

MEDIUM TERM PLAN 2001-2003

ICLARM

**INTERNATIONAL CENTER FOR LIVING AQUATIC
RESOURCES MANAGEMENT**

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Executive Summary

Introduction:

The International Center for Living Aquatic Resources Management (ICLARM) presents its Medium Term Plan (MTP) for 2001-2003 for the consideration by TAC and members of the CGIAR. The Plan has been developed in a period when there is growing public discontent over the limitations of global fish catches from natural environments and the provision of adequate nutrition for the burgeoning human population, especially in developing countries.

The current plan reflects five influences:

- 1) Continuity and an annual update of earlier plans based on a consultative development process undertaken in 1996 and 1997 which prioritized the institute's activities for the forthcoming three to five year period. This sequence commenced with the period 1998-2000.
- 2) The outcomes and research directions arising from ICLARM's recent strategic planning process. ICLARM's Strategic Plan 2000 - 2020 was published in September 1999 and expands our research thrusts from ponds, coral reefs and coastal waters to freshwater systems, namely lakes, small water bodies (SWBs) and floodplains. This strategy will emphasize the development of aquaculture in ponds and SWBs, the sustainable exploitation of coral reefs within integrated coastal zone management (ICZM), and generic contributions to tools and knowledge to augment the performance of developing country fisheries. The Center will also continue its focus on Asia, while enhancing its activities in Africa and the small island developing states (SIDS) of the Indo-Pacific and Caribbean. Work in mainland Latin America will not be a principal priority.
- 3) The review and guidance provided by the second External Program and Management Review of ICLARM completed in early 1999. The review confirmed the appropriateness of ICLARM's work in living aquatic resources management described in this plan and the adoption of a new internal program structure.
- 4) The adoption for the first time of a centre-level logframe and the revision of the TAC activity categories. The withdrawal of the categories "saving the environment" and "protecting biodiversity" have led to more than half of ICLARM's activities being allotted to the "sustainable production" output category which reflects ICLARM's focus on natural resources management.
- 5) An evolution of earlier activities based on emerging issues and new research opportunities in high priority areas.

Moreover, the plan has been produced at the time of ICLARM's transfer of its headquarters site to Penang, in Malaysia, the establishment of a Philippine office and the temporary suspension of some activities in the Solomon Islands.

Thus whilst the present plan steers towards the goals of ICLARM's long term strategy, the annual changes in the current plan result from progress with projects in 1999, further projections for milestones in 2002/3 and the anticipated availability of donor support for the period. This Plan also presents an account of progress that we achieved in 1999 and expected achievements in the year 2000 and beyond.

Changes in the Research Program portfolio since 1998-2000:

The current program portfolio maintains an emphasis on productivity enhancement in natural and culture systems, and appropriate conservation and use of aquatic resource systems, particularly those providing direct benefits to the poor. Strong weight is given to NARS strengthening, and to improving policies to augment management of living aquatic resources.

The intention is that the projects will increase critical mass in areas for specific topic research and maintaining global scientific contacts. Secondly, ICLARM's project portfolio developed in 1995, although then addressing issues of high importance differed in implementation in some cases from the actual evolution of priorities and active projects foreseen for 2000. The grouping of projects described in this Plan has therefore been consolidated (close to the previous number of programs) and the overall number reduced (see Table C). These changes also have the effect of simplifying research management and concentrating financial resources on larger project entities.

Specifically, the changes from last year's MTP are as follows:

- The number of projects has been reduced from 17 to 10. The current MTP project portfolio consists of: (1) Conservation of Aquatic Biodiversity; (2) Genetic Enhancement and Breeding; (3) Improvement of Freshwater Aquaculture; (4) Fisheries Resources Assessment and Management; (5) Assessing and Limiting Coral Reef Degradation; (6) Coastal Aquaculture and Stock Enhancement; (7) Economic Monitoring and Evaluation of Developing Country Fisheries; (8) Legal and Institutional Analysis for Fisheries Management; (9) Aquatic Resources Research, Planning and Impact Assessment; and (10) Information and Capacity Building for Aquatic Resources Research in Developing Countries.
- Policy research has been given a higher profile within the Center with three of the ten projects (#7, #8, and #9) addressing socio-economic, legal and institutional issues involved in aquatic resources management, as well as assessing impacts of aquatic resources research.
- The former projects on Multi-Lingual Information and Communications (#14), New Methods and Technologies for Training (#15) and Information and Research Networks and Linkages (#16) have been incorporated into new project #10. This new project brings together the aspects of managing relationships with research and development partners, networks, training and the sharing of ICLARM and aquatic resources research data which all contribute to the enhancement of knowledge and capacity of NARS scientists and managers in the aquatic resources sector in tropical developing countries.
- The former project on Multisectoral Use of Inland Systems (#6) is not included as originally designed but aspects are covered in new projects #1 as a new intercenter collaborative initiative in the Mekong region with IWMI, #3 as integral to inland water management, and #8 as policy issues in community-based management of aquatic resources in Bangladesh.
- The former project on Fish Health (#17) was not activated as designed and aspects of the project are conducted under new projects #2 and #3, as part of integrated management of freshwater aquaculture on the African continent and other aspects of aquaculture research, especially genetics, for extended relevance to developing countries.

- The former System-Wide Initiative on Coastal Environments was not activated as designed, but specific coastal zone management research will be designed within 2000, in relation to activities under new project #5.

The subsequent section treats ICLARM's activities by CGIAR Output category.

Germplasm Improvement:

In research towards Genetic Improvement of aquatic species, ICLARM includes genetic enhancement research on carps, tilapia and other aquaculture species used by smallholders, as well as other approaches to the integrated management of freshwater aquaculture. Coastal aquaculture and stock enhancement research focusses on species that can be appropriately exploited by coastal dwellers, such as high value invertebrates and reef fish. In six participating Asian countries in 1999, extensive socioeconomic surveys were carried out for the carp producers, consumers, and hatchery operators. Simultaneously, genetic enhancement research is being carried out on different carp species (principally common carp, silver barb, two species of major Indian carps and a Chinese bream) in all the collaborating countries under the project. Family selection procedures are augmented in some countries by the experimental production of monosex populations and interstrain hybridisation. Generally results to date show better than 8% per generation increases in growth rate. Documentation of carp genetic resources in Asia that are used or available for aquaculture and genetic improvement has been developed for publication in 2000. The combination of socioeconomic, biodiversity and genetic knowledge will together assist the prioritisation of carp genetics research in several Asian countries. Work on tilapia improvement is continuing during the plan period with an emphasis on the transfer of selection procedures to Africa for application to indigenous species. Genetic and statistical training has been provided to both Asian and African collaborating scientists.

Within Africa ICLARM staff have improved hatchery methods and the non-hormonal induction of spawning of catfish and the extension of the breeding/growing season in Egypt. Fish Health research is being pursued following the development of a registry of aquatic animal health scientists in Africa and formulation with the FAO of plans for a fish disease database for the continent.

ICLARM continues work on the improvement of giant clam culture for coastal dwellers and the traits important for market acceptability. Black lip pearl oyster research has been successful, including the demonstration that hatchery reared spat can be used as successfully as wild caught spat for grow out and in pearl production. Research will pass to the pilot industry stage in conjunction with national partners and donor agencies. The collection and hatchery technologies for both giant clams and pearl oysters are being extended to other states in the Pacific and to South East Asia. Two batches of the sea cucumber *Holothuria scabra* ("sandfish") were produced in the CAC hatchery prior to its closure in 1999. Further experiments on the release of sea cucumbers will be conducted in 2000. The next stage involves production of larger numbers of juveniles for use in field experiments to assess the size at release, release season, release habitat and stocking density that gives the best ratio of survival in the wild/cost of producing and releasing the juveniles. The experiments will be concluded in 2004.

In the project to evaluate the possibility of development of new artisanal fisheries based on the capture and culture of postlarval coral reef fish it has been shown that two fishing techniques successfully capture small juveniles of up to 50 families of reef fish, most of which can be supported on formulated diets for a grow out period of 3-4 months.

Germplasm Collection:

ICLARM does not undertake activities for which the collection of germplasm is a major goal or output and the institute has not established germplasm collections, except transiently, to support individual research activities. Small collections of tilapia are held for germplasm improvement projects, mostly as live fish. The establishment of hatchery procedures for conservation and stock enhancement purposes of invertebrate species (giant clams, sea cucumbers) has involved the collection of broodstock and their maintenance in land based hatcheries. Experimental procedures for the collection of juvenile reef fish for grow out procedures or of adult reef fish for genetic studies are continuing. Collectively these studies result in the relatively small percentage allocation of resources to this output. These activities do not result in permanent collections of germplasm and in instances where germplasm transfers are arranged ICLARM shares germplasm under specific Material Transfer Arrangements.

Sustainable Production:

The bulk of ICLARM's research portfolio aims at the output of Sustainable Production. The activities encompass those that were previously described under "Conserving Biodiversity" and "Protecting the Environment" as well as aspects of farming systems research in relation to the introduction of aquaculture.

In 1999, the species coverage and content of ICLARM's global database on finfish, FishBase was increased (to >23,600 species), as were its utility (new graphs for analysis of fisheries data) and Internet accessibility. Two major training courses were conducted in sub-Saharan Africa (Senegal and Kenya) for fisheries and biodiversity managers. New genetic data on *S. melanotheron* and *B. gonionotus* was accumulated. The latter, and ICLARM's work with IWMI on the modelling of the extent and productivity of the floodplain fisheries of the Mekong open new research opportunities for biodiversity research central to management of the region's wetlands that will be conducted during the plan period. ICLARM published with the FAO the proceedings and policy recommendations of a Bellagio conference "Towards Policies for Conservation and Sustainable Use of Aquatic Genetic Resources". ICLARM will continue to address research and policy issues that impact the management of aquatic genetic resources.

ICLARM is developing new approaches to integrate biological, climatic and socio-economic variables in the evaluation of best practices for the introduction of aquaculture into farming systems. ICLARM links its own field experience in Asia and southern Africa with those of others in the evaluation of the development impact of the introduced technology. New initiatives are being taken to extend field and assessment activities to the humid zone of West Africa, and to the drier zone of southern Africa, with CGIAR and regional NARS partners.

Additional project activities focus on increasing and sustaining the productivity of rice and fish in the floodplain ecosystems of South and South East Asia are carried out in Bangladesh and Vietnam. In the former, IAA technologies are being extended to 6,000 new farm households

throughout the country. Monitoring and socioeconomic impact analysis is being conducted on a large sample of these. 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 group access to waterbodies and adequate provision of inputs and access to markets.

Under the Fisheries Resources Assessment and Management project, ICLARM conducts research on tropical fish stock assessment and the management of multispecies fisheries.

A computer package, TrawlBase, has been finalized and is being used to analyze the dynamics of coastal fisheries in eight participating Asian countries. The coverage had been widened to allow the analysis of fisheries in an ecosystem context (e.g. Ecopath). This is likely to be extended to other tropical regions during the plan period. ICLARM continues to extend the use of its tools to other applications, such as the ecosystem valuation of coral reef marine protected areas in the Caribbean. It is ICLARM's intention to conduct and make applicable the outputs of its research to the small island states of the Caribbean and the Pacific which are so dependent on living aquatic resource use. Most recently ICLARM has completed Phase I of its Caribbean Marine Protected Areas Project and has shown that in relatively degraded reef situations where overfishing occurs, that recruitment stems largely from juveniles with long lived larval stages. This and the migration of reef fish (which has also been studied), contribute important scientific information to address the best use of marine protected areas in the rehabilitation of coastal coral reef fisheries within the appropriate social context.

In partnership with others around the world, ICLARM is developing ReefBase, a global database of coral reef systems and their resources and profiles of their use by people. ReefBase is designed to provide scientists and resource managers with the data required for the comparison of reef systems, the identification of problem areas, and the prioritization of action. Version 4.0 of ReefBase, an interrelational compendium of information of global coral reef data will be published on CD ROM in 2000. This effort has been augmented by (i) a global study of "Reefs at Risk, (ii) a first global assessment of fish catch from reefs, (iii) detailed studies of a small number of selected reefs to derive indicators of sustainability and reef health and (iv) genetic study of key coral reef species in countries bordering the South China Sea in collaboration with national partners, to establish the degree of inter-connectivity amongst coral reef organisms in a large marine ecosystem. Research will contribute substantially to ICLARM's economic valuation of resources project. The International Coral Reef Action Network (ICRAN) is currently being developed, and integrates the ICLARM activities, the regional Reefs at Risk assessments and Coastal Management training with other projects to assist the United Nations Environment Programme (UNEP) Regional Seas Program in upgrading the management of coral reefs globally.

In 1999, ICLARM has continued research with New Zealand partners on the effects of alternative logging practices on coral reef and coastal aquatic resources. A pilot study to compare various methods for sampling freshwater fish and invertebrates, marine infauna, coral, and coral reef fish was completed. The first of four annual samples from the study sites will be made in June 2000 of this long term project.

Policy:

ICLARM's overall programs seek innovative and new technologies to augment aquatic production and find better ways to manage the aquatic environment. ICLARM conducts three projects specifically examining the policy environment to ensure wider adoption of these technologies to benefit the poorer people in developing countries. In 1999 the program developed project logframes covering the three following activities: (i) Economic Monitoring and Evaluation of Developing Country Fisheries - ICLARM has completed the first phase of its worldwide collaborative research project on case studies of coastal fisheries co-management. A further phase has been initiated in collaboration with Danish partners in 1999 with emphasis, in Asia, on sociological analysis of community participation and conflict resolution. Action research on co-management and community based fisheries management has continued in Bangladesh, and will be evaluated more widely as a preferred means of management of inland water fisheries in developing countries. Small scale work has also commenced on the evaluation of coral reef systems in the Philippines to provide baseline studies for more generally applicable resource valuation methods. A project has also been formulated in conjunction with IFPRI to include fish products in the World Food Model. Following the publication of similar work in Cambodia, ICLARM and NGO partners have started to conduct household studies in representative parts of Vietnam to gauge true household consumption values of aquatic produce and their contribution to food security in this region. ICLARM hopes to initiate a supply and demand study for aquatic produce in Asia and effects on poor consumers.

(ii) Legal and Institutional Analysis for Fisheries Management - This project examines the linkage between society, economic and natural systems and policy to develop adaptive and flexible solutions for the sustainable use of aquatic resource systems. Current research in this area is conducted as part of a collaborative worldwide project on fisheries co-management strategies focusing on institutional aspects of sustainable governance. Institutional research extends to the governance of common property aquatic resources, especially inland water fisheries in Bangladesh and the multiple use of the wetlands in the Mekong Basin countries.

The project has completed resource assessments in a) the Philippines describing the constraints on the supply of bangus (milkfish) fry for aquaculture and b) on aquatic resource use by smallholder households in Cambodia and Vietnam. This work and that of the MRC and other partners suggests that official statistics underestimate aquatic resource use in these countries substantially (up to tenfold in Cambodia). During the plan period ICLARM expects to implement a cooperative approach with the riparian states in the definition of institutional and legal governance mechanisms of the wetlands of the Lower Mekong Basin. This builds on a pre-project logframe exercise with key stakeholders in wetlands management conducted in each of the key countries in 1999.

The project will also implement a new phase of community-based fisheries management to develop a management framework for inland waters in Bangladesh to ensure equity in access and the distribution of benefits. Similarly, ICLARM will implement new studies of fisheries co-management in Asia and Africa - returning to successful case study sites, but focussing on compliance and legitimacy of governance mechanisms for the more effective use of devolved management regimes.

(iii) Aquatic Resources Research Planning and Impact Assessment. This project evaluates the impact of technological research completed by the institute (*ex post* analysis) and, where appropriate, other technological impacts on the aquatic resources sector. ICLARM has already conducted such analyses of the impact of fisheries co-management initiatives and the potential benefit of farm-level introduction of genetically improved tilapia. The project will increasingly provide *ex ante* analysis of research areas of potential importance to developing country fisheries e.g. in relation to the carp improvement project and to augment ICLARM's strategic planning process. A database for the assessment of developing country fisheries utilizing official FAO statistics and other contributory data has been developed to assist ICLARM's internal planning and priority setting. ICLARM's Strategic Plan for 2000-2020 was published in 1999 and has provided analysis of fisheries and aquaculture statistics, regional, resource system and poverty data which was evaluated for research planning purposes. ICLARM is strongly convinced of the need for continual in-house assessment of the impact of its own research, and that of others which affects sustainable productivity and management issues in aquatic resources.

Enhancing National Aquatic Research Systems:

ICLARM has consolidated its activities for the enhancement of NARS capacity in aquatic resources research and management under a single project for the new plan period. The project brings together the aspects of managing relationships with research and development partners, networks, training and the sharing of ICLARM's own outputs and other aquatic resources research data. Other individual projects within ICLARM also contribute to capacity-building of NARS through project-related training programs (e.g., training in use of FishBase in ACP countries). Moreover, public awareness activities on behalf of the institute are also carried out under this program in conjunction with the office of the Director General; additional activities are undertaken in conjunction with the PARC and Future Harvest of the CGIAR.

This ICLARM project coordinates a research network called the International Networks for Genetics in Aquaculture (INGA). Membership of INGA has been extended to leading ARIs in aquaculture genetics worldwide and eleven such institutes are now included to provide additional assistance to national members so that the combined INGA network now covers four continents. INGA continues to assist in the exchange of germplasm between INGA member countries following FAO guidelines and appropriate material transfer agreements. A long term strategy for ICLARM's program-associated training was developed as part of the institute's strategic plan. ICLARM has contributed to the establishment of the Group on Fisheries and Aquatic Research (GoFAR) under the regional agricultural organization APAARI, to give a voice to the fisheries and aquaculture sector in agricultural regional groupings.

Resource Issues for ICLARM's MTP 2000-2003:

As the adoption by ICLARM of a new project portfolio for this MTP removes the project redundancies accumulated since 1996, the majority of activities are expected to continue as outlined through 2003. Emphasis will be placed on the development of more interdisciplinary projects according to the priorities outlined in ICLARM's strategic plan 2000-2020.

The plan describes research and research-associated activities amounting to US\$ 14.74 million in 2000 rising to US\$ 15.59 million in 2001 and US\$ 17.38 million in 2003.

In 2001, utilising the previous activity categories of the CGIAR, approximately, 24% of resources would be allocated to increasing productivity, 38% to protecting the environment, 2% to saving biodiversity, 21% to improving policies and 15% to strengthening NARS. This relationship changes under the classification by outputs now adopted so that in 2000, 9.2% of resources are devoted to Germplasm Improvement, less than 2% to Germplasm Collection, 61% to Sustainable Production, 17.8% to Policy and 10.2% to Enhancing NARS.

An analysis of resource allocation by region shows that ICLARM allocates approximately 58% of resources to Asia, 30% to Sub-Saharan Africa, 4% to the Caribbean and Latin America and 8% to West Asia and North Africa.

Around 44 positions for center-hired Internationally Recruited staff (including post-doctoral fellows and visiting scientists) are anticipated. Additional positions are planned subject to funding availability in 2000 and beyond. Nationally Recruited Staff are expected to number around 210 after restoration of the staff complement following the move to Malaysia.

Facilities:

The Malaysian Government has made available to ICLARM on a long-term basis 5.2 ha of land with buildings. Plans are underway to renovate these building to international standards. The cost of renovation and setting up the facility is estimated at US\$ 3.52 millions.

ICLARM was forced to discontinue work at the Coastal Aquaculture Centre in November 1999 due to the deteriorating security situation. Projects at the Nusa Tupe field site in the Solomon Islands have continued and ICLARM is actively engaged with the Government of the Solomon Islands and others to identify a new site from which to promote coastal aquaculture in the Pacific region. However, a number of staff of the CAC have been separated because of the closure and social unrest.

A. The Research Agenda

(a) *Introduction, Context, and Program Discussion for 1999/2000:*

a.1 The Global Context

In stark contrast to the increase in the yields of staple cereals and price stability provided through genetic enhancement research, the relative supply of wild caught fish is in decline and prices are increasing, often beyond the reach of poor people.

Today the majority of the world's consumption of fish and other aquatic products is still provided by capture fisheries. In 1989, the volume of the world's capture fisheries was estimated at just over 100 mmt¹, representing approximately 89% of total production. Although total world fishery production is continuing to show annual increases², capture fisheries had declined to 81% of total production in 1995 and all indications are that the trend is accelerating. Aquaculture products provide the balance of the total catch, and world production (from both marine and freshwater aquaculture and including aquatic plants) has more than doubled in the decade since 1984 and in 1996 reached 34 mmt. However, it is not yet clear whether such production can make up for the capture fisheries short-fall in most tropical regions, and ensure a continued supply of aquatic food for a growing population. New technologies and the wider adoption of aquaculture can certainly help, but aquaculture (even under optimistic projections of both aquaculture and capture fisheries development) is unlikely to provide more than about 28 - 30% of total production of the sector by 2010.

There is therefore an urgent need to provide better management advice and methods to conserve current fish stocks and to provide for their sustainable use, and to develop more efficient technologies for aquaculture so that it can provide the necessary augmentation in productivity needed to meet growing global demand. ICLARM, the only tropics-based research institute that focuses equally on both fisheries and aquaculture research for low-income people, has a unique role in providing such advice and technologies.

ICLARM's broad and complex mandate allows it a breadth of vision ideal for the generation of international public goods derived from desk and laboratory studies and field research conducted at sites throughout the developing world. Developed in 1975, the original tenets of the Center still underlie the current goals and objectives, which govern its work today: ICLARM's goal is to enhance the well-being of present and future generations of poor people in the developing world through improved production, management and conservation of living aquatic resources.

¹ The majority of statistics are taken from Williams, M.J. The Transition in the Contribution of Living Aquatic Resources to Food Security, Food Agriculture and the Environment, Discussion Paper 13, 2020 Vision, IFPRI, Washington, USA and the FAO data sources quoted therein.

² The FAO catch statistics for 1993 shows a significant upward revision from the earlier figures, mainly due to adjustment of statistics on China. China's total fishery production in 1993 reached 37.97 million metric tons of which aquaculture contributed 13.28 million metric tons. In 1992, reported total catch for China was only 15.01 tons although aquaculture statistics showed 11.00 metric tons of production from cultured sources. Figures quoted for 1995 are also from FAO statistics.

ICLARM's objectives are through international research and related activities, and in partnership with national government and non-government research institutions, to:

- improve the biological, socioeconomic and institutional management mechanisms for sustainable use of aquatic resource systems ;
- devise and improve production systems that will provide increasing yet sustainable yields and;
- help develop the capacity of national partners to ensure sustainable development of aquatic resources.

As described in detail in subsequent sections, ICLARM's program over the Plan period continues to give approximately equal weight to research on both fisheries and aquaculture with a dominance of biophysical research but an increasing emphasis on socioeconomic and policy research. The program blends biological and social science with state of the art communications technologies to provide outputs of value to a wide range of clients, from fishing families to aquatic resources research scientists and resource managers.

Global debate and statistics however tend to mask many different regional, national and local fishing practices and conflicts (most glaringly between commercial fishing fleets and small scale artisanal fishers), and the sector, because of the general connectivity of aquatic ecosystems and the open access to fishers of much of the world's aquatic resources, is subject to a number of interacting and sometimes contradictory constraints. Direct conflict between the need to reduce fishing to conserve stocks, and the need to keep up employment often leads to policy deadlock. In the industrialized world, massive overcapacity is aggravated by subsidies and the political clout of the sector. In developing countries, whose total marine catch has, since around 1986, exceeded that produced by developed countries, small-scale fisheries provide direct employment for 50 million people involved in catching, processing and marketing. However, overcapacity and hence overfishing is widespread, and alternative employment can be difficult or even impossible to find. For these and other reasons, both marine and freshwater ecosystems are being degraded by a variety of factors. Coral reefs, a major habitat for tropical fish and among the world's most biologically diverse ecosystems, are deteriorating. Large numbers of fresh water fishes are in danger of extinction.

Intensive aquaculture, which accounts for much of the dynamic economic growth of the sector, is capital intensive and export oriented. Exports yield cash and foreign exchange, which may be used to import food. However, water is in short supply in many regions of the world and water quality is in decline. Aquaculture is in competition with other uses for water and aquaculture itself (together with livestock rearing) consumes about 30% of fish meal production (or 5% of the fish catch) as feed. Tension still exists in the international debate over opportunities for aquaculture development in developing countries between producer-targeted, low input aquaculture versus consumer-targeted, intensive aquaculture with sometimes deleterious effects on environment and sustainability. A start is only now being made in exploiting the genetic potential of fish for aquaculture, possibly centuries behind similar approaches to plant commodities and more than 50 years behind farm animal breeding.

Because of the decline in production or availability of some species, fish prices are rising. About one billion people, many of them poor, rely on fish as their main source of animal protein.

Further losses in productivity or long term price rises are likely to jeopardize the nutrition and livelihood of many, especially the poorest of the urban and rural poor of developing countries.

