Medium-Term Plan
2004 - 2006

WorldFish
CENTER

formerly known as "ICLARM - The World Fish Center"

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

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

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

WorldFish Center

Medium Term Plan 2004-2006

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The WorldFish Center: who we are and what we do

The WorldFish Center is a unique international research center involved in research and training on fisheries and other living aquatic resources.

Our vision is to contribute to food security and poverty eradication in developing countries.

Our mission is to promote sustainable development and use of living aquatic resources based on environmentally sound management.

The Challenge
One billion people rely on fish as a source of animal protein.

One hundred and fifty million people depend on fish for employment.

There are 80 or 90 million more people in the world every year to be fed, most of them poor and in developing countries. More people means more demand for food, including fish. How will the demand for more fish be met?

Natural fish stocks are being severely depleted and under serious threat. Many forms of aquaculture have yet to prove their sustainability and be accessible to the poor.

The WorldFish Center is responding to this challenge by working to:

- Raise and sustain the productivity of fisheries and aquaculture systems;
- Protect the aquatic environment;
- Save aquatic biodiversity;
- Improve policies for sustainable development of aquatic resources; and
- Strengthen the capacity of national programs to support sustainable development.

The WorldFish Center has identified 13 specific **research thrusts** (MTP Projects) to achieve meaningful impacts in these areas:

1. Conservation of aquatic biological diversity
2. Mitigation of adverse impacts of alien species on aquatic ecosystems and biological diversity
3. Genetic improvement and breeding
4. Strategies and options for realizing gains from sustainable freshwater aquaculture systems
5. Freshwater fisheries in an integrated land and water management context
6. Restoration of capture fisheries
7. Environmentally-friendly coastal aquaculture
8. Reversing degradation of coastal habitats
9. Economic, policy and social analysis and valuation of aquatic resources
10. Aquatic resources planning and impact assessment
11. Legal and institutional analysis for aquatic resources management
12. Improved partnerships and capacity-building among developing country institutions and agencies
13. Access to information for sustainable development of fisheries and aquatic resources

Executive Summary

This Medium Term Plan 2004-2006 presents the World Fish Center's programs and partnerships and describes how they are designed to provide the scientific basis for multiple positive contributions that living aquatic resources (fish for short) can make to poverty eradication, food and nutritional security, and sound management of the environment.

Building upon the WorldFish Center's recent achievements in aquatic resources research and development, the MTP has been developed against the backdrop of world events in 2002-2003, particularly the World Summit on Sustainable Development, the review of the Millennium Development Goals in the recent Human Development report, and the ongoing trends of overexploitation, reduced production and increased demand for fish and other aquatic resources. An important achievement in 2002, which will be further developed over the next 9 years is the *Fish for All* initiative, launched during a global summit at the Center in November 2002. A Global Steering Committee comprised of prominent leaders from the north and south is working to create a credible, global science and policy dialogue capable of instilling urgency into the issues at hand through the active participation of senior policy-makers, opinion leaders and researchers at various levels of the community. The ultimate goal of *Fish for All* is to establish fish-related matters as a significant issue on world economic and environmental agendas.

This MTP also highlights the Center's approach to working to maximize our impact by clustering our efforts in specific areas or "geographies". Examples of our work are provided in the Greater Mekong Region, and the growing program in Africa based on the Center's recent Africa Strategy.

Achieving meaningful impacts in food security and poverty alleviation amongst the poor in developing countries through research on aquatic resource systems requires careful analysis of impact pathways and the mechanisms and constraints that influence the final impact of our work. This understanding can in turn be used to strategically prioritize the nature and location of our future research in order to maximize the impact and utility of the donor investments. In 2003 the Center initiated a Research Prioritization and Impact Pathway Analysis Task Force that will continue to investigate these issues in 2004 -2006 and incorporate them in future MTPs.

During the development of the previous MTP, a major review in 2002 of the Center's research program was initiated, and a series of 13 Research Thrusts and 29 Outputs was developed. These Thrusts (MTP Projects) and Outputs have been retained with minor modifications in the present MTP. Major achievements and future directions for activities in these areas are highlighted below.

Highlights 2002-2003

MTP PROJECT 1: Conservation of aquatic biodiversity

- FishBase expanded its global geo-referenced species coverage to more than 1.5 million records by expanding collections in developing countries, updating existing databases and repatriating fish biodiversity data to Asia, Africa, Caribbean and the Pacific countries. During 2002 over 1.1 million unique users from 187 countries accessed the website.
- FishBase tools development expanded to include use of internet-based resources for species mapping; extension of the capture fishery length-frequency analysis wizard to length-converted catch curve analyses; detailed reporting of species introductions by

FAO area and country; and adding of fish identification keys included for fish larvae. Site-specific database modules were developed that allow FishBase data and tools to be applied at localized geographic scales and linked to governance information.

- A DVD version of FishBase ("FishBase 2003") was developed containing all the updated database tables on one disc. This would have web links to the FishBase internet version and other global databases. A 2003 version of Species 2000 was also developed on CD-ROM and distributed.
- The semi-quantitative model for the management of water flows to optimize aquatic resources production in the Mekong Basin developed in the recent years has been made operational and it is now part of the management activities of the Cambodian Inland Fisheries Research and Development Institute (collaborative project with WorldFish).
- For three West African lagoon Tilapia species, based on identification of distinct population genetic units over their entire distribution range, priority areas for conservation have been delimited in four countries. In both *Sarotherodon melanotheron* and *Oreochromis niloticus,* distinct differences in growth were observed between populations that are genetically different and these populations could be used in developing aquaculture programs.

MTP PROJECT 2: Mitigation of adverse impact of alien species on aquatic biodiversity

- The project developed partnership arrangements in its first year of implementation with Malaysia and the Philippines to work on freshwater aquatic alien species.

MTP PROJECT 3: Genetic Improvement and Breeding

- The first round of selection of GIFT fish at Jitra has been successfully completed producing about 80 families. A control population has been established, which will enable the estimation of genetic gain.
- The fish tank facility in the headquarters of the WorldFish Center – Penang is now fully operational. Back-up stock for the GIFT selection line at Jitra were transferred to the fish tanks in July 2003 and will be held there as insurance against disasters in the former location.
- A three-week workshop on quantitative genetics and statistical analysis of fish breeding data was held in October 2002 in Bangkok. There were 29 participants from African, Asian and Pacific Island partner countries.

MTP Project 4: Strategies and options for realizing gains from sustainable freshwater aquaculture systems

- In Cameroon, one hundred farmers are being monitored and a range of additional studies by local partners undertaken. These determine the effects of population density and market access on aquaculture adoption and the extent to which this improves their livelihood is being implemented.
- Production Research: In Egypt/Abbassa, the new method of natural spawning of African catfish was achieved through manipulation of the environment (water level, shelter) and further validated on-station and on-farm.
- In Bangladesh, several thousand new farmers implemented either project-supported on-farm aquaculture demonstrations or trials of improved aquaculture technologies based on training given to them by the Center-trained NGO extensionists.

MTP Project 5: Freshwater fisheries in an integrated land and water management context

- In Malawi, improved erosion-reducing land management options were tested and their effects documented. Techniques for enhancement of fish production from the lake through managed brush-parks were tested and show higher potential harvests.
- In the Mekong River delta, surveys of fish markets, trawl surveys of fish abundance, plankton, benthos and water chemistry revealed the seasonality of fish species composition and their abundance in human-made canals.

- Research in Bangladesh and Vietnam proved that the seasonal operation of community-based fish culture in fenced flooded areas is socially and economically viable.
- A new project assessing the "adaptive learning" approach for community-based fish culture in eastern India commenced in 2003.

MTP PROJECT 6: Restoration of capture fisheries

- The proceedings of the “International Workshop on Management of Tropical Coastal Fisheries in Asia” were published in 2003. The proceedings contain 33 papers from eight partner countries documenting the resource and socio-economic status of coastal fisheries, the key issues and opportunities facing coastal fisheries management, and the recommended action plans developed at national level consultations.
- The WorldFish Center continued to raise awareness of the serious plight of coastal fisheries in Asia and Southeast Asia by arranging national consultations with Bangladesh, Malaysia, and the Philippines. At these consultations, WorldFish highlighted the decline in coastal fishery resources throughout the region to 10-30 per cent of the original unfished levels, the sharp decrease in relative abundance of the more valuable fish, such as groupers, snappers, sharks and rays, and potential management actions to address the problems. In Malaysia, this consultation has resulted in a proposed “Integrated Fisheries Management and Rehabilitation Program”, with a national level, multi-agency Steering Committee to oversee its implementation.
- The pre-proposal for a CGIAR Challenge Program entitled “Making the Most of the Coast” was rated as meritorious by the Executive Council of the CGIAR. A decision of whether the pre-proposal will progress to a full proposal has been deferred until 2004.
- The project has been expanded to cover straddling stocks in the South China Sea. Genetics facilities at WorldFish headquarters have been upgraded to permit the analysis of hypervariable microsatellite DNA within and among the large numbers of commercially important fish and invertebrate populations that overlap national boundaries and, therefore, must be managed cooperatively.

