay Bahasa language lessons for IRS and RRS.

Developed guidelines/plan for clearance and payment of separation packages.

Arranged for clearance and payment of separation packages.

Developed/revised outreach site personnel policy manuals and obtained Board approval.

Prepared a staff directory.

Implemented a new ID system.

Developed a competency-based framework for non-research staff with the assistance of a consultant.

**Activities Planned for 2000**

*Recruitment of Manager and HR Assistant*: The HRU Manager is expected to be on board by May 2000. The HRU Manager will select the HRU Assistant.

*Recruitment and Staffing*: ICLARM has a large number of vacancies especially in the NRS category. Filling these will be a major effort and will include developing appropriate personnel policies, compensation systems, recruitment strategies, etc. The new HRU Manager will give high priority to this integrated activity.

*Human Resources Information System*: An integrated human resources system will be developed to assist in the efficient arrangement and assessment of human resource needs.

*Competency-based Human Resources Management*: In February 1998, ICLARM implemented a new classification system and salary structure for research staff at HQ based on a competency framework which evolved from the Center's vision and core values. The intention is to use this framework to develop other HR areas. To ensure proper implementation, a concept for competency-based HR management will be developed.

*Staff Performance Management Program (PMP)*: The existing PMP has been in place for four years and is partially linked to the competency-based system. A revised PMP system with appropriate forms linked to the new competency-based system will be produced in 2000 and 2001.

*IRS Salary and Benefits*: A salary and benefits survey is currently underway for the CGIAR system. ICLARM will compare its salary and benefits system to determine its competitiveness and ability to attract qualified and experienced scientists and administrators. A revised IRS salary structure and IRS position classification system will be developed.

*Staff Training and Development*: ICLARM management believes that continuing training and development improves morale of employees, helps them identify with organizational objectives and contributes to ICLARM's overall effectiveness. New staff will be provided with opportunities to learn and integrate into the Center's culture. Appropriate training and seminars will be developed by the HRU Manager with assistance from specialized consultants.

## Project 7.3
## Financial Management Unit (FMU)

**ICLARM Staff**

Ms. Loriza E. Dagdag (Manager); four accountants to be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 months)

**Functions**

- Manage the Center's financial resources to ensure availability of funds and generate financial information to enable management to make informed and timely decisions.
- Maintain adequate operating reserves and accounting and internal control systems.
- Safeguard and maximize the Center's assets and resources, and ensure the accuracy and reliability of financial information.

**Current Status**

*Reorganization of FMU*: The restructuring of the unit has been deferred due to the HQ move.

*Design and Implementation of Phase Two of Financial Management System (FMS)*: The implementation of phase two of Platinum has been completed and the Accounts Payable/Purchase Order System (AP/PO) was operational in March 1999. The AP/PO fully integrates with the Platinum system.

*Financial Position, Operating Reserves and Liquidity Position*: Most of management reports have been automated for improving the accuracy and timeliness of financial reporting to management and Program/Project leaders. These reports allow the monitoring and collection of receivables for enhancing the cash position and reserves. A review of indirect costs is also underway for better recovery from projects.

*Financial Management System for Regional Operations*: A uniform chart of accounts has been in use by outreach operations. Reporting to HQ is done electronically and fed into the Platinum system at HQ with minimal manual intervention. An external audit of Abbassa operations has been initiated in 1999.

*Review of Audit of the Center Overheads*: There is a review of indirect costs at the CGIAR system level. The methodology will be used by ICLARM for developing the indirect costs of its projects.

*Financial Reporting Structure*: Internal automated financial reports have been revised and are issued to management and program leaders on a timely basis. Further review and refinement will be undertaken in 2000.

*1999 Financial Statements*: The 1999 Center financial statements were finalized by 31 January 2000. This early date has been selected to enable the audit to be completed by ICLARM's Philippine-based auditors and allow FMU to transfer to Penang in February 2000.

*Implementation of the Revised CGIAR Accounting Manual*: ICLARM has adopted the revised CGIAR Accounting Manual in 1999 and the annual financial statements have been produced based on the revised manual.

**Activities Planned for 2000**

*Management and Operations:* Recruit new staff and develop a new organizational structure with reduced staffing levels.

Review the financial policies, systems, procedures and processes, and revise them with the aim of improving operational efficiency and enhancing controls. Develop simplified flow of transactions with emphasis on controls.

Enhance automated operations to eliminate manual processes.

Design and implement appropriate systems.

*Improve Center Financial Reporting Structure Including that to Donors*: Review and improve financial reporting structure; develop plan and timetable for donor reporting; review financial reports and introduce improvement and transparency; fully automate financial reporting to donors; review donor reporting requirements monthly; develop overall system of financial reporting tracking including preparation, followup and monitoring.

*Design and Implement Outreach Accounting System to Integrate with Platinum*. Develop a uniform chart of accounts to be used at all locations; and identify an appropriate software package that integrates with Platinum. The new system will be tested and put into operation with the necessary orientation and training for outreach sites.

Develop methodology for indirect cost identification and reporting.

Review financial statements, including assets and liabilities, monthly and provide a summary report to the DG; produce and monitor an action list on a monthly basis.

## Project 7.4
Administration and Operations Unit (AOU)

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 months)

**Functions**
- Provide administrative and logistical services to the Center (mail, communication, travel, material management, purchasing, receiving, storage, shipping and transport).
- Manage the operation and maintenance of the physical plant and facilities, including safety and security.

**Current Status**
The activities of AOU have focused in 1999 on the HQ transition.

*Fixed Assets*: A new fixed asset count was made at HQ and updated and signed accountability forms for all HQ-based staff were accomplished to ensure the proper monitoring of assets during the transition.

A revised disposal policy and procedure was developed and implemented, and an asset disposal committee was formed.

An appraisal company (Cuervo Appraisers, Inc.) was commissioned to assist the asset disposal committee in preparing fair market value for the assets as a guide for the determination of bid prices for assets intended for disposal and insurance values for those to be shipped to Malaysia.

Approval was obtained from the Department of Foreign Affairs (DFA), Protocol Office, in the Philippines, for the disposal of ICLARM assets.

*Relocation and Transfer Activities*: Two brokers/movers were selected to handle the packing, loading, shipping and releasing in Malaysia of ICLARM files, documents, reference materials, books, equipment and personal effects of IRS.

Exit clearances for these goods were obtained from DFA.

ICLARM's Philippine office was moved to the International Rice Research Institute in December 1999.

Short and long-term storage facilities have been arranged for files and documents that need to be stored in the Philippines for one to two years.

Move coordinators were selected to represent each Unit and Program. They were responsible for ensuring the smooth and orderly packing of their respective offices.

All 9E visas (diplomatic) of IRS and dependents included in the transfer have been renewed beyond 1999.

All IRS/RRS personal effects have been surveyed by the brokers and readied for packing and transporting to Malaysia.

A transition administrative team has been created during the final stages of the move to ensure the continuity of delivery of basic administrative services.