Although fisheries scientists became concerned several years earlier, it was not until well into the 1990s that the world became more generally aware of the precarious condition of the world's fisheries. Highly publicized international fishing disputes have multiplied in number and severity, and popular media articles on the cost of fish for poor people, and the environmental cost of fishing practices, have increased public demand for accurate and impartial information on the underlying issues.

In the context of these changes, governments are seeking help in scientific assessments of the problem, and technical, managerial and policy solutions. ICLARM's MTP program addresses these issues accompanied by a growing effort in improving policies and impact assessment.

a.2 Regional Differences

The global trends outlined above need to be refined to take into account important regional differences, which have affected ICLARM's choice of program priorities. The bulk of both marine (45.0%) and inland fisheries (77.5%) production is in Asia which is currently estimated to have 584 million people living below the poverty line, the majority in South Asia. Many Asian nations have a tradition of fish-farming and many island states of Asia and the Pacific are heavily dependent on fish as a source of dietary protein. Continued concentration of research to achieve a sustainable output, particularly from coastal fisheries, is essential for the future of Asia's aquatic resources productivity. Experience shows that technical advances in aquaculture, backed by continuing research, are swiftly adopted, and can show substantial impact over a wide area. The preponderance of ICLARM's research will continue to be undertaken in Asia and the Pacific, in collaboration with regional partners, and targeted primarily at Asian beneficiaries. Within the Plan period there will be a concentration on the poorer countries of Asia.

Whilst the world's greatest number of poor people reside in Asia, the most dramatic anticipated rise in the number of people living in poverty in the near future will be in Africa. (In sub-Saharan Africa, those living in poverty are expected to number over 300 million; this figure rises to almost 400 million if North Africa and the Middle East are included). The marine fisheries of West Africa and the Indian Ocean represent major resources requiring continued or improved management. Inland fisheries production in Africa provides 10% of the world total. In the face of the rapidly growing population it will be critically important to manage successfully the continent's lakes and other inland water bodies to sustain their productivity and unique diversity in aquatic biota. Aquaculture is practiced in an increasing number of countries in Africa with eight countries (including Egypt) reporting production of over 500 tons per annum by 1992. Efforts are required to extend and adapt existing technologies more widely in concert with the improved management of water and sustainable agricultural practices. ICLARM has previously recognized these requirements but, within the plan period and with the recent acquisition of a facility in Egypt, will design and initiate new programs of research to assist aquaculture and fresh water fisheries development with a primary focus on sub-Saharan Africa and a secondary focus on WANA. ICLARM's work in Africa will increase steadily in the next plan period.

The Center will continue to expand linkages with countries in Latin America and the Caribbean within its area of expertise (e.g., methods for the assessment of coastal and coral reef fish stocks) and will continue active research on marine protected areas with national programs in the Caribbean.

Despite regional differences, the issues of fisheries and aquaculture are global and resource-system specific. ICLARM therefore manages its research through a series of programs implemented at field sites throughout the developing world. Field research projects are supported by centralized capacity to develop software tools, relational databases and research methods which can inform national planners and scientists about fisheries management options, fish biodiversity, coral reef monitoring and sustainable use and contribute to decision making for better fisheries management.

a.3 Establishing Priorities and Evolving Programs

As can be seen from the general conservation of research effort during recent years (Table E a-c) ICLARM's projects have shown a steady evolution over the years rather than dramatic changes of direction. This MTP is based in part of the preparation for the 1998-2000 Plan period, prefaced by an extensive interaction with stakeholders in July of 1996 on likely research areas. A specially convened discussion in September of 1996 with an invited Scientific Advisory Panel, selected to represent a cross section (by subject matter, region, research or development background) of expert opinion, and discussions with a TAC panel were also included in the development of the plan for the period 1998-2000.

More recent events which have shaped the modifications in the current plan were (i) the development of a new strategic plan in a year long exercise (1998/1999) involving ICLARM staff and stakeholders, (ii) a review of ICLARM's future view and new research areas with the External Program and Management Review Panel (amongst many important considerations this modified, for instance, the target for ICLARM's involvement in the work on the African Great Lakes), and (iii) institute and Board involvement with the development of a Center logframe with a more explicit focus on beneficiaries and means of delivery of outputs.

A draft of this plan was prepared in January of 2000 and discussed by ICLARM's Board prior to its submission to TAC in March 2000.

These substantial priority setting exercises were necessary because ICLARM's mandate potentially could have been broadly interpreted - there are for instance approximately 25,000 species of finfish (nearly ten thousand of which could be considered as food fish) and tens of thousands of other living aquatic organisms which encompass invertebrates, algae, seagrasses and mangroves. The use of these aquatic resources occurs across a spectrum of activities from simple hunting and gathering from the wild, and to sophisticated modern industrial harvesting and high technology culture. There is also exploitation of aquatic habitats or individual species for tourism and pharmaceutical purposes. This presents a staggering array of potential research topics to augment the productivity and sustainability of living aquatic resources. It is also quite different from a mandate to improve a single agricultural commodity supported by a relatively small number of resource species to be grown as a monoculture.

ICLARM's resource systems approach³, bearing in mind the CGIAR's poverty target groups simplifies this choice with research conducted on the monitoring and improved management of the individual system or on species assemblages and community analyses. However, addressing the needs of biodiversity research, or aquaculture and stock enhancement for widely important aquatic species groups, the scientific focus shifts to the species level either in its natural setting or in production systems akin to those considered by agricultural researchers. For selected aquaculture species whose better productivity is sought through genetic enhancement, ICLARM has developed programs which are essentially commodity-focused although the underlying research methods (e.g. selective breeding) are generic. At this level the choice of commodity is determined by its value as a food resource for large numbers of poor people and the amenability of the species/group to the research methods (e.g. Nile tilapia and carps) or in promoting income generation for coastal communities through the appropriate exploitation of low-input but high-value species such as giant clams, oysters or sea cucumbers. Therefore ICLARM works on aquatic resource systems and ecosystems or on species and commodities, depending upon the nature of the problem being addressed or the opportunity being created.

ICLARM's Medium Term Plans developed during the 1990's were predicated on an earlier Strategy,⁴ developed in 1991/92 and a participatory review of planned activities with stakeholders in 1996. Research was organized around nine major thematic areas or programs and into 17 projects (see Table C).

ICLARM's 1992 strategy called for an allocation of resources and effort approximately in the ratio: Resource conservation and management - 35%; Fish productivity - 25%; Social Sciences - 20%; Institution Building - 20%.

This allocation was chosen on the basis of an analysis that measured fish catch, aquaculture production, potential to increase production in both of the above, and an index of potential gain, along with modifiers for numbers of poor, NARS strengthening needs, threats to sustainability and equity. The allocation also drew on the "research activity types" outlined by TAC in their document "A Possible Expansion of the CGIAR". Evolving through the series of reviews outlined and a change in CGIAR activity classifications, this anticipated a breakdown of effort in the year 2000 to be: Increasing Productivity - 29%; Protecting the Environment - 24%; Saving Biodiversity - 13%; Improving Policies - 18%; Strengthening National Systems - 16% (see Table E, a and b).

In 1998/99 ICLARM again undertook an institutional and stakeholder analysis of the situation of developing country fisheries and aquaculture. This followed a decade in which there was greater public awareness of the state of fisheries and the environment and in which aquaculture had become the fastest growing sector in agriculture. The Center adopted the resource system approach to setting priorities used earlier. Geographic emphasis was determined by an analysis of the needs of poor people who benefit most from living aquatic resources in developing

³ See ICLARM's 1992 Strategy for International Research on Living Aquatic Resources Management and the Appendix tables which bear on the evaluation and selection of target aquatic species groups.

⁴ ICLARM's Strategy for International Research on Living Aquatic Resources Management, ICLARM, Manila, 1992.

countries (as seven regional groupings). Aquatic resource systems are defined as the zone of convergence of the resources, their aquatic environment and the human users.

The priority setting evaluated production and resource and environmental management needs, the ability of science of all types to address the constraints, feasibility, definition of benefits and beneficiaries, likelihood of adoption and comparative advantage. This approach and the outcomes for ICLARM's strategy entering the next decades is laid out in detail in the ICLARM Strategic Plan 2000-2020 and in a related supplement.⁵ The outcomes confirm the needs and priorities for research on pond (and rice-field) aquaculture, coral reefs and coastal fisheries established earlier and expand ICLARM's focus on floodplain and other inland water fisheries. ICLARM confirms that it has a role to play in developing globally applicable models and drawing attention to issues of wide strategic relevance for developing countries and the sector, and will focus its action research on Asia, Africa and the small island developing states of the Caribbean and the Pacific. (See Table A)

⁵ ICLARM Strategic Plan 2000-2020, ICLARM, Manila 1999 27pp, and Aquatic resources research in developing countries: data and evaluation by region and resource system. Supplement to ICLARM's Strategic Plan 2000-2020. ICLARM Manila, 102pp + tables

Table A. ICLARM's priority research thrusts by aquatic resource system and regional focus - from ICLARM's Strategic Plan (2000 - 2020).

AQUATIC RESOURCE SYSTEM	PRIORITY STATUS*	RESEARCH THRUSTS	REGIONAL FOCUS
Ponds	Very high	Introduce integrated aquaculture systems and impact analysis Enhance genetic techniques	Asia, Sub-Saharan Africa (SSA)
Small water bodies, reservoirs and lakes	Medium	Develop knowledge base Enhance productivity Integrate management	SSA
Floodplains, streams and rivers	High	Enhance yields Develop appropriate research methods and data to evaluate the resources and improve policy decisions and institutional framework	Mekong Basin, South Asia
Coastal waters (including estuaries and lagoons)	High	Co-manage coastal and fisheries resources Plan for integrated resource use Introduce sustainable coastal aquaculture and stock enhancement	Southeast Asia (SEA) (including Mekong Basin), SSA, SIDS
Coral reefs	Very high	Integrate data on coral reefs to determine parameters of reef health Practice better management within ICZM context Encourage sustainable exploitation of coral reef resources through aquaculture and marine protected areas (MPAs)	SIDS (Pacific, Caribbean), SEA, East Africa
Soft bottom shelves	Medium	Conduct analysis and study policy implications of changes in coastal fisheries	Asia, Africa
Upwelling shelves	Low	Keep watching brief on productivity and influences of catch on trade and other aquaculture development	--
Open oceans	Low	Monitor world catch statistics and trade for their effects on ICLARM's target beneficiaries and other resource systems and global patterns	--

*'Very high' represents the heartland of ICLARM's research; it will be allotted between 15-30% each of ICLARM's total financial and human resources and preferentially protected from budget shortfalls. 'High' priority research will be pursued by ICLARM, but usually covering not more than 15% of resources. 'Medium' priority research will be pursued by ICLARM, normally covering not more than 7.5-10% of resources. 'Low' priority indicates that extant data will be used from these systems to contribute to generic research (e.g., fisheries models) and any additional research will generally be conducted by collaborators.

ICLARM then reviewed the planned areas for research and the structure of programs and projects reported in earlier MTPs (including discussions with ICLARM's External Program and Management Review Panel). Three major observations arose relating to the increasing spread of projects, the potential for dispersing disciplinary skills and the complexity of research management of a large number of programs and projects in a small institute. Noting that the majority of problems in aquatic resources management require multidisciplinary, integrated solutions, the programs have therefore been organized into a smaller number of two disciplinary and two resource system programs, with a fifth program providing institutional support to partners through information, training and networking. The new program structure will be implemented commensurate with ICLARM taking up its new headquarters arrangements in Malaysia in March 2000. The intention is that (i) the programs will increase critical mass in areas for specific topic research and maintaining global scientific contacts, and (ii) the programs themselves be linked so that larger more integrated institutional project activities call on the various biological, socioeconomic and management expertise required for individual problem solving.

Secondly, ICLARM's project portfolio developed in 1995, although then addressing issues of high importance differed in implementation in some cases from the actual evolution of priorities and active projects foreseen for 2000. The grouping of projects described in this Plan has therefore been consolidated (close to the previous number of programs) and the overall number reduced (see Table B). These changes also have the effect of simplifying research management and concentrating financial resources on larger project entities.

Table B. Relationship between ICLARM's consolidated program structure (2001-2003) and the CGIAR project portfolio (2001-2003).

ICLARM's Consolidated Program Structure (2001-2003)	"CGIAR" Project (2001-2003)
Biodiversity and Genetic Resources Research	#1- Conservation of Aquatic Biodiversity #2- Genetic Enhancement and Breeding
Freshwater Resources Research	#3- Improvement of Freshwater Aquaculture
Coastal and Marine Resources Research	#4- Fisheries Resources Assessment and Management #5- Assessing and Limiting Coral Reef Degradation #6- Coastal Aquaculture and Stock Enhancement
Policy Research and Impact Assessment	#7- Economic Monitoring and Evaluation of Developing Country Fisheries #8- Legal and Institutional Analysis for Fisheries Management #9- Aquatic Resources Research, Planning and Impact Assessment
Partnerships, Information and Training	#10- Information and Capacity Building for Aquatic Resources Research in Developing Countries

Table C. Relationship between ICLARM project portfolio (2001 - 2003) and ICLARM's project portfolio (1996-2000).

#	ICLARM Project Title (2001-2003)	ICLARM Project Number (1996-2000)
1	Conservation of Aquatic Biodiversity	<ul style="list-style-type: none"> Assessing Aquatic Biodiversity (#1) Aquatic Biodiversity Training (#2) Multi-Sectoral Use of Inland Systems (#6)^a
2	Genetic Enhancement and Breeding	<ul style="list-style-type: none"> Germplasm Enhancement (#3) Fish Health (#17)^b
3	Improvement of Freshwater Aquaculture	<ul style="list-style-type: none"> Aquaculture-Agriculture Systems Analysis, Management (#9) Multi-Sectoral Use of Inland Systems (#6) Fish Health (#17)
4	Fisheries Resources Assessment and Management	<ul style="list-style-type: none"> Fisheries Assessment and Management (#8)
5	Assessing and Limiting Coral Reef Degradation	<ul style="list-style-type: none"> Assessing, Managing Reef Degradation (#4) Decision-Making in Coastal Zones (#5)^c System-Wide Initiative on Coastal Environments (#7)^d
6	Coastal Aquaculture and Stock Enhancement	<ul style="list-style-type: none"> Aquaculture, Enhanced Fisheries on Reefs (#10)
7	Economic Monitoring and Evaluation of Developing Country Fisheries	<ul style="list-style-type: none"> Ecological Economics (#11)
8	Legal and Institutional Analysis for Fisheries Management	<ul style="list-style-type: none"> Policy Analysis (#13) Multi-Sectoral Use of Inland Systems (#6)
9	Aquatic Resources Research, Planning and Impact Assessment	<ul style="list-style-type: none"> Aquatic Research Impact (#12)
10	Information and Capacity Building for Aquatic Resources Research in Developing Countries	<ul style="list-style-type: none"> Multi-Lingual Information & Communications (#14) New Methods and Technologies for Training (#15) Information & Research Networks & Linkages (#16)

^a This project was not formulated as originally designed but aspects are covered in new projects #1, #3 and #8.

^b This project was not activated as designed and aspects of the project are conducted under new projects #2 and #3.

^c Includes coastal zone management training.

^d This project was not activated as designed, but specific coastal zone management research will be designed within 2000, in relation to activities under new project #5.

Table D. Relationship between ICLARM projects and CGIAR outputs (2001-2003).

#	Project Title	Germplasm Improvement ^a	Germplasm collection ^b	Sustainable production ^c	Policy ^d	Enhancing NARS ^e
1	Conservation of Aquatic Biodiversity	- (+)	- (+)	65%	10%	25%
2	Genetic Enhancement and Breeding	80%	5%	- (+)	- (+)	15%
3	Improvement of Freshwater Aquaculture	- (+)	- (-)	100%	- (++)	- (++)
4	Fisheries Resources Assessment and Management	- (-)	- (+)	100%	- (++)	- (++)
5	Assessing and Limiting Coral Reef Degradation	- (-)	5%	85%	- (++)	10% (++)
6	Coastal Aquaculture and Stock Enhancement	10%	5%	85%	- (+)	- (+)
7	Economic Monitoring and Evaluation of Developing Country Fisheries	- (-)	- (-)	- (-)	100%	- (+)
8	Legal and Institutional Analysis for Fisheries Management	- (-)	- (-)	- (-)	100%	- (++)
9	Aquatic Resources Research Planning and Impact Assessment	- (-)	- (-)	- (-)	100%	- (+)
10	Information and Capacity Building for Aquatic Resources Research in Developing Countries	10%	- (-)	- (-)	- (+)	90%

^a Germplasm improvement includes breeding and the genetic enhancement of finfishes, and the hatchery rearing and stock enhancement of marine invertebrates.

^b Germplasm collection is only carried out on an experimental basis for biodiversity or enhancement research. ICLARM does not possess any long term gene banks.

^c The bulk of ICLARM's research portfolio is considered to be the management of living aquatic resources in their natural environment or in agriculture and is thus allotted under this heading.

^d A number of ICLARM's projects have policy implications but only those addressed specifically from a policy (or socioeconomic) stand point are included under this heading. The Aquatic Resources Research Planning and Impact Assessment activities could contribute to all categories of activities but are listed here because of the way they are managed within ICLARM.

^e The majority of ICLARM's projects are conducted in partnership with NARS partners and contain substantial elements of training through research. However, only those projects with discrete training activities, information exchange and networks are included under this activity category.

^f Figures represent financial allocations, while plus/minus in parentheses represent direct and indirect contributions of project activities to each CGIAR category.

^g The percentages represent a breakdown of each ICLARM project into component CGIAR activities.

Table E (a-c) Percentage allocation of ICLARM resources to CGIAR activity/output classifications.

(a)

Strategic plan 1992

CGIAR activity		Fish productivity	Resource conservation & management	Social Sciences	Institution Building
% allocation		25	35	20	20

(b)

1998, anticipated for 2000

CGIAR activity	Increasing Productivity	Protecting the Environment	Saving Biodiversity	Improving Policies	Strengthening National Systems
% allocation	29	24	13	18	16

(c)

2000, anticipated for 2000 to 2003

CGIAR outputs	Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS
% allocation	9	2	61	18	10

a.4 MTP Program Focus

ICLARM has adopted an environment-saving, resource-conscious approach to both freshwater and marine aquaculture systems for the sustainable exploitation of these technologies by smallholders and their communities.

As noted above, aquaculture will have an important role in gap-filling the total fisheries product requirement as the world's capture fisheries decline. It will also provide significant economic and livelihood opportunities which benefit food security. ICLARM seeks to lead new initiatives in the genetic enhancement of freshwater aquaculture species appropriate for tropical developing countries and will continue programs on the stock enhancement of important marine aquaculture species not being addressed by others

Developing appropriate schemes for the productive and sustainable use of the coastal zone of tropical countries in the face of competing uses, some of which carry with them the risk of pollution or degradation of existing coastal resources, is a major challenge. The coastal zone is home to large numbers of artisanal fishers and others, many of whom are women, who earn income from the use or processing of aquatic products. To support these people, the need is for interdisciplinary research coupled with the development and implementation of policies which create an equitable and profitable environment whilst paying due regard to the conservation of the resources for future generations.

Definition of the state of health of coral reefs, and appropriate mechanisms for the protection and productive exploitation of reefs and the organisms they harbor, are being tackled by ICLARM on several fronts. In providing inputs to the development of such policies and research, ICLARM will collaborate with others providing expertise in forestry, soil and water management, coastal agriculture and institutional arrangements, as envisioned through a revised development of the initiative on coastal environments. The aim will be to study and provide general methods for the improved management of the coastal zone taking into account the numerous actors and ICLARM's expertise in coastal fisheries management and data analysis systems.

Special emphasis will continue to be placed on the policy and implementation aspects of technological solutions through research on the co-management aspects of commonly held fisheries resources, proper resource accounting of the roles played by aquatic resources in contributing to food security and environmental and other functions in key aquatic resource systems, and on technology impact assessment. Much of the extended focus under the new Strategic Plan on floodplains and other freshwater bodies will be to integrate social and biological research to optimize the exploitation of these resources. ICLARM has made conscious and pragmatic decisions since its inception to work in scientific partnership and thus extend the scope of its research and expertise and to provide immediate applicability of its research results.

Partners in the fisheries sciences and development community include NARS and universities in developing countries, NGOs, advanced research institutions and development agencies. New opportunities are being explored for productive links with philanthropic Foundations and the private sector. As a unique international institute conducting research on both marine and freshwater fisheries for developing countries, ICLARM has an especial responsibility to provide

technical and other literature for scientific and development advances and to provide information on which improved management decisions can be based. The Center intends to continue and strengthen the dissemination of its research products and information services and, where appropriate, will consider cost-recovery mechanisms to enhance these services. ICLARM will continue to support the two main networks with which it is currently involved (i.e., the International Network for Genetics in Agriculture, or INGA, and the Asian Fisheries Social Science Research Network) and to provide a coordinator for INGA. Similarly, ICLARM will be continuing steps already initiated to work more closely with existing regional groupings of NARS, such as APAARI, and their NGO partners.

Finally, because of ICLARM's position at the nexus of fisheries, aquaculture and conservation research, the Center continues to be called upon to provide input on fisheries and aquatic resources in relation to poverty concerns to international debates on fisheries policy and management, the conservation and use of biodiversity and genetic resources, natural resource management at the ecosystem level, food security and sustainable agriculture, in fora within and outside the CGIAR. The Center believes that it plays an important role in providing information and cross fertilization in these debates, often conducted by institutes and agencies which are part of the wider research and developmental community and for whom poverty is not a prime focus. Such inputs improve the impact of ICLARM's work and ICLARM will make provision for the continuance of this role through the Plan period.

ICLARM acknowledges the range of institutes and agencies which provide research and information relevant to the improved utilization and management of fisheries both globally and more regionally. ICLARM seeks not to duplicate these other sources of expertise but, through collaborative and open partnerships, to focus research advances or new data on the problems of developing country fisheries and on research solutions which benefit poor people.

Because of its relatively small size, ICLARM continues to exercise prudence in its strategic approach and to identify with its partners strategically important research topics on which to focus. Rather than developing additional research programs however, but in line with its mandate, ICLARM will develop information and position papers on such topics as the evolution of smallholder and commercial aquaculture in the next decades, and supply and demand issues in developing country fisheries

Similarly ICLARM will continue to provide input to the Species 2000 project, and will continue to work closely with the Fisheries Department of the FAO and to liaise with the IUCN in the classification and conservation of marine and coastal resources. ICLARM will continue to remain abreast of issues such as ecolabelling of aquatic produce, intellectual property rights and bioprospecting legislation on behalf of itself and partners. ICLARM's membership of the CGIAR since 1992 has helped raise awareness within the system of the important role played by fish and other aquatic resources in human nutrition and food security for poor people in developing countries. ICLARM is confident that this full range of interactions and its strong portfolio of programs will develop results and methods of direct benefit to the enhancement and sustainability of fisheries and aquatic resources. Improvement in the provision of these resources will ensure their contribution to global efforts to enhance food security and substantially alleviate poverty in the context of protecting our world's environment.

a.5 ICLARM's Research Agenda and CGIAR Goals

ICLARM fully subscribes to the CGIAR goals of developing generic methods and technologies which provide international public goods that have an impact on poverty alleviation, food security and environmental protection. ICLARM has chosen its research agenda and outputs that will make a significant contribution to each of these goals.

a.5.1 Poverty Alleviation

Communities engaged in small-scale fishing and farming are often very poor and in danger of being further disadvantaged as resources degrade or as larger-scale operators dominate land and resource use. These poor fishing and farm families are the main ultimate targets of ICLARM's work but the provision of increased quantities of low-cost aquatic produce will similarly assist the urban poor. The Center recognizes that food security is best obtained through promoting equitable use of resources and raising incomes, and not simply through productivity. As such, the Center has developed a research portfolio which benefits access to the means of production, maintenance of a productive resource base, and affordable and sustainable technologies to produce not only edible products but also in some cases, such as cultivation of clams and pearl oysters, high value/low input market items.

Several of ICLARM's projects, including those on integrated agriculture and aquaculture, marine stock enhancement and co-management studies of fisheries, are conducted directly with farmers and fishers affected by project outcomes. For instance, in Bangladesh, the integration of aquaculture into farming systems has been demonstrated to have positive impacts on farm productivity, human nutrition and the involvement of women. For these reasons, ICLARM has maintained this research as a high priority in the Plan period, adding research on deepwater rice systems and to comparable systems in countries in Indo-China. Other ICLARM projects are focused on the development of new scientific results, information and databases which will optimize the use of developing country fisheries for the benefit of all sectors of society but with the emphasis on reducing the cost of fish for poor people. This has been demonstrated in the case of genetic enhancement for Nile tilapia and has led to concurrent research in the Plan period on new initiatives in tilapia and carp genetic enhancement research.

Improving nutrition is an important component of alleviating poverty. ICLARM will seek, through its various programs, to help in maintaining fish consumption among the poor, not just in fishing communities but more generally in both rural and urban areas. Through the development of position papers and policy research, ICLARM will examine how best to maximize the number of beneficiaries from aquatic resources research.