MTP PROJECT 7: Environmentally-friendly coastal aquaculture

- WorldFish has tested environmentally friendly methods for catching juvenile coral reef fish and invertebrates for the marine aquarium trade, using crest nets and light traps in the Pacific. The juvenile fish, which can be grown to market size in 6-8 weeks with village based methods, have been well received by the buyers.
- Hatchery production of the sea cucumber (*Holothuria scabra*) in New Caledonia has been aided by the transfer of methods from Vietnam. Our genetic study showed that populations of this sea cucumber can be distinct at short-spatial scales in New Caledonia, so releases of hatchery produced juveniles need to be carefully planned. The cultured juveniles have been released in the wild in experiments that show that high initial survival can be achieved when the optimal habitats are identified. Experiments were also completed on the optimal times for release, transportation methods, and protection of juveniles from predators. A further experiment that grew juvenile sea cucumbers with juvenile shrimp showed that the two animals can cohabit successfully at these stages, giving promise for co-culture on a larger scale in ponds.

MTP PROJECT 8: Reversing degradation of coastal habitats

- The ReefBase website now includes substantial data on the resources, status, threats and management of coral reefs worldwide, together with an interactive mapping facility to display much of this information. This material includes the national status reports produced by the Global Coral Reef Monitoring Network for more than 50 countries. In June 2003, the website was receiving over 24 000 visitors per month.
- The Action Phase of the ICRAN project to reverse the degradation of coral reefs has continued to work in collaboration with six other partners and with support from UNF. Projects are now underway to strengthen management and transfer knowledge of lessons learned and best practice between 17 demonstration sites and 14 target sites.

MTP Project 9: Economic, policy and social analysis and valuation of aquatic resources in developing countries.

- Methodologies and approaches for eliciting economic values of aquatic resources and their contribution to livelihoods in selected areas of the Mekong River region have been adapted, designed and applied. Work on aquatic resources valuation has raised awareness among officials in multiple sectoral agencies in Cambodia, the Lao PDR, Thailand, and Vietnam, and provided inputs for implementation of national and regional programs of the ADB, DFID, IUCN, and MRC.
- Detailed analyses of the socio-economic profiles of various integrated agriculture-aquaculture (IAA) technologies in Bangladesh were conducted and their roles in alleviating poverty and improving food security were assessed.
- The book entitled "Fish to 2020: Supply and Demand in a Changing World" was launched in November 2002, WorldFish Center, Penang, Malaysia. This book was jointly published by the Center and IFPRI.
- A detailed and disaggregated assessment of fish supply and demand in nine major fish producing and consuming countries of Asia (i.e., Bangladesh, China, India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Vietnam) was made.

MTP Project 10: Aquatic resources planning and impact assessment

- A common framework for participatory monitoring of aquatic resources use was implemented in Bangladesh and Vietnam.

MTP Project 11: Legal and institutional analysis for aquatic resources management

- Case studies on co-management were completed in Africa (i.e., Malawi, Mozambique, and Zambia) and Asia (i.e., Indonesia, the Philippines, and Thailand). An international workshop to present the results of the research on co-management will be held at the end of 2003.

MTP Project 12: Improved partnerships and capacity-building among developing country NARS

- New collaborations and strengthened research partnerships were developed with national institutions in Bangladesh, Cambodia, China, India, Indonesia, Malaysia and the Philippines and with regional and international organizations. Workshops were held in Bangladesh, Malaysia, and the Philippines to identify national research priorities.

- A strategy for WorldFish training programs to enhance the research capabilities of developing country NARS scientists and institutions was formulated and implemented. Short training programs on topics that are within areas of specialization of the Center were organized. Guidelines, procedures for selection and appointments of Visiting Scientists, Post-doctoral fellows, Ph.D. scholars and Research Interns have been developed.

- Efforts have been made to address issues needed for achieving the full benefits of fish genetics research through: (i) provision of assistance to INGA member countries in developing plans/strategies for management and dissemination of improved fish breeds; and (ii) development of a framework for ecological risk assessment and guidelines for the environmentally-safe dissemination of improved fish breeds.

MTP Project 13: Access to information for the sustainable development of fisheries and aquatic resources

- A new name and logo for the Center were launched. Wide communication of the change was conducted and corporate imagery developed along with new corporate materials.
- WorldFish participated heavily in the *Fish for All* initiative including developing the brand, creating a new web site, assisting the launch of the initiative, achieving significant national and international media coverage, and developing a communications concept paper called "Fish Unlimited".

New directions 2004–2006

MTP PROJECT 1: Conservation of aquatic biodiversity

- Through joint meetings with national partners (initially in the Philippines) customized FishBase solutions for fisheries and biodiversity management on a thematic approach will be developed and demonstrated. Work on developing similar databases in China, India and in the Mekong region will be initiated.
- Analytical tools such as "Species / Key Facts" matrices for ecological and community analyses, species introductions, responsible fish trade and analytical tools on species identifications will be further refined.
- For key economically important species of the Mekong River region, information on their bio-ecology will be consolidated using FishBase and bio-ecological monitoring to assess the present status will be carried out in collaboration with the Cambodian Inland Fisheries Research and Development Institute.
- The Bayesian model of Mekong fish resources, their environment and the stakeholders will be fully developed for the Tonle Sap (Great Lake) fisheries in Cambodia.
- Characterization of domesticated and selected stocks of carp and tilapia at the genetic as well as the phenotypic levels will be carried out.
- Improved tilapia strains will be genetically characterized.

MTP PROJECT 2: Mitigation of adverse impact of alien species on aquatic biodiversity

- WorldFish will develop a national strategy and guidelines for Malaysia on aquatic alien species with Malaysian partners.

MTP PROJECT 3: Genetic Improvement and Breeding

- The transfer of selective breeding (GIFT) technology for aquaculture improvement from the Philippines to Sub-Saharan Africa and Egypt will continue with increased emphasis on the multiplication and dissemination of improved fish to farmers.
- Research will be initiated on the feasibility of incorporating delayed female reproduction as an additional trait in the breeding objective of Nile Tilapia selection, development of sex control technologies that are appropriate for the production of all-male progeny in Tilapia in small-scale farmers' production systems, and on the estimation of genetic parameters for cold tolerance in Tilapia in Egypt with a view to incorporating the trait to the breeding objective.
- WorldFish will develop the concept and a proposal for funding the establishment of an International Breeding Center at the WorldFish Center to support aquaculture developing country geneticists and their countries' genetic improvement programs.
- The selective breeding program of Nile Tilapia in Egypt for high and low input pond environments will continue as a component of integrated farming.
- WorldFish will organize and implement courses on genetic improvement of aquatic species at a number of levels (including training at a very high level).

MTP Project 4: Strategies and options for realizing gains from sustainable freshwater aquaculture systems

- In Bangladesh together with partner institutions, research will be conducted to solve production bottlenecks and clarify key aspects of IAA systems. Over 500 extension workers and senior NGO staff of cooperating NGOs will be trained.
- In Egypt, a study on the socio-economic constraints to aquaculture will be undertaken. Further work will study fish farming economics and assess overall supply and demand of fish in Egypt.
- The Malawi site will expand the implementation of the Research Extension and Training (RET) approach to cover the major aquaculture areas in Malawi. Newly initiated activities in Zambia will be further supported.
- In Vietnam, farm households with homestead garden-ponds will be assessed using the RESTORE approach. In addition, farmer-selected technologies for homestead garden ponds (e.g., polyculture of carp species with Nile tilapia (GIFT strain), freshwater prawn or marble goby will be tested in on-farm trials. In Vietnam, in

cooperation with the Department of Fisheries of Bac Lieu Province in the Mekong Delta, and the University of Cantho, efficient dissemination of IAA options to target farmers will be implemented.
- The BMZ-funded "Recommendation Domains" project will be implemented. This will identify characteristics of successful aquaculture development pathways and conditions, and formulate them into a useful tool for wider application.

MTP Project 5: Freshwater fisheries in an integrated land and water management context.

- Malawi and Mozambique will employ GIS mapping of historical land use changes and will conduct water quality monitoring in the Mnembo Catchment, Mozambique.
- In Bac Lieu province of Vietnam in the Mekong Delta, monitoring of actual catch and effort of different fishing gears, and salinity and pH of canal water before, during and after sluice gate opening will provide data for better understanding of the role of brackish water fisheries for the landless poor.
- A new research initiative into the improvement of fish production (naturally occurring and stocked) in seasonally fenced areas will be implemented.
- Social science studies will examine the adoption patterns and agreed institutional arrangements among communities already implementing the community-based fish culture approach. The expansion of this community-based aquaculture approach in Bangladesh will be monitored. A similar research project is planned for West Africa.