Administrative contracts have been reviewed, and actions taken to ensure smooth transition activities.

**Actions Planned for 2000**
*Setting Up the Temporary Office in Penang*: Assist the ADG in this activity.

*Hiring Staff:* Hire a manager and four support staff in early 2000 to provide the necessary logistical support to the Center and assist in the renovation program.

*Systems and Procedures*: Establish operating policies, procedures and systems to enable efficient operations in Penang.

*Customs Clearing and Visas*: Assist in the customs clearance of office equipment and documents, and in clearing personal effects of staff.

*Building Operation and Renovation*: Provide all logistical and janitorial support for the temporary office. Assist in procurement and logistics for the renovation of the new office.

*Travel and Purchasing*: Develop procedures and identify recognized travel agents and suppliers.

## Project 7.5
Information Technology Unit (ITU)

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 Months)

**Functions**
- Operate ICLARM's central computer systems and its local and area-wide networks.
- Provide technical services, help-desk support and user training.
- Develop and maintain IT infrastructure that supports research and administration within the Center and in national aquatic research systems.
- Actively initiate improvement by capitalizing on modern technology for greater effectiveness of the Center's activities.

**Current Status**
*Standardization of the IT Environment*: Standard configurations are set for personal computers and peripherals, and the specifications are updated regularly to keep pace with new developments in technology.

There are currently 58 powerful and well-configured Dell systems in use at ICLARM (37 desktops, five workstations, 13 laptops and three servers), all equipped with appropriate software.

An inventory of all personal computers and peripherals was conducted. The information was used in identifying units to be disposed of before the move to Penang.

All computers were configured to log on to the Windows NT domain, ICLARMNET. This provides better security and easier file and printer sharing, and standardizes the network operating system.

*Exchange Support*: Smooth transition was made from Microsoft Mail to Exchange. Training and technical support were provided to staff in using Outlook as the new e-mail client program. Exchange's public folders were developed to provide better collaboration. Facilities for remote access to e-mail were provided for ICLARM researchers. Successfully used was the backup dialup solution for e-mail operation when the IVDN line had problems.

*Internet Support*: ICLARM's Intranet design and organization were improved. All ICLARM existing policy manuals and information regarding HQ transition were published. Online access to updated virus DAT files and essential software and patches was provided and access through the Internet of ICLARM's library databases was implemented.

*Y2K Problem Support:* Noncompliant computers were identified. The Y2K tests of all outreach offices were coordinated and the results were compiled. Recommendations and guidance for noncompliance were provided; and a successful rollover of all computer system dates from 1999 to 2000 was achieved.

*Communications Support*: The Ariel facility for document exchanges between HQ and the outreach sites was installed; an Ariel store-and-forward server was set up to provide a continuous delivery system even after office hours. Ariel was installed to PU's server which was operational 24 hours a day and configured it to act as a gateway; the IVDN voice board was upgraded to provide better quality at lower bandwidth.

*Transition Support*: An inventory of hardware, software, servers and workstations was conducted - equipment for disposal, transfer to IRRI office or shipping to Penang were determined; coordinated with IRRI Computer Services and Physical Plant Services on the network and communications requirements of ICLARM office at IRRI; migration of Exchange mailboxes and computer systems onto IRRI's network; files and databases of Programs/Units/Offices were secured. Network storage was allocated to accommodate essential documents and data; technical support was provided in document imaging and archiving. Programs/Units were given assistance in digitizing paper documents and archiving onto CD-ROMs for ease of access and transfer.

**Activities Planned for 2000**
*Hiring Staff*: Hire staff to enable the Unit to respond to the computing and communication needs of the Center.

*Setting Up of Servers and Communication Facilities*: Ensure uninterrupted communication and computing at the new HQ. Also set up PCs and internet support for all the programs and units.

*Liaise with CGNet*: Set up an IVDN and leased line for communication and data exchange.

*Intranet Support*: Reactivate the Intranet and enhance its utilization. Put on the intranet more policies and procedures to contribute to a paperless work environment.

*Other Support*: Provide technical support to Programs and Units to ensure uninterrupted operations and communication. Use innovative approaches to enhance IT operation and environment.

## Project 7.6
Financial and Administrative Systems Team (FAST)

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 months)

**Functions**
- Develop and maintain the financial and administrative system. The Unit uses a team approach with user Units and coordinates with ITU to develop and implement systems.
- Oversee the database administration and smooth operation of implemented applications and recommend system enhancements/ upgrades.

**Current Status**
*Implementation of Accounts Payable/Purchase Order (AP/PO) Module:* Installation and configuration of Platinum AP and PO software were done in both server and client workstations in FMU and AOU. Master file policies were set up to address additional AP processing and reporting requirements. User access rights were updated to accommodate these new modules. User training was conducted for AP/PO users. Parallel run was successfully completed for January and February 1999. Transactions with the ending balances from Platinum reconciled with the reports generated in the old system. Using Crystal Reports, reports forms were constructed for AP/PO, and check vouchers. With the implementation of AP/PO in March 1999, updated old payables can be generated on an on-need basis and vouchers for payment of PO are automatically created when the items are received.

*Migration of Platinum for Windows 4.6 to Version 4.7*: FAST initiated the acquisition of a new server that is fully compliant with the Platinum server requirements. The Platinum application has been upgraded to Platinum 4.8 and became fully operational beginning April 1999. The new Platinum version eliminated intermitent system shutdown on client workstations, and this resulted in increased user productivity and improved system reliability. The upgrade version also introduced Pervasive SQL, a new database platform for Platinum for Windows. Pervasive SQL server and client software editions were installed and configured. The introduction of Pervasive SQL to the Platinum system greatly improved database access, transaction processing, server response time and simultaneous multiple workstation queries.

*Maintenance of Other Financial and Administrative Applications*: An independent application for payroll was developed to address the Social Security System (SSS) reporting requirements. This application replaced the SSS reporting provided in the current payroll system developed by PriceWaterhouse that limits the numeric figures to only three digits for recording SSS remittances. Travel plan reporting was extended to Planning and Budgeting Unit.

*Y2K Compliance Testing of Existing Legacy Systems*: Source code review and modifications were conducted to ensure Y2K compliance of the applications system that may be used in the year 2000. FAST browsed a total of 42,884 lines of code to complete this task. Minimal data conversion was also done for a number of database tables. Critical modules such as payroll and NRS personnel allocation modules were certified Y2K compliant and can be used at the Philippine office.

*Financial Reporting Structure*: In coordination with FMU and PBU, a new financial reporting structure was developed. This was implemented in July 1999 with system-generated financial reports provided to different levels of management. Various summarized and comparative Center-wide reports are

provided to the Executive Management Team. Project leaders receive comparative budget and expenditures reports at the project level. These project-level reports are summarized for program level reporting.

**Activities Planned for 2000**
*Setting Up the Platinum System*: Set up Platinum servers and workstations at the new ICLARM HQ; ensure uninterrupted financial computing and timely generation of financial reports; coordinate with the new ITU staff on the network installation, configuration and finetuning to ensure system reliability and efficiency of financial systems.