The gender impact of ICLARM programs will be carefully monitored. In fishing and aquaculture, there is a traditional division of labor between men and women but this is breaking down. In many cultures, fishing is generally a male occupation but women make and mend nets, process and sell the catch. Women are likely to be engaged in aquaculture, especially in tending the ponds and feeding the fish, after men have dug the ponds and stocked them. Men usually harvest the fish but post-harvest activities are usually dominated by women. ICLARM intends to contract or co-sponsor a desk study with other expert institutes to examine the researchable issues in post-harvest treatment of aquatic products as a key area affecting overall productivity

of the sector and women's role within it. ICLARM expects to play a lead role in first Asian, and later global, efforts to highlight women in fisheries and fisheries research issues. A regional conference on this subject was convened by ICLARM and the Asian Fisheries Society in 1999.

a.5.2 Food Security

Food security in poor households may mean growing enough to feed the family, or having enough money to feed the family. ICLARM's projects recognize both these objectives. The genetic improvement of aquaculture strains and the development of integrated aquaculture-agriculture systems provide research outputs that can help poor households grow more of their own fish; the work in the Solomon Islands, on cultivating high-value crops like giant clams, pearl oysters and sea cucumbers, helps poor reef fishers to augment their income substantially, allowing for increased food purchases.

Research for the improved management of tropical marine and freshwater fisheries can not only help to preserve the environment, but can also provide national governments with data and recommendations on how to make their fisheries sector more sustainable, and hence productive over time. Work in biodiversity also will serve to increase food security, by highlighting threatened, useful food species and recommending ways to preserve them. Similarly ICLARM will seek to identify improved methods for protecting the biological services of ecosystems. Much of ICLARM's policy work, too, can be seen as supporting this aim through the economic monitoring and evaluation of developing country fisheries.

a.5.3 Environmental Protection

All of ICLARM's research is concerned with the conservation through responsible use of the world's aquatic resources. ICLARM continues to play an important global role in research, data collection and management and as a source of scientific advice on the conservation and sustainable use of aquatic resources at the ecosystem, species and sub-species level. From FishBase, a program that seeks to gather data on the world's finfish species, to coral reef monitoring and assessments for environmental health to the development of fish ponds on small holder farms (that provide water households and vegetable use, as well as for fish); every effort is made to ensure that natural resources (fish, shellfish and water) are managed with a view to sustainable use for future generations. The development by ICLARM of fish biodiversity and coral reef databases, and ecosystem modeling capacity (e.g. ECOPATH with EcoSim), places the Center in a central position in relation to monitoring the effects of climate change on living aquatic resource systems. The Center will continue to make its expertise available to scientific fora concerned with climate change and anticipates a more focused involvement in this global environmental issue beyond the Plan period.

a.5.4 Collaboration: ICLARM's role in the global forum

Since its inception, ICLARM has worked with an array of international partners and collaborators, principally the national aquatic resources research activities in developing countries. This continues to be both a philosophical and pragmatic *modus vivendi*, as working with NARS is the best way of appreciating the actual problems requiring solution, responding to them, experiencing the practicalities of dissemination and implementation of new findings and sharing results and achievements. In recognition of the importance of partnerships, ICLARM

has developed an institutional, Board-approved partnership policy to guide its research and training activities with a wide-range of partner organizations. The Center has been instrumental in developing GoFAR, a fisheries chapter of the Asian regional organization APAARI to provide a voice to aquaculture and fisheries NARS in fora otherwise dominated by agricultural concerns.

ICLARM's tradition of working in partnerships has led it into collaborative consortia of NARS and NGOs. The presence of such consortia has been particularly helpful to the implementation of studies of co-management of coastal fisheries resources and in the extension of integrated resource use for aquaculture/agriculture systems in both Asia and Africa. NGOs are expected to play an especially important technology transfer and feedback role in ICLARM's future IAA work where training in RESTORE software and the introduction of the integrated approach to aquaculture in smallholder farming systems will be provided specifically for appropriate NGOs.

As a small Center with a wide mandate, ICLARM has always been conscious of the need to maximize its links with appropriate advanced scientific institutes or university departments in both developed and developing countries. An excellent example comes from the equitable collaborative arrangements ICLARM has developed for the provision and sharing of data through FishBase and ReefBase. International interest in these two databases has led ICLARM into an enormous network of colleagues and collaborators, from FAO fisheries scientists and through museum curators to divers concerned with reef monitoring. ICLARM's out-posted scientists and time-sharing arrangements with other staff provide linkages to such institutes as the World Resources Institute in the USA and the University of British Columbia in Canada. Collaborative research in, for instance, the Solomon Islands is conducted together with national program staff and scientists from the Australian universities and marine science institutes. ICLARM will also continue to conduct research projects with European institutes under "holdback" funding arrangements.

ICLARM increasingly wishes to capitalize on new technical advances and will benefit through the Plan period from contacts made with advanced institutes in the fields of remote sensing of coral reef health, genetic marker technology for aquaculture species, mangrove ecology and fish health, amongst others. ICLARM's strategy will be to establish new links through project contracts (such as with UK collaborators in quantitative genetics) or the secondment of young scientists from advanced institutes globally to augment the rate of research in new areas and information exchange.

ICLARM will continue to take an active part in the CGIAR's System-wide Genetic Resources Program (SGRP) and its System-wide Information Network on Genetic Resources (SINGER). ICLARM contributes its experience in fisheries co-management studies to the system-wide program on common property resources (CAPRI) managed by IFPRI. Further work with IFPRI will be conducted on the inclusion of fish into the IMPACT World Food model. In the year 2000 ICLARM will conduct collaborative research with IWMI, the Mekong River Commission and other partners from the riparian countries to model the flooding patterns and fish productivity of the Lower Mekong Basin countries. Collaborative research on the introduction of aquaculture into the farming systems of humid west Africa is planned for the Plan period with IITA and WARDA.

As the only fisheries Center of the CGIAR, ICLARM's linkages take it outside the traditional partnerships in agricultural research and into marine science, environment and natural

resources management research for aquatic systems. ICLARM enjoys excellent working relations with central and regional offices of the FAO and with SEAFDEC, the Mekong River Commission and the Asian Fisheries Society. Other partnerships of importance include the IUCN, UNEP, the Global Coral Reef Monitoring Network, the USAID-supported CRSP for Pond Dynamics and Aquaculture and many others. The number and scope of ICLARM's partnerships are certain to grow over the MTP period and beyond.

a.6 Highlights of Achievements 1999/Expected 2000.

The following section lists ICLARM's research and related achievements by CGIAR output, citing those projects which contribute to each output (and see Table D). Readers are also referred to the Project portfolio (Annex 2) which discusses recent milestones by CGIAR project.

Category 1: Germplasm Improvement

ICLARM pursues activities under three projects which contribute principally or in part to the goal of germplasm improvement. These are *Genetic Enhancement and Breeding, Improvement of Freshwater Aquaculture*, and *Coastal Aquaculture and Stock Enhancement*.

Project # 2. Genetic Enhancement and Breeding This Program aims to develop techniques for improving breeds of fish, the dissemination of these techniques and the training of staff in their use. The Program focuses on carp and tilapia species that are important for aquaculture systems prevalent in developing countries. In the case of carps, the project is carrying out a combined genetics and socioeconomic evaluation of the appropriate species, farming systems and breeding goals that will yield the highest potential impact on increased protein production, efficiency, equity, sustainability and environmental issues. The countries collaborating in this project are Bangladesh, the People's Republic of China, India, Indonesia, Thailand and Vietnam.

Work has also been conducted on the enhancement of tilapia in Asia and in Africa

Results in 1999

- Extensive socioeconomic surveys are being carried out in six-participating countries for the carp producers, consumers, and hatchery operators. Substantial data and information have already been collected by national research teams and have been encoded for analysis. Producer, household consumption, and fish species prioritization surveys were completed in all the participating countries. Documentation of carp genetic resources in Asia that are used or available for aquaculture and genetic improvement has been developed for publication in 2000.
- Preliminary analysis indicates that fast growth, disease-resistance, high survival rate, and resistance to low-dissolved-oxygen environments are the priority traits commonly identified by participating countries for prioritizing carp genetic research. Better morphological characteristics (color, body shape, eye shape) are considered high priority traits for common carp in Indonesia and meat quality for common carp in China.

- Genetic enhancement research is being carried out on different carp species (principally common carp, silver barb, two species of major Indian carps and a Chinese bream) in all the collaborating countries under the project. Family selection procedures are augmented in some countries by the experimental production of monosex populations and interstrain hybridisation. Generally results to date show better than 8% per generation increases in growth rate.
- Links have been formed with ARIs in the U.S. and in Europe to introduce the methods of monosexing, cloned inbred lines and genetic markers into selection procedures for Nile tilapia and carps. For instance, a collaborative project with scientists from the University of Auburn and using resource families of Nile tilapia at ICLARM's aquaculture facility in Egypt is being carried out. Auburn scientists have completed a tilapia microsatellite library. 60-100 microsatellites are available for the QTL mapping from previous research. Genetic markers for channel catfish were also tested as a control to determine the utility of markers with other species. 90% were successfully used for the closely related blue catfish, only 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. At Abbassa tilapia germplasm is being collected from various African countries and defined families are being developed for testing of the markers. Training in statistical analyses has been provided to Egyptian scientists.
- Five scientific papers (to be augmented by a sixth, summary and synthesis paper) resulting from the previous DEGITA (dissemination of genetically improved tilapia in Asia) project have been accepted for publication in a special issue of Aquaculture Economics and Management.
- An intensive training course in quantitative genetics and its application to aquaculture was organized through INGA in collaboration with Norwegian scientists in which 22 scientists from 13 developing countries participated.

Expected outputs in 2000

- Substantial information on carp genetic resources has been collected and compiled in all the participating countries and a document on carp genetic resources in Asia has been drafted. The document will be valuable in designing appropriate genetic research programs in the participating countries giving due consideration to the available fish biodiversity. Completion of the documentation is expected by September 2000. Similarly, priorities for future research will be developed through the collected outcomes of the socioeconomic and genetic evaluations at workshops to be held in Malaysia in 2000.
- A new project entitled "Transfer of Selective Breeding (GIFT) Technology for Aquaculture Improvement from the Philippines to Sub-Saharan Africa and Egypt" will be implemented in 2000. The project has been granted by the Technical Cooperation Among Developing Countries (TCDC), fund of the United Nations Development Programme). Collaborators will be: the GIFT Foundation International, Muñoz, Nueva Ecija, Philippines; ICLARM's Regional Center for West Asia and Africa, Abbassa, Egypt; Centre National de Recherche Agronomique, Bouake, Côte d'Ivoire; Central Laboratory for Aquaculture Research, Sharkia, Egypt; Water Research Institute, Accra, Ghana; and the University of Malawi, Zomba, Malawi.

- A further project “Genetic Enhancement of Nile Tilapia and Utilization of F₁ Crossbred Clones” is likely to be implemented in 2000 following its reformulation. This project was held over from 1999 whilst the donor (DfID of the UK), ICLARM and national and UK university partners conducted a review of the Intellectual Property issues in aquaculture relevant to this and other related projects. This three-year project has several objectives: to compare the performance of improved strains, to determine correlated responses to selection and to determine the feasibility of utilizing F₁ cloned crossbreeds as standard genetic controls to facilitate comparison of genetic enhancement programs of tilapia worldwide.

Project # 3. Improvement of Freshwater Aquaculture The project develops approaches to integrated management of aquaculture and major outputs contribute to the Sustainable Production output. However, on the African continent the project will place a greater emphasis on the selection of local strains and the genetics of adaptive traits such as resistance to stress including disease. Many fish diseases are introduced along with the transfer of fish from elsewhere and/or are induced by stress due to poor aquaculture management and the intensification of production.

Results in 1999

- Development of improved hatchery methods and the non-hormonal induction of spawning of catfish and the extension of the breeding/growing season in Egypt.
- Development of a registry of aquatic animal health scientists in Africa and formulation with the FAO of plans for a fish disease database for the continent.
- Evaluation of the migration patterns and the sensitivity to pollution of two barb species in the Lake Chilwa watershed in Malawi

Expected outputs in 2000

- Implementation of the fish disease database and entry of material from network collaborators. This will employ the database structure successfully developed by FAO and the Network of Aquaculture Centres in Asia (NACA) for fish diseases in Asia.

Project # 6. Coastal Aquaculture and Stock Enhancement

Results in 1999

- A project on Village Farming and Restocking of Giant Clams is investigating ways to enhance the color, and hence price, of giant clams sold to the aquarium trade. The shading and increased nutrient treatments applied to *Tridacna maxima* maintained in land-based tanks did not produce significant changes to the mantle color of the clams after 16 weeks. However, clams held in the sea at a depth of 1m had a significantly greater percentage of blue and green pigments.

- Collaborative experiments on the polyculture of giant clams and trochus with OFCF of Japan have continued. Trochus with a shell diameter > 40 mm were harvested from sea cages used to grow giant clams and released in different habitats. Survival and movement of all individuals is currently being assessed but initial mortality rates were negligible.
- ICLARM transferred the technology for collection of blacklip pearl oyster spat from Solomon Islands to Tonga in a process that will continue through mid 2000 and will include methods for the village-based farming of giant clams for the aquarium trade to Tonga.
- The experiment comparing the growth and survival of the blacklip pearl oyster spat produced in the hatchery at the CAC with wild spat has been completed. The hatchery-reared spat had a significantly greater rate of survival than the wild spat indicating that there is no impediment (with respect to growth and survival) to using spat produced in hatcheries to establish pearl farms.
- Two batches of the sea cucumber *Holothuria scabra* ("sandfish") were produced in the CAC hatchery prior to its closure in 1999. The two batches have been maintained by caretaker staff for release of juveniles in stock enhancement experiments in 2000. They will be released in the Western Province in February at the site where the broodstock were collected.
- In the project to evaluate the possibility of development of new artisanal fisheries based on the capture and culture of postlarval coral reef fish it has been shown that between May (using light traps), and since October 1999 (using crest nets) more than 36,000 individuals from 50 families have been caught in the light traps and > 5,000 juveniles from 36 families have been collected by crest nets. The small juveniles of more than 20 species of fish captured have been reared using formulated diets for a grow out period of 3-4 months. All these species, with the exception of the butterflyfishes, accepted food pellets within 24 hours of capture.

Expected outputs in 2000

- Further experiments on the release of sea cucumbers will be conducted in 2000. The next stage involves production of larger numbers of juveniles for use in field experiments to assess the size at release, release season, release habitat and stocking density that gives the best ratio of survival in the wild/cost of producing and releasing the juveniles. The experiments will be concluded in 2004.
- Giant clam and sea cucumber rearing techniques extended to at least two countries each in the Pacific and Southeast Asia. Methods for the collection and grow-out of spat were transferred to Fiji, and will be transferred to Tonga in 2000.
- Work on postlarval reef fish will focus on quantifying temporal availability of juvenile fish and development of methods for rearing them to market size.

- The implementation of more extensive work on pearl oysters and a comprehensive program of coastal aquaculture enhancement in the Solomon Islands is possible but is dependent upon the speed of identification and appropriateness of new sites for the work.

Category 2: Germplasm collection

ICLARM does not undertake activities for which the collection of germplasm is a major goal or output and the institute has not established germplasm collections, except transiently, to support individual research activities. Small collections of tilapia are held for germplasm improvement projects, mostly as live fish. The establishment of hatchery procedures for conservation and stock enhancement purposes of invertebrate species (giant clams, sea cucumbers) has involved the collection of broodstock and their maintenance in land based hatcheries. Experimental procedures for the collection of juvenile reef fish for grow out procedures or of adult reef fish for genetic studies are continuing. Collectively these studies result in the relatively small percentage allocation of resources to this output. These activities do not result in permanent collections of germplasm and in instances where germplasm transfers are arranged ICLARM shares germplasm under specific Material Transfer Arrangements.

Category 3: Sustainable Production

Project # 1. Conservation of Aquatic Biodiversity. This project pursues strategic research on biodiversity and genetic resources and contributes to the development of research methods and policy.

ICLARM continues to develop a global database on finfishes. It is also linked to the latest tools for fisheries management. FishBase now provides for direct Internet access. The project also provides training in 55 African, Caribbean and Pacific (ACP) NARS, emphasising the use of biodiversity databases (learning from FishBase), ecosystem-based management and electronic networking. A new LarvalBase project which commenced in 1998 contains additional information on the identification of fish larvae to the main database, to expand its utility for fisheries and aquaculture managers.

Work is conducted to characterize the extent of biodiversity in important aquaculture species for developing countries, particularly tilapiine species in West Africa and the small carp species, *Barbodes gonionotus* in Southeast Asia with European collaborators.

The project contributes to the work of the Convention on Biological Diversity and the Clearing House Mechanism; Global Biodiversity Fora; Species 2000; the FAO Fisheries Division and Commission on Genetic Resources for Food and Agriculture (CGRFA); IUCN; the CGIAR's System-wide Genetic Resources Program (SGRP) and the CGIAR System-wide Information Network for Genetic Resources (SINGER).

Results in 1999

- The species coverage and content of FishBase was increased (to >23,600 species), as were the utility (new graphs for analysis of fisheries data) and (Internet) accessibility of

FishBase. Two major training courses were conducted in sub-Saharan Africa (Senegal and Kenya).

- New genetic data on *S. melanotheron* and *B. gonionotus* was accumulated.
- ICLARM published with the FAO the proceedings and policy recommendations of a 1999 Bellagio conference "Towards Policies for Conservation and Sustainable Use of Aquatic Genetic Resources".

Expected outputs in 2000

- Completion of coverage of all 25,000 existing fish species in FishBase, produced on CD ROM and as a book.
- Preparation of detailed checklists with regional experts of the freshwater fishes of South and Central America.
- Improved coverage of FishBase on the Internet.
- More extensive coverage of aquaculture will be provided through FishBase by developing tools for aquaculturalists and the inclusion of aquaculture data and profiles.
- Completion of the collection of samples from *S. melanotheron* populations in its western range (Gambia, Guinea, Sierra Leone, Cote d'Ivoire) and additional samples from its eastern range (at least from Ghana, Togo, Benin, Nigeria and Cameroon).
- Begin testing methods for the identification of tilapia species and hybrids and the efficacy of chosen strains for aquaculture.
- Final report on the assessment of diversity of *B. gonionotus* in Indonesia and the Mekong Basin countries will be completed.

Project # 3. Improvement of Freshwater Aquaculture ICLARM is developing new approaches to integrate biological, climatic and socio-economic variables in the evaluation of best practices for the introduction of aquaculture into farming systems. ICLARM links its own field experience in Asia and southern Africa with those of others in the evaluation of the development impact of the introduced technology. New initiatives are being taken to extend field activities to the humid zone of West Africa with CGIAR and regional NARS partners.

Activities are currently focussed on the improvement of small farm productivity through the introduction of multiuse water bodies on farms. Contrasting country sites are employed for action research, namely Bangladesh, in humid south Asia having abundant small water bodies; Malawi, a semi-arid country in southern Africa dependent upon seasonal rainfall; and the Philippines, where the project seeks to combine aquaculture with buffer zone management in the highlands. Research at each site is linked through data collection and common analytical software. At each site, the integration and uptake of aquaculture is supported by biological research and the adaptation of aquaculture systems to local conditions. The intention is to

extend the best practices learned from these studies to the introduction of aquaculture into the high potential farming systems of humid West Africa together with national and IARC partners.

Additional project activities focus on increasing and sustaining the productivity of rice and fish in the floodplain ecosystems of South and South East Asia are carried out 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 group access to waterbodies and adequate provision of inputs and access to markets. Both climatic, biological and sociological parameters will be amassed and correlated to provide recommendation domains for the optimal use of water bodies for aquaculture.

Results in 1999

- Publication of a report on work evaluating the contribution of aquaculture in IPM and rice agriculture in the Philippines.
- External review and improvement of the RESTORE software.
- An "Orienter" framework for the selection of sustainability indicators was formulated and a set of simulation models of rice-based IAA farming systems was completed.
- In Bangladesh, IAA technologies are being extended to 6,000 new farm households throughout the country. Monitoring and socioeconomic impact analysis is being conducted on a large sample of these.
- The Malawi Department of Fisheries is implementing their newly adopted strategy of Research-Extension teams developed by ICLARM.
- A study has been completed on the status and reproductive success of two *Barbus* species important as human food in the Lake Chilwa watershed of Malawi. Results will be contributed to the management plan for the watershed.
- Deepwater rice-fish trials with communities in Vietnam and Bangladesh have shown that functioning institutional arrangements between different social groups can be achieved and the technology is economically profitable.

Expected outputs in 2000

- Project review and implementation of a new project on the introduction of IAA into sites in Cameroon in conjunction with IITA.
- Implementation of IAA extension and household impact (including nutritional) studies started from Malawi site.

- Further major projects on the development of methodology to develop recommendation domains for IAA and action research in the inland valleys of West Africa, and in Bangladesh are being prepared.
- The RESTORE package with two manuals will be released.
- The impact analysis of a large IAA technology program in Bangladesh will be completed. Institutional arrangements in community-shared management of deep water rice-fish culture in Bangladesh and Vietnam will be verified on a wider dataset.
- ICLARM will contribute water quality and aquaculture expertise in a collaborative project with IRRI investigating alternative farming practices in response to saline intrusion in the Mekong delta region.

Project # 4. Fisheries Resources Assessment and Management Under this project, ICLARM conducts research on tropical fish stock assessment and the management of multispecies fisheries.

The Project has previously focussed on the development and provision of support in the use of fisheries assessment software for researchers in national institutes (e.g. the Compleat Elefan, FISAT (FAO-ICLARM Stock Assessment Tools etc.). A test version of the ecosystem modelling software, Ecopath, was developed in 1998, which includes the dynamic simulation module, Ecosim, developed in conjunction with Canadian partners. A further spatial model, Ecospace, developed by Canadian scientists, has also been incorporated and ICLARM staff conducted seven international training workshops based on the use of Ecopath during 1998.

A computer package, TrawlBase, has been finalized and is being used to analyze the dynamics of coastal fisheries in eight participating Asian countries. The coverage had been widened to allow the analysis of fisheries in an ecosystem context (e.g. Ecopath).

With the realization that fisheries are difficult to manage through the regulation of catch or effort, attention has been drawn to using protected areas (with fishing restricted or banned) as part of management schemes. 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. The work is supported by the recent development of spatial modelling as part of the Ecopath with Ecosim system that allows for model-based studies of protected areas.

ICLARM has completed Phase I of its Caribbean Marine Protected Areas Project and has shown that in relatively degraded reef situations where overfishing occurs, that recruitment stems largely from juveniles with long lived larval stages. This and the migration of reef fish (which has also been studied), contribute important scientific information to Phase II of the project which commenced in 1999 and which addresses the best use of marine protected areas in the rehabilitation of coastal coral reef fisheries within the appropriate social context.

Results in 1999

- TrawlBase was released in June 1999 to collaborating partner countries in Asia and a further module for the estimation of biomass is under development.
- Ecopath was further tested in a number of applications through international workshops held in 1999 and will be further developed for its release in 2000.
- A final technical report covering activities of a three year project on MPAs in Jamaica has been prepared and a follow up phase of the project initiated.
- Sampling has commenced at sites in the Caribbean to construct a dynamic model of the MPAs under study in Jamaica and the British Virgin Islands.
- The last sampling of a three year project to evaluate the utility of MPAs in protecting and reestablishing invertebrate species in the Solomon Islands was completed. Under the prevailing conditions, three years was found to be too short a period to demonstrate recovery of these species after MPA closure.

Expected outputs in 2000

- Release of a new version of Ecopath with Ecosim including the ability to include seasonal climatic or biological data (in modules provided by collaborating scientists at the University of British Columbia).
- Asian regional workshop held to analyze fisheries and socioeconomic data on trawl fisheries in eight partner countries.
- Continuation of MPA analysis and publishing of scientific papers on the consequence of implementing MPAs in specific areas.

Project # 5. Assessing and Limiting Coral Reef Degradation In partnership with others around the world, ICLARM is developing ReefBase, a global database of coral reef systems and their resources and profiles of their use by people. ReefBase is designed to provide scientists and resource managers with the data required for the comparison of reef systems, the identification of problem areas, and the prioritization of action. Version 3.0 of ReefBase, an interrelational compendium of information of global coral reef data has been published on CD ROM. The development of the database will continue for most of the Plan period with efforts in 2000 being directed to develop a map-based access for the available data and increasing the treatment of socioeconomic factors governing effective reef management. ReefBase will aim to incorporate a set of processed satellite images for each, major, near-surface reef to be used as a basis for management planning and scientific survey design. An associated task of the fieldwork will be to relate changes in ecological community structure associated with anthropogenic stresses to information collection from satellite and aerial sensing capabilities.