MTP PROJECT 6: Restoration of Capture Fisheries

- The TrawlBase database will be expanded geographically to include data from Australia. Follow-up activities to assist more countries to enhance their information, assessments, capabilities and action programs for sustainable use of coastal fisheries resources and strengthen regional collaboration will be initiated.
- WorldFish will continue the process of assisting nations to restore their fish stocks by the year 2015, primarily through identifying the extent of the resources, understanding all the factors that underpin the production cycle, identifying options to rebuild the spawning biomass of wild stocks to increase yields, and ensuring equitable distribution of the costs and benefits of sustainable fisheries management.
- WorldFish plans to develop reliable indicators of the effectiveness of MPAs in a variety of contexts to better target their use in fisheries enhancement.

MTP PROJECT 7: Environmentally-friendly coastal aquaculture

- Methods for hatchery production and restocking of sea cucumbers will be transferred to the Philippines.
- WorldFish will review the potential for culture-based restocking and stock enhancement to determine which general types of fisheries are likely to benefit from such interventions, and when they should be used to complement other forms of management. Recommendations will be accompanied by management guidelines that can help optimize the cost/benefit ratio of investments in restocking.

MTP PROJECT 8: Reversing degradation of coastal habitats

- ReefBase will expand and update its information on coral reef status, threats and management to include comprehensive and current information for all countries with reef resources; create an on-line data access and summary analysis facility for all reef level data derived from the GCRMN network, develop new pages to focus on reef fisheries management and socio-economic values of coral reefs, and work with national counterparts to create coral reef information systems for each country or region, incorporating links between detailed national data and summary global information.
- ICRAN will continue to develop target and demonstrations sites, and will work to expand its activities with new funding.
- WorldFish will continue to take a lead role in the further development of the Coastal Challenge Program.

MTP Project 9: Economic, policy and social analysis and valuation of aquatic resources in developing countries.

- Work on the economic valuation and policy analysis in Southeast Asia, the Caribbean and meso-America, East Africa and South Pacific for sustainable management of coral reefs will be continued.
- A regional workshop will be organized in 2005 to present to policy-makers the results of bio-economic modeling in the Mekong River region, China and South Asia.
- Detailed studies on the socio-economics of IAA technologies in five countries of Africa and Asia will be conducted.
- Assistance to nine Asian countries in developing country-specific action plans for poverty reduction among poor fish producers and consumers will be extended.

MTP Project 10: Aquatic resources planning and impact assessment

- Impacts of community-based fisheries management in Bangladesh and Mekong River region will be evaluated in terms of household assets and access to resources, fish catches and fish consumption, income-expenditure patterns and institutional performance.

MTP Project 11: Legal and institutional analysis for aquatic resources management

- A paper on governance of aquatic resources based on a decade of research experience from the WorldFish Center's research will be published, as well as lessons from the worldwide study on co-management.

MTP Project 12: Improved partnerships and capacity-building among developing country NARS

- Research planning meetings in the targeted countries will be held to identify the country's overall priorities and to determine how the Center's strategic research thrusts could address country/regional priorities and become more relevant to their priorities/needs.
- The WorldFish Center will continue to implement the new strategy for capacity building among developing country NARS in research for aquatic resource management. The Center will also service a diverse range of training needs relating to coastal zone management through the establishment and operationalization of the "Southeast Asian Regional Training Center for Integrated Coastal Zone Management in the Philippines".

MTP Project 13: Access to information for the sustainable development of fisheries and aquatic resources

- The Center will continue to improve its information services to partners and stakeholders as well as its own staff around the world.

Section A. The Research Agenda

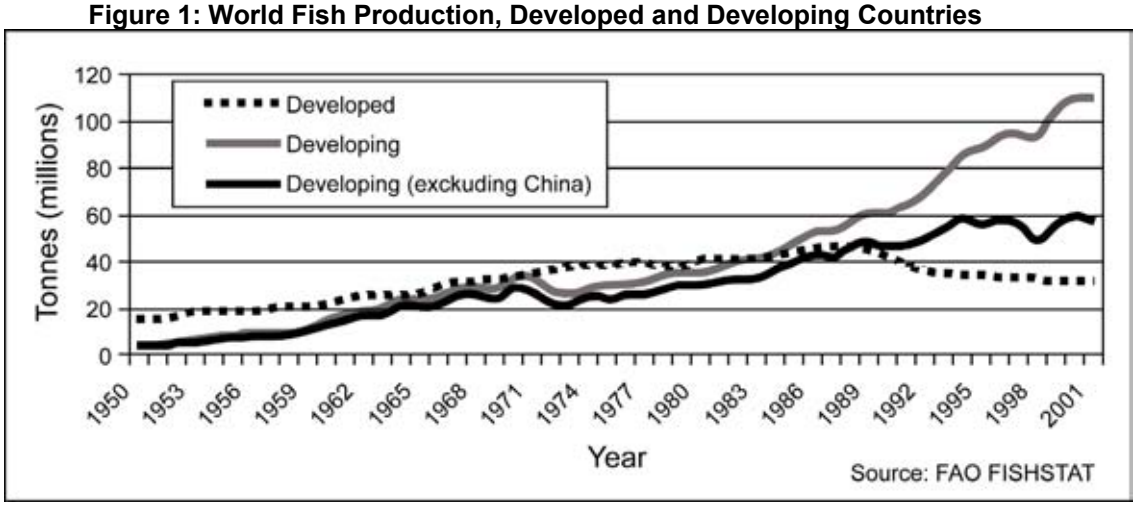
Introduction: Ensuring Fish for All

Fish, as well as other aquatic plants and animals are a crucial resource for millions of people throughout the world. Fish contribute over 15% of the world's protein supplies, and poor people in developing countries are particularly dependent on fish for income and basic nutrition. Yet fish are perhaps one of the most vulnerable resources, because leaders at all levels do not perceive them as being a high priority.

In less than 50 years, the world's average per capita consumption of fish has almost doubled, while those who catch, grow, process, trade and consume fish have changed almost beyond recognition. The world population will increase from 6 to 8.5 billion in the next 25 years. Meat and fish production must double in the next 25 years to meet projected demand. Can we produce enough food to feed the increasing global population? Can we do this in a sustainable way, without harming the environment?

As overall demand for an adequate supply of fish continues to increase, we are forced to face the fact that this level of demand may not be met. Global fish production is no longer keeping pace with demand, and if not for the contribution from China, would have been falling slightly for the last decade (Figure 1). Trying to meet future demand may cause long-term, irreversible damage to the environment and limit the future options of many people. Projections by the U.N. Food and Agriculture Organization suggest that fishery production has only limited scope for growth under present conditions, and that under a pessimistic scenario, will decrease by 25% by the year 2010 (Table 1).

Figure 1: World Fish Production, Developed and Developing Countries



Today, fishing is the largest extractive use of wildlife in the world. In 2001, worldwide production of fish, crustaceans and mollusks reached 130.2 million tonnes (Table 1). More than 76% of that amount was used for direct human consumption. But demand is exceeding supply, and this is a growing problem: 75% of the wild caught fish came from fish stocks that are even now depleted, over-fished or fully exploited. In the future, many of these stressed fish stocks will not be able to even produce their current catch, let alone cater to the expected increase in demand. Aquaculture is providing a steadily increasing proportion of the total fish production, but pollution, mangrove destruction, fish disease and the use of wild-caught fish as feed for aquaculture species, means that sustainable growth in this sector is not certain.

Table 1. Projection of World Fishery Production (million tonnes) in 2010

	Production 2001	Pessimistic scenario 2010	Optimistic scenario 2010
Capture fisheries	92	80	105
Aquaculture	38	27	39
Total production	130	107	144
Fish for non-food use	31	33	30
Fish for human consumption	99	74	114

Source: FAO Fisheries Website

For many economically developing nations, fish are the first or second largest export commodity. Fish products generate foreign exchange and income, but at a price. These markets are often vulnerable to the market and trade demands of their customers from the developed world. Production usually requires imported fish gears or feeds.

Poverty, food security, and the environment interconnected. The low incomes and purchasing power of hundreds of millions of poor people in developing countries largely determine that they will be food-insecure. The majority of these are women and rural dwellers. Of the 777 million food-insecure people, who mostly live in rural, including coastal, areas, in the developing world, 70% are women. Many more than this number, perhaps as many as half the people on Earth, are chronically undernourished in some way, e.g., they lack sufficient iron, calcium or vitamin A in their diets and hence do not reach their full human potential. Poverty and the environment intersect – the poor, almost by definition, are those who lack access to environmental goods and services, such as clean freshwater, good fishing grounds and productive farming land. Meanwhile, the wealthy consume an increasing share of all natural resources.

These issues present huge challenges for the future. How can we ensure that in the future there are adequate fish resources to feed and support the growing number of people who will depend on them? How can we maintain the aquatic systems that produce these resources, and ensure that these resources are equitably distributed among the poorest people in developing countries? How can we ensure that women are given adequate recognition and involvement in resolving these problems? In short: How can we ensure "*Fish for All*"?