*System Administration*: Continue administration of the Platinum system to ensure smooth operation of all modules; perform backup procedures to ensure data integrity and reliability.

*Liaise with the Technical Support Provider*: Establish contact with an outside local provider for implementing Platinum system upgrades; provide third-party solutions to address additional financial and administrative processing requirements not provided by Platinum.

*Improve Financial Reporting Structure and Reporting to Donors*: Update formats to generate financial reports compliant with the new reporting requirements of CGIAR. Further review capabilities of available reporting tools to automate financial and donor reports.

*Technical Assistance in HR/Payroll System for HQ Use*: Provide technical assistance in the use of the current payroll system at HQ; look for a new payroll software package that will serve the Center's payroll requirements more efficiently.

*Other Support*: Provide user support to the new FMU staff in the use of the Platinum system and available reporting tools for Platinum. Provide support in the implementation of an outreach accounting system for Platinum integration.

## Project 7.7
## Planning and Budgeting Unit (PBU)

**ICLARM Staff**
To be appointed

**Donor** : ICLARM core funds

**Duration** : 2000 (12 months)

**Functions**
- Assist in the formulation, development and management of the Center's budget, including establishment of databases, procedures and guidelines.
- Provide Programs with budgeting and financial support services.

**Current Status**
*Program Administration and Administrative Functions*: Staff time and functions were organized and streamlined to provide focused delivery of financial and other required information to Programs.

*Budget Management and Control*: Internal office procedures were set up to effectively monitor project budgets and other statistics.

*Revised Budget Cycle and Process*: Standard budget tables and financial chapter(s) for the Medium-term Plan (MTP) 2000-2002 and the 2000 financing plan were developed. The 2000 budget, based on the revised budget cycle and resource allocation process, were prepared.

*Staffing Patterns by Programs and Staff Levels*: These were prepared for all ICLARM locations with related costs for 2000.

*Rolling MTP 2000-2002*: The budget was developed in accordance with guidelines issued by the CGIAR Secretariat.

*Financing Plan 2000*: This was also developed following the guidelines issued by the CGIAR Secretariat.

*Monitoring of Restricted Projects*: Quarterly monitoring of restricted Projects' expenditure levels and remittances was developed with the assistance of FMU.

**Activities Planned for 2000**
*Program Administration and Administrative Functions*: Provide financial management support to the board, management, programs and staff as needed. Assist in producing the annual budgets and updates for submission to CGIAR, TAC Secretariat and donors. Ensure complete documentation and monitoring of results.

*Budget Management and Control*: Maintain proper procedures for effective control and monitoring of the budget functions. Identify the procedures used in financial planning, budgeting, monitoring and controlling which can be fully automated and linked together, to ensure accurate and timely outputs. Develop and implement a fully automated system that will provide users with online access to budget balances.

*Revised Budget Cycle and Process*: Continuously review and improve the newly implemented planning and resource allocation process.

*Control, Studies and Analysis*: Generate budget-related reports on a regular basis, i.e., projections of revenues and expenditures, annual inflation studies, specific reports, information for donors and other statistical reviews.

*Staffing Patterns*: Fully automate the databases on staffing under one system and implement proper clearance procedures and monitoring of staffing patterns.

## Project 7.8
HQ Renovation

**ICLARM Staff**
Mr. Edward N. Sayegh; Mr. Brian Tierney (Project Manager)

**Donors** : CGIAR Finance Committee; ACIAR; USAID; other donors

**Duration** : 14 months

**Function**
- Oversee the renovation of the facilities at the HQ site in Penang.

**Activities Planned for 2000**
- The main outputs expected are: space allocation; preliminary design; bidding document; bid and tender; contract negotiation and award; workshop and housing quarter relocation; construction; interior design; landscaping; and finalization of renovation project.

# 8. OFFICE OF THE DEPUTY DIRECTOR GENERAL - AFRICA AND WEST ASIA (ODDG-AWA)

## Project 8.1
Office of the DDG-AWA

**ICLARM Staff**
Dr. Roger Rowe; Dr. Randall Brummett; Dr. John F. Craig (Consultant); nationally recruited staff

**Collaborating Institution**
*Egypt*: Agriculture Research Center, Ministry of Agriculture:

**Donors** : Restricted core (Arab Fund; Government of Egypt; Government of Japan; USAID)

**Duration** : Since January 1997

**Functions**
- Develop and manage ICLARM's Regional Research Center for AWA (Abbassa site).
- Work with the Director General and Deputy Director General (Programs) to develop a strategic research and training program on fisheries and aquaculture for AWA.

**Background and Justification**
ICLARM established a regional research center in Egypt to expand its operations in AWA. The Government of Egypt made available the facilities of the Central Laboratory for Aquaculture Research (CLAR) at Abbassa. This facility is the regional center for aquaculture research and a hub for more extensive activities in AWA. Full operation of the regional center began in January 1998.

**Current Status**
The final part of the refurbishment of the Abbassa facility is complete. The dry labs and dormitory and apartment buildings are in operation. The facility is ready for regular operation.

Joint research projects are being developed with CLAR.

Contacts have been made with fisheries and aquatic resources research and development organizations in Egypt.

Contacts with scientists in the region have been expanded through visits to six countries and participation in three regional meetings.

Funding proposals for research in fish genetics, inland fisheries management and aquaculture development have been prepared.

The proceedings of the Lake Nasser Workshop, held in 1998, is in press.

The second issue of the Abbassa Update was distributed internationally in May 1999, and a report on our activities in Egypt was distributed within the country in August 1999.

**Activities Planned for 2000**
Replace and repair old laboratory and operating equipment, subject to availability of funding.

Expand the research and training program in the region in collaboration with and as an extension of headquarters research programs. Conduct work on the genetic evaluation and enhancement of tilapia species, aquaculture development, fish health and training.

Develop further links with fisheries and aquatic resources research and development organizations in AWA to collaborate in setting research priorities and extending research results.

Develop funding proposals for research and training activities for individual countries and for the region as a whole.

Participate in the development of material for a special edition of the *Naga* that will focus on Africa.

## Project 8.2
Genetic Improvement of Tilapia

**ICLARM Staff**
Dr. Randall Brummett; Mr. Mahmoud A. Rezk; Mr. Ebtehag A. Kamel; Dr. A. El Gamal; nationally recruited staff

**Collaborating Institutions**
*Egypt*: Channel Maintenance Research Institute, Central Laboratory for Agriculture Research
*USA*: Auburn University

**Donors** : Restricted core

**Duration** : Since January 1998

**Objectives**
- Produce genetically improved tilapia for aquaculture in Africa.
- Identify appropriate methods of tilapia breeding in AWA.
- Compare mass selection, family selection and marker-assisted selection procedures to produce improved tilapia for aquaculture.
- Determine the relative value of genetic variability in tilapia base populations for selective breeding programs.
- Evaluate GxE interaction in Nile tilapia stocks grown in ponds, cages and integrated rice-fish culture.
- Develop an approach to evaluate the potential ecological impacts of alien species and genetically modified stocks.