This effort has been augmented by (i) a global study of "Reefs at Risk, (ii) a first global assessment of fish catch from reefs, (iii) detailed studies of a small number of selected reefs to derive indicators of sustainability and reef health and (iv) genetic study of key coral reef species in countries bordering the South China Sea in collaboration with national partners, to establish the degree of inter-connectivity amongst coral reef organisms in a large marine ecosystem. Research will contribute substantially to ICLARM's project (#7) on economic valuation of resources for the sustainable use of aquatic resource systems.

The "Reefs at Risk" assessment of the status of the world's coral reefs (jointly with WCMC, WRI and UNEP) was published in 1998. This publication has had a major impact on policymakers responsible for ocean and environmental health. ICLARM has applied a technique (the Rapid Assessment of Management Parameters, RAMP) to develop integrated bio-socioeconomic indicators in coral reef fisheries. ICLARM has held two major courses on coastal zone management training in 1998. This project was commended and supported by a center commissioned external review in 1998.

Results in 1999

- The data gathering for all aspects of ReefBase (particularly with respect to remotely sensed images), consolidation and dissemination activities have been supplemented by increased data analysis.
- Genetic data from the project entitled "Population Interdependencies in the South China Sea Ecosystems" (PISCES) has shown connectivity between groups of coral reef organisms from different areas around the South China Sea. A proposal has been formulated to extend this determination including representative materials collected from other parts of the ecosystem.
- Principles elucidated under the Population, Consumption and Environment (PCE) project which ICLARM coordinates have been included in Coastal Zone management training materials.
- The International Coral Reef Action Network (ICRAN) currently being developed, integrates PISCES, ReefBase, the Rapid Assessment of Management Parameters (or RAMP), Reefs at Risk and the Coastal Management training with other projects to assist the United Nations Environment Programme (UNEP) Regional Seas Program in upgrading the management of coral reefs globally.

Expected outputs in 2000

- A new version of ReefBase (ReefBase 4.0) will be published as a CD ROM with increased amounts of socioeconomic and management variables.
- Publication of scientific papers identifying transboundary connectivity amongst aquatic populations around the South China Sea.

- Implementation of integrated coastal zone management training in two further Asian countries.
- Probable implementation of the collaborative ICRAN project to marry scientific information in public awareness materials for improved coral reef protection.
- Publication of a regional Reefs at Risk analysis for Southeast Asia.

Project # 6. Coastal Aquaculture and Stock Enhancement This project focuses on developing methods to increase the productivity of species associated with coral reefs. Its location at the Coastal Aquaculture Center (CAC) in the Solomon Islands had allowed research to be undertaken on the conservation and management of inshore marine resources. In 1999, research was concentrated on the farming and stocking of giant clams, culture of black lip pearl oysters, stock enhancement of sea cucumbers and development of artisanal fisheries for aquarium species based on the capture and culture of post larvae. With Australian partners, the project is conducting an investigation of the feasibility of utilizing wild caught larval fish in grow-out trials to supply the marine aquarium and food fish industries to overcome biodiversity threatening overexploitation of adult fish. ICLARM has extended its technological knowledge to improve the captive rearing of high value molluscs (pearl oysters, giant clams) to other countries of the region and continues the organization of regional efforts to promote coastal aquaculture industries in partnership with coastal farmers, NARS, development banks and the private sector. (and these projects have been reported against the *Germplasm Improvement* output above).

In 1999, ICLARM has continued research with New Zealand partners on the effects of alternative logging practices on coral reef and coastal aquatic resources.

ICLARM was forced to discontinue work at the Coastal Aquaculture Centre in November 1999 due to the deteriorating security situation. Projects at the Nusa Tupe field site have continued and ICLARM is actively engaged with the Government of the Solomon Islands and others to identify a new site from which to promote coastal aquaculture in the Pacific region.

Results in 1999

- In relation to determining the effects of logging practices on coastal biota, a pilot study to compare various methods for sampling freshwater fish and invertebrates, marine infauna, coral, and coral reef fish was completed in June 1999.
- The final report for the project to test the use of Marine Protected Areas to Manage Fisheries for Tropical Marine Invertebrates in the Arnavon islands has been drafted (and will be available in 2000). There has been substantial increase in the abundance of trochus in the Arnavon Islands Marine Conservation Area (MCA) relative to the three areas outside the MCA that remain open to fishing.
- The response of most of the species of sea cucumbers to protection from fishing has been negligible over the three year closure, indicating that far greater periods of protection are needed for their recovery. A proposal for a further three year monitoring phase is under discussion

Expected outputs in 2000

- The investigation on the effects of runoff from forestry operations was confined to the selection 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 samples from the study sites will be done in June 2000.
- Phase II of the work on sea cucumbers, extending the trials for stock enhancement of the cultivable species will be initiated.
- Work on postlarval reef fish will focus on quantifying temporal availability of juvenile fish and development of methods for rearing them to market size.
- Establishment of regular collections of wild spat of black lip pearl oysters to determine availability and scope for commercial operations.
- The implementation of more extensive work on pearl oysters and a comprehensive program of coastal aquaculture enhancement in the Solomon Islands is possible but is dependent upon the speed of identification and appropriateness of new sites for the work.

Category 4: Policy

ICLARM's overall programs seek innovative and new technologies to augment aquatic production and find better ways to manage the aquatic environment. ICLARM conducts three projects specifically examining the policy environment to ensure (a) wider adoption of these technologies to benefit the poorer people in developing countries, and (b) promotion of improved policies for the management of natural aquatic systems. In 1999 the program developed project logframes covering the three following activities.

Project # 7. Economic Monitoring and Evaluation of Developing Country Fisheries The project combines the development of information and methods to provide the economic value of goods and services from aquatic resources with research conducted on the effect of macro-level policy developments on the contribution which living aquatic resources make to food security. The intent over the Plan period will be to extend economic and ecological evaluation techniques to other aquatic resource systems, concentrating on coral reefs and wetlands areas in the first instance.

There are relatively few social scientists working in the area of fisheries policy research and ecological economics specifically addressing developing country concerns. ICLARM is increasingly called upon to augment national capacity in these areas. For these reasons, the social science/improving policies projects have expanded during the Plan period.

ICLARM has completed the first phase of its worldwide collaborative research project on case studies of coastal fisheries co-management. A further phase has been initiated in collaboration with Danish partners in 1999 with emphasis, in Asia, on sociological analysis of community

participation and conflict resolution. Action research on co-management and community based fisheries management has continued in Bangladesh, and will be evaluated more widely as a preferred means of management of inland water fisheries in developing countries. Small scale work has also commenced on the evaluation of coral reef systems in the Philippines to provide baseline studies for more generally applicable resource valuation methods.

Results in 1999

- A database of fisheries and aquaculture production and market statistics has been accumulated and proposals developed for Supply and Demand studies by continental regions.
- A project has also been formulated in conjunction with IFPRI to include fish products in the IMPACT World Food Model.
- Following the publication of similar work in Cambodia, ICLARM and NGO partners have started to conduct household studies in representative parts of Vietnam to gauge true household consumption values of aquatic produce and their contribution to food security in this region.

Expected outputs in 2000

- Technical report on the application of non-market valuation techniques and benefit transfer analysis in the estimation of benefits from coral reef systems, including field studies undertaken by ICLARM and UPV in the Philippines.
- Final report of Vietnam household studies of consumption of aquatic produce published with recommendations on the effects in alterations of this supply.
- Completion of impact assessment work on the efficacy of research and extension methods on the uptake of aquaculture in Bangladesh, and report of this work published.
- Initiation of supply and demand study for aquatic produce in Asia and effects on poor consumers.

Project # 8. Legal and Institutional Analysis for Fisheries Management This project examines the linkage between society, economic and natural systems and policy to develop adaptive and flexible solutions for the sustainable use of aquatic resource systems. Current research in this area is conducted as part of a collaborative worldwide project on fisheries co-management strategies focusing on institutional aspects of sustainable governance. Institutional research extends to the governance of common property aquatic resources, especially inland water fisheries in Bangladesh and the multiple use of the wetlands in the Mekong Basin countries.

The project has completed resource assessments in a) the Philippines describing the constraints on the supply of bangus (milkfish) fry for aquaculture and b) on aquatic resource use by smallholder households in Cambodia and Vietnam. This work and that of the MRC and other

partners suggests that official statistics underestimate aquatic resource use in these countries substantially (up to tenfold in parts of Cambodia). Legal and institutional analysis of fisheries in the Mekong Basin countries will be developed into a wider approach to resource evaluation and governance of the wetlands of this region with existing partners. A database for the assessment of developing country fisheries utilizing official FAO statistics and other contributory data has been developed to assist ICLARM's internal planning and priority setting.

Results in 1999

- New project leader for the global co-management project appointed at ICLARM.
- ICLARM and the Institute for Fisheries Management, Denmark organised a major workshop on co-management with Asian and African counterparts to share experiences from the first phase of the co-management project which was completed in 1999.
- Publication of country studies, following four national workshops in Cambodia, Laos, Thailand and Vietnam, identifying institutional and legal issues and contradictions in the governance framework in four riparian and two non-riparian countries.

Expected outputs in 2000

- Implementation of a new phase of community-based fisheries management to develop a management framework for inland waters in Bangladesh to ensure equity in access and the distribution of benefits.
- Implementation of new studies of fisheries co-management in Asia and Africa - returning to successful case study sites, but focussing on compliance and legitimacy of governance mechanisms for the more effective use of devolved management regimes.
- Implementation of a cooperative approach with the riparian states in the definition of institutional and legal governance mechanisms of the wetlands of the Lower Mekong Basin. This builds on a pre-project logframe exercise with key stakeholders in wetlands management conducted in each of the key countries in 1999.

Project # 9. Aquatic Resources Research Planning and Impact Assessment. This project evaluates the impact of technological research completed by the institute (*ex post* analysis) and, where appropriate, other technological impacts on the aquatic resources sector. ICLARM has already conducted such analyses of the impact of fisheries co-management initiatives and the potential benefit of farm-level introduction of genetically improved tilapia. The project will increasingly provide *ex ante* analysis of research areas of potential importance to developing country fisheries e.g. in relation to the carp improvement project and to augment ICLARM's strategic planning process. ICLARM is strongly convinced of the need for continual in-house assessment of the impact of its own research, and that of others which affects sustainable productivity and management issues in aquatic resources.

Results in 1999

- Impact assessment studies largely confined to the completion of earlier work on genetic improvement (see publication outcomes for project#2) and underpinning impact assessments of aquaculture technology and aquaculture extension (see projects #3 and #8).
- A bioeconomic model to help determine the impact of giant clam mariculture in Pacific islands states is being used to investigate optimal harvesting time and the trade-off between harvesting time and the application of husbandry labor by village clam farmers
- ICLARM's Strategic Plan for 2000-2020 was published in 1999 and has provided analysis of fisheries and aquaculture statistics, regional, resource system and poverty data which was evaluated for research planning purposes.

Expected outputs in 2000

- ICLARM will host a workshop on methodology for Integrated Natural Resource Management practitioners in the CGIAR.
- Completion of studies on the evaluation of the impact of giant clam research and initiation of a project to evaluate the factors governing the relative success of the milkfish aquaculture industry in three countries of SE Asia to be conducted with SEAFDEC Aquaculture Headquarters, Philippines.
- Initiation of studies to determine the data and methods required to accurately determine the beneficiaries of LARM research.

Category 5: Enhancing NARS

Project #10: Information and Capacity Building for Aquatic Resources Research in Developing Countries. ICLARM has consolidated its activities for the enhancement of NARS capacity in aquatic resources research and management under this one project for the new plan period. The project brings together the aspects of managing relationships with research and development partners, networks, training and the sharing of ICLARM's own outputs and other aquatic resources research data. Other individual projects within ICLARM also contribute to capacity-building of NARS through project-related training programs (e.g., training in use of FishBase in ACP countries). Moreover, public awareness activities on behalf of the institute are also carried out under this program in conjunction with the office of the Director General; additional activities are undertaken in conjunction with the PARC and Future Harvest of the CGIAR.

This ICLARM project coordinates a research network called the International Networks for Genetics in Aquaculture (INGA) and the research outputs are listed under the *Germplasm Improvement* heading. Membership of INGA has been extended to leading ARIs in aquaculture genetics worldwide and eleven such institutes are now included to provide additional assistance to national members so that the combined INGA network now covers four continents. INGA

continues to assist in the exchange of germplasm between INGA member countries following FAO guidelines and appropriate material transfer agreements. ICLARM has contributed to the establishment of the Group on Fisheries and Aquatic Research (GoFAR) under the regional agricultural organization APAARI, to give a voice to the fisheries and aquaculture sector in agricultural regional groupings.

Results in 1999

- A long term strategy for ICLARM's program-associated training was developed as part of the institute's strategic plan.
- Specialist information was retrieved and consolidated in response to numerous requests e.g. ICLARM's journal Naga carried 700 bibliographic entries for the four copies of Naga in 1999; the Library and Information service provided technical information over 1,300 on-site users/visitors from the university and aquatic resources sectors. The selective Fisheries Information Service responded to 426 requests from 75 countries.
- ICLARM's lists of library holdings was made available on the InterNet.
- The publications unit published 42 publications of all types and an additional 68 scientific papers were edited and submitted for publication. ICLARM's HomePage has been regularly updated and some outreach sites (which are also served by the information services) have created their own home pages.
- The fifth steering committee meeting of the International Network for Genetics in Aquaculture took place in Kuala Lumpur, Malaysia which was attended by national member countries and experts from advanced institutes conducting aquaculture genetics research.
- Attachment training for young NARS scientists was given in virtually all projects.
- Public awareness of ICLARM's headquarters move was raised through the development of brochures and flyers.

Expected outputs in 2000

- ICLARM expects to continue to provide these services to partners and stakeholders, as well as its own program staff around the world.
- A Training workshop on Research Priority Setting for Asia Pacific NARS will be held.
- A third course for "Quantitative Genetics and selective breeding" will be organised for INGA and other NARS scientists.

(b) Highlights of the 2001 Project Portfolio

As the new research portfolio described in this plan for the 2001-2003 period has obviated the redundancies that had developed in the earlier portfolio dating from 1996, nearly all the activities described above and in the project portfolio (Annex 2) are expected to be continuing in 2001.

For Germplasm Improvement the focus will be on the development of in-country genetic improvement programs for a limited number of carp species and traits identified in current work. There will be an increasing focus on genetic enhancement and experimental methods for the improvement of tilapia aquaculture and technology transfer for Africa conducted through ICLARM's site in Abbassa Egypt. Additional studies on coastal aquaculture are anticipated but the modus vivendi for this research will be worked out with the identification of an appropriate site to serve the Pacific island states. ICLARM anticipates moving into its permanent headquarters facilities in Penang Malaysia during 2001 when the adoption of its own modest research facilities may expand technical possibilities for genetic enhancement and biodiversity research beyond those currently listed.

The majority of ICLARM's research thrust will continue to be towards Sustainable Production. This will encompass the characterization and conservation of biodiversity (initiation of new regional applications of FishBase with partner institutions, the publication of floodplain and fisheries productivity estimates for the Mekong with associated experimental studies underway for the identification and management of fish biodiversity in the wetland ecosystems of the region). Substantial new activities for in-country research (in Cameroon with IITA) and at the global synthesis level for the identification of appropriate IAA practices will be underway. The latter is expected to concomitantly enhance the GIS capacity at ICLARM. Research aimed at the protection of the environment will be continued, focussing on coral reefs (and the implementation of the new ICRAN project which integrates the research and public awareness thrusts of ICLARM and international partner organizations), coastal fisheries and integrated coastal zone management training (anticipated to be implemented in two additional countries of Asia in 2001).

New initiatives in policy research will be underway, specifically the estimation of the supply and demand for fish and seafood products in Asia, and ICLARM will be pursuing its emphases on the co- and community management of fisheries and wetlands with an emphasis on the poorer regions of South and South East Asia.

ICLARM believes it has a strong role to play in the supply of new research and synthesized information on fisheries, aquaculture and aquatic environments for research and resource managers in developing countries. The partnership and network services will also be strongly pursued throughout the plan period, increasingly exploring means to enhance NARS capacity in Africa in ICLARM's specialist fields.

(c) *Highlights of the Plan for 2003*

This section briefly recapitulates the major milestones anticipated for 2003, the additional year not highlighted previously in earlier Medium Term Plans.

Category 1: Germplasm Improvement

Collaborative work between ICLARM, upstream partners and NARS in Asia will be focussed on the genetic enhancement of two carp species for growth and locally selected traits. At least two (and possibly five) countries in Africa will be applying quantitative methods to the improvement of indigenous species for aquaculture. ICLARM will publish evaluations of the feasibility study for the capture and culture of juvenile reef fish as well as of a pilot study for the stock enhancement of sea cucumbers.

Category 2: Germplasm collection

This will remain a small proportion of ICLARM's total activities conducted with the full knowledge of partner countries for experimental research purposes.

Category 3: Sustainable Production

Regional and ecosystem-specific fisheries and biodiversity data will be compiled as datasets in FishBase. Techniques and results of fish and larval mapping in the Mekong Basin area and contributions to wetland management plans will be published. Additional project activities will derive from the new program management of this area. The emphasis will be on the utilisation of genetic methods to determine the effects at the population level of changes in ecosystems caused by human activity e.g. aquaculture strain introductions, stock enhancement, localised overfishing, creation of fisheries protected areas etc.

Work on the integration of aquaculture into agricultural systems will provide published reviews of two inland aquatic resource systems, focussed on Africa. Historic data will have been analysed of the development of the aquaculture sector and its subsector in selected countries with "success stories" in Asia, and characterisation of potential threshold countries in Asia and Africa. It is expected that 2003 will mark the start of a project in an African country on productivity enhancement and equitable management of flood prone ecosystems, following from ICLARM's experience in Asia.

The results of ICLARM's fisheries assessment research will provide updated modules for the estimation of biomass in trawl fisheries and will be included in extensions of trawl estimations to other regions (Indian Ocean, Africa). In research and awareness raising for coral reef health, ReefBase 7.0 will be released. Reefs at risk analyses will be published for two more regions of the world (for a total of at least 5 regions to have been covered). Application of the results of the logging run off study by communities is anticipated in the management of their inshore marine resources. The results of the feasibility trial for the grow out of wild caught larvae for aquaculture and trade will be published, leading to the definition of new research and management policy implications for this trade.

Category 4: Policy

The project on Economic Monitoring and Evaluation of Developing Country Fisheries will identify the variables needed to assess and monitor trends in demand for and supply of seafood products in relation to food security, employment, income, consumption, trade, resource management and sustainable production. Studies of Asia and Africa may have been completed depending upon the time of donor engagement and a companion study for the Caribbean and Latin America will be planned or in train.

An international workshop will be conducted to disseminate research results from the co-management projects implemented in Asia and Africa. A national wetland management plan or program in each of the riparian countries of the Mekong River region is expected to have been developed which incorporates local management systems, integrates across sectors and involves local communities.

Constraints on and opportunities for the growth of the milkfish industry in the Philippines, Indonesia and Taiwan with emphasis on the adoption and technological development will have been identified.

Category 5: Enhancing NARS

The information, publication and other service functions of this program will be continuous with increased use of InterNet for the dissemination of information, when appropriate. Increased activities with NARS in Malaysia are anticipated. Technical backstopping will be given to the implementation of biodiversity and genetic enhancement research carried out by INGA member countries.

(d) *Measures of Achievement: Project Milestones*

Each major ICLARM project has developed a set of time bound milestones to describe and monitor progress towards the overall outputs. ICLARM has developed an overall institute logframe but has not formally produced logframe analyses of all projects. It is anticipated that this will be carried out within the year 2000. The currently defined project milestones are given in the project portfolio (Annex 2).

B. FINANCE

B.1 1999 Results and 2000 Development

The 1999 expenditure level was US\$12.74 million of gross expenditures and US\$12.29 million net of overhead recoveries; 68% of 1999 resources was utilized for programmatic activities. ICLARM ended the year with a deficit of US\$0.43 million due to the EU default on the 1999 funding.

The 1999 income from donors amounted to US\$13.31 million in addition to US\$0.26 million of earned income and US\$.45 million of recovery of overheads from restricted projects.

The 1999 financial statements were produced based on the revised CGIAR Accounting standards. The CGIAR Accounting Standards are fully compliant with the International Accounting Standards. The 1998 financial figures had to be restated to provide comparable data.

The 2000 expenditures are estimated at US\$14.74 million compared to actual spending of US\$12.29 million for 1999. Overall income from donors is estimated at US\$ 14.54 million compared to US\$13.31 million for 1999. The EU contribution for the Year 2000 remains uncertain and should it not materialise it will have a negative impact on ICLARM's finances for the year. Further, it will reduce ICLARM's operating reserves to an alarmingly low level for the year.

Allocation to programs for 2000 is around 77 % of total resources.

Table F: Comparison of 1999 performance and 2000 current estimate

	1999 Actual (US\$(M))	2000 Estimate US\$(M)
Sources of funds		
Donor funding	13.31	14.54
Earned income	.26	.20
Total	13.57	14.74
Applications of funds		
Programmatic	8.69	11.84
General management	2.32	2.69
General operations/relocation	1.48	.48
Depreciation	.25	.29
Less: Overhead Recoveries	(.45)	(.56)
Net Expenditures	12.29	14.74
Unexpended balance	1.28	0.00

The 1999 spending and 2000 current planned resource allocation by CGIAR activity are summarized below:

Table G: Actual and planned resource allocation by CGIAR activity for 1999 and 2000

	USD (M)		
	1999 Actual	2000	
		Current	%
Increasing Productivity	3.20	3.49	23.7
Protecting the Environment	4.72	6.27	42.5
Saving Biodiversity	0.17	0.26	1.8
Improving Policies	1.87	2.63	17.8
Strengthening NARS	2.33	2.09	14.2
	12.29	14.74	100.0

42.5% of 2000 resources are allocated to protecting the environment, 23.7% to increasing productivity, 17.8% to improving policies and 14.2% to strengthening NARS. These allocations are consistent with ICLARM's long term strategic direction.

Table H: Allocation of resources by outputs (logical Framework Format) US\$ (M)

	1999	2000	%
Germplasm Improvement	1.44	1.36	9.2
Germplasm Collection	0.17	0.26	1.8
Sustainable production	7.24	8.99	61.0
Policy	1.87	2.63	17.8
Enhancing NARS	1.57	1.50	10.2
Total	12.29	14.74	100.0

B.1.2 Funding Trends

Concerted efforts in fund raising and greater awareness of the seriousness of fisheries issue amongst donors have consistently increased ICLARM's share in the CGIAR System resources since 1993. Reorganizing and focusing the research programs has revitalized research and its impact driven outputs. Funding has increased, in nominal terms, from US\$7.8 million in 1995 to US\$14.7 million in 2000 (expected), an increase during the five-year period of over 88%. In real terms (in 2000 US\$ at 4% price change) the increase has been from US\$9.4 million in 1995 to US\$14.7 in 2000, an increase of around 56%.

Table I: Nominal and Real Funding to ICLARM, 1995-2000 in US\$ (M)

Funding (USD-M)	1995	1996	1997	1998	1999	2000	% increase in 2000 over 1995
Nominal	7.8	9.6	9.0	10.4	12.3	14.7	88
Real	9.5	11.2	10.1	11.2	12.8	14.7	56

*(2000\$ at 4% price change).

With the active, current development of a revised fund raising strategy, development of a new strategic plan, further sharpening of the research focus and the establishment of the Regional Center for Africa and West Asia, ICLARM expects a steady growth in funding beyond the year 2001.

B.1.3 Inflation and Exchange Rates

ICLARM has relocated its HQ to Penang Malaysia. 2000 will be the first year of operations at the new headquarters. Actual inflation has not been gauged yet but it is forecast to be between 2.5-3% in 2000. ICLARM will monitor actual inflation in 2000 and assess its impact on the purchasing power of the budget. The RM is presently fixed at the exchange rate of RM 3.8 to one US\$. If the RM is liberalized its impact on the budget will be assessed.

Inflation on the US\$ expenditures is expected to be around 2.7% for the year 2000.

B.1.4 Depreciation of Fixed Assets

The actual depreciation of existing ICLARM fixed assets for 1999 was US\$0.25 million. Depreciation for 2000 is projected to be at the level of US\$0.29 million. Annual depreciation charges are used to finance the Center Capital Fund and capital replacements.

B.1.5 Capital Fund

The Purpose of the Capital Fund is to finance all Center core capital requirements. The balance of the Capital Fund to 31 December 1999 was US\$1.60 million, financed through the annual depreciation charges. For 2000, the fund is expected to increase by US\$0.29 million, which is equivalent to the budgeted depreciation for the year.

B.1.6 Capital Investments

The Malaysian Government has made available to ICLARM, on a long-term basis, 5.2 ha of land with buildings. Plans are underway to renovate these buildings to international standards. The cost of renovation and setting up the facility is estimated at US\$ 3.52 millions broken down as follows:

Table J: Building and Renovation costs for ICLARM's new headquarters, US\$ (M)

	US\$ (M)
Building renovation	1.95
Project Management	.22
Equipment and furniture	.86
Other capital needs	.49
Total	3.52

Through the fund raising efforts ICLARM has generated approximately US\$ 2.56 million of the total building renovation and headquarters relocation estimated at a total cost of US\$ 5.2 million.