The task of ensuring fish for all is beyond the capacity of single nations or agencies. It requires a coordinated and concerted effort by a range of organizations working at different levels and in different disciplines.

The WorldFish Center is working at a number of levels and with a range of partners to address these issues. We achieve this by focusing on specific areas where we can make a difference.

At the global level, the WorldFish Center recently launched the *Fish for All* initiative. The ultimate goal of *Fish For All* is to establish fish-related matters as a significant issue on world economic and environmental agendas.

The *Fish for All* initiative is designed to be a credible, global science and policy dialogue capable of instilling urgency into the issues at hand through the active participation of senior policy-makers, opinion leaders and researchers at various levels of the community. Information dissemination will play a key role and wide

ownership will be sought. As the Chief Minister of our host state in Malaysia stated during the launching ceremony, "*Fish for All"* should lead to "All for Fish".

Over a 10-year period, we aim to achieve an inclusive and informed public dialogue on issues such as fish and development, fish and nutrition, health, livelihood, environment, gender, water, river basins and coasts, trade and economic growth, through the following means:

- By establishing the highest profile steering committee possible to direct and connect with the highest level policy makers from various parts of the world;
- Through events such as policy-science-stakeholder workshops and fora, conferences and dialogues;
- Through studies, policy analyses, opinion pieces, newsletters, and a website on the issues and solutions.

Fish for All was launched at an international summit in Penang, Malaysia, on 3 November 2002. The event brought together policy-makers, scientists, and representatives of non-governmental organizations from developing and developed countries with a role in reversing the declines in living aquatic resources and finding ways to restore the livelihood, food and income of those who use and depend on fish. Over 300 participants from 40 countries attended.

Since then, the Philippines has held a "Water and *Fish for All* Summit" in January 2003, which identified major issues and courses of action to ensure the sustainable development of these resources in the country until 2020 and beyond.

Other follow-up actions include: (i) organization of the first meeting of the Global Steering Committee through a teleconference held in May 2003 and identification of issues that need to be addressed; (ii) preparations for a second Global Steering Committee meeting scheduled for November 2003 in Kuala Lumpur; and (iii) a national *Fish for All* Summit scheduled for December 2003 in India. Future plans for the initiative include: (i) *Fish for All* initiatives at the national level through catalyzing and convening national *Fish for All* studies, summits and activities in key fish dependent countries; (ii) innovative and flexible options for strategic partnerships to implement relevant parts of WSSD Plan of Implementation; (iii) targeting critical international water fora such as Stockholm Water Conference to influence agendas for getting prominence for fish and people themes; (iv) analyses of the changing private sector landscape; and (v) communications initiative for reaching the grassroots level in partnerships with "Television for the Environment" (TVE).

The WorldFish Center Program outlined in this Medium Term Plan 2004-2006 is designed to make contributions to poverty eradication, food security and environmental conservation through research targeted to several of the multiple roles of fish in development. Activities will focus on improving equity benefits from capture fisheries and aquaculture, enhancing the livelihoods of fishing and farming households, improving access to fish at affordable prices for consumers, reducing the impact of fishers on overstressed resources, increasing the number of fish farmers where resources permit, and protecting the aquatic environment and biodiversity.

The WorldFish Center: who we are and what we do

Achieving meaningful impacts

In identifying the work we plan to do in 2004-2006, we have looked carefully at where and how we can maximize our impacts among poor communities in developing countries, and in promoting sustainable development and use of fish and other aquatic resources.

This process involves the following approach.

1. We target specific activities where the World Fish Center is able to work within the **context** of global and regional issues and initiatives.
2. We take advantage of our **strengths and core competencies.**
3. We work **across disciplines** to tackle complex problems.
4. We work in **partnerships** with other research and government agencies in key regions and countries.
5. We carefully review our work and refine our **priorities** based on an **analysis of past impacts** and successes and **anticipated needs.**
6. We **cluster** our work into areas where we can maximize our impact through the combined effort of our own scientists in different disciplines.
7. We ensure the benefits of our work, and that of our partners, are captured, retained and disseminated to developing countries through online **information systems, knowledge bases**, and **effective information sharing technologies.**

Each of these approaches is discussed below in more detail.

1. The context we work in: Global, Regional and Local Issues

Against the backdrop of global population growth, and increasing demand for food, and the need to achieve sustainable development while protecting the environment and its biodiversity, a number of recent international initiatives are seeking to highlight the need for coordinated action and renewed strategies and objectives. These are the external drivers that provide the leverage for our work. We acknowledge the relevance of these international initiatives and have factored them into the identification of activities of our next MTP.

2002 World Summit on Sustainable Development

The World Summit on Sustainable Development (WSSD), held in Johannesburg during 26 August – 4 September 2002, reviewed the progress in the ten years since the Earth Summit in Rio de Janeiro in 1992 and the adoption of Agenda 21, a wide-ranging blueprint for action to achieve sustainable development worldwide. The Plan of Implementation adopted by state parties at WSSD makes significant references to fisheries and aquatic environments. These include:

- Deter and eliminate illegal, unreported and unregulated fishing by 2004. Establish by 2004 a regular process under the United Nations for global reporting and assessment of the state of the marine environment, including socio-economic aspects.
- Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012.

- Maintain or restore (fisheries) stocks to levels that can produce the maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible not later than 2015.

Acknowledging that poverty eradication is currently one of the greatest global challenges and essential for sustained development, the following issues and actions arising from WSSD are relevant for identifying and planning the Center's activities:

- Promote empowerment of people living in poverty and their organizations and facilitate their access to agricultural and fisheries resources and knowledge;
- Develop policies and ways and means to improve access by indigenous people and their communities to economic activities;
- Provide access to agricultural and fisheries resources for people living in poverty;
- Disseminate sustainable techniques and knowledge, including natural resource management to the rural poor;
- Promote women's equal access to and full participation in decision making;
- Effectively reduce, prevent and control waste and pollution and their health-related impacts by undertaking initiatives aimed at implementing the Global Program of Action for the Protection of the Marine Environment.

Millennium Development Goals

During the United Nation Millennium Summit in 2000, nations reaffirmed their commitment to working towards a world in which sustainable development and elimination of poverty would have the highest priority. Of the eight Millennium development goals, two are of particular relevance to the WorldFish Center. **Goal 1: "Eradicate extreme poverty and hunger"** aims to halve, between 1990 and 2015, both the proportion of people whose income is less than $1dollar a day, and the proportion of people living in hunger. **Goal 7: "Ensure environmental sustainability"** seeks to integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.

Human Development Report

This report is produced annually by the United Nations Development Program ((UNDP). In addition to producing a Human Development index which compares all countries in terms of life expectancy, education, and income, the report for 2003 focuses on progress towards the Millennium Development Goals. While significant progress has been made for some areas, the results are disappointing for many countries and regions. Sub-Saharan Africa, Latin America, and the Caribbean are getting worse in terms of poverty eradication, while progress towards hunger elimination in Southeast Asia and Sub-Saharan Africa is so slow it will take until the year 2200 to reach the Millennium Goal. These areas are ones where interventions by the WorldFish Center in ponds, genetic improvements of fish, and sustainable management of coral reefs and coastal habitats could make a difference in their current performance.

World Development Report

The World Bank's annual World Development Report (WDR) provides a guide to the economic, social and environmental state of the world today. The latest report (2002) highlights the rapid growth of the world's population, with 3 billion people expected to be added in the next 30 years.

The report notes that societies need to manage a broad portfolio of assets—not just human and physical capital, but also environmental assets (such as fresh water and fish stocks) and social assets (such as trust). Thus the immediate gains of depleting or degrading these assets can be outweighed by costs in productivity and lost options. Coordinating mechanisms among institutions working for sustainable development often fail to commit so that assets can thrive. The wasteful destruction of forests, overexploitation of fisheries, plundering of people's savings through inflationary monetary policies — all of these actions reflect a lack of social mechanisms for restraint.

In meeting the various challenges outlined in the Report, the role of technological changes that enable developing countries to skip stages in the developmental process is emphasized. Institutions are needed that stimulate and disseminate technical innovations and minimize any adverse technological developments.

Global Environmental Outlook

The Global Environmental Outlook or GEO 3 (2002) produced by the United Nations Environment Program (UNEP) highlights a range of issues relating to biodiversity, environmental degradation and sustainable development. It identifies some areas that are relevant to the mission of the WorldFish Center in planning its work over the next five years.

Some of the issues raised include:

- The environment is still at the periphery of socio-economic development; there is an overriding need in policy development for a balanced approach towards sustainable development.
- Alleviating poverty, reducing excessive consumption among the more affluent, reducing the debt burden of developing countries, and ensuring adequate governance structures for funding and the environment.
- Greater provision of and access to information as the basis of planning and decision-making. The information revolution holds the possibility of providing cheap and reliable information in appropriate forms to all stakeholders, so they can more effectively participate in the planning processes.
- The need for integrated water resources management in freshwater systems.
- Progress in protecting the marine and coastal environment over the past 30 years has generally been confined to a few, mostly developed countries, and to relatively few environmental issues. Overall, coastal and marine environmental degradation not only continues, but has intensified.
- Human vulnerability to environmental change – people in developing countries have less capacity to adapt to change and are more vulnerable to environmental threats and global change. The poor bear a disproportionate burden of the impact of disasters, conflict and pollution. Governments need to assess and map national threats and institute early warning, mitigation and response measures. Vulnerable populations and environmental systems need to be assessed.