**Background and Justification**
Tilapia culture in AWA is based largely on natural populations of Nile tilapia and, in many farms, natural mixes of species from the wild. Substantial improvements in production can be achieved through the use of improved germplasm. A systematic appraisal of breeding systems and the environmental consequences of genetically modified stocks will make a lasting contribution to aquaculture in the region.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**
*Mass Selection*: The largest 10% of males and females from one *Oreochromis niloticus* population and one *O. aureus* population were randomly selected. The selected populations were reproduced and the performance of their progenies is being tested in earthen ponds.

*GxE*: As part of the International Network on Genetics in Aquaculture project, broodstock of four *O. niloticus* populations has been reproduced, and their progeny is currently being cultured in earthen ponds for evaluation. Over-wintered fry are being evaluated for production in cages and in an experimental rice field. Broodstock are being evaluated for pair spawning in *hapas* and mass spawning in earthen ponds.

*Marker-Assisted Selection*: Families were formed from four populations of Nile tilapia for intermating. These have been spawned in *hapas* and are currently being grown out for family selection and subsequent DNA sample collection and analysis at Auburn University.

*Establishment and Maintenance of Tilapia Germplasm*: We have eight populations from Egypt and two new stocks from Kenya and Côte d'Ivoire.

**Activities Planned for 2000**
Based upon results of 1999 experiments, continue mass and family selection programs in *O. niloticus* and *O. aureus*.

Provide samples to Auburn University for identification of biochemical genetic markers in preparation for marker-assisted selection.

Develop protocols for the study of the potential environmental impact of genetically modified stocks.

## Project 8.3
Aquaculture Research for AWA

**ICLARM Staff**
Dr. Randall Brummett; Dr. Gamal El-Naggar; Khalid Hussein; Mr. Ahmed Diab; nationally recruited staff

**Collaborating Institutions**
*Côte d'Ivoire*: Centre National pour la Recherche Agricole; International Institute of Tropical Agriculture; West Africa Rice Development Association; Institut de Recherché Agricole pour le Dévelopment (de Cameroun), Ministere de l'Elévage, des Pêches et des Industries Animales (de Cameroun)
*Egypt*: Central Laboratory for Aquaculture Research; Cairo University; Zagazig University; Food and Agriculture Organization; International Fund for Agricultural Development
*Ghana*: Water Research Institute
*Kenya*: Sagana Fish Farm
*Malati*: Malawi National Aquaculture Center
*USA*: Pond Dynamics/Aquaculture CRSP; Auburn University; State University of New York (Brockport)

**Donors** : Restricted core

**Duration** : Since January 1998

**Objectives**
- Execute a plan of research to support aquaculture development in Africa and West Asia (AWA) via experimentation at the Abbassa site and active collaborative relationships throughout the region.
- Maintain a range of international and regional collaborative relationships to provide input on the research agenda and disseminate findings.
- Develop practical techniques for *Clarias gariepinus* and *O. niloticus* spawning and larval rearing for small-scale farms in AWA.
- Develop and/or adapt broodstock management techniques to optimize reproductive performance.
- Study larval feeding ecology and behavior to optimize fry survival in low-tech systems.
- Determine the extent and distribution of pollutants (heavy metals and pesticides) in cultured aquatic organisms in Egypt.
- Identify and document epizootics among aquatic animals in AWA to improve therapies and plan prevention.
- Develop a fish health database for aquaculture in Africa in collaboration with FAO.

**Background and Justification**
The regional center for AWA was established to support the research for regional fisheries and aquaculture development efforts. Collaborative relationships with international partners and regional national aquatic research systems are being sought as a means of accomplishing this mission.

In AWA, *O. niloticus* and *C. gariepinus* are in high demand as fast-growing and hardy species for aquaculture. The main limiting factor for their extensive use is the shortage of high-quality fingerlings. Most existing technology for reproduction and larval rearing is too complicated and expensive for use by smallholders. A farmer participatory approach is being used to develop more appropriate technology for application in the region.

In Egypt, consumers rely heavily on fish captured in the Nile river and/or grown on fish farms. Previous research in the most polluted industrial and municipal areas of the Nile river has documented bioaccumulation of heavy metals to levels above those considered safe for human consumption. That work is being extended to aquaculture systems that use either Nile water or drainage water from irrigated agriculture.

The relatively extensive aquaculture systems that dominate in sub-Saharan Africa have so far not experienced major fish health problems. This is expected to change when systems become intensive. Since many disease-causing organisms are indigenous or have already been introduced to the region, documentation of relatively minor outbreaks in both natural and culture systems can provide valuable information for predicting future problems. Quarantine and early warning systems will be more effective if the specific diseases they have to guard against have been identified.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | L | Anticipatory Research | H |

**Current Status**
Proposals are being developed with IITA for an evaluation of infrastructure constraints to aquaculture development in Cameroun.

Two projects are being conceptualized with WARDA to integrate small-scale aquaculture with rice cultivation in west Africa.

Discussions are being held with the Ministry of Agriculture of South Africa to provide support for a subregional ICLARM entity based at Rhodes University.

The IFAD/FAO/ICLARM collaborative project on integration of aquaculture into irrigation schemes is now at the stage of country (Zambia) approval.

USAID is reviewing a proposal to expand the Malati Research Extension work to female-headed households.

Laboratory and pond experiments conducted last season demonstrated the benefit of high levels of protein (40%) in broodstock diets for *C. gariepinus* broodstock. Diets containing 30% and 40% protein levels resulted in a significantly higher egg production per female and larger sized eggs than for females fed on diets with 20% crude protein. Also, fish fed the 30% and 40% protein diets had a significantly higher gonadosomatic index and reached sexual maturity earlier than the group with lower dietary protein.

*C. gariepinus* fingerlings grown in earthen ponds during the winter were fed a commercial fish feed (25% protein) at three different feeding rates for 14 weeks. Catfish fingerlings fed at 1% of their biomass grew as fast as those fed at 2% and 3% of their biomass during the cold season.

By manipulating water temperature and broodstock nutrition, substantial numbers of *O. niloticus* tilapia fry were produced 45 days earlier than under normal conditions in Egypt. These fry reached an average size of 160 g compared to 45 g for those spawned normally.

Artificial spawning nests (used car tires, at a rate of one tire per spawning pair) for pond spawning of *C. gariepinus* had minimal effect on reproduction. Stress was identified as a possible proximate cue in catfish spawning. The hatchery management project established and organized a collaborative relationship with the PD/A-CRSP and the Government of Kenya.

Water and sediment samples from farms and irrigation canals in Abbassa, El-Fayoum and Kafr El-Sheik revealed the presence of copper, iron, manganese, zinc and lead with concentrations depending on site and irrigation system. Tissue samples of fish from these sites have been prepared for analysis of heavy metal content.