B.1.7 Operating Fund

With the projected funding for 2000 (including the impact of exchange rate fluctuations) and the EU default in 1999 of US\$.9 million, it will be difficult to increase the operating fund from the present level of US\$1.15 million, equivalent to 34 days of operation, to the targeted level of approximately US\$2.40 million, equivalent to 60 days of operations. Owing to the Center's low cash position (due to long delays in receipt of core contributions from some donors), building the Operating Fund to a 60 days target level is crucial for maintaining a stable operating environment for the Center.

B.1.8 Liquidity

The Center liquidity can markedly improve if donor contributions are remitted in a timely fashion. The default of the EU in 1999 has weakened further the cash position of the Center which was improving.

The Center is making all efforts to refine its rolling cash flow by programming operating and capital expenditures.

B2. 2001 - 2003 PLANS

B2.1 Funding Requirements and Financing Plans

The 2000 Financing Plan level, approved at MTM-99, has been used as the basis for developing the plans for 2001 to 2003. The Financing Plan level has been adjusted to reflect the actual level of ICLARM's operations for 2000.

The expected level of donor funding for 2000 is US\$14.54 million, in addition to earned income and indirect cost recoveries from restricted projects. The EU contribution represents 16% of ICLARM's unrestricted funding and thus the flexibility of ICLARM's finances are heavily dependent on the EU contribution. Delays or change in the designation of the contribution will have a detrimental impact on ICLARM finances especially at this time of relocation of the

ICLARM headquarters. ICLARM operating levels (net of indirect cost recoveries) for 2000 to 2002 will be:

Table K: ICLARM Operating Levels, US\$ (M)

	US\$ (M)			
	2000*	2001	2002	2003
Projected Donor Funding	14.54	15.39	16.26	17.18
Percent of System Resources	4.10	4.50	4.40	4.30

*2000 Operating Level.

A 5.5% combined growth and inflation rate has been incorporated in the annual plans.

Earned income. Delayed donor contributions, reduction in grants and the inability of ICLARM to build up the operating fund and proper reserves have affected earned income. Steps were taken to improve the billing and collection of project funds. Also better investment opportunities have been explored. Earned income is projected at US\$0.20 million during the plan period.

Indirect Cost/ Overhead. Most donors are resistant to meeting real overheads of the Centers. Overhead is a critical component of ICLARM's cost recovery and finances non-research activities and operations that are an essential support to research. The CGIAR Secretariat has initiated a system wide indirect cost study to increase transparency and donor awareness. ICLARM's overhead is expected to be at an annual level of approximately US\$0.56 million over the plan period.

B2.2 OPERATING BUDGET 2001-2003

The focus of research activities and allocation of resources were determined by a review of ICLARM projects and activities by program leaders and Center-wide review by management. It is also shaped by the newly developed strategic plan. The five programs were allocated around 80% of total resources consistent with Center priorities and strategy. The allocation of funds to the projects, source of funding, and linkage with the CGIAR research agenda within the newly adopted log frame are reflected in the main budget tables.

TABLE L: Resource allocation to Center activities for specified years, US\$ (M).

	2000		2001		2002		2003	
	US\$ (M)	%	US\$(M)	%	US\$(M)	%	US\$ (M)	%
Programs *	11.84	80	12.57	81	13.32	81	14.10	81
General administration	2.24	15	2.34	15	2.43	15	2.54	15
General operations	0.37	3	0.38	2	0.40	2	0.42	2
Depreciation	0.29	2	0.30	2	0.31	2	0.32	2
Total	14.74	100	15.59	100	16.46	100	17.38	100

* Inclusive of all direct costs

Allocation of resources by object of expenditures (cost structure). ICLARM's cost structure has been under annual review to ensure that fixed costs are kept within a reasonable proportion of the annual budget. Approximately 44% of the resources are allocated to personnel costs.

Table M: Resource by object of expenditures, 2000-2002 (US\$ millions)

	2000	2001	2002	2003
Personnel	6.49	7.20	7.94	8.29
Supplies and Services	6.93	6.98	7.01	7.48
Operating travel	1.03	1.11	1.20	1.29
Depreciation	0.29	0.30	0.31	0.32
Total	14.74	15.59	16.46	17.38

Allocation of resources by CGIAR undertaking: The allocation of resources to CGIAR undertakings is in accordance with ICLARM's research directions and consistent with CGIAR strategies and priorities.

Table N: Allocation of resource by CGIAR undertakings (%)

	2000	2001	2003
Increasing productivity			
Germplasm enhancement and breeding	9.2	9.1	8.7
Production systems development	14.5	14.6	14.4
Protecting the environment	42.5	38.0	40.6
Saving biodiversity	1.8	1.5	1.7
Improving policies	17.8	21.6	19.7
Strengthening NARS	14.2	15.2	14.9

In 2001, Approximately, 24% of resources are allocated to increasing productivity, 38% to protecting the environment, 2% to saving biodiversity, 21% to improving policies and 15% to strengthening NARS.

Table O: Allocation of resources by outputs (logical Framework Format) (US\$M)

	2001	2003	%
Germplasm Improvement	1.42	1.52	8.7
Germplasm Collection	.24	.29	1.7
Sustainable production	8.92	10.32	59.4
Policy	3.36	3.42	19.7
Enhancing NARS	1.65	1.83	10.5
Total	15.59	17.38	100.0

The 2001 to 2003 resources are 8% allocated to germplasm improvement, 59% to sustainable production, 20% to policy and 10% to enhancing NARS.

Allocation of resources by region. Approximately, 58% of resources are allocated to Asia, 30% to Sub-Saharan Africa, 4% to Latin America and the Caribbean and 8% to West Asia and North Africa. See budget Table 5.

Personnel input: The Center-hired Internationally Recruited staff (IRS) level will be around 44 positions including post-doctoral fellows and visiting scientists. This includes a regionally recruited staff category which has been established at the new headquarters in Penang, Malaysia which currently consists of the Philippine senior national staff. Additional positions are planned subject to funding availability in 2000 and beyond.

Nationally Recruited Staff (NRS) level will reach around 210 including the staff at the Regional Center for Africa and West Asia (Egypt).

Thirty staff of the Coastal Aquaculture Center in the Solomon Islands have been separated due to the social unrest there. Nine are retained on contract in a caretaker capacity in 2000.

67 nationally recruited staff were separated from the Philippines HQ due to the relocation of the ICLARM headquarters to Penang, Malaysia. New support positions will be recruited in Malaysia.

Table P: Staffing summary (positions)

	2000	2001
Internationally-recruited staff *	44	53
Nationally-recruited staff	204	210
Total Center Hired	248	263

* Including post-doctoral fellows and 12 regionally recruited staff

It is projected that the staffing level will reach around 370 by the end of 2003 which was the level of ICLARM staff in 1998.

B2.3 CAPITAL BUDGET

The capital requirements of ICLARM will be almost US\$ 4.52 million for the plan period. The requirements are for the renovation of the headquarters facility in Penang, Malaysia and the purchase of laboratory and operating equipment. The requirement is summarized as follows:

Table Q: ICLARM Capital Requirements 2000-2003, US\$ (M)

	2000	2001	2002	2003
Capital needs	2.5	1.0	0.5	0.5

The refurbishment of the Regional Center for Africa and West Asia was completed in 1999.

Capital fund. The capital fund is the only source for financing ICLARM's core capital purchases. The balance in the capital fund to 31 December 1999 was US\$ 1.60 million.

B2.4 FINANCIAL RATIOS

Liquidity. ICLARM's operating fund has not increased to the targeted level of 60 days of operation. The balance as of 31 December 1999 was US\$1.15 million, which will cover 34 days at the 1999 operational level. This level is not adequate to bridge delays in donor disbursements. ICLARM will be attempting to gradually build the fund to cover a minimum target of 60 days of operations.

Sustainability. The liquidity position of ICLARM is shown in the table below.

Table R: Financial ratio analysis 1999-2003

	1999	2000	2001	2002	2003
Current ratio-times	1.53	1.66	1.66	1.67	1.64
Quick ratio-times	1.53	1.66	1.66	1.67	1.64
Working capital-%	99	91	90	89	87
Cash/current assets-%	68	67	69	67	67
Operating fund-days	34	40	38	36	35
Working capital-days	162	137	132	124	118

B2.5 INFLATION AND EXCHANGE RATES

Combined annual weighted inflation in developed countries is projected to be around 2.7-3% while local inflation in the developing countries in which ICLARM works is estimated to fluctuate between 3.5-4.5% during the plan period. The Malaysian Ringitt (RM) is fixed at the rate of RM 3.8 for one US\$. If the RM is liberalized during the plan period, the impact of the change on the purchasing power of the budget will be assessed.

The US dollar is expected to slightly decline against most currencies, which will have positive impact on non-US dollar denominated contributions.

B2.6 SUMMARY OF FINANCING PLAN

The resource requirements over the plan period are based on the Financing Plan level approved at the MTM-99 adjusted to reflect the expected operational level for 2000. The adjusted level is increased by an annual inflationary factor of 3.5 %. We have also projected that ICLARM will grow in real terms by 2% for each of the years 2002-2003.

LIST OF ACRONYMS

ACP	African, Caribbean and Pacific countries
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AFSSRN	Asian Fisheries Social Science Research Network
APAARI	Asia Pacific Association of Agricultural Research Institutes
ARIs	Advanced Research Institutes
CAC	Coastal Aquaculture Center
CAPRI	Community Action and Property Rights Initiative
CGIAR	Consultative Group on International Agricultural Research
CIDA	Canadian International Development Agency
CIFOR	Centre for International Forestry Research
CRSP	Collaborative Research Support Program
DANIDA	Danish International Development Assistance
DEGITA	Dissemination of Genetically Improved Farmed Tilapia in Asia
DFID	Department for International Development (UK)
ECOPATH	A software for ecosystem modeling
ECOSIM	Ecopath Simulation
ELEFAN	Electronic Length-Frequency Analysis
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FISAT	FAO-ICLARM Stock Assessment Tool
GIFT	Genetic Improvement of Farmed Tilapia
GoFAR	Group on Fisheries and Aquatic Resources
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (Germany)
IAA	Integrated Aquaculture-Agriculture
IAAS	Integrated Aquaculture-Agriculture Systems
IAEA	International Atomic Energy Agency
IBSRAM	International Board for Soil Research and Management
ICES	International Council for the Exploration of the Sea
ICLARM	International Center for Living Aquatic Resources Management
ICRAN	International Coral Reef Action Network
ICZM	Integrated Coastal Zone Management
IDRC	International Development Research Institute
IFM	Institute of Fisheries Management
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
INGA	International Network on Genetics in Aquaculture
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research

IUCN	International Union for the Conservation of Nature
IWMI	International Water Management Institute
LARM	Living Aquatic Resources Management
OFCF	Overseas Fisheries Cooperation Center (Japan)
MPAs	Marine Protected Areas
MTP	Medium-Term Plan
QTL	Quantitative Trait Loci
NARS	National Agricultural Research Systems
NGOs	Non-Governmental Organizations
NTAs	Network of Aquaculture Scientists
NTFS	Network of Tropical Fisheries Scientists
PARC	Public Awareness Committee (of the CGIAR)
PCE	Population, Consumption and the Environment
RAMP	Rapid Assessment of Management Parameters
RESTORE	Research Tools for Natural Resource Systems, Monitoring and Evaluation
SEAFDEC	South East Asian Fisheries Development Center
SIDA	Swedish International Development Agency
SIDS	Small Island Developing States
SINGER	System-Wide Information Network on Genetic Resources
SWB	Small water body
SWGRP	System-Wide Genetic Resources Program
SWICE	System-Wide Initiative on Coastal Environments
SWIM	System-Wide Initiative on Irrigation Management
TAC	Technical Advisory Committee
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
WARDA	West African Rice Development Corporation
WANA	West Asia and North Africa
WCMC	World Conservation Monitoring Council
WRI	World Resources Institute

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Table 1. ICLARM -- 2001 Research Agenda Requirements by CGIAR Output

(expenditure in US \$ million)

Center Projects	Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS	PROJECT TOTALS
001. Conservation of Aquatic Biodiversity			1.64	0.25	0.63	2.52
002. Genetic Enhancement and Breeding	1.11	0.07	0.21			1.39
003. Improvement of Freshwater Aquaculture			2.18			2.18
004. Fisheries Resources Assessment and Management			1.52			1.52
005. Assessing and Limiting Coral Reef Degradation		0.09	1.52		0.18	1.79
006. Coastal Aquaculture and Stock Enhancement	0.16	0.08	1.34			1.58
007. Economic Monitoring and Evaluation of Developing Country Fisheries				0.57		0.57
008. Legal and Institutional Analysis for Fisheries Management				2.47		2.47
009. Aquatic Resources Research, Planning and Impact Assessment				0.07		0.07
010. Information and Capacity Building for Aquatic Resources Research in Developing Countries	0.15		0.51		0.84	1.50
OUTPUT TOTALS	1.42	0.24	8.92	3.36	1.65	15.59

Table 2. ICLARM RESEARCH AGENDA - ALLOCATION OF RESOURCES, 1999 to 2003
(expenditure in US \$ million)

**Allocation of Resources by Outputs
Logical Framework Format**

Outputs:

Germplasm Improvement

(Activity: Germplasm Enhancement & Breeding, plus Networks as appropriate)

Germplasm Collection

(Activity: Saving Biodiversity, plus Networks as appropriate)

Sustainable Production

(Activity: Production Systems Dev & Mgmt, Protecting the Environment, plus Networks as appropriate)

Policy

(Activity: Improving Policies, plus Networks as appropriate)

Enhancing NARS

(Activity: Strengthening NARS - the three sub-activities, plus Networks as appropriate)

TOTAL

	1999 (actual)	2000 (estimate)	2001 (proposal)	2002 (plan)	2003 (plan)
Germplasm Improvement	1.44	1.36	1.42	1.47	1.52
Germplasm Collection	0.17	0.26	0.24	0.26	0.29
Sustainable Production	7.23	8.99	8.92	9.51	10.32
Policy	1.88	2.63	3.36	3.48	3.42
Enhancing NARS	1.57	1.50	1.65	1.74	1.83
TOTAL	12.29	14.74	15.59	16.46	17.38

Allocation of Resources by CGIAR Activity

Increasing Productivity

of which:

Germplasm Enhancement & Breeding

Production Systems Development & Management

Protecting the Environment

Saving Biodiversity

Improving Policies

Strengthening NARS

of which:

Training and Professional Development

Documentation, Publications, Info. Dissemination

Organization & Management Counselling

Networks

TOTAL

	1999 (actual)	2000 (estimate)	2001 (proposal)	2002 (plan)	2003 (plan)
Increasing Productivity	3.19	3.49	3.69	3.84	4.01
<i>of which:</i>					
Germplasm Enhancement & Breeding	1.44	1.36	1.42	1.47	1.52
Production Systems Development & Management	1.75	2.13	2.27	2.37	2.49
Protecting the Environment	4.72	6.27	5.93	6.39	7.06
Saving Biodiversity	0.17	0.26	0.24	0.26	0.29
Improving Policies	1.88	2.63	3.36	3.48	3.42
Strengthening NARS	2.33	2.09	2.37	2.49	2.60
<i>of which:</i>					
Training and Professional Development	0.86	0.99	0.97	1.04	1.11
Documentation, Publications, Info. Dissemination	0.71	0.51	0.68	0.70	0.72
Organization & Management Counselling					
Networks	0.76	0.59	0.72	0.75	0.77
TOTAL	12.29	14.74	15.59	16.46	17.38

Table 3. ICLARM RESEARCH AGENDA PROJECT & OUTPUT COST SUMMARY, 1999 to 2003

(in US \$ million)

	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
001. Conservation of Aquatic Biodiversity	2.36	2.57	2.52	2.61	2.70
002. Genetic Enhancement and Breeding	1.47	1.39	1.39	1.44	1.49
003. Improvement of Freshwater Aquaculture	1.69	2.01	2.18	2.25	2.34
004. Fisheries Resources Assessment and Management	1.55	1.60	1.52	1.58	1.86
005. Assessing and Limiting Coral Reef Degradation	0.96	2.31	1.79	2.17	2.54
006. Coastal Aquaculture and Stock Enhancement	1.04	1.37	1.58	1.63	1.69
007. Economic Monitoring and Evaluation of Developing Country Fisheries	0.06	0.09	0.57	0.59	0.41
008. Legal and Institutional Analysis for Fisheries Management	1.32	2.24	2.47	2.56	2.66
009. Aquatic Resources Research Planning and Impact Assessment	0.26	0.04	0.07	0.07	0.08
010. Information and Capacity Building for Aquatic Resources Research In Developing Countries	1.58	1.12	1.50	1.56	1.61
Total	12.29	14.74	15.59	16.46	17.38

Summary by CGIAR Output:

	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
Germplasm Improvement	1.44	1.36	1.42	1.47	1.52
Germplasm Collection	0.17	0.26	0.24	0.26	0.29
Sustainable Production	7.23	8.99	8.92	9.51	10.32
Policy	1.87	2.63	3.36	3.48	3.42
Enhancing NARS	1.57	1.50	1.65	1.74	1.83
Total	12.29	14.74	15.59	16.46	17.38

Institutional Cost Components:

	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
Direct Project Costs	12.74	15.30	16.15	17.02	17.94
Indirect Project Costs (Overhead)	(0.45)	(0.56)	(0.56)	(0.56)	(0.56)
Total Project Costs	12.29	14.74	15.59	16.46	17.38

Table 4. ICLARM Allocation of Project Costs to CGIAR Activities, 1999 to 2003

(in US \$ million)

Project	Activity	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
001. Conservation of Aquatic Biodiversity	Production Systems	0.47	0.51	0.51	0.52	0.54
	Protecting the Environment	1.06	1.16	1.13	1.18	1.21
	Improving Policies	0.24	0.26	0.25	0.26	0.27
	Strengthening NARS-Training	0.59	0.64	0.63	0.65	0.68
	Total	2.36	2.57	2.52	2.61	2.70
002. Genetic Enhancement and Breeding	Enhancement & Breeding (crops, etc)	1.18	1.11	1.11	1.15	1.19
	Saving Biodiversity	0.07	0.07	0.07	0.07	0.08
	Strengthening NARS-Networks	0.22	0.21	0.21	0.22	0.22
	Total	1.47	1.39	1.39	1.44	1.49
003. Improvement of Freshwater Aquaculture	Production Systems	0.51	0.60	0.65	0.68	0.70
	Protecting the Environment	1.18	1.41	1.53	1.57	1.64
	Total	1.69	2.01	2.18	2.25	2.34
004. Fisheries Resources Assessment and Management	Production Systems	0.15	0.16	0.15	0.16	0.19
	Protecting the Environment	1.40	1.44	1.37	1.42	1.67
	Total	1.55	1.60	1.52	1.58	1.86
005. Assessing and Limiting Coral Reef Degradation	Production Systems	0.05	0.11	0.09	0.11	0.13
	Protecting the Environment	0.76	1.85	1.43	1.73	2.03
	Saving Biodiversity	0.05	0.12	0.09	0.11	0.13
	Strengthening NARS-Training	0.10	0.23	0.18	0.22	0.25
	Total	0.96	2.31	1.79	2.17	2.54
006. Coastal Aquaculture and Stock Enhancement	Enhancement & Breeding (crops, etc)	0.10	0.14	0.16	0.16	0.17
	Production Systems (crops, etc)	0.57	0.75	0.87	0.90	0.93
	Protecting the Environment	0.32	0.41	0.47	0.49	0.51
	Saving Biodiversity	0.05	0.07	0.08	0.08	0.08
	Total	1.04	1.37	1.58	1.63	1.69
007. Economic Monitoring and Evaluation of Developing Country Fisheries	Improving Policies	0.06	0.09	0.57	0.59	0.41
008. Legal and Institutional Analysis for Fisheries Management	Improving Policies	1.32	2.24	2.47	2.56	2.66
009. Aquatic Resources Research, Planning and Impact Assessment	Improving Policies	0.26	0.04	0.07	0.07	0.08
010. Information and Capacity Building for Aquatic Resources Research In Developing Countries	Enhancement and Breeding	0.16	0.11	0.15	0.16	0.16
	Strengthening NARS-Information	0.71	0.51	0.68	0.70	0.72
	Strengthening NARS-Training	0.17	0.12	0.16	0.17	0.18
	Strengthening NARS- Networks	0.54	0.38	0.51	0.53	0.55
	Total	1.58	1.12	1.50	1.56	1.61
Total		12.29	14.74	15.59	16.46	17.38

Summary by Undertaking:

	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
Increasing Productivity	3.19	3.49	3.69	3.84	4.01
Protecting the Environment	4.72	6.27	5.93	6.39	7.06
Saving Biodiversity	0.17	0.26	0.24	0.26	0.29
Improving Policies	1.88	2.63	3.36	3.48	3.42
Strengthening NARS	2.33	2.09	2.37	2.49	2.60
Total	12.29	14.74	15.59	16.46	17.38

Summary by Output:

	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
Germplasm Improvement	1.44	1.36	1.42	1.47	1.52
Germplasm Collection	0.17	0.26	0.24	0.26	0.29
Sustainable Production	7.23	8.99	8.92	9.51	10.32
Policy	1.87	2.63	3.36	3.48	3.42
Enhancing NARS	1.57	1.50	1.65	1.74	1.83
Total	12.29	14.74	15.59	16.46	17.38

Table 5. ICLARM RESEARCH AGENDA, 1999 to 2003
Investments by Sector, Commodity, and Region (in US \$ million)

PRODUCTION SECTORS & COMMODITIES	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
1/ <u>Germplasm Improvement</u>					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	1.44	1.36	1.42	1.47	1.52
TOTAL	1.44	1.36	1.42	1.47	1.52
2/ <u>Sustainable Production</u>					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	7.23	8.99	8.92	9.51	10.32
TOTAL	7.23	8.99	8.92	9.51	10.32
3/ <u>Total Research Agenda</u>					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	12.29	14.74	15.59	16.46	17.38
TOTAL	12.29	14.74	15.59	16.46	17.38
REGION	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
Sub-Saharan Africa (SSA)	3.69	4.42	4.68	4.94	5.21
Asia	7.13	8.55	9.04	9.55	10.08
Latin American and the Caribbean (LAC)	0.49	0.59	0.62	0.66	0.70
West Asia and North Africa (WANA)	0.98	1.18	1.25	1.31	1.39
TOTAL	12.29	14.74	15.59	16.46	17.38

Table 6. ICLARM RESEARCH AGENDA, 1999 to 2003
Expenditure by Functional Category, and Capital Investments (in US \$ million)

OBJECT OF EXPENDITURE	1999 (actual)	2000 (est)	2001 (proposal)	1/	1/
				2002 (plan)	2003 (plan)
Personnel	5.53	6.49	7.20	7.94	8.29
Supplies and Services	5.70	6.93	6.98	7.01	7.48
Operational Travel	0.81	1.03	1.11	1.20	1.29
Depreciation	0.25	0.29	0.30	0.31	0.32
TOTAL	12.29	14.74	15.59	16.46	17.38
CAPITAL INVESTMENTS	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
<i>Physical Facilities</i>					
Research					
Training					
Administration					
Housing					
Auxiliary Units					
sub-total		1.86	0.31		
<i>Infrastructure & Leasehold</i>					
<i>Furnishing & Equipment</i>					
Farming					
Laboratory & Scientific					
Office					
Housing					
Auxiliary Units					
Computers					
Vehicles					
Aircraft					
sub-total		0.64	0.69		
TOTAL		2.50	1.00		
CAPITAL FUND CASH RECONCILIATION	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
<i>Balance, January 1</i>		1.60	1.83		
plus: annual depreciation charge		0.29	0.30		
plus / minus: disposal gains/(losses)					
plus / minus: other			0.05		
minus: asset acquisition costs		0.40			
<i>equals: Balance, December 31</i>					

* Capital investment due to relocation to Malaysia have not been included in this presentation

Table 8a. ICLARM ALLOCATION OF MEMBER FINANCING TO PROJECTS BY OUTPUT
For the year 1999
(in \$ million)