In Asia and the Caribbean the Report's findings are particularly relevant to the WorldFish Center. Urbanization, industrialization and tourism, coupled with a growing coastal population, have degraded many Asian coastal areas. More than 60 per cent of Asia's mangroves have been converted to aquaculture farms. Environmental degradation in Latin America and the Caribbean has increased over the past 30 years. The main pressures on the environment and natural resources are the rising

population, increasing inequality of incomes, limited planning, especially in urban areas, and the high dependence of many economies on natural resources exploitation. More than 300 million ha of land have been degraded and almost 30 per cent of the reefs in the Caribbean are considered to be at risk.

2. *Where we can make a difference: leveraging our strengths and core competencies*

The WorldFish Center both facilitates and conducts research. Our greatest strength lies in applying state-of-the-art technical expertise in the biophysical, socio-economic and institutional conditions found in developing countries.

Our major strengths, aside from scientific expertise, that cut across all the Center's programs include: experience in mobilizing partners and managing collaborative research; establishment of networks with advanced science institutions, national institutions and agencies in developed and developing countries; continued presence in target developing countries; and our ability to build capacity at a range of levels within these countries.

Our staff's core technical competencies are:

i. Socio-economic analysis of the aquaculture and fisheries sectors

- We have proven expertise in fish sector modeling, analysis of the supply of and demand for fish, valuation of aquatic resources, livelihood analysis and impact assessment.
- Our scientists are also linked with developing country policy-makers and planners in an active fisheries social science network.
- The Center uses synergies between socio-economic research and the network of policy-makers to assist developing countries to design appropriate strategies for improving food security and livelihoods, reducing poverty and protecting aquatic environments.

ii. Institutional analysis for governance of aquatic resources

- The Center's significant global experience in fisheries co-management has developed core competencies in institutional analysis for the improved governance of aquatic resources.
- The results of our research into methods to facilitate consensus-building and the processes involved in undertaking participatory action have been used to develop planning at local and national levels for aquatic resources management.
- We have also developed appropriate tools for evaluating the impacts of community approaches for governance of aquatic resources.

iii. Global databases for management of aquatic resources

- The Center provides structured resource information essential for effective management of aquatic resources, through its public databases, including FishBase, ReefBase and FiRST.
- FishBase is the premier global biodiversity database on fish and it receives approximately 7 million hits per month. It provides not only information, but also independent analytical tools for scientists and managers.
- ReefBase covers over 10,000 coral reefs and their resources. It has gathered the available knowledge about coral reefs into one information repository to facilitate analyses and monitoring of coral reef health.

- FiRST (Fisheries Resource Information System and Tools) is also known as TrawlBase. This database has collated historical research survey information on fish stocks in Asia. It aims to provide fisheries scientists and managers with information on the state of fish stocks, biodiversity, and options for restoring productivity.

iv. Stock assessment of coastal fisheries

- We aim to identify the measures needed to restore coastal fish stocks to more productive levels, while ensuring an equitable distribution of the benefits.
- The Center is well placed to make appraisals of the abundance, size structure, and species composition of multi-species tropical coastal fisheries.
- Our ability rests upon: 1) length-based methods for single species stock assessment, which culminated in the widely-used FAO-WorldFish Center FiSAT software, 2) the Ecopath software and modeling approach to assess the effects of fishing on entire assemblages and ecosystems, and 3) regional databases and analytical methods to evaluate the status and extent of shared stocks.

v. Watershed approach to aquatic resources management

- The Center has developed a unique approach to respond to the management needs of developing countries with respect to their river systems.
- By modeling nutrient cycles and resource flows within a watershed context, the Center has developed a range of tactical options for the mitigation of negative consequences of changes in watershed management.
- We are currently developing models for river management within a river basin context, focused on the Mekong River Basin. These models will range from large to small-scale, and will be applicable to other basins.

vi. Methods for developing improved fish strains for aquaculture

- The Center has made substantial contributions to methods for developing improved fish strains, clearly demonstrated by our involvement in the development of the Genetically Improved Farm Tilapia (GIFT) project. Trials resulted in an 85% improvement in tilapia growth.
- We have a demonstrated ability to produce improved strains for pond aquaculture, resulting in increased income for poor fish farmers and providing fish to consumers at a reasonable price.
- Our work covers a range of activities starting from the assessment of market requirements, development of high yielding strains, evaluation under different farm conditions, quantification of the impact of improved strains, and development of dissemination mechanisms for farmers.

vii. Development and evaluation aquaculture technologies for small farm holders

- Through partnerships in Africa and Asia we have acquired experience with a wide range of smallholder focused fish production technologies.
- We are able to identify suitable entry-level technologies that can be progressively adapted and refined *in situ* to increase fish production and aquaculture profitability.
- We have a long-term working knowledge at the field level of tools and protocols that bring researchers, farmers and extension personnel together to overcome the constraints to aquaculture development.
- We use a range of participatory monitoring and evaluation tools to measure farm productivity, efficiency, and other household indicators to document and

track changes resulting from aquaculture introduction or technology improvement. This guides planning and implementation of new initiatives.

viii. Culture and restocking of coral reef invertebrates

- Our expertise in the development of sustainable methods for producing and growing low-input high-value coral reef species (e.g., pearl oysters, sea cucumbers) has provided small island developing states with additional options to create alternative livelihoods through farming and restocking of severely depleted fisheries.
- The ability to culture several species (e.g., giant clams, small reef fish and corals) has also provided managers of inshore resources with alternative, environmentally-friendly ways to supply the marine aquarium trade.

3. Adopting a multidisciplinary approach

In order to achieve impact, our research must take into account the technical, social, economic, and political aspects within our partner countries. To achieve this, our research involves weaving together the relevant biophysical, socio-economic, legal, and institutional influences. Through our multidisciplinary approach, which cuts across our programs, we ensure our work gives equal consideration to technical feasibility, social acceptability, economic viability, and environmental sustainability. Through multidisciplinary projects, which include the understanding of livelihoods dependent on fish as well as the biological environment, pro-poor policies can be recommended to improve the livelihoods of local communities.

4. Working through partnerships

We believe our work will be most successful when carried out **in partnership and with the participation of the users** of our research results. Through our partnership approach we aim to:

- Develop strong national research and development systems;
- Better utilize the scare resources available for research;
- Achieve quicker gains from research results; and
- Match complementary skills.

Box 1. Partnerships in Research and Related Activities

Partnerships at the WorldFish Center are formally recognized collaborative, mutually beneficial research and research related activities. Our partners include National Aquatic Research Systems (NARS), government and non-government organizations, advanced scientific institutions, regional and international organizations, research centers, individual scientists and the private sector. Partnerships could be with farmers/fishers, when they are experimenters in the generation and evolution of production/management technologies.

Guiding principles
Selection of partners and partnerships are guided by the principles that partnership(s) should:

- have a shared vision of the needs being addressed and how these may be addressed;
- be on a participatory basis, with joint sharing of responsibilities and accountability;
- be based on mutual respect between the parties;
- have complementarity of skills between partners;
- be pro-active, responsive and flexible;
- be undertaken in a research, teaching, learning or information-sharing mode, depending on which is appropriate to the activity;
- involve interdependence in that neither partner would be able to complete the tasks alone;
- be conducted in a contractual, collaborative or collegial mode;
- have joint responsibility for the preparation of reports and publication of research results;
- be within priority areas of World Fish Center's strategic research and those of partner(s), and meet the criteria set by them;
- result in the World Fish Center's skills and knowledge benefiting the partners' activities which are aimed at a shared goal; and
- give due cognizance to political, cultural, and institutional sensitivities of the participating agencies/organizations/individuals.

Source: ICLARM Policy on Partnerships in Research and Related Activities

Since our inception in 1977, the Center has worked in partnership in research and related activities (training, workshops, conferences, and information dissemination). Our partners include national aquatic research organizations, non-government organizations, the private sector, universities, academic institutions, advanced scientific institutions, and regional and international organizations. To reach the end users of our research, we have formed partnerships with farmers, fishers, individual scientists, managers and policy-makers. In 2003, a total of 294 partner institutions from developing and developed countries have existing collaborations with us (Figures 2 and 3).

To strengthen our partnerships with developing countries and to ensure we are meeting their needs, since 1996 we have held meetings with partner institutions to identify priority areas for collaboration. We consulted partners in developing our Strategic Plan 2000-2020. In 2003 we undertook comprehensive meetings with partners in Bangladesh, India, Indonesia, and the Philippines. The formal and

informal results of these consultations with partners are used to develop our research programs.