An African Fish Health Network is under discussion with collaborators. Eighteen African fish health scientists in Nigeria, Kenya, South Africa, Côte d'Ivoire and Ghana have been approached with a questionnaire to ascertain the level of infrastructure and human resources available for fish disease diagnosis, therapy and documentation.

**Activities Planned for 2000**

Continue efforts to develop project sites in Cameroun, Côte d'Ivoire and South Africa.

Establish structural and ecological requirements for natural pond spawning and larval rearing of *C. gariepinus*. Subject to funding, implement a collaborative research project to study on-farm production of *C. gariepinus* fingerlings using low levels of technological inputs in monoculture and polyculture with CRSP and Sagana Fish Farm in Kenya. The timing of broodstock removal and stress will be studied.

Conduct a study to improve the spawning output of *O. niloticus* via manipulation of nutritional inputs and/or temperature. Evaluate the incorporation of a growth promoter (biogene) in diets used for sex reversal of *O. niloticus* fry and undertake studies of sexual maturation.

Based on 1999 findings, complete the collection of water, sediment and fish samples on selected farms with different sources of irrigation water to identify residual heavy metals and pesticides. Prepare a draft manuscript of survey results and develop recommendations on how to deal with pollution problems in aquaculture systems.

In collaboration with Cairo University, an M.S. student will study the effect of levels of vitamin C in the diet on absorption of heavy metals (Cu and Zn) by *C. gariepinus* fingerlings.

In collaboration with FAO, continue to develop a Fish Health Network and organize a regional fish health workshop for representatives from African countries to: (i) identify the scope of the proposed network; (ii) determine training and infrastructure requirements; and (iii) formulate a data collection strategy.

## Project 8.4
Training Activities

**ICLARM Staff**

Dr. A. El Gamal; other ICLARM staff

**Collaborating Institutions**

*International*: Multi-sector Support Programme (MSSP); Food and Agriculture Organization (FAO), Regional Office for the Near East
*Egypt*: Institute of National Planning

**Donors** : Social Fund for Development (Egypt); MSSP; FAO Regional Office; ICLARM restricted core

**Duration** : Since January 1999

**Objectives**

- Train fish producers to adopt new technology in their farm operations and further spread this technology to others.
- Assess how training can be used directly and efficiently in enhancing productivity of existing fish farms.
- Enhance the skills of aquaculture professionals working in the region.

**Background and Justification**

While the production from capture fisheries in marine and inland waters may have reached its peak, there is evidence that aquaculture can produce substantial quantities of high quality fish. Most of the countries in the region have a potential for aquaculture in fresh, brackish and marine waters. The yields that can be obtained from aquaculture depend greatly on the state of technology, level of inputs and skill of the farmers. The future success of the sector depends to a large extent on the availability of trained and experienced people.

Lack of knowledge is a major factor limiting the output of fish farms. There is often little direct contact between researchers and farmers. The training program aims to transfer appropriate technology directly to fish farmers with the goal of increasing productivity.

**Scores Against Principles**

| | | | |
|---|---|---|---|
| Sustainability | H | Participation | H |
| Equity | H | Systems Approach | H |
| Gender | M | Anticipatory Research | H |

**Current Status**

A three-week course (7-24 March 1999) was attended by 14 fish farmers from the Fayoum area. All participants had a high school diploma. Although the main focus was general aquaculture, the Fayoum area received special attention in regard to current culture practices, species cultured and environmental situations (climate, salinity, etc).

The first two weeks of the program were spent in Abbassa while the final week of training was conducted on fish farms in the Fayoum region. During the on-farm training, issues raised by the participants were addressed, such as sexing of tilapia, grading of different sizes and the production of silage. Water quality management was also emphasized in this phase.

An on-farm demonstration pond was established to follow the training. Fertilizers and feed inputs are being managed and recorded. Water quality is being monitored closely due to its special importance in this region. A field day will be held at the end of the growing season to present the production data and the economic analysis.

Nineteen fish producers and staff of government agencies (including universities) from the Abbassa area participated in a five-day course held 6-11 November. The course entitled Enhancing the Productivity of Fish Farming in Egypt focused on ways to increase the productivity of aquaculture operations in this area.

A regional aquaculture training course, developed in close collaboration with the regional office of FAO, for specialists from West Asia was conducted in October. Eleven participants from nine countries were given a two-week course on general topics on farming of aquatic animals in fresh and marine waters. The course included lectures, practical training, and demonstrations in Abbassa and field trips to hatcheries, fish farms (freshwater and marine), a shrimp farm and a fish feed mill. This course attempted to update and integrate the scientific and technological knowledge of aquaculture professionals for successful and responsible hatchery and farm management.

**Activities Planned for 2000**

Conduct six training programs for local and regional producers and specialists. Add a training on specific subjects such as genetic enhancement and aquaculture in arid lands. Develop a course for scientists in sub-Saharan Africa.

## Project 8.5
Fish Health

**Current Status**

An African Fish Health Network has been discussed with collaborators. Eighteen African fish health scientists in Nigeria, Kenya, South Africa, Côte d'Ivoire and Ghana have been approached with a questionnaire to ascertain the level of infrastructure and human resources available for fish disease diagnosis, therapy and documentation.

**Activities Planned for 2000**

In collaboration with FAO, continue to develop a Fish Health Network for Africa and organize an African Regional Fish Health Workshop for representatives from participating countries to: (i) identify the scope of the proposed network; (ii) determine training and infrastructure requirements; and (iii) formulate a data collection strategy.

# 9. OFFICE OF THE DEPUTY DIRECTOR GENERAL - PROGRAMS (ODDG-P)

## Project 9.1
Office of the DDG-P

**ICLARM Staff**
Dr. Peter Gardiner; office support to be appointed

**Donors** : ICLARM core funds; TAC/CGIAR project funds for specific intercenter project activities

**Duration** : Continuous since August 1996

**Functions**
- Provide assistance to the Director General in the planning, implementation, monitoring and reporting of ICLARM's research and research-related Programs.
- 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.
- Convene the internally commissioned external review of scientific Programs.

**Current Status**
Finalized ICLARM's Strategic Plan 2000-2020 and a Supplement with background data and statistics on aquatic resource systems and target developing country regions (published in October 1999).

Finalized ICLARM's Medium-term Plan 2000-2002 in consultation with Program Leaders.

Contributed to the Center-wide discussions on the movement of program activities following the decision to relocate ICLARM's headquarters to Malaysia.

Crystallized the adoption of a five-Program structure for adoption in 2000 and a schedule of reviews for the monitoring of progress over a four-year period.

Convened ICLARM's logframing exercise and the annual in-house Scientific Review.

Developed an intercenter proposal (with the International Water Management Institute) and the Mekong River Commission) for collaborative work in the Mekong basin in support of ICLARM's policy and biodiversity objectives. The project has been funded by the TAC holdback fund for intercenter research and will be implemented in 2000.

Developed position papers for the CGIAR, TAC Secretariat and ICLARM's Board of Trustees.