Project	Member	Total	Outputs						
			Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS		
							Training	Info/doc	Org/Mgmt
001. Conservation of Aquatic Biodiversity	EU	1.36			0.88	0.14	0.34		
	FAO	0.02			0.01	0.00	0.01		
	GTZ	0.12			0.08	0.01	0.03		
	Others	0.09			0.06	0.01	0.02		
	Unrestricted+center inc.	0.77			0.50	0.08	0.19		
	Total Project	2.36	0.00	0.00	1.53	0.24	0.59	0.00	0.00
002. Genetic Enhancement and Breeding	ADB	0.35	0.28	0.02	0.05				
	FAO	0.02	0.02	0.00	0.00				
	Japan	0.19	0.15	0.01	0.03				
	Unrestricted+center inc.	0.91	0.73	0.04	0.14				
	Total Project	1.47	1.18	0.07	0.22	0.00	0.00	0.00	0.00
003. Improvement of Freshwater Aquaculture	USAID	0.49			0.49				
	BMZ	0.02			0.02				
	IFAD	0.10			0.10				
	DANIDA	0.01			0.01				
	Japan	0.09			0.09				
	Others	0.01			0.01				
	Unrestricted+center inc.	0.97			0.97				
	Total Project	1.69	0.00	0.00	1.69	0.00	0.00	0.00	0.00
004. Fisheries Resources Assessment and Management	ADB	0.39			0.39				
	DFID	0.37			0.37				
	Japan	0.07			0.07				
	Others	0.01			0.01				
	Unrestricted+center inc.	0.71			0.71				
	Total Project	1.55	0.00	0.00	1.55	0.00	0.00	0.00	0.00
005. Assessing and Limiting Coral Reef Degradation 0.96	UNFIP	0.18		0.01	0.15		0.02		
	SIDA	0.14		0.01	0.12		0.01		
	McArthur Foundation	0.16		0.01	0.14		0.01		
	USAID	0.01		0.00	0.01		0.00		
	Others	0.05		0.00	0.04		0.01		
	Unrestricted+center inc.	0.42		0.02	0.35		0.05		
	Total Project	0.96	0.00	0.05	0.81	0.00	0.10	0.00	0.00
	006. Coastal Aquaculture and Stock Enhancement	ACIAR	0.19	0.02	0.01	0.16			
CIDA		0.03	0.00	0.00	0.03				
NZODA		0.05	0.00	0.00	0.05				
Unrestricted+center inc.		0.77	0.08	0.04	0.65				
Total Project		1.04	0.10	0.05	0.89	0.00	0.00	0.00	0.00
007. Economic Monitoring and Evaluation of Developing Country Fisheries	SIDA	0.01				0.01			
	MRC	0.01				0.01			
	OXFAM	0.03				0.03			
	Unrestricted+center inc.	0.01				0.01			
	Total Project	0.06	0.00	0.00	0.00	0.06	0.00	0.00	0.00
008. Legal and Institutional Analysis for Fisheries Management	SIDA	0.31				0.31			
	DANIDA	0.10				0.10			
	Ford	0.05				0.05			
	Unrestricted+center inc.	0.86				0.86			
	Total Project	1.32	0.00	0.00	0.00	1.32	0.00	0.00	0.00
009. Aquatic Resources Research Planning and Impact Assessment	IFAD	0.13				0.13			
	DSE	0.02				0.02			
	IFPRI	0.03				0.03			
	Unrestricted+center inc.	0.08				0.08			
	Total Project	0.26	0.00	0.00	0.00	0.26	0.00	0.00	0.00
010. Information and Capacity Building for Aquatic Resources Research In Developing Countries	Norway	0.09	0.01		0.03		0.01	0.04	
	IDRC	0.03	0.01		0.01		0.00	0.01	
	Japan	0.10	0.01		0.03		0.01	0.05	
	World Bank	0.02	0.00		0.01		0.00	0.01	
	Ford	0.01	0.00		0.01		0.00	0.00	
	Others	0.01	0.00		0.00		0.00	0.01	
	Unrestricted+center inc.	1.32	0.13		0.45		0.14	0.59	
	Total Project	1.58	0.16	0.00	0.54	0.00	0.17	0.71	0.00

Center Totals		Total	Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS		
							Training	Info/doc	Org/Mgmt
Total Targeted Funding		5.47	0.50	0.07	3.46	0.85	0.47	0.12	
Total Unrestricted Funding		6.82	0.94	0.10	3.77	1.03	0.39	0.59	
Total Center Income									
Total Allocations		12.28	1.44	0.17	7.23	1.88	0.86	0.71	0.00

Table 8b. ICLARM ALLOCATION OF MEMBER FINANCING TO PROJECTS BY OUTPUT
For the year 2000
(in \$ million)

Project	Member	Total	Outputs						
			Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS		
							Training	Info/doc	Org/Mgmt
Conservation of Aquatic Biodiversity	EU	1.39			0.90	0.14	0.35		
	GTZ/BMZ	0.19			0.12	0.02	0.05		
	TAC	0.17			0.11	0.02	0.04		
	UBC	0.02			0.01	0.00	0.01		
	Others	0.01			0.01	0.00	0.00		
	Unrestricted+center inc.	0.80			0.51	0.08	0.19		
Total Project		2.57	0.00	0.00	1.67	0.26	0.64	0.00	0.00
Genetic Enhancement and Breeding	ADB	0.30	0.24	0.01	0.05				
	DfID	0.07	0.05	0.01	0.01				
	UNDP/TCDC	0.14	0.11	0.01	0.02				
	Unrestricted+center inc.	0.81	0.65	0.04	0.12				
	Total Project	1.32	1.11	0.07	0.20	0.00	0.00	0.00	0.00
Improvement of Freshwater Aquaculture	USAID	0.90			0.90				
	IFAD	0.14			0.14				
	EU	0.13			0.13				
	Unrestricted+center inc.	0.84			0.84				
	Total Project	2.01	0.00	0.00	2.01	0.00		0.00	0.00
Fisheries Resources Assessment and Management	NOAA	0.02			0.02				
	ADB	0.41			0.41				
	DfID	0.45			0.45				
	EU	0.07			0.07				
	Unrestricted+center inc.	0.65			0.65				
	Total Project	1.60	0.00	0.00	1.60	0.00	0.00	0.00	0.00
Assessing and Limiting Coral Reef Degradation	WB	0.02		0.00	0.02		0.00		
	McArthur Foundation	0.54		0.03	0.46		0.05		
	SIDA	0.23		0.01	0.19		0.03		
	UNFIP	0.94		0.05	0.80		0.09		
	EU	0.09		0.01	0.07		0.01		
	Unrestricted+center inc.	0.49		0.02	0.42		0.05		
	Total Project	2.31	0.00	0.12	1.96	0.00	0.23	0.00	0.00
Coastal Aquaculture and Stock Enhancement	CIDA	0.04	0.00	0.00	0.04				
	NZODA	0.17	0.02	0.01	0.14				
	ACIAR	0.28	0.03	0.02	0.23				
	EU	0.24	0.02	0.01	0.21				
	Unrestricted+center inc.	0.64	0.06	0.03	0.54				
	Total Project	1.37	0.14	0.07	1.16	0.00	0.00	0.00	0.00
Economic Monitoring and Evaluation of Developing Country Fisheries	SIDA	0.05				0.05			
	EU	0.01				0.01			
	Unrestricted+center inc.	0.03				0.03			
	Total Project	0.09	0.00	0.00	0.00	0.09	0.00	0.00	0.00
Legal and Institutional Analysis for Fisheries Management	SIDA	0.68				0.68			
	DfID	0.57				0.57			
	EU	0.22				0.22			
	Unrestricted+center inc.	0.77				0.77			
	Total Project	2.24	0.00	0.00	0.00	2.24	0.00	0.00	0.00
Aquatic Resources Research Planning and Impact Assessment	IFAD	0.02				0.02			
	EU	0.00				0.00			
	Unrestricted+center inc.	0.02				0.02			
	Total Project	0.04	0.00	0.00	0.00	0.04	0.00	0.00	0.00
Information and Capacity Building for Aquatic Resources Research In Developing Countries	Norway	0.09	0.01		0.03		0.01	0.04	
	IDRC	0.02	0.00		0.01		0.00	0.01	
	Unrestricted+center inc.	1.01	0.10		0.34		0.11	0.46	
	Total Project	1.12	0.11	0.00	0.38	0.00	0.12	0.51	0.00

Center Totals	Total	Outputs						
		Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS		
						Training	Info/doc	Org/Mgmt
Total Targeted Funding	8.70	0.54	0.17	5.57	1.73	0.64	0.05	
Total Unrestricted Funding	5.84	0.82	0.09	3.42	0.90	0.35	0.46	
Total Center Income	0.20							
Total Allocations	14.74	1.36	0.26	8.99	2.63	0.99	0.51	0.00

Table 9. ICLARM RESEARCH AGENDA STAFF COMPOSITION, 1999 to 2003

	1999 (actual)**		2000		2001 (proposal)		2002 (plan)		2003 (plan)	
	Hired by:		Hired by:		Hired by:		Hired by:		Hired by:	
	center	other	center	other	center	other	center	other	center	other
<u>Internationally-Recruited Staff (IRS)*</u>										
Research and Research Support	24	1	35		43		48		48	
<i>of which:</i>										
<i>Post-doctoral Fellows</i>	1				4		7		7	
<i>Associate Professionals</i>										
Training / Communications	1		2		3		3		3	
<i>of which:</i>										
<i>Post-doctoral Fellows</i>										
<i>Associate Professionals</i>										
Research Management	5		7		7		7		7	
<i>of which:</i>										
<i>Post-doctoral Fellows</i>										
<i>Associate Professionals</i>										
Total IRS	30		44		53		58		58	
<u>Support Staff</u>	291		204		210		212		212	
TOTAL STAFF	321	1	248		263		270		270	

* includes regionally recruited staff

** still included 67 nationally recruited staff who were separated from the Philippine HQ due to the r
ICLARM headquarters to Penang, Malaysia

Table 10. ICLARM CASH REQUIREMENT, REVENUE FLOW, & CURRENCY SHARES, 1999 to 2001

(in \$'000)

MONTHLY CASH USES AND SOURCES

1999	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cash Requirement	308	941	939	1,284	761	580	1,290	936	972	1,005	1,131	1,112
Member & Center Income	2,104	381	1,343	227	823	3,112	2,041	507	710	1,206	522	3,544
Net Monthly Position	1,796	(560)	404	(1,057)	62	2,532	751	(429)	(262)	201	(609)	2,432
Accumulated Position	1,796	1,236	1,640	583	645	3,177	3,928	3,499	3,237	3,438	2,829	5,261

2000	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cash Requirement	527	1,298	996	1,361	807	615	1,468	1,099	969	1,300	889	1,231
Member & Center Income	2,141	349	1,262	251	924	587	1,858	525	736	1,716	500	2,246
Net Monthly Position	1,614	(949)	266	(1,110)	117	(28)	390	(574)	(233)	416	(389)	1,015
Accumulated Position	1,614	665	931	(179)	(62)	(90)	300	(274)	(507)	(91)	(480)	535

CURRENCY STRUCTURE OF EXPENDITURES

Currency	1999 note 1/ (actual)			2000 note 2/ (estimate)			2001 note 3/ (proposal)		
	Amount	\$ value	% share	Amount	\$ value	% share	Amount	\$ value	% share
US Dollar					10.3	70%		10.9	70
Malaysian Ringgit					3.4	23%		3.6	23
Others					1	7%		1.1	7
TOTAL			100%		14.7	100%		15.6	100%

note 4/

Table 11. ICLARM STATEMENT OF FINANCIAL POSITION, 1999 to 2003

(in \$'000)

	1999 (actual)	2000 (est)	2001 (proposal)	2002 (plan)	2003 (plan)
<u>Assets</u>					
<u>Current Assets</u>					
Cash & Cash Equivalents	8,213	8,748	8,936	9,301	9,637
Accounts Receivable					
Donors	3,368	3,525	3,616	3,580	3,720
Employees	100	150	140	130	120
Other	1,170	950	900	850	825
Inventories					
Prepaid Expenses	30	25	24	23	20
Other Current Assets*	2,559	500	500		
Total Current Assets	15,440	13,898	14,116	13,884	14,322
<u>Fixed Assets</u>					
Property, Plant, & Equipment					
Less: Accumulated Depreciation					
Total Fixed Assets - Net	338	520	600	660	770
Total Assets	15,778	14,418	14,716	14,544	15,092
<u>Liabilities and Net Assets</u>					
<u>Current Liabilities</u>					
Bank Indebtedness					
Accounts Payable					
Donors	4,267	2,388	2,304	2,131	2,231
Employees	82	101	95	110	130
Others	36	28	25	23	22
Advances from Donors	1,626	1,400	1,400	1,400	1,400
In-Trust Accounts	1,636	1,531	1,515	1,502	1,480
Accruals and Provisions	2,633	2,919	3,150	3,115	3,454
Total Current Liabilities	10,280	8,367	8,489	8,281	8,717
<u>Long-Term Liabilities</u>					
	0				
Total Liabilities	10,280	8,367	8,489	8,281	8,717
<u>Net Assets</u>					
Capital Invested in Fixed Assets					
Center Owned					
In Custody					
Capital Fund					
Operating Fund					
Other Funds					
Total Net Assets	5,498	6,051	6,227	6,263	6,375
Total Liabilities & Net Assets	15,778	14,418	14,716	14,544	15,092

* Based on the revised CGIAR Accounting Manual review in 1999

ANNEX 1. ICLARM's CENTER LOGFRAME

LOGICAL FRAMEWORK FOR ICLARM			Elaborated:	Sept. 24 th , 1999
			Planning Period	2000 - 2005
ICLARM Overall Goals	Contributing to CGIAR Overall Goal #	Indicators	Assumptions	
1. Improved equity of benefits from fisheries catches	1	No indicators formulated; indication according to CG system logframe		
2. Improved livelihood of fishing households	3 (+1)			
3. Improved access to fish at affordable prices for consumers				
4. Reduced number of fishers	2			
5. Protection of aquatic environment				
ICLARM Intermediate Goals	Contributing to CGIAR Inter. Goal #			
1. Aquaculture production increased in a sustainable manner	Mainly part 1	<ul style="list-style-type: none"> • Targeted adopters will realize a sustained increase in yields of at least 20% higher than non-adopters • Note: target figures are derived for Asian freshwater systems and will vary between continents and other types of aquaculture systems. • National production statistics on aquaculture increase by at least 5% and remain high 		
2. Fish stocks restored and harvested in a sustainable manner	Mainly part 2	<ul style="list-style-type: none"> • Analysis of catch statistics show decreasing number of stocks which are overfished • Current stocks available to capture fisheries are improved in terms of biomass and age structure. 		
3. Aquatic ecosystems are valued, conserved and used in a sustainable manner	Part 1 and 2	<ul style="list-style-type: none"> • In at least 3 of the targeted 5 projects (see indicator for purpose # 2) poor fishers realize a sustained production of at least 10% more • Monitoring and use programs for appropriately sited and managed aquatic protected areas implemented in four continental areas. 		

LOGICAL FRAMEWORK FOR ICLARM		Elaborated:		
		Sept. 24 th , 1999	2000 - 2005	
ICLARM Purpose		Contributing to CGIAR Purpose #	Indicators <i>Note: unless otherwise stated, all targets refer to end of planning period – i.e. 2005</i>	Assumptions
1. Governments in developing countries adopt improved governance and recommended policies for fisheries and aquatic eco-systems	3	<ul style="list-style-type: none"> Benefits of aquatic resources given appropriate value in intersectoral decision making by national governments in developing countries Changes in government policies, rules and laws favoring aquatic eco-systems and fisheries 	<ul style="list-style-type: none"> Continued commitment from participating governments to implement schemes for local resource management (including fisheries and aquatic resources) <i>Note: assumption still controversial</i> 	
2. NARS and NGOs use tools and methods for understanding, conserving and sustainably using aquatic bio-diversity	1	<ul style="list-style-type: none"> At least 5 projects in the field of fisheries management incorporate ICLARM's tools in their project design ICLARM data and advice incorporated into the bio-diversity strategies of at least 20 countries 		
3. Users of resources, concerned agencies and research institutions in developing countries adopt improved methods, strategies and policies for management and conservation of tropical aquatic eco-systems	1 (+2)	<ul style="list-style-type: none"> Increased number of fishery agencies, NGO's and research institutions use ICLARM data, software and methods for aquatic resources management Increasing number of fishing communities work with NARS and NGOs to exploit fisheries at more sustainable levels based on tools and methods / principles designed and recommended by ICLARM 	<ul style="list-style-type: none"> Developing countries have sufficient expertise, funds and political will to formulate and implement action plans 	
4. NARS and NGOs use genetic methods to produce and disseminate better breeds and apply tools for the introduction of more productive and sustainable integrated aquaculture farming systems	1 (+2)	<ul style="list-style-type: none"> Genetic methods (including selective breeding, cross breeding and marker-assisted breeding techniques) are being utilized by national breeding programs in seven Asian countries (for carp) and three further countries globally (for tilapia) Farming systems including aquaculture and improved germplasm are demonstrated to be superior in terms of income generation for poor farmers and/or stability than non-integrated systems and non-improved breeds 	<ul style="list-style-type: none"> Relative profitability of technologies developed by ICLARM does not change significantly Land and water use policies allow expansion of aquaculture 	

LOGICAL FRAMEWORK FOR ICLARM			
		Elaborated:	Sept. 24 th , 1999
		Planning Period	2000 - 2005
ICLARM Purpose	Contributing to CGIAR Purpose #	Indicators <i>Note: unless otherwise stated, all targets refer to end of planning period – i.e. 2005</i>	Assumptions
5. Small scale farmers adopt improved farming systems and better breeds for aquaculture	No direct correspondence because purpose formulation for CG system level Logframe refers only to innovative behavior of NARS and does not include farmers directly	<ul style="list-style-type: none"> • Adoption rates of new methods and / or breed for new species 	<ul style="list-style-type: none"> • The intersectoral supply and the support for aquaculture remain stable
6. Wide utilization of ICLARM outputs in the scientific community and amongst other stakeholders reflecting an increased awareness of aquatic resources issues	2	<ul style="list-style-type: none"> • Increased citation of ICLARM publications • Incorporation of ICLARM tools into teaching curricula of relevant institutions • Number of invitations to ICLARM to speak / contribute in major fora of aquatic resources issues • Increasing investment in aquatic resources research in developing countries 	

LOGICAL FRAMEWORK FOR ICLARM			Elaborated:	Sept. 24 th , 1999
			Planning Period	2000 - 2005
ICLARM Outputs	Contributing to CGIAR Output #:	Indicators	Assumptions	
<p><i>The following outputs are developed and disseminated to NARS and other partners (e.g. through publications, Internet, Training etc.</i></p>				
1. Data, tools and policy recommendations for understanding, conserving and sustainable use of aquatic biodiversity	4+5	<p><i>Note: unless otherwise stated, all targets refer to end of planning period – i.e. 2005</i></p> <ul style="list-style-type: none"> • Tools functioning and available (Web-page, CD-Rom) that assist in analyzing bio-diversity data, identification and implementation of conservation strategies, analyzing and indicating strategies for sustainable use • Policy recommendations developed and published relevant for understanding, conserving and sustainable use of bio-diversity 	<ul style="list-style-type: none"> • Telecommunication and technical support is available to NARS and NGOs 	
2. Methods and tools for integrated management of aquatic stocks and ecosystems (e.g. coral reefs, flood plains)	3	<ul style="list-style-type: none"> • Methods for integrated management of aquatic stocks and eco-systems ensuring sustainable yields and equitable distribution of benefits are developed, published and disseminated through conferences, training courses and networks 	<ul style="list-style-type: none"> • NARS and NGOs have increased access to the Internet 	
3. Methods for germplasm improvement of carp and tilapia species	1	<ul style="list-style-type: none"> • Genetic methods (including selective breeding, cross breeding and marker-assisted breeding techniques) are being developed and made available for utilization in national breeding programs 	<ul style="list-style-type: none"> • National programs continue to capture / provide sufficient financial and other resources required to maintain long term aquaculture breeding programs 	
4. Genetically improved aquatic species (especially carp and tilapia)	1	<ul style="list-style-type: none"> • Genetically improved breeds of 5 fish species which are at least 10% more productive in farming systems than existing materials are developed and made available to national breeding programs • Up to 2004, four improved carp species are available to national programs in Asia • Up to 2004, four improved tilapia species are available on stations in Africa 	<ul style="list-style-type: none"> • Government policies allow importation of improved strains • Genetically enhanced fish is accepted for use in aquaculture in developing countries • Current and anticipated market demand for targeted aquaculture species is maintained 	

LOGICAL FRAMEWORK FOR ICLARM			Elaborated:	Sept. 24 th , 1999
			Planning Period	2000 - 2005
ICLARM Outputs	Contributing to CGIAR Output #:	Indicators	Assumptions	
<p>The following outputs are developed and disseminated to NARS and other partners (e.g. through publications, Internet, Training etc.</p> <p>5. Methods for aqua-culture, re-stocking and stock enhancement of tropical coastal and freshwater species</p>	3 (+ 2)	<p><i>Note: unless otherwise stated, all targets refer to end of planning period – i.e. 2005</i></p> <ul style="list-style-type: none"> • Seed of great clams, pear oyster and reef fish is produced and used for demonstration of pilot operations at a commercial scale • Juveniles of sea cucumber trochus and grant clams are released in restocking projects at the pilot sites 	<ul style="list-style-type: none"> • Political stability is re-established / maintained in Solomon Islands • Interest and ability of private sector to implement methods for aquaculture • Government continues to provide complementary legislation to support aquaculture (e.g. prohibition of exploitation of wild stocks) 	
	3	<ul style="list-style-type: none"> • For at least 3 agroecological environments the following have been developed and tested: <ul style="list-style-type: none"> ⇒ Diagnostic procedures and tools at macro and micro level for identifying potential areas and on-farm changes; ⇒ at least 10 IAA technologies and corresponding diffusion strategies which are adaptable to local conditions and ⇒ a set of impact indicators which measure the (a) the improvement of livelihood of rural farm households and (b) the sustainability of rural farming in their watersheds 	<ul style="list-style-type: none"> • National policies encourage the extension of IAA, targeting small scale farmers • NARS continue to have the resources (human, financial) and the mandate to apply the latest methods and strategies for IAA diffusion 	
<p>6. Strategies for integrated agriculture and aqua-culture (IAA) to improve the livelihood of rural households</p>				

LOGICAL FRAMEWORK FOR ICLARM			Elaborated:	Sept. 24 th , 1999
			Planning Period	2000 - 2005
ICLARM Outputs	Contributing to CGIAR Output #:	Indicators	Assumptions	
<p>The following outputs are developed and disseminated to NARS and other partners (e.g. through publications, Internet, Training etc.</p> <p>7. Analytical tools, governance models and policy recommendations for the management of improved fisheries and aquatic environments (based e.g. on resource evaluation, market analysis, institutional and legal analysis</p>	4	<p><i>Note: unless otherwise stated, all targets refer to end of planning period – i.e. 2005</i></p> <ul style="list-style-type: none"> • Approaches to participatory legal and institutional analysis developed (up to 2002) • Recommendations and models of community management of fisheries and wetlands in Bangladesh are developed and tested with partners in at least 5 sites and are disseminated to policy makers • Valuation methods for aquatic resource systems are developed and values estimated for coral reefs and for wetlands in the Mekong Basin • Co-management models for fisheries are analyzed in 6 countries in SE Asia and 7 countries in Africa (up to 2003) • Demand, supply and trade models for 7 fish producing / consuming Asian countries are developed and disseminated to policy makers • Policy briefs and recommendations for improved governance are communicated to NARS, governments and broader scientific community 	<ul style="list-style-type: none"> • Effective partners continue to be associated with ICLARM • Relevant government agencies within target countries continue to co-operate 	
	5	<ul style="list-style-type: none"> • NARS and NGOs provided with training, educational support, publications and library services for ICLARM research areas • Annual information sharing meetings arranged for each network 	<ul style="list-style-type: none"> • The NARS staff involved in ICLARM training continues to work in respective institution • NARS agree to work in an more interdisciplinary fashion 	
8. Increased capacity of NARS for research and management of aquatic resources				

LOGICAL FRAMEWORK FOR ICLARM			Elaborated:	Sept. 24 th , 1999
			Planning Period	2000 - 2005
ICLARM Outputs	Contributing to CGIAR Output #:	Indicators	Assumptions	
<p><i>Note: The following three outputs refer to the effective functioning of the ICLARM as a research institution within the CGIAR. They have the character of "management outputs" and do not relate directly to CGIAR systems outputs</i></p>				
<p>(a) Increased awareness of fisheries and aquatic resources issues in agricultural and biodiversity fora</p>	<p><i>n a</i></p>	<ul style="list-style-type: none"> • Fish fully integrated into the world model for projections of food supply, demand and trade (IMPACT) • A range of public awareness products / activities have been put on show every year to the scientific community and key stakeholders (during ICW, at least 2 conferences, at least 2 media outlets, etc.) • Policy statements and documents are contributed to CBD, FAO and CGIAR for inclusion in policies related to bio-diversity • An increased number of publications relevant to all aspects of ICLARM research agenda are included in peer review journals and made widely assessable to NARS (special reprints, abstracts, etc.) 	<ul style="list-style-type: none"> • Public and donor perception of high intensity aquaculture (e.g. salmon, shrimp farming) as polluting technologies does not have generally adverse effects on the possibilities to develop more sustainable forms of aquaculture in developing countries 	
<p>(b) Impact of aquatic research is demonstrated (on management, food security and environmental sustainability goals)</p>	<p><i>n a</i></p>	<ul style="list-style-type: none"> • Methods and indicators for assessing the impact of aquatic resources research have been developed, applied in one case each for production, natural resource management, biodiversity and policy research and communicated to relevant for a 		

ANNEX 2. ICLARM's PROJECT PORTFOLIO

Title: Conservation of Aquatic Biodiversity

Objectives:

There are two objectives for this project, namely:

1. To assist in the characterization and evaluation of aquatic biota for their conservation and sustainable use, through acquiring, generating and providing information, in relational databases, and developing research tools and methods.