Fig. 2. Partners of the WorldFish Center in 2003 by Category

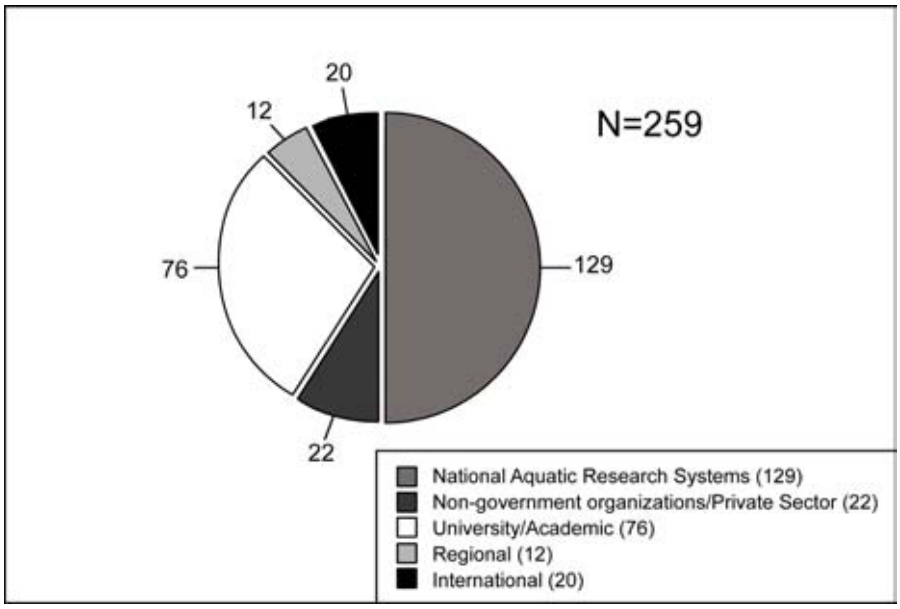
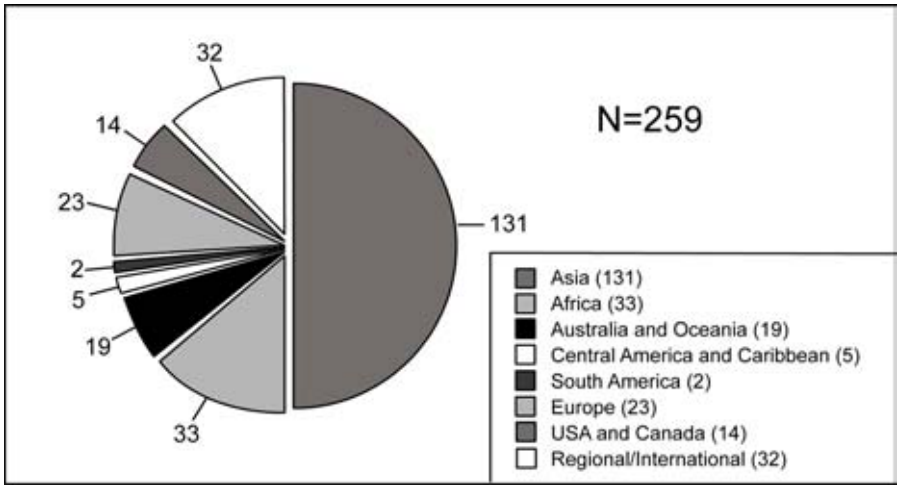


Fig 3. Partners of the WorldFish Center in 2003 by Origin



Capacity building among developing country institutions is an essential part of developing and maintaining our partnerships. For over 25 years we have conducted formal and informal training programs in our areas of expertise. Through this we have developed a critical mass of scientific competence among developing country institutions. We also provide management and policy advice focused on the aquatic resources sector, and enhance the capacity of managers to make decisions based on new knowledge.

Box 2: The evolution of the GIFT project is a good example of how the WorldFish Center has, through extensive partnerships, developed a product, the "GIFT strain" that could have a positive impact on poor farmers.

5. Impact pathways and research prioritization

Impact pathway analysis

Ultimately, the value of the work that we do will be judged in terms of how well we achieve our mission of contributing to food security and poverty eradication in developing countries. For each project undertaken, we need to determine what its impact will be and how this impact will be achieved. However, because poverty and food security can be influenced by a myriad of factors and processes, there are numerous pathways through which project activities of different types can have an impact. To obtain quantitative estimates of the impact of our work requires that we understand the pathway(s) from our intervention to social benefit. This task is challenging, as many worthwhile projects are several steps removed from the ultimate benefits envisaged. The WorldFish Center is actively involved in analyzing the impact pathways of its projects and developing quantitative indicators for each step.

The other reason for clarifying the impact pathways of our research is to assess what additional activities or interventions are needed, and by whom, to achieve or improve our impact. By documenting potential impact pathways at the start of projects, we can examine where we need input from other organizations, with complementary skills or where we need to do additional activities to maximize impact. The Center's work is necessary, but not always sufficient to achieve the impacts desired, and so

we aim to identify identify potential barriers and intermediate steps to impacts and actively address these.

In defining impact pathways and developing indicators of the impact, the Center is looking at three commonly applied criteria, or types of benefits: efficiency, equity and environmental sustainability.

The efficiency criterion uses an economic approach, which has the advantage of reducing research inputs and outputs into monetary units. The benefits of research are measured by an increase in economic value, while costs are measured by foregone economic value. Economic efficiency is achieved by selecting the alternative that yields the largest net economic value.

Economic efficiency alone applies an indifferent yardstick for measuring benefits, i.e., it values benefits received by different people in exactly the same way. This may be unacceptable to an organization that is biased to the well being of the poor. The second criterion of equity introduces this bias. Equity refers to both inequality, which is based on a comparison between low and high standards of living, as well as to poverty, which focuses on deprived standards of living, relative to an absolute threshold. If living standards can be determined in monetary units, it becomes possible to merge efficiency and poverty in a modified measure of economic benefit.

The foregoing criteria do not specifically incorporate a regard for beneficiaries of environmental services, or the well being of future generations. In the last few decades the impact of environmental destruction has been increasingly recognized, while alarming trends on resource depletion have been observed worldwide. Poverty alleviation is also dependent on protection and restoration of the environments that people depend on for their resources. Environmental sustainability is, therefore, another important basis for assessing research impacts.

The pathway from research activities to equity, and economic and environmental benefits is complex. It is useful to construct abstract maps of the pathways to make explicit the relevant factors as well as suggest indicators for measurement. These pathways depend on the category of research being considered. At the WorldFish Center our research may be broadly grouped into three categories:

1. **Technology research**. The immediate aim of the research activity may be a direct improvement in production technology or the adoption of technology, e.g., the genetic improvement of fish strains for aquaculture.

2. **Resource management research**. This category aims at providing recommendations to resource management or providing supporting information for management decisions, e.g., estimates of the maximum sustainable yield or maximum economic yield for fisheries.

3. **Policy research**. This includes research that provides recommendations or support to policy-makers and examines the social, economic and political factors affecting the production and the distribution of benefits, e.g., examining the governance structure and role of co-management in fisheries.

The potential impact pathway for technology research is illustrated in Figure 5.