Visited ICLARM's research site in Egypt and members of the national research systems and regional organizations in Malaysia and the Philippines.

**Activities Planned for 2000**
Redraft ICLARM's MTP 2001-2003 taking into account new Program and Project structures in line with the Strategic Plan 2000-2020.

Develop inter-Program projects for research on the basis of the Strategic Plan and help initiate planned intercenter projects.

Assist in the development of staffing, Project and Program activities as ICLARM establishes its research at its new headquarters in Malaysia.

Assist the DDG-Africa and West Asia and Program staff in the implementation of submitted research proposals for work at Abbassa in Egypt, with renewed emphasis on aquaculture and aquaculture genetics.

Continue the development of strategic papers for internal priority setting and external audiences on poverty mapping and the identification of the beneficiaries from aquatic resources research.

# 10. OFFICE OF THE DIRECTOR GENERAL (ODG)

**Project 10.1**
Office of the DG

**ICLARM Staff**
Dr. Meryl J. Williams; others to be appointed

**Donor** : ICLARM core funds

**Duration** : Ongoing

**Functions**
OVERALL

- Lead and manage the Center and ensure that ICLARM's Programs are properly developed and carried out and that they contribute optimally to the achievement of the Center's mission.

SPECIFIC

- Manage the staff and resources of ICLARM, observing the policies approved by the Board of Trustees.
- Manage the Center's external relations with research and development organizations worldwide (national, regional and international) and with current and potential financial partners.
- Act as ICLARM's legal representative and, within the limits established by the Board, taking whatever actions are necessary to attain ICLARM's purpose.
- Create a supportive organizational environment for efficient delivery of the work program.
- Publicly represent ICLARM's interests positively and assertively.
- Provide assistance in the policy and decision-making functions of the Board.

**Current Status**
The major outcomes of 1999 were:
Led the Center through the successful second External Program and Management Review (delivered to the Consultative Group on International Agricultural Research at the Mid-term Meeting in 1999).

With the assistance of the Executive Management Team (EMT), supported the Board in making its decision on a new headquarters for ICLARM and led all the headquarters staff successfully through the first major phase of the headquarters transition process. Led the successful start to the fund raising campaign for the renovation of the new headquarters site and transition costs.

Monitored the security situation at the troubled Guadalcanal site of ICLARM in Solomon Islands. Provided leadership during the partial closure of the ICLARM operations in Solomon Islands following the armed assault on the main site in November 1999.

Represented ICLARM at the major semi-annual meetings of the CGIAR and with research partners and development assistance agencies.

**Activities Planned for 2000**
Provide leadership to the Center in all its activities. Priority will be given to the following areas.

Complete the transition to the new headquarters site in Penang, Malaysia, and startup of all activities. The renovation of the headquarters buildings will be undertaken in 2000, with completion and an official opening envisaged for mid-2001.

Establish the ICLARM-Philippines site at the International Rice Research Institute in Los, Baños, Philippines.

Establish a secure site for ICLARM's operations in the Pacific Islands in view of the security problems experienced at the main site in Solomon Islands.

Oversee the introduction by the Deputy Director General - Programs of the new research Program structure.

Finalize and introduce a more focused and appropriate corporate image for ICLARM.

Raise adequate financial and scientific resources from multilateral, bilateral and private sector sources. This year, emphasis will be given to commencing more concerted fund raising initiatives from the private sector while preserving ICLARM's ability to create international public goods.

Under the new Strategic Plan 2000-2010, work with international, regional and national aquatic resources research and management partners to improve the understanding of the status of aquatic resources and their ecosystems, identify positive interventions that can be made to improve the welfare of poor people who depend on these resources, and strengthen the capacity of developing country agencies to study and address fisheries and aquaculture sector problems.

Help raise the awareness of ICLARM's mission, role and achievements in order to have greater positive impact on target beneficiaries, including through influencing the direction of development assistance efforts.

Actively participate in CGIAR activities directed towards establishing a new vision for the CGIAR. This effort is expected to be completed at International Centers' Week 2000.

## Project 10.2
## Project Development Coordination Unit (PDCU)

**ICLARM Staff**
Dr. Meryl J. Williams; Ms. Rizalina Camañag; Mr. Philip Bontuyan

**Donor** : ICLARM core funds

**Duration** : Continuous from 1996

**Objectives**
- Guide and assist Program Leaders and staff in their project development needs.
- Ensure that project concepts/proposals undergo a thorough review process through the Research Management Committee.
- Help identify funding sources for ICLARM in general and its research projects in particular.
- Develop and promote a good working relationship between ICLARM and its actual and potential donors.

**Background and Justification**
The PDCU was created mainly to answer the need for an improved system for project development and fundraising at ICLARM. Specifically, the PDCU keeps track of the Center's project development activities and performance in terms of proposal quality and approvals. It also acts as the Center's catalyst for resource mobilization.

The PDCU assists the DG in developing, maintaining and enhancing the Center's relationships with its donor stakeholders. This involves formulating and implementing strategies and methods for fundraising and enhancing donor relations. The Unit also assists the Center's scientists in the preparation and submission of proposals to donors and keeps them informed of changing donor priorities and requirements.

**Current Status**
The Unit currently maintains an electronic project proposal tracking and database program. A total of 73 proposals are in the inventory, of which 12 are being further developed, four are for donor submission, 24 are being negotiated, nine were already submitted to donors but need to be further submitted to others, one is partially funded, six are approved and 17 are archived.

PDCU received a total of 37 proposals in 1999. Six (16%) are being further developed; two (5%) are for donor identification or submission; 16 (43%) are under negotiation with various donors; three (8%) need to be further submitted to other donors; three (8%) are funded (plus two other proposals received prior to 1999 that were also approved for funding this year); and seven (19%) were archived or subsequently replaced with new proposals.

Private sector fundraising concepts are being discussed with EMT and the Board. A strategy to tap private sector resources is currently being developed.

**Activities Planned for 2000**
Continue efforts in streamlining the process of project development, donor identification, submission and negotiations.

Improve further the ratio of proposals approved by enhancing the quality of proposals submitted and more vigorous identification of donors and negotiations. To support this goal a donor tracking and database program will be developed and used by the Unit.

Initiate a private sector fundraising and partnership.