Conservation and sustainable use of aquatic biota require robust methods and accurate, up to date, globally accessible information at the molecular genetic, species, population and ecosystem levels. Laboratory and field methods for the characterization and evaluation of aquatic biodiversity and genetic resources will be developed through partnerships with other IARCs, NARS and ARIs. Relational databases for use by researchers, teachers and planners will be established through multiple partnerships and linkages: initially for all finfish species and, linked to ecosystem modeling functions. Countermeasures to the threats to aquatic biodiversity (for example, to the world's freshwater fishes) and to adverse genetic impacts of human interventions will be emphasized.

2. The second objective is to train scientists and national resource managers for the sustainable management of aquatic biodiversity and genetic resources.

The training materials and information needed by NARS scientists and national resource managers to manage aquatic biodiversity and genetic resources sustainably are not widely available. This will be addressed by regional training courses for the appropriate utilization of FishBase supported by workshops, organized for NARS through five regional centers in Africa, the Caribbean and the Pacific (ACP).

Outputs (Results):

1. Global biological databases, provided as CD-ROMs and through the Internet, and laboratory and field methods for assessing living aquatic resources and their vulnerability to human interventions; the end-users will be NARS researchers and policymakers and, through their research, extension services and policies, the resource-poor fishers and farmers, and consumers of aquatic produce. In 2001 collaborative methods research on the identification of biodiversity will be formed in Southeast Asia, the Mekong Basin countries and West Africa.
2. Training course materials (computer software and manuals, CD-ROMs) and trained NARS personnel.
3. Fifty-five ACP NARS will receive training materials and the necessary computer hardware and software. The training will emphasize finfish as indicator species for achieving conservation with sustainable use. The geographical scope is global, emphasizing the ACP countries.

Gains (Impacts):

1. The project will assist the identification of the positive attributes that confer actual or potential 'resource' status on aquatic biota for use in providing food (in fisheries and in breeding programs for aquaculture), income, employment, recreation and a healthy environment. The gains can be measured in terms of the successful conservation of living

aquatic resources for sustainable use and the use of the project's outputs by NARS in pursuing their national biodiversity strategies.

2. Assist national level characterization and evaluation of aquatic biodiversity and genetic resources and management of information for conservation and sustainable use of these resources. This relates directly to the CGIAR's goals of capacity building for conservation and sustainable use of natural resources.

Duration and Milestones:

Duration: The milestones cover 5 years of a continuing program

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ New methods developed for assessing genetic variability of fish and conservation status and potential for sustainable aquaculture, defined for <i>S. melanotheron</i> in West African regional case study. ❖ FishBase 99 released with 22,500 species listed, over 300,000 occurrence points, a functional link to Ecopath, and books and help systems in English, French, Spanish and Portuguese. ❖ FishBase made available on the Internet. ❖ NARS Training curriculum on fisheries and biodiversity management completed including workshops held in west Africa and east Africa, including guidelines for national biodiversity databases and ecosystem-based management tools, and establishments of a network of NARS Fisheries Trainees. ❖ New LarvalBase project commenced. ❖ Proceedings of Bellagio Conference "Towards Policies for Conservation and Sustainable Use of Aquatic Genetic Resources" published with FAO.
2000	<ul style="list-style-type: none"> ❖ Consolidation of the five fully functional regional nodes serving the ACP developing countries and substantial progress towards national fish biodiversity databases, established by project trainees and available on the Internet, for most of the 55 ACP countries participating in the project. ❖ FishBase strengthened by addition of specific tables and aquaculture species profiles. ❖ Species coverage of FishBase increased to 25,000 species. ❖ All of FishBase available on the Internet. ❖ Definition of the dynamics of flood plains habitats demonstrated for the lower Mekong River Basin to provide a baseline for fish production and biodiversity management in the region.
2001	<ul style="list-style-type: none"> ❖ New methods for genetic differentiation and assessment of suitability of <i>Barbodes gonionotus</i> carp species for aquaculture in Asia published. ❖ FishBase 2001 released, with update and consolidated coverage of all finfishes, 2 million occurrence points, consolidated and new analytical routines, and improved interface for use in education and by the general public. ❖ Hydrodynamic model and scientific papers of Mekong flood plains and projected effects on fish productivity and biodiversity published. ❖ Fishbase data reviewed by region to enhance utility of application in biodiversity and fisheries management in (2-3) selected areas. ❖ NARS fisheries' trainees' collaboration on fisheries and biodiversity management operative in three regions (Asia and the Pacific, Caribbean and Africa). ❖ FishBase team, regional ACP nodes and collaborators expand networking with research and development project teams, providing them with tools, training, and data management workshops so that such projects both use and contribute to FishBase thereafter.

	<ul style="list-style-type: none"> ❖ Coverage increased to 2,000 species, LarvalBase becomes an integral part of FishBase with provision for further expansion of coverage and use in fisheries and aquaculture research and development.
2002	<ul style="list-style-type: none"> ❖ Large historical and current fish biodiversity datasets compiled and analyzed for 2-3 selected developing country regions to identify early warnings, trends, threats to and rehabilitation of fish biodiversity. ❖ Threats to fish biodiversity categorized for selected ACP countries, especially for threatened freshwater fishes. ❖ Final report compiled integrating the results of biochemical genetic studies, aquaculture trials and secondary data on the status of the genetic resources of <i>S. melanotheron</i>. Conservation and management recommendations and related training materials published. ❖ Project initiated to evaluate the genetic impacts of the introduction of improved species for aquaculture in the collaborating countries of INGA.
2003	<ul style="list-style-type: none"> ❖ Consolidation of the structures and linkages necessary to sustain FishBase and its further evolution and services to developing countries ❖ Techniques and results of fish and larval mapping in the Mekong Basin area published and contributed to wetlands management plans.

Costs:

2001 2 million
2002 2.52 million
2003 2.61 million

Users:

The users will be the researchers, national resources decision-makers and policymakers concerned with living aquatic resources and their environments and, through them, the beneficiaries will be the fishers and farmers and consumers of aquatic produce in the developing regions. The geographical scope is global.

Beneficiaries will be NARS scientists and national resource managers, and, through their efforts, the farmers and fishers and consumers of aquatic produce in the ACP countries.

Collaborators:

World Conservation Union (IUCN); FAO; museums and centers of taxonomic expertise worldwide [for example; the British Museum (Natural History), London; the Musée National d'Histoire Naturel, Paris; the Musée Royal de l'Afrique Centrale, Tervuren]; all IARCs participating in the SWGRP, especially IPGRI (SINGER) and CIFOR; NARS in all developing regions, individually as research partners (e.g., the Institute of Aquatic Biology, Ghana) and through international and regional networks (e.g., the INGA); ASIs (e.g., the University of Hamburg, the University of Perpignan, the University of Wales, Swansea); other Global projects such as Species 2000.

Regional organizations, networks and NARS in the ACP countries, the Mekong River Commission and riparian NARS in the Mekong River region, IUCN, FAO, IWMI and other IARCs participating in the SWGRP, especially IPGRI and museums and other centers of taxonomic expertise which contribute to the development of FishBase.

New partners to be developed initially in Africa and West Asia through the INGA network (See project 10).

System Linkages:

System-wide Genetic Resources Program and its information project, SINGER. IWMI, through inter-center collaborative project in the Mekong River region.

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, EU, GTZ, DFID, TAC Holdback funds, and others to be identified.

Title: Genetic Enhancement and Breeding

Objectives:

Application of genetics to aquaculture has so far been limited; most aquaculture stocks in current use are similar to wild, undomesticated stocks whose potential for improvement is virtually untouched. The project focus is on tilapias and carps which, together, form the mainstay of many resource-poor small scale farmers throughout the developing world. The project will develop research methods and strategies for domestication and genetic improvement of tilapia and carp germplasm, assess their potential socioeconomic and environmental impacts, and contribute to initiation of national fish breeding programs. The project will continue to develop breeding plans for tilapia genetic enhancement in Africa and Asia and to document and prioritize carp genetics resources in Asia ex ante. Socioeconomic impact studies, choice of farming system and selection of traits for research will be combined to provide genetically improved carp for agriculture, and to help transfer technology to collaborating country scientists and to farmers.

Outputs (Results):

1. (GIFT) strain of *O. niloticus* (Nile tilapia) improved in growth rate and survival characteristics;
2. National tilapia breeding program in at least 3 Asian countries initiated; knowledge base for wider research in tilapia germplasm improvement established;
3. Options for operation of a model national tilapia breeding program in Philippines developed;
4. Plans and strategies for genetic improvement developed and systematic characterization and evaluation of existing farmed stocks initiated;
5. Identification of key carp species and strains for genetic improvement in Asia;
6. Extension of tilapia improvement research to Africa;
7. Carp genetics resources book
8. Carp genetics improvement book
9. Genetically improved carp lines
10. Publication on the status of tilapia genetic improvement

Gains (Impacts):

Provision of better breeding materials to world's major carp and tilapia farming countries and methods for their safe and productive deployment, expected to provide a more stable increase in fish productivity and consequently improved income of small-scale enterprises. The gains will be measured by investigation of potential socioeconomic and environmental impacts in collaboration with developing countries.

Duration and Milestones:

YEAR	MILESTONES
1999	❖ Completion of baseline surveys to understand the existing farming practices, marketing & consumption patterns & care of carp species in 6 Asian countries.
2000	❖ Prioritization and selection of carp species, choice of farming system and selection of traits for research carried out. ❖ Documentation of carps genetic resources in Asia published ❖ Documentation of genetic improvement of carps in Asia published
2001 - 2002	❖ Transfer of breeding technology to scientists in selected African countries from ICLARM's Egyptian sites commenced ❖ Plans developed for the introduction of biotechnology into breeding programs concurrent with environmental risk assessments

	<ul style="list-style-type: none"> ❖ Phase II of carp genetic enhancement programs initiated focusing on improvement of key traits in one or a few selected species in collaborating Asian countries ❖ Programs for the possible use of interspecific clones of tilapia evaluated in China.
2003	<ul style="list-style-type: none"> ❖ Application of quantitative methods to the improvement of indigenous fish species in at least two African countries.

Costs:

2001 1.39 million
2002 1.44 million
2003 1.49 million

Users:

Scientists in national institutions, in particular those participating in the International Network on Genetics in Aquaculture; Fish farmers in developing countries.

Collaborators:

NARS: specifically Bangladesh, China, India, Indonesia, Philippines, Thailand, Vietnam, Egypt, and other INGA centres and additional African counterparts anticipated over the period.

ARI: Norwegian Institute of Aquaculture Research (AKVAFORSK), the University of Swansea, Stirling and Wageningen, and other European and US institutes concerned with germplasm enhancement and genetic marker development for fish species.

System Linkages:

None specifically, but was also reported to SWGRP and Central Advisory Service.

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, ADB, UNDP-TCDC, USAID Holdback Funds, DFID, and others to be identified.

Title: Improvement of Freshwater Aquaculture

Objectives:

Farming systems in developing countries frequently have low production due to low levels and inefficient use of nutrients together with an unavailability of water when needed, leading to a net loss of soil nutrients. These unsustainable traditional practices have, coupled with smaller plot sizes due to population increase, led to widespread degradation of the natural resource base. There is an urgent need for improvement of productivity and efficiency of a large proportion of farm household operations.

The potential number of smallholder farmers who could benefit is considered to be very large, but remains underexploited. The target group in Africa are the large number of smallholder farmers who presently are not performing any form of IAA but would benefit from additional contributions to food security and resource preservation.

The objective is to provide data on:

1. the types of farming systems and agroecological zones in which integrated aquaculture-agriculture (IAA) can be sustainably incorporated into existing farming systems;
2. the impact of IAA on farm productivity, economics, ecology, human nutrition and the socio-cultural context;
3. which types of IAA are viable in which farming systems (in many cases, these need to be developed); and
4. what socio-economic criteria govern adoption and which strategies and mechanisms for widespread adoption of IAA are required.

Research will be conducted in partnership with farmers, NARS, NGOs and extensionists. Farmer-participatory technology development, evaluation and dissemination are key elements for success.

Outputs (Results):

New knowledge, tools and protocols will be created for

1. the assessment and characterization of agroecosystems, including the human communities as to their potential for sustainable adoption of IAA technologies and approaches (to enable decisions to embark on large-scale IAA development activities or not);
2. the quantification of the impact of IAA on smallholder farming systems (including dynamic and steady-state simulation models) and households in terms of bioproductivity, economics, ecology, human nutrition and social context factors;
3. assessing the viability of IAA systems themselves and optimizing them, depending on the farming system, based on alternative approaches to aquaculture research on small farm sites; and
4. the definition of the appropriate, efficient and cost-effective mechanisms and strategies for widespread adoption.

Gains (Impacts):

1. Enhanced household nutrition and income, proven sustainability for IAA farming systems;
2. Protocol for the assessment of IAA potential in a given area
3. Higher productivity (i.e., intensification) through IAA systems and greater enterprise diversity and nutrient recycling, leading to improved soil nutrient conditions and reduced pressure on natural resource base.
4. Ability of NARS, NGOs and extensionists to facilitate widespread IAA adoption and monitor its impact through proven strategy and tools.

Duration and Milestones:

YEAR	MILESTONES
2000	<ul style="list-style-type: none"> ❖ Release of research tool package: (1.) Field Operations Guide, and (2.) Software Manual for RESTORE ver. 1.0, for farmer-participatory design and impact assessment of the integration of new enterprises (such as aquaculture) into farming systems. ❖ Training course on RESTORE conducted for 12 NARS participants (scientists, extensionists and decision makers, including NGOs) either in Bangladesh or Malawi. ❖ Technical Report on IAA integration into farming systems in an upland forest buffer zone in the Philippines published. ❖ Start of new project on developing a tool for estimating potential impact scenarios and necessary support for inland aquatic resources management in Bangladesh. ❖ Start of a project in Malawi and up to two neighboring countries, to train research and extension staff in new approaches for dissemination and appropriate and successful IAA technologies, with a focus towards improvement of the nutritional conditions of targeted households. ❖ Start of new research project in collaboration with IITA-HFS in Cameroon, into the opportunities for IAA introduction into the continuum of different farming systems ranging from peri-urban to forest-margin situations.
2001	<ul style="list-style-type: none"> ❖ Definition of socio-economic variables governing successful adoption of IAA in selected sites in Africa and Asia ❖ Publication of Technical Report on deepwater rice-fish research project, including recommendations for productivity enhancement and equitable management of flood prone ecosystems in Bangladesh and Vietnam. ❖ Publication of recommendations for improved IAA systems designed for different farming systems in Bangladesh. ❖ Start of research project on improvement of recommendation domains for introduction of IAA practices.
2002	<ul style="list-style-type: none"> ❖ Reviews on two inland aquatic resource systems conducted, outlining potential for development and defining scope of required research, with particular focus on African inland waters. ❖ Database designed, required data identified, analysis routines defined for tool for estimating potential impact scenarios and necessary support for inland aquatic resources management in Bangladesh. ❖ Start of new project in collaboration with WARDA on assessment of the potential for introduction of different IAA technologies into the lowland valley farming systems of West Africa. ❖ Workshop held and recommendations for implementation formulated, on productivity enhancement and equitable management of flood prone ecosystems in Asia, Africa and Latin America, based on conclusions from the project conducted in Bangladesh and Vietnam.
2003	<ul style="list-style-type: none"> ❖ Historic data analysed of development of aquaculture sector and its subsectors in selected countries with "success stories" in Asia, and characterisation of potential threshold countries in Asia and Africa. Results will lead into work on formulation of recommendation domains for IAA introduction in Asia and Africa. ❖ Start of project in African country on productivity enhancement and equitable management of flood prone ecosystems.

Costs:

2001	2.18 million
2002	2.25 million
2003	2.34 million

Users:

1. Farmers in tropical developing countries with adequate site characteristics for IAA adoption.
2. NARS and NGOs with mandate for enhancement of aquatic protein availability for nutrition of the poor, or for improved natural resource management of traditional farming systems under population pressure.
3. Extensionists and development agencies - for defining appropriate areas for IAA dissemination and for planning effective action towards sustainable implementation reaching large numbers of poor smallholders including women.

Collaborators:

IARCS: IRRI (for Bangladesh/Vietnam projects); and IFPRI, IRRI, IITA, WARDA, AVRDC, (largely through utilization and extension of RESTORE)

NARS: Including institutes in Bangladesh, Philippines, Vietnam and Malawi and others to be selected in West and East Africa

NGOs: Including AIT, IIRR and NGOs in countries of operation

ASIs: University of Kassel; institute members of PD/A CRSP; (others yet to be identified)

New partners to be identified during 2000 design plan for Africa

System Linkages:

Links to regional activities of IITA and WARDA in West Africa work contributed to participatory research of the CGIAR.

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, USAID-Washington, USAID Bangladesh, DFID, GTZ, IFAD, and others to be identified.

Title: Fisheries Resources Assessment and Management

Objectives:

Because of their complexity, small-scale, multi-species, multi-gear fisheries for tropical fishes and invertebrates are extremely difficult to assess and manage. Several hundred species of fishes or invertebrates are often regular components of the catches in a diverse array of fishing gears. Catches are often landed at widely scattered villages, beaches and docks from where they are distributed by vendors throughout the adjacent countryside. There is seldom any centralized marketing and distribution system. Conventional fisheries assessment methods are unable to cope with this complexity. Consequently, very few small-scale fisheries in tropical developing countries have been assessed in terms of their potential yields and virtually none are managed in order to optimize yields. Most are overexploited and yield less than their potential.

Outputs (Results):

Outputs will include analytical tools, models, cost-effective data acquisition systems and databases relevant to living aquatic resources and their supporting ecosystems, upon which management systems can be based, for the benefit of fishing communities and fish consumers in tropical developing countries.

Gains (Impacts):

Importance is proportional to the importance of fish and fish production in regional economies and diets, with the greatest production in Asia and LAC and the greatest unfilled demand in SSA. Implementation of fisheries management systems in LDCs will lead to sustained or increased fish production and stable food supplies, employment, export earnings and the conservation of aquatic biodiversity.

Duration and Milestones:

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ Fully functional model of TrawlBase, a computerized database for collecting and analyzing trawl data, distributed to all partner countries ❖ Phase II of Caribbean MPA project commenced.
2000	<ul style="list-style-type: none"> ❖ Release of Ecopath (ecosystem modeling tool) version 4.0 incorporating dynamic simulation module, EcoSim ❖ Asian regional workshop held to analyze fisheries and socioeconomic data on trawl fisheries in partner countries ❖ Scientific evidence published of the consequences of implementation of MPAs in selected areas (Caribbean, Pacific) ❖ Maintenance and update of the software for distribution will be conducted ❖ Biomass estimation module/ analysis in relation to Trawl Fisheries project developed
2001	<ul style="list-style-type: none"> ❖ Action plans for management systems for coastal fisheries implemented in selected LDCs in Asia ❖ Action plans published for the implementation of MPAs for both fish and aquatic invertebrate fisheries in selected areas (Caribbean, Pacific) ❖ Completion of the development of Fisheries Resource Information System (TrawlBase) and release of the final project version and related documentation. ❖ National/regional fisheries resource management strategic planning workshops conducted.

	<ul style="list-style-type: none"> ❖ National development strategies and action plans for management of coastal fishery resources in selected Asian countries formulated. ❖ Ecopath models of reef systems in the British Virgin Islands and on the north coast of Jamaica completed. ❖ Feasibility of using rectangular escape gaps as a management tool in Caribbean trap fisheries evaluated. ❖ Information base for management of coastal resources (based on work in the Philippines) established. ❖ Information system developed to store information on resource collection sites in support of coastal resource management activities and across-site comparison of selected sites in the Philippines. ❖ Local capacity in resource assessment methods and database use developed in at least one southeast Asian country.
2002	<ul style="list-style-type: none"> ❖ Initiation of project on simple measures for fisheries management in data-poor fisheries. ❖ Publication of the effects of fishing closures in selected MPAs after three years. ❖ Monitoring of invertebrate populations completed 5 and 6 years after closure of area to fishing in the Solomon Islands, with emphasis on assessing the time needed for recovery of sea cucumbers
2003	<ul style="list-style-type: none"> ❖ Minimum parameter methods for fisheries estimation and management tested for feasibility in two Asian countries. ❖ Biomass estimation module/ analysis in relation to Trawl Fisheries project will be developed

Costs:

2001	1.52 million
2002	1.58 million
2003	1.86 million

Users:

Fisheries managers will benefit from training in the use of analytical methods and improved understanding of the status of stocks and improved ability to communicate results to fishing communities and politicians. The principal users will be the fishers who should benefit from more stable and improved incomes and the consumers who will have better assurance of adequate fish supplies.

Collaborators:

1. Centre for Marine Sciences, University of the West Indies; Conservation and Fisheries Department of the Ministry of Natural Resources and Labour, British Virgin Islands; North Sea Centre, Denmark; Fisheries Centre, University of British Columbia; FAO; Environment and Conservation Department, Solomon Islands; The Nature Conservancy, USA; CARICOM Fishery Resources Assessment and Management Project, Belize
2. Trawlbase Partners:
 - Bangladesh: Department of Fisheries; Bangladesh Fisheries Research Institute (BFI); University of Chittagong (UC)
 - India: Indian Council for Agricultural Research (ICAR)
 - Indonesia: Directorate of Fisheries Resource Management (DFRM)
 - Malaysia: Fisheries Research Institute (FRI); Department of Fisheries (DOF)
 - Philippines: Bureau of Fisheries and Aquatic Resources (BFAR); University of the Philippines in the Visayas (UPV)
 - Sri Lanka: Ministry of Fisheries and Aquatic Resources Development (MFARD)
 - Thailand: Southern Marine Fisheries Development Center (SMFDC); Department of Fisheries

- Vietnam: Research Institute for Marine Products (RIMP); Ministry of Fisheries (MOF)
3. New partners to be identified in Africa & West Asia Program with similar resource assessment requirements.

System Linkages:

None

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, DANIDA, ADB (through RETA and through the Philippine FRMP), DFID, Nature Conservancy, and others to be identified.

Title: Assessing and Limiting Coral Reef Degradation

Objectives:

This project aims to combine global assessments of the causes, rates and consequences of reef degradation with studies on the nature of coral reef responses to human disruptions, the development of criteria and cost-effective diagnostic approaches for assessing coral reef ecosystem integrity, and the development of effective management strategies to ensure the sustainability of coral reef resource systems.

The project also aims to develop user-oriented decision analysis and optimization modeling tools based on interdisciplinary studies of the consequences of various management decisions in a variety of situations.

Outputs (Results):

1. Sustainable management procedures for coral reefs
2. Cost-effective resource evaluation criteria and protocols
3. National, regional and global assessments of coral reefs
4. Data exchange, networking, assimilation and dissemination on a user friendly database and analytical software
5. Technical and non-technical publications with policy makers, resource managers community leaders as primary target audience
6. Procedure manuals, training programs and supportive software for use by the target end users

Gains (Impacts):

1. Improved management of coral reefs at local, national, regional and global scales
2. Increased dissemination of information which would otherwise be limited to the scientific community
3. Facilitate prioritization of funding, research, development and policy efforts
4. Heightened public awareness of the status and importance of coral reefs
5. Move towards a sustainable production/ fisheries of coral reef species
6. Improved management of coastal zones at local, regional and global scales through the use of the decision analysis tools and optimization models
7. Sustainable use of coastal environments
8. Improved quality of life for coastal dwellers

Duration and Milestones:

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ Preliminary genetic analysis on reef organisms in South China Sea ecosystem carried out. ❖ Workshop on the integration of results from the PISCES project - genetic studies on target coral reef species to examine reef interconnectivity - held with partner institutions ❖ GIS database incorporating satellite and remotely sensed images of coral reefs and tropical surface layer parameters incorporated into ReefBase ❖ Existing data on biology and taxonomy of coral reefs (CoralBase) incorporated into ReefBase ❖ Completion and publication of RAMP (Rapid Assessment of Management

	Parameters) coral reef study in the Philippines with the University of Rhode Island
2000	<ul style="list-style-type: none"> ❖ PISCES results published and new project addressing transboundary management mechanisms formulated. ❖ ReefBase 4.0 released. ❖ A set of coral reef valuation tables, produced in collaboration with ICLARM's policy program designed, verified by experts and operational within ReefBase. ❖ A paper on "Fishing and Coral-Algal Phase Shifts" published ❖ A paper on "Biosocioeconomic Indicators" of coral reef health published in collaboration with the University of Rhode Island.
2001	<ul style="list-style-type: none"> ❖ The global ICRAN network operational with projects among seven international agencies. ❖ ReefBase 5.0 released. ❖ South East Asian Regional network of coastal zone managers operational and involved in coastal zone training activities in 3 countries of Asia. ❖ A reef linkage network established among active research institutions to enhance the investigation of "source" vs "sink" reefs globally. ❖ Southeast Asian Reefs at Risk Analysis with the World Resources Institute will be published
2002	<ul style="list-style-type: none"> ❖ ReefBase 6.0 released. ❖ Reefs at Risk analyses published for two more regions of the world
2003	<ul style="list-style-type: none"> ❖ ReefBase 7.0 released. ❖ Reefs at Risk analyses published for two more regions of the world (for a total of at least 5 regions to have been covered).