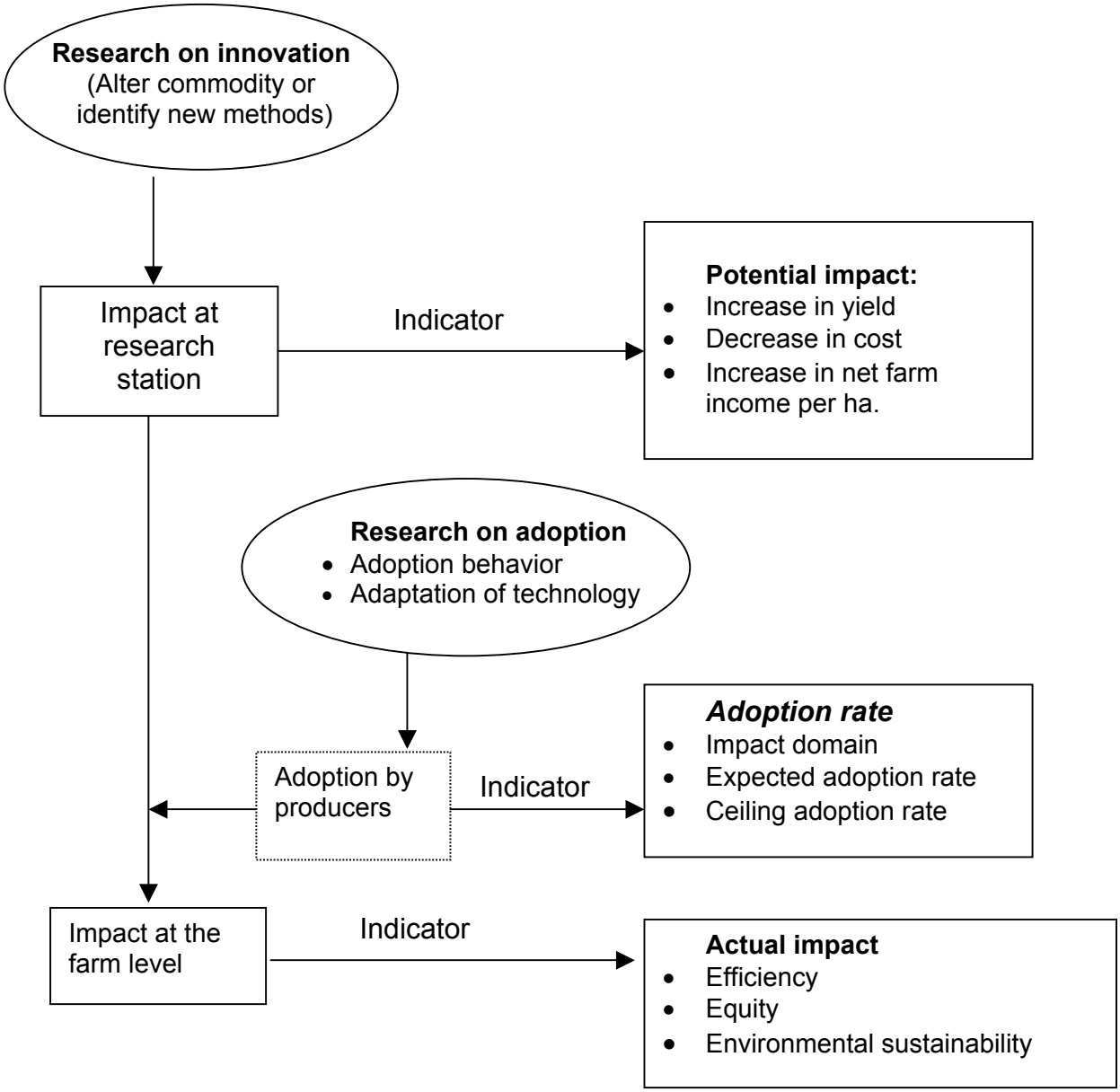
Research Prioritization
Funding constraints are presently a paramount consideration in agricultural research planning. There is increasing emphasis on using research resources more effectively

and efficiently to benefit the poor. It is important, therefore, that the Center be strategic in terms of how its resources are allocated in order to maximize impacts and long-term gains. This involves the setting of priorities for future and current research activities. Historically, the WorldFish Center has undertaken priority setting for a range of time-scales, within its Strategic Plan 2000-2020, within its Medium Term Plan and annual Operational Plan. The methods for priority setting have also varied. In learning from these experiences, and also those from other CGIAR Centers, WorldFish has formed a task force to examine the framework and methods of our priority setting.

In 2003 a WorldFish Center Task Force on Priority Setting recommended evaluating the methods for setting priorities and ultimately guiding resource allocations. The Center's aim is to ensure that the priority setting is transparent, recognized, and helpful for overall planning. The framework should also integrate input from staff, partners, donors and other stakeholders. The long-term goal is to develop a framework that can be reevaluated regularly as externalities change.

The priority-setting framework currently under development builds on the impact pathway analysis described above. The impact pathways are used as a basis for estimating the equity, and economic and environmental benefits of the Center's research. The priorities are then evaluated in terms of maximizing the potential benefits of the research.

Figure 5. The generalized impact pathway for technology research, including research on innovation and adoption. Examples of this would be research into the genetic improvement of species for aquaculture or aquaculture methods for small farm holders.



BOX 3: Stakeholder Consultations in Priority Setting

A major component of any research prioritization exercise is to get feedback and direction from our stakeholders. Information on which past projects have been most useful to different groups, and which a proposed new project is most relevant and attractive to potential beneficiaries is essential in future planning and project prioritization. In 1998 the Center undertook an extensive series of consultations with stakeholder groups. This included a consultative conference attended by over 50 people from partner countries and institutions in developing and developed countries. The ideas and feedback received were a major source of direction and information in the development of the Center's Strategic Plan 2000-2020, which provided the overall context for this Medium Term Plan.

In 2002 further input from stakeholders was sought from over 386 scientists, policy-makers, resource managers, community workers and academics in the form of a questionnaire. This effort was part of the preparation for the *Fish for All* Summit Meeting in November 2002, and sought to identify the key issues that need to be addressed in order to ensure sustainable supplies of fish and other aquatic resources from healthy and productive aquatic ecosystems. We received 137 responses from this questionnaire which identified the following key issues:

- Withdrawal of fresh water from productive systems for other uses
- Rapid population growth and environmental degradation from development and urbanization
- Lack of political will to eliminate perverse subsidies
- Unsustainable land use patterns
- The low priority given to aquatic resources in national environmental development programs
- The predominance of open access systems and lack of property rights over fisheries resources
- Lack of resources for monitoring and enforcement
- Lack of understanding of the long-term implications and synergistic effects on aquatic species and fisheries

While there was a diversity of views on the preferred solutions to these issues, respondents consistently indicated that improved knowledge of the issues and substantial information for establishing policies and making decisions was an important part to solve a number of issues. This highlights the responsibility of scientists and institutions such as the WorldFish Center to provide information and technology to ensure that the fish for food, livelihoods, and the environment that supports them will continue to be available to poor people in the developing world.

6. Clustering for maximum impact

Our Priority resource systems

As part of its overall strategic planning, the WorldFish Center has reviewed the global aquatic resource systems in which we work, and identified five systems of medium to very high priority (Table II).

Table II. ICLARM-The WorldFish Center's priority resource systems and regions

AQUATIC RESOURCE SYSTEM	PRIORITY STATUS*	REGIONAL FOCUS
Ponds	Very high	Asia, Sub-Saharan Africa
Coral reefs	Very high	Small Island Developing States (SIDS in the Pacific, Caribbean), Southeast Asia, East Africa

Floodplains, streams and rivers	High	Mekong River Basin, South Asia, Sub-Saharan Africa
Coastal waters (including estuaries and lagoons)	High	South Asia Southeast Asia, Sub-Saharan Africa, Small Island Developing States (SIDS)
Small water bodies, reservoirs and lakes	Medium	Sub-Saharan Africa
Soft bottom shelves	Low	
Upwelling shelves	Low	
Open oceans	Low	

Source: ICLARM Strategic Plan 2000-2020

Research outputs from centers with a global mandate are visibly expressed first in specific geographic areas (referred to here as "geographies") before a generalized impact is felt. For WorldFish, a CGIAR Center regarded as small to medium sized, it is imperative that its limited resources be focused on a selected number of such geographies to create impact within an anticipated period. Two such geographies, varying in size and diversity, are highlighted in this MTP for this purpose.

Greater Mekong Subregion: a geography with huge potential

The WorldFish Center recognizes the need for the application of cutting-edge science in the Mekong. This subregion, which includes Cambodia, the Lao PDR, and Vietnam, and parts of Thailand and China, has a strong need for development to improve the quality of life. However, this should not be at the expense of the poor, who depend heavily on the natural resources for food security and a living. The subregion is one in which freshwater resources play a vital role in the economic and cultural life of people and communities. More than 60 million people live in this region, of which between 60-90% of households are involved in fishing; the sub-region has a very rich freshwater fish biodiversity.

Development projects must pay due attention to the whole range of values provided by the aquatic environment and the resources. The Center's overall strategy is thus one that focuses on pro-poor interventions that will provide sustainable livelihoods to the poor through increased social participation in the management of the aquatic environments, and through the introduction of improved, appropriate technologies.

A key WorldFish priority is the development of knowledge for the improved governance of the aquatic resources and improved policy dialogues at all levels. This aims to achieve:

- Integration of aquatic resources and food security issues into inter-sectoral policy and management issues;
- Enhancing the quality of life of the people by supporting environmentally sound development and participatory management to sustain and improve the values and functions of wetlands in the Mekong River region.

The WorldFish Center is collaborating with donors and research partners in the following research and capacity building activities:

- Gathering and evaluating data, maximizing use of incomplete data on fisheries and hydrology;
- Developing hydro-biological models;

- Estimating fish resources – their quantity and consumption;
- Assessing biological and genetic diversity;
- Assessing alternative farming practices in the light of changed hydrological regimes;
- Integrating fish resources and food security into inter-sectoral policy and management;
- Enhancing the understanding of participatory natural resource management and development of models for application by policy-makers and local communities; and
- Increasing the local capacity for research and policy dialogue engagements.

Donor and research partners include the Mekong River Commission, the International Water Management Institute, Oxfam America, Wetlands International, Asian Institute of Technology, International Union of Conservation Network, the International Irrigation Management Institute, the International Rice Research Institute, University of Swansea, Department for International Development, Danish International Development Assistance, Swedish International Development Cooperation Agency, and the Asian Development Bank (ADB). With support from the ADB, we made a major commitment in 2003 to participate in strengthening the new Inland Fisheries Research and Development Institute in Cambodia so that it assumes a pivotal role in this geography for future partnerships.