# ACRONYMS

| | |
|---|---|
| ACIAR | Australian Centre for International Agricultural Research |
| ACP | African, Caribbean and Pacific |
| ADB | Asian Development Bank |
| AFS | American Fisheries Society; Asian Fisheries Society |
| AFSSRN | Asian Fisheries Social Science Research Network |
| AIMS | Australian Institute of Marine Science |
| AIT | Asian Institute of Technology |
| ALCOM | Aquaculture for Local Community Development Programme |
| AOU | Administration and Operations Unit |
| AP/PO | Accounts Payable/Purchase Order |
| APFIC | Asia-Pacific Fisheries Commission |
| ASFA | Aquatic Sciences and Fisheries Abstracts |
| AWA | Africa and West Asia |
| BFAR | Bureau of Fisheries and Aquatic Resources |
| BFRI | Bangladesh Fisheries Research Institute |
| BGRRP | Biodiversity and Genetic Resources Research Program |
| BMZ | Bundesministerium für Wirstchaftliche Zusammenarbeit (Germany) |
| BOT | Board of Trustees |
| BRAC | Bangladesh Rural Advancement Committee |
| BRRI | Bangladesh Rice Research Institute |
| BRS | Bureau of Rural Sciences |
| BVI | British Virgin Islands |
| CAC | Coastal Aquaculture Centre |
| CARICOM | Caribbean Community |
| CAS | California Academy of Sciences |
| CASS | Center for Applied Social Sciences |
| CBFM | Community Based Fisheries Management |
| CCESM | Caraga Center for Environmental Studies Management |
| CEASDES | Center for Environmental and Social Studies on Sustainable Development |
| CERED | Center for Environmental Research and Education |
| CIDA | Canadian International Development Agency |
| CIFA | Central Institute of Freshwater Aquaculture |
| CITES | Convention on International Trade in Endangered Species |
| CLAR | Central Laboratory for Aquaculture Research |
| CMI | Christian Michelsen Institute |
| CNRS | Center for Natural Resource Studies |
| CORAL | Coral Reef Alliance |
| CORIN | Coastal Resources Institute |
| CPR | Common property resources |
| CRED | Center for Resource and Environment Development |
| CRIFI | Central Research Institute for Fisheries |
| CRODT | Centre de Recherche Océanographique, Dakar-Thiaroye |
| CSD | Corporate Services Division |
| CTU | Cantho University |
| DANIDA | Danish International Development Assistance |
| DDG-P | Deputy Director General - Programs |

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|---|---|
| DDG-AWA | Deputy Director General - Africa and West Asia |
| DENR | Department of Environment and Natural Resources |
| DFID | Department for International Development (UK) |
| DOF | Department of Fisheries |
| DSE/ZEL | German Foundation for International Development/ Food and Agriculture Development Centre |
| ESCAP | Economic and Social Commission for Asia and the Pacific |
| EU | European Union |
| FAC/CLSU | Freshwater Aquaculture Center/Central Luzon State University |
| FAO | Food and Agriculture Organization of the United Nations |
| FAQs | Frequently Asked Questions |
| FAST | Financial and Administrative Systems Team |
| FFRC | Freshwater Fisheries Research Centre |
| FiRST | Fisheries Resources Information System and Tools |
| FiSAT | FAO-ICLARM Stock Assessment Tools |
| FIVDB | Friends in Village Development of Bangladesh |
| FMS | Financial Management System |
| FMU | Financial Management Unit |
| FRAMP | Fisheries Resources Assessment and Management Program |
| FRDC | Fisheries Research and Development Corporation |
| FRRP | Freshwater Resources Research Program |
| GBRMPA | Great Barrier Reef Marine Park Authority |
| GCRMN | Global Coral Reef Monitoring Network |
| GHK | University of Kassel |
| GoFAR | Group of Fisheries and Aquatic Research |
| GTZ | Deutsche Gesellschaft für Technische Zusammenarbeit (Germany) |
| HQ | Headquarters |
| HRIS | Human Resources Information System |
| HRU | Human Resources Unit |
| IAA | Integrated aquaculture-agriculture |
| ICAR | Indian Council for Agricultural Research |
| ICEIDA | Icelandic International Development Agency |
| ICM | Integrated Coastal Management |
| ICRI | International Coral Reef Initiative |
| ICRW | International Center for Research on Women |
| IDA | Institute for Development Anthropology |
| IDRC | International Development Research Centre |
| IFAD | International Fund for Agricultural Development |
| IFM-K | Institut für Meereskunde, Kiel |
| IFPRI | International Food Policy Research Institute |
| IIRR | International Institute of Rural Reconstruction |
| INGA | International Network on Genetics in Aquaculture |
| IRM | integrated resource management |
| IRRI | International Rice Research Institute |
| ISNAR | International Service for National Agricultural Research |
| ITU | Information Technology Unit |
| IUCN | World Conservation Union |
| IWMI | International Water Management Institute |

| | |
|---|---|
| JIRCAS | Japan International Research Center for Agricultural Sciences |
| KFPL | Kolombangara Forest Products Limited |
| KU | Kasetsart University |
| LARReC | Living Aquatic Resources Research Center |
| LFSA | Length-Frequency Stock Assessment |
| LGA | Local Government Academy |
| LISU | Library and Information Services Unit |
| MAF | Ministry of Agriculture and Fisheries |
| MCA | marine conservation area |
| MFA | Ministry of Foreign Affairs |
| MNHN | Museum National d'Histoire Naturelle |
| MPA | Marine protected areas |
| MRAC | Musée Royale de l'Afrique Centrale |
| MRC | Mekong River Commission |
| MSEP | Mbowe Sustainable Ecofarming Project |
| MSSP | Multi-Sector Support Programme |
| MUK | Manobik Unnayan Kendra |
| NAC | National Aquaculture Center |
| NACA | Network of Aquaculture Centres in Asia-Pacific |
| NAGRI | National Aquaculture Genetics Research Institute |
| NARA | National Aquatic Resources Research and Development Agency |
| NARS | National Aquatic Research Systems |
| NCAR | National Center for Atmospheric Research |
| NCICM | National Course on Integrated Coastal Management |
| NHM | Natural History Museum |
| NMIRC | National Marine Information and Research Centre |
| NORAD | Norwegian Agency for Development Cooperation |
| NSC | North Sea Centre |
| NTAFP | Network of Tropical Aquaculture and Fisheries Professionals |
| NTAS | Network of Tropical Aquaculture Scientists |
| NTFS | Network of Tropical Fisheries Scientists |
| OADG | Office of the Associate Director General |
| ODDG-AWA | Office of the Deputy Director General - Africa and West Asia |
| ODDG-P | Office of the Deputy Director General - Programs |
| ODG | Office of the Director General |
| OVI | Ocean Voice International |
| PAU | Public Awareness Unit |
| PBU | Planning and Budgeting Unit |
| PCAMRD | Philippine Council for Aquatic and Marine Research and Development |
| PCE | Population, Consumption and Environment |
| PCSD | Palawan Council for Sustainable Development |
| PDCU | Project Development Coordination Unit |
| PISCES | Population Interdependencies in the South China Sea Ecosystems |
| PITP | Partnerships, Information and Training Program |
| PKSPL-IPB | Pusat Kajian Sumberdaya Pesisir dan Lautan, Institut Pertanian Bogor |
| PMUK | Proshika Manobik Unnayan Kendra |
| PRIAP | Policy Research and Impact Assessment Program |
| PU | Publications Unit |