Costs:

2001	1.79 million
2002	2.17 million
2003	2.54 million

Users:

1. People dependent on coral reefs for food and livelihood now and in the future
2. Coral reef coastal zone and other complex ecosystem managers and researchers
3. Global policy makers and the general public in need of information on coral reefs
4. Coastal dwellers and local community leaders
5. Coastal zone managers, policy makers and development workers
6. Researchers and academic institutions

Collaborators:

NARS in Indonesia, Malaysia, Philippines, Republic of China, Solomon Islands, and Vietnam
World Conservation Monitoring Centre
World Resources Institute
Other research agencies or networks on coral reefs worldwide (e.g., Global Coral Reef Monitoring Network/ICRI, NOAA/USA)
National Center for Atmospheric Research (NCAR), Colorado, USA
US Geological Survey
Coastal development, policy makers and management agencies
Philippine Department of Agriculture, national academic and administrative institutions, local government units and management councils in the Philippines (e.g. UP Marine Science Institute; Silliman University); Subic Bay Management Authority
Local Government Units and management councils

System Linkages:

None

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, World Bank, SIDA, United Nations Fund, MacArthur Foundation, Rockefeller Brothers Fund, and others to be identified.

Title: Coastal Aquaculture and Stock Enhancement

Objectives:

Coral reefs support a rich variety of animals of value to human societies, including fish, spiny lobsters, sea cucumbers, giant clams, pearl oysters and shells such as trochus, conch and green snail. Traditionally, these animals were harvested at subsistence levels. More recently, development of lucrative export markets has also provided coastal villagers with opportunities to earn money from coral reef species. These earnings are now an important source of income for many coastal communities. Unfortunately, the transition from a subsistence to a market economy has usually been far from ideal: chronic overfishing has often occurred and, on many reefs, there are now too few of the most prized animals to sustain reasonable harvests. Destructive fishing methods have compounded the problem by degrading some reefs to the point where they cannot support valuable species. Many coral reefs in developing nations no longer provide benefits to the people who live near them.

The productivity of coral reef fisheries can be regained and maximized by restoring damaged habitats, restocking fish and shellfish populations to the carrying capacity of the ecosystem, and then managing them to obtain optimum yields on a sustainable basis. Productivity can also be increased by developing aquaculture methods for various species.

The objective of this project is to improve the productivity of coral reef fisheries through development of biotechnical systems for the culture of high value species by village farmers and cost-effective methods for propagating and releasing juveniles to restore and enhance inshore fisheries. Once these methods have been demonstrated to be economically viable and environmentally sustainable, they will be transferred to NARS in the Asia-Pacific region through reports, manuals and workshops.

Outputs (Results):

The outputs will be:

1. methods to reduce the cost of "seed" giant clams produced in hatcheries;
2. identified sources of wild spat (seed) of blacklip pearl oysters;
3. improved methods for collecting pearl oyster spat;
4. robust estimates of growth and survival of giant clams and pearl oysters at village farms;
5. market information (prices, demand) for farmed giant clams;
6. establishment of village farms for pearl oysters, and
7. methods for spawning sea cucumbers and rearing their larvae;
8. data on the survival of wild caught juvenile reef fish relevant to the development of enhanced fisheries
9. knowledge of the fish to coral reef-based aquaculture from terrestrial-based enterprises such as logging.

The beneficiaries of this research will be the coastal villagers who will have greater opportunities to derive income from coral reef species on a sustainable basis, either through small-scale farming operations or by improved harvests from enhanced fisheries.

Gains (Impacts):

1. Increased and diversified opportunities for coastal villagers to earn income through the sale of farmed products and improved catches from wild fisheries that have been restored or enhanced through release of cultured juveniles. Gains based on culture of pearl oysters and sea cucumbers will benefit growers in remote areas, however, sale of giant clams to live seafood markets will only be possible for villagers close to adequate transport links.

2. Improved knowledge of the value of coral reef habitats leading to greater care of the ecosystem and increased productivity from wild stocks.

Duration and Milestones:

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ Research implemented on methods for capture and rearing of juvenile reef fish with Australian partners ❖ Documentation of the viability of village-based culture of pearl oysters (and pearls) based on the collection of wild spat and documentation of methods in another Pacific island country; development of cost-effective methods for the mass propagation of juvenile sea cucumbers and publication of results
2000	<ul style="list-style-type: none"> ❖ Establishment of restocking initiatives by village-based giant clam farmers and transfer of technology to at least one other Pacific Island country. ❖ Identification of the size at which to release the giant clam species <i>Tridacna derasa</i>, and the habitats that result in the best survival ❖ Sea cucumber hatchery and restocking methods extended to appropriate Southeast Asian countries.
2001	<ul style="list-style-type: none"> ❖ Regular spat collection of blacklip pearl oysters established in Solomon Islands to determine availability and scope for development of commercial operations ❖ Villagers in the collection and grow-out of blacklip pearl oyster spat trained. ❖ Village-based farms established for giant clams for sale to the aquarium market
2002	<ul style="list-style-type: none"> ❖ Large scale production of juvenile sandfish (sea cucumber species) for release experiments completed. ❖ Methods for the reliable transport of juvenile sea cucumbers to release sites demonstrated and reported. ❖ The size, habitat, season and stocking density that optimizes the survival of juvenile cultured sandfish released into the wild identified. ❖ A pilot-scale mass-release of sandfish to assess their growth and survival completed ❖ Completion of feasibility trial for the grow-out of wild caught reef fish larvae for aquaculture and trade.
2003	<ul style="list-style-type: none"> ❖ The best faunal assemblages for detection of effects of sedimentation on productivity of freshwater and inshore marine receiving waters identified ❖ Comparisons of the effects of runoff from different types of logging operations on receiving waters completed ❖ Local communities participate in the assessment process ❖ Application of the results of the study by Pacific communities in the management of their inshore marine resources
2004	<ul style="list-style-type: none"> ❖ Assessment of optimum strategies for releasing hatchery-reared juveniles to enhance wild stocks of sea cucumbers carried out

Costs:

2001 1.58 million
 2002 1.63 million
 2003 1.69 million

Users:

NARS in the Asia-Pacific region who will use the results of the research to identify opportunities to establish viable, village-based aquaculture industries, or enhanced wild fisheries. The main beneficiaries will be growers and fishers, who will have substantial, and sustainable

opportunities to derive income from coral reef habitats. The farming of giant clams is as suitable for women as it is for men. Growing pearl oysters includes activities that can be similarly shared. The local companies (e.g., exporters, governments) will also benefit from the increased volume of commodities. The project will have an immediate benefit to the western Pacific and has potential for impact in tropical coastal areas throughout Asia and WANA.

Collaborators:

Ministry of Agriculture and Fisheries, Solomon Islands
Overseas Fishery Cooperation Foundation (Japan)
South Pacific Forum Fisheries Agency
South Pacific Commission
James Cook University, Australia
AIMS, Australia
University of Notre Dame, Canada
NIWA, New Zealand

System Linkages:

None

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, ACIAR, NZODA, OFCF (Japan), CCLF (Canada), and others to be identified.

Title: Economic Monitoring and Evaluation of Developing Country Fisheries

Objectives:

The project aims to examine the linkage between society, economic and natural systems, and policy with a view to developing adaptive and flexible ways of achieving sustainable use of aquatic resource systems.

Outputs (Results):

Methods and models will be developed for (a) providing an economic value of goods and services from coastal resources; (b) addressing the relationship between natural ecosystems and economic systems as an integral part of the policy and management process; and (c) sustainable, equitable and efficient institutions for sustainable governance of coastal resources.

Gains (Impacts):

1. Improved coastal resource management policies and systems;
2. More participatory coastal resources management
3. Improved quality of life for fishers
4. Strengthening of NARS

Duration and Milestones:

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ Economic assessment of coral reefs in selected areas conducted. ❖ Data from various sources about goods and services provided by the coral reefs as well as non-market values compiled and correlated. ❖ A database that includes biophysical and socioeconomic information on world fisheries with special reference to developing countries established. ❖ Policy analysis of food security and management issues in small-scale fisheries (ricefields, wetlands, rivers and reservoirs) in Indo-China extended to institutional and legal issues in other Indo-China countries (Cambodia). ❖ A database on economic fisheries statistics for use in institute planning established. ❖ International workshop on fisheries co-management held to synthesize Phase 1 research outputs and plan for Phase 2 research strategy.
2000	<ul style="list-style-type: none"> ❖ Demand and supply study implemented with national and international partners in Asia. ❖ Integration of economic values of coral reefs in ReefBase (ICLARM Project 5). ❖ Implementation of the IFPRI-ICLARM joint proposal on the integration of fish in the World Food Model. ❖ The values and relevance of aquatic resources to households in selected areas of the Mekong River Basin determined and community and institutional capacities created for improving the management through community inputs and interventions. ❖ Publication of the proceedings of Asian and African workshops on results from co-management case studies and commencement of pilot testing of optimal co-management arrangements in countries in South East Asia. ❖ Priorities for socioeconomic & policy research on coastal wetlands in South & Southeast Asia determined through workshops and consultations with NARS. ❖ Research framework on fisheries co-management reviewed and case studies

	<p>revisited to determine long-term progress. A study on compliance developed.</p> <ul style="list-style-type: none"> ❖ Legal, policy and institutional analysis of fisheries and coastal zone management expanded to at least one African country.
2001	<ul style="list-style-type: none"> ❖ The variables needed to assess and monitor trends in demand for and supply of fish and seafood products in relation to food security, employment, income, consumption, trade, resource management and sustainable production in the developing countries of Asia identified. ❖ Socioeconomic information that will aid in developing strategies and action plans for sustainable utilization of coastal fish stocks in Asia provided (in collaboration with ICLARM Project 6). ❖ The variables needed to assess and monitor trends in demand for and supply of fish and seafood products in relation to food security, employment, income, consumption, trade, resource management and sustainable production in the developing countries of Africa identified. (This will look at fish only in Africa while the IFPRI-ICLARM Model considers all food supply globally.) ❖ Fish integrated into world food model from IFPRI-ICLARM project. ❖ Ecological and economic assessment of selected coastal and coral reef resources completed in the Philippines and other Southeast Asian countries. ❖ Evaluation of pilot co-management arrangements completed; policy guidelines for co-management developed.
2002	<ul style="list-style-type: none"> ❖ Trends in demand for and supply of fish and seafood products in relation to food security, employment, income, consumption, trade, resource management and sustainable production in the developing countries of Asia assessed and monitored for a two-year period.
2003	<ul style="list-style-type: none"> ❖ The variables needed to assess and monitor trends in demand for and supply of fish and seafood products in relation to food security, employment, income, consumption, trade, resource management and sustainable production in the developing countries of Latin America identified. <p>Note: The focus in assessing the supply-demand project will first be in Asia (2000-2002) then Africa (2001-2003) and finally LAC (2002-2004).</p>

Costs:

2001	0.57 million
2002	0.59 million
2003	0.41 million

Users:

Resource managers, fishers, policymakers, NGOs, development workers, scientists in Asia, Sub-Saharan Africa, Caribbean

Collaborators:

NARS and NGOs in Bangladesh, Benin, Cambodia, Cote d' Ivoire, Indonesia, Malaysia, Malawi, Mozambique, Philippines, South Africa, Thailand, Vietnam, Zambia, Zimbabwe.
ARIs in Canada, Caribbean, Denmark, and US

System Linkages:

Links to IFPRI's World Food Model development

Financing Plan:

This project will funded through the following sources: ICLARM unrestricted core fund, ADB, SIDA, Oxfam, and others to be identified.

Title: Legal and Institutional Analysis for Fisheries Management

Objectives:

To examine the range of policy issues and measures by which governments might strive to increase the supply of fish for human consumption and the economic benefits which are available from the fisheries sector.

Outputs (Results):

Macro and micro-level policy analysis of global problems affecting fisheries, particularly resource overexploitation and environmental degradation, technology, markets and structure of the economy, linkages between fisheries and other sectors, food security and nutrition, trade and macroeconomic policies and gender.

Gains (Impacts):

Improved government policies to provide an enabling environment for the fisheries sector to make the optimum contribution to economic and social welfare.

Duration and Milestones:

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ Legal, policy and institutional analysis of coastal fisheries management in selected Southeast Asian countries and Bangladesh completed. ❖ Proceedings of Asian and African workshops on results from co-management case studies published. ❖ Research framework on fisheries co-management reviewed and case studies revisited to determine long term progress. ❖ Resource assessment in the Philippines describing constraints on bangus (milkfish) fry completed. ❖ Proceedings of the Workshop on Community-Based Fisheries Management (CBFM) published and general management options provided for inland fisheries in Bangladesh.
2000	<ul style="list-style-type: none"> ❖ Results of policy analysis of food security and management issues in small-scale fisheries in Indo-China integrated and published. ❖ Proposals developed with NARs in Africa for co-management research. ❖ Collaboration established with national agencies in Asia (Philippines, Indonesia, Thailand, Malaysia, Bangladesh and Lao PDR) and Africa (Malawi, South Africa, Zambia, Zimbabwe, Cote d'Ivoire, Benin and Mozambique) to work on the legal, institutional and policy analyses and the evaluation of specific set of hypotheses about co-management. ❖ Methodologies developed for testing hypotheses on scale, legitimacy, resiliency, transaction costs and compliance in co-management of coastal resources. ❖ A comprehensive agenda for socioeconomic and policy research on coastal wetlands management issues in Southeast Asia formulated. ❖ Methodologies developed for analyzing the legal and institutional framework for wetlands management in the Mekong River Basin. ❖ Country-specific logframes formulated with objectively verifiable indicators and finalize means of verification developed for legal analysis of wetlands management. ❖ National plans and programs for legal and institutional analysis of wetlands governance in the Mekong Basin countries reviewed through national

	workshops. ❖ Manual on CBFM training modules completed.
2001	❖ Policy actions recommended for global and regional co-management arrangements. ❖ Projects on inland aquatic wetlands in the Mekong Basin sub-region implemented and analysis and recommendations completed for publications. ❖ Two workshops conducted to disseminate research results to policymakers and other researchers for the co-management of fisheries at the national level. ❖ Four training courses conducted on legal and institutional analysis and economic valuation of wetland resources. ❖ Information materials disseminated to foster debate and advocate policy changes on CBFM.
2002	❖ Regional results of the effects of supply and demand of seafood and aquatic produce on availability for the poor published, starting with Asia. ❖ Guidelines for policymakers on implementing co-management arrangements developed and published. ❖ National workshops to disseminate research information to policymakers and other researchers on the importance of aquatic resources to food security conducted in 3 regions of Asia. ❖ Research completed on legal and institutional analysis and economic valuation of wetland resources in the Mekong River Region together with NARS in the riparian countries.
2003	❖ International workshop conducted to disseminate research results from co-management projects implemented in Asia and Africa. ❖ Awareness generated and understanding of wetland management issues at the local, provincial, national and regional levels enhanced as shown by the active participation in workshops in each of the riparian countries. ❖ A national wetland management plan or program of riparian experts in each of the riparian countries of the Mekong River Region which incorporates local management systems, integrates across sectors and involves local communities. ❖ Described and published the economic values of wetlands and their resources in the Mekong River Region.

Costs:

2001	2.47 million
2002	2.56 million
2003	2.66 million

Users:

Policymakers, government agency managers, NARS, NGOs, regional bodies.

Collaborators:

FAO, IFPRI, NARS, ASIs including the North Sea Centre
New partners to be identified during 1997 design phase of Africa and West Asia program but including the countries of Indo-China.

System Linkages:

IFPRI, System-wide project on common property and collective action research (CAPRI)

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, DANIDA, SIDA, DFID, and others to be identified.

Title: Aquatic Resources Research, Planning and Impact Assessment

Objectives:

To evaluate and assess the results and impacts of completed aquatic resources research activities, initially undertaken only by ICLARM, but possibly in later years including research by others.

Outputs (Results):

Assessment of the impact of long-term research, ex-ante and ex-post assessments of return on research investment, and priority setting and achievement monitoring of research.

Gains (Impacts):

Meet accountability requirements or gain support for research, to contribute to internal decision-making and the research management process, and to contribute to knowledge in a more general sense.

Duration and Milestones:

YEAR	MILESTONES
1999	❖ ICLARM published strategic plan that includes preliminary analysis of beneficiaries of LARM research.
2000 - 2001	<ul style="list-style-type: none"> ❖ The impact of research and technology development for giant clam mariculture in the Indo-Pacific region assessed. ❖ Workshop of CGIAR's INRM group hosted on methods for addressing indicators and scale consideration in NR systems. ❖ A national workshop in Bangladesh conducted to provide recommendations on appropriate fishery extension systems for transfer of technology based on evaluation of existing alternative extension approaches. ❖ A set of recommendations published that will include a comprehensive framework and guidelines on principles and strategies towards assessment of impact of aquatic resources research. ❖ Assessments of parameters required to assess the beneficiaries from LARM research in developing countries completed. ❖ Local workshop with farmers conducted on assessment and improvement of farming systems that include aquaculture in Bangladesh.
2001	<ul style="list-style-type: none"> ❖ Ex-post assessment of carp genetic/breeding research completed ❖ Impact of co-management research evaluated
2002	<ul style="list-style-type: none"> ❖ The constraints and opportunities to the growth of milkfish industry in the Philippines, Indonesia and Taiwan identified with emphasis on the adoption and technological development. ❖ The impact of research and technology development for giant clam mariculture in the Indo-Pacific region assessed. ❖ National workshop in Bangladesh conducted to provide recommendations on appropriate fishery extension systems for transfer of technology based on evaluation of existing alternative extension approaches. ❖ Provided a set of recommendations that will include a comprehensive framework and guidelines on principles and strategies towards assessment of impact of aquatic resources research.
2003	❖ Constraints and opportunities to the growth of milkfish industry in the Philippines, Indonesia and Taiwan identified with emphasis on the roles of adoption and technological development.

Costs:

2001	0.07 million
2002	0.07 million
2003	0.08 million

Users:

ICLARM scientific staff, Board and management, donors and NARS

Collaborators:

ISNAR, ASIs, and ICLARM research programs
SEAFDEC Aquaculture HQ, Philippines
NARS in South and Southeast Asia and the Pacific

System Linkages:**Financing Plan:**

This project will be funded through the following sources: ICLARM unrestricted core fund, IFAD, and others to be identified.

Title: Information and Capacity Building for Aquatic Resources Research in Developing Countries

Objectives:

The objectives of the project are:

1. to provide continually improving access to scientific information, through publications in various media, translations and sharing of resources and training.

This will increase public awareness of global living aquatic resources issues and of ICLARM's role in resolving them.

2. to increase the capacity of NARS scientists to undertake and report on relevant aquatic resources research.

Scientists in developing countries often have difficulty in carrying out and reporting their work. The project seeks to assist them by developing appropriate training courses and materials, using and adapting the latest available materials and methods and to provide guidance to senior NARS managers in priority setting; and

3. to establish new research partnerships and strengthen existing partnerships with NARS, ARIs, IARCs and NGOs, for better management of living aquatic resources worldwide; improved capabilities of NARS scientists in genetic resource conservation and improvement through the International Network on Genetics in Aquaculture (INGA) and in social science research through the Asian Fisheries Social Science Research Network (AFSSRN); continuation of two information networks: the Network of Tropical Fisheries Scientists (NTFS) and the Network of Tropical Aquaculture Scientists (NTAS); provide assistance to NARS in research planning and prioritization for aquatic resource management.

Outputs (Results):

Outputs will include:

1. globally disseminated information on aquatic research results and publications in paper and electronic media, including research news and library databases;
2. more efficiently disseminated material in different languages;
3. tailored courses and training packages in a variety of research and related areas for NARS scientists and managers worldwide;
4. a network of trainers and training centers;
5. support to other ICLARM programs.
6. enhanced knowledge and research capabilities of NARS scientists from international cooperation developed through genetics and social science research networks and other information networks; improved research methodologies for conservation and management of living aquatic resources; a network for genetic evaluation and enhancement of carps; improved breeds of fish and other aquatic organisms.

The beneficiaries are national scientists whose skills in research methods and reporting will be improved, thus streamlining the research process by eliminating poor methodology and lack of reporting.

Gains (Impacts):

1. Wider and more efficient use of information on aquatic resources
2. Improvements in national fisheries management and research methods

3. Raised awareness of fisheries and aquatic resources issues to inform policy and public debate.
4. Better informed ICLARM and NARS scientists, who, along with aquatic resource managers, educators and students are the main recipients and users of the Center's information products.
5. Human resources development in networking and collaborating countries;
6. Strengthening of NARS;
7. Increased production of aquatic organisms through improved breeds developed;
8. Improved farming systems;
9. Conservation and improved management of aquatic resources;
10. Food security for small farmers/fishers through increased incomes and nutrition.
11. Better informed NARS scientists and managers and thus improved aquatic resources management.

Duration and Milestones:

YEAR	MILESTONES
1999	<ul style="list-style-type: none"> ❖ Long term strategy for ICLARM's program-associated training developed as part of institute's strategic plan development ❖ Regular use established of current information technologies (e.g., through the Internet) to facilitate information (literature/news on aquaculture, fisheries, genetics, etc.) dissemination and exchange (discussion fora) among members of information networks ❖ Recommendations of the external audit of the publications unit implemented ❖ Forty two institutional publications produced ranging from technical to annual reports on ICLARM contributions to LARM research. ❖ An occasional new publication series titled Impacts designed to highlight the impact of ICLARM's LARM research for development agencies. ❖ Membership of INGA broadened to include 11 additional ARIs. ❖ GoFAR established within APAARI.
2000	<ul style="list-style-type: none"> ❖ INGA/Africa collaborative project: Performance evaluation of tilapia strains in test environments completed for participating countries ❖ Workshop on 'Development of strategies and action plans for distribution of improved fish breeds to small scale farmers' in INGA member countries organized ❖ Proceedings of 5th INGA steering committee meeting published ❖ Germplasm exchange among member-countries facilitated/coordinated by use of standardized MTAs. ❖ Third Course on 'Quantitative Genetics and Selective Breeding' organized for INGA/NARS scientists held. ❖ Training workshop on 'Research Priority Setting for Asia-Pacific NARS' conducted. ❖ INGA web page made available on the Internet ❖ Library, publication and information services serving ICLARM staff and stakeholders established in temporary office in Malaysia. ❖ Electronic publishing of ICLARM's research work commences ❖ External Review of ICLARM's information services completed
2001	<ul style="list-style-type: none"> ❖ International workshop on 'Ecological risk assessment of the genetically improved and modified organisms' organized ❖ INGA/Africa collaborative project: Base population for selective breeding program established in participating countries ❖ Germplasm exchange among member-countries facilitated/coordinated ❖ Technical backstopping provided in implementation of national breeding programs in member countries of INGA ❖ Library, publication and information services serving ICLARM staff and stakeholders established in permanent HQ in Malaysia.

2002	<ul style="list-style-type: none"> ❖ INGA/Africa collaborative project: Selective breeding experiments for genetic improvement of native tilapias undertaken and strategies developed for dissemination of improved tilapia breeds in African member countries ❖ Training unit established within ICLARM as focal point for NARS enhancement
2003	<ul style="list-style-type: none"> ❖ INGA/Africa collaborative project: First generation of selected fish developed; dissemination of improved tilapia breed to local farmers in the participating countries initiated ❖ Information, publication training and support services to NARS in continuous operation

Costs:

2001	1.50 million
2002	1.56 million
2003	1.61 million

Users:

Global community concerned with aquatic resources research and management, ICLARM and collaborating scientists;
NARS scientists and managers, educators and students
Policy makers and donors

By being better informed, these users can better assist the beneficiaries, the users and consumers of aquatic resources in developing countries.

Collaborators:

Other data sources such as FAO, regional aquaculture or fisheries information repositories etc. Researchers from NARS and ARIs worldwide.
ASIs may also provide trainers, materials, methods and participants.
NARS (presently 13 INGA member countries in Asia, Africa and the Pacific; and five member countries in AFSSRN), IARCs and NGOs involved in living aquatic resources management worldwide.

System Linkages:

PARC and other information exchanges within the CGIAR. INGA outputs reported through projects 1 and 2 and the SWGRP.

Financing Plan:

This project will be funded through the following sources: ICLARM unrestricted core fund, Norway, IDRC, and others to be identified.