| | |
|---|---|
| RAMP | Rapid Assessment of Management Parameters |
| RBF | Rockefeller Brothers Fund |
| RESTORE | Research Tool for Natural Resources Management, Monitoring and Evaluation |
| RET | Research Extension Teams |
| RETA | Regional Technical Assistance |
| RIA | Research Institute for Aquaculture |
| RIFF | Research Institute for Freshwater Fisheries |
| RIMF | Research Institute for Marine Fisheries |
| SADC | Southern African Development Community |
| SCS | South China Sea |
| SEAFDEC-AQD | Southeast Asian Fisheries Development Center-Aquaculture Department |
| SEARCA | Southeast Asian Regional Center for Graduate Study and Research |
| SFIS | Selective Fisheries Information Service |
| SIDA | Swedish International Development Agency |
| SPC | Secretariat of the Pacific Community |
| TAC | Technical Advisory Committee |
| TCDC | Technical Cooperation Among Developing Countries |
| TDC | Tambuyog Development Center |
| TERI | Tata Energy Research Institute |
| TNC | The Nature Conservancy |
| TU | Training Unit |
| UBC | University of British Columbia |
| UNDP | United Nations Development Programme |
| UNE | University of New England |
| UNEP | United Nations Environment Programme |
| UP | University of the Philippines |
| UPLB | University of the Philippines at Los Baños |
| UPM | Universiti Putra Malaysia |
| UP-MSI | University of the Philippines - Marine Science Institute |
| UPV | University of the Philippines in the Visayas |
| URI | University of Rhode Island |
| USAID | United States Agency for International Development |
| USDA | United States Department of Agriculture |
| VASI | Vietnam Agricultural Science Institute |
| WCMC | World Conservation Monitoring Centre |
| WRI | World Resources Institute; Water Research Institute |
| ZIM/UH | Zoologisches Institut und Zoologisches Museum, Universität Hamburg |

# INDEX OF COLLABORATING INSTITUTIONS[1]



[1] Page numbers refer only to sections on 'Collaborating Institution(s)' in the book.

# INDEX OF DONORS[1]



[1] All ICLARM projects are supported by its core (unrestricted) funds. • Donors to ICLARM core funds (unrestricted) and specific project funds (restricted); ¤Donors to only project related funds (restricted); * Donors to only core fund (unrestricted).

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### *Our commitment:*

ICLARM **contributes to food security and poverty eradication in developing countries.**

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

### *How we achieve this:*

**Through research, partnership, capacity building and policy support, we promote sustainable development and use of living aquatic resources based on environmentally sound management.**

Our 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 our research are | The values of our work are |
|---|---|
| • Sustainability<br>• Equity<br>• Gender role in development<br>• Participation<br>• Systems approach<br>• Anticipatory research | • Excellence in achievement<br>• Relevance to our beneficiaries' needs<br>• Partnerships<br>• Centerwide teamwork<br>• Communication<br>• Efficiency and flexibility in program delivery<br>• Continual growth in our knowledge and understanding. |

### *International links:*

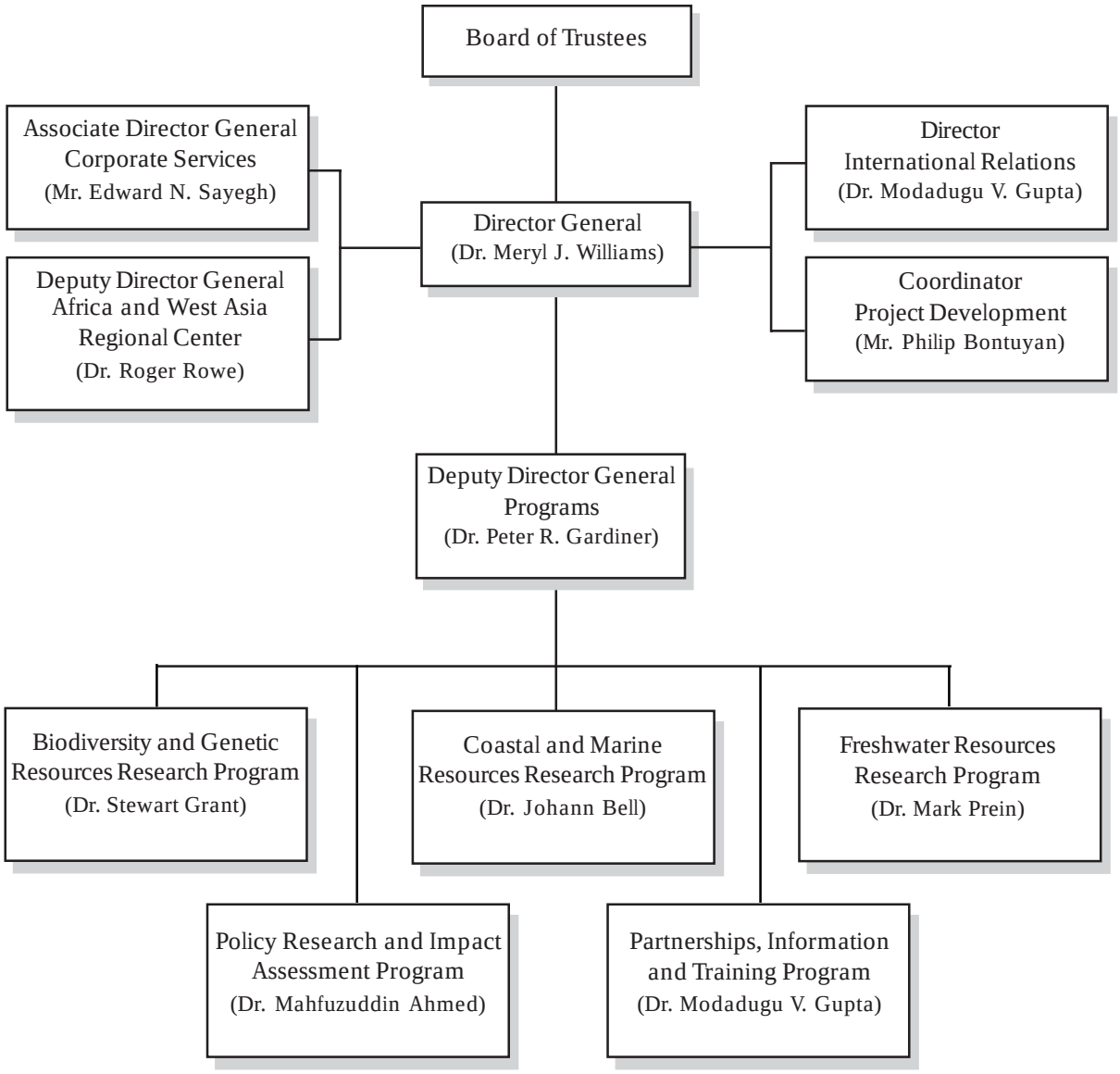
ICLARM has its headquarters in Malaysia and offices in Egypt, Bangladesh, the Caribbean, Malati, Philippines and Solomon Islands.

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

### *ICLARM's corporate makeup:*

ICLARM is an autonomous, nongovernment, nonprofit organization, established as an international center in 1977 with its headquarters in Malaysia. 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 155 staff from 18 countries.



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