Thus the Center's research in the Mekong River Basin integrates scientific disciplines, seeks out collaborators who can contribute information and expertise for the common good, builds on strengths to provide solutions to ecosystem sustainability threatened by development, and develops tools that stakeholders can use and understand. The WorldFish Center strives to ensure that development will result in the equitable distribution of wealth, and where development will not be seen to benefit one sector of society at the expense of the others. WorldFish also anticipates that the synergy between technology and social interventions in this subregion, working closely with partners, will accelerate the timetable to bring about impact.

Africa: a geography with pressing needs

The most dramatic anticipated rise in the number of people living in poverty in the near future will be in Africa, where the total population will reach 1 billion by 2010. In sub-Saharan Africa, those living in poverty are expected to number over 300 million and this figure rises to almost 400 million if North Africa and the Middle East are included. While the average per caput fish consumption is low (7.1 kg in 1997), the regional, national and local differences are large and some countries are highly dependent on fish, almost entirely from marine, riverine, lake and wetlands capture fisheries. WorldFish began its African work in Malawi in 1986. The Center expanded its efforts in the region when it took over the aquaculture research facility in Abbassa, Egypt in 1997. A further site, Cameroon, was added in 2000.

Strategy for Africa and West Asia

The framework for these efforts is a new Strategy for Africa and West Asia 2004-2006 that has been developed drawing from achievements and learning over the course of the past decade and harnessing the advice provided through an extensive consultation with regional and national partners. The Center is now reaching out to the international development and scientific communities in search of partnerships to help implement the new Strategy.

The overall **Goal** of the Center in Africa and West Asia for the period 2004-2006 is to:

- Enhance the contribution of capture fisheries and aquaculture to rural and urban food security and livelihood.

We will pursue this by focusing upon four aquatic production systems: rivers and floodplains, lakes and reservoirs, coastal fisheries, and aquaculture; and through a number of overarching policy studies and capacity-building activities. The first three systems (all capture fisheries) currently dominate fish production in Africa and West Asia, while it is projected that aquaculture will expand rapidly in the next decades in response to the growing demand for fish and the livelihood opportunities that it provides. The Center will seek to generate research results that will help strengthen national and regional policies and capacity to sustain and enhance the development benefits from these capture fisheries, while identifying and designing ways to overcome technical, economic and social bottlenecks to the development of aquaculture across the region.

In pursuing this strategy, the Center will initially build upon research activities already underway, notably in Cameroon, Egypt, and Malawi, and described later in this document. We will then develop a complementary set of regional activities outlined below, and progressively initiate a broader set of activities that address fisheries and aquaculture concerns in a number of countries.

Current Work:

Egypt. The Center is continuing to expand collaboration with Egyptian partners in support of sustainable fish farming practices. Low cost options for fish production are being tested and successful techniques promoted through targeted training activities. Family and mass selection programs for Nile tilapia are also underway in order to provide farmers with strains of fish that grow best under Egyptian pond conditions.

Malawi. Building upon the success of the Center's work in support of integrating aquaculture into small-scale farming systems, research is continuing to document the impact of this work and the learning that can be applied in other countries of the region. In addition, the Center is diversifying its collaboration with partners in Malawi through extended work on the implications of catchment processes for fishery productivity in Lake Chilwa, on restoring fish populations in Lakes Malawi and Malombe, and on governance and water requirements of the fisheries of the Shire River.

Cameroon. Current research on the integration of aquaculture into farming systems in the Forest Margins Zone of southern Cameroon is being expanded and complemented by research on the productivity, economic importance, biodiversity and management requirements of forest river fisheries. The impact of deforestation on these fisheries will also be studied with a view to contributing to improved management.

Regional Projects in Development

Demand and Supply. In order to better understand the changing demand for fish and the implications for fisheries and aquaculture in the region, a series of studies on demand and supply is planned. Research is currently being initiated in Egypt and sub-regional workshops designed to plan future research are scheduled for North Africa and West Asia, the Gulf States and sub-Saharan Africa.

Sea Cucumbers in the Red Sea. In response to the heavy fishing and decline of Sea Cucumber stocks in the Red Sea, the Center has worked with the Egyptian Environmental Affairs Agency to identify a program of research that can contribute to the long-term rehabilitation of these populations in Egypt. This will serve as a pilot for other countries of the Red Sea and collaboration is being explored with the Program for the Environment of the Red Sea and the Gulf of Aden. This work build on the significant progress made recently by our staff in SE Asia and the Pacific to rear sea cucumbers illustrates our capacity to facilitate south-south technology sharing.

National Projects – Plans and Developments
A number of initial consultations, workshops, and priority setting exercises have been carried out in several other African countries, and plans are being developed for training programs, research on small-scale aquaculture, market analyses, and governance issues. Countries targeted for future collaborative work include Ethiopia, Ghana, Jordan, Mozambique, Nigeria, Tanzania, Uganda, and Zambia..

7. Knowledge Management: capturing and retaining the benefits of our work

The WorldFish Center is committed to using knowledge management and information technology to maximize the impact of its work through effective communication and dissemination of its research results and implications, facilitation of virtual teams across all its geographic areas of work, provision of research information tools to all its researchers and collaborators, and effective linking of its systems with all of the CGIAR centers. We have taken a number of initiatives in the past few years that support these commitments and support the vision and objectives of the new CGIAR ICT-KM strategy. We will further develop these in the period covered by this Medium Term Plan.

Database and Information Systems
The WorldFish Center operates two major public information systems: FishBase and ReefBase. FishBase provides comprehensive information to fishers and fisheries managers and scientists on 27 405 fish species. Users can look up information such as common names, taxonomic details, biology, aquaculture and fisheries. FishBase receives about 7 million hits per month.

ReefBase is a global information system and knowledgebase for coral reefs. It has information and data on the status, threats and management of coral reefs in nearly 100 countries. ReefBase targets its information services reef managers, policy-makers, scientists, educators and students. The website currently receives approximately 750,000 hits per month.

A third database operated by the WorldFish Center is TrawlBase. This database contains data from 20,000 trawl hauls from 11 countries. While not a public database, the relevant data are accessible to managers in each country. The database has been able to facilitate retrospective analysis that has demonstrated significant effects from overfishing in the Southeast Asian region. For example, TrawlBase results show that fish stocks in the SE Asian region are <> % of the levels encountered <> years ago. These results are being used to raise awareness of the problem amongst policy-makers in the region. Finally, a comprehensive database on fisheries and related economic data is being developed by the WorldFish Center to support its work on the fish component of a global supply and demand model. All of the above databases are considered as Global Public Goods within the CGIAR system, and received special funding from the World Bank in 2003 to upgrade the

systems so that they are able to continue their important services throughout the term of this MTP.

During 2003 the Center has also examined the potential links between the databases. The Center will continue to work towards greater integration and links during this MTP period so that we can address our partner's needs more efficiently.

Collaborative Virtual Teams
Increasingly, the collaborative work of the Center occurs across regions and continents. Maintaining an active and coordinated program involving widely dispersed partners requires constant communication and exchange of messages and documents. Following a review of collaborative software commissioned by the CGIAR, the WorldFish Center has developed a collaboration system based on Sharepoint Team Services. It is being used to keep over 60 researchers from 15 countries informed and in touch in a GEF- funded project on Targeted Research for Coral Reefs executed by the Center. A similar system is considered by the International Coral Reef Action Network, which involves over 70 experts in 27 countries.

GIS Consortium
The WorldFish Center is an active member of the CGIAR Consortium on Spatial Information. This consortium has received funding in 2003 to develop common spatial datasets that can be shared throughout the CGIAR system. This will allow all participating CG Centers to develop comprehensive maps of resources, resource use and other data, and to carryout sophisticated analyses involving combinations of these data sets.

Box 4. The Ian R. Smith Memorial Library: a vital knowledge management tool

The Ian R. Smith Memorial Library and Documentation Center houses a rich and diverse collection of materials on fisheries and aquaculture, particularly in "grey" literature from developing countries. The Center provides information services to the fisheries and aquatic research community worldwide, focusing on services to scientists in countries where access to information is limited. Increasingly, the Center provides access to its vast information resources on-line, both as electronic publications and direct access to catalogues and gateways to information, with the aim of becoming a cyber-information resource at users' desktops.

Linking our Computer networks through the CGIAR Active Directory system

As part of an effort to set up a common communication platform for increased inter-center collaboration, the CGIAR Chief Information Officer is implementing an Active Directory structure and upgrade to Microsoft Exchange 2000 servers for CGIAR in 30 countries. This is believed to be the world's most globally distributed Active Directory implementation. The WorldFish Center has taken the lead in implementing this system throughout its headquarters in Malaysia.

This last initiative illustrates the Center's ongoing commitment to integrate its knowledge management activities within the CGIAR system. The CGIAR has recently released its 3-year Information and Communication Technology and Knowledge Management (ICT KM) strategy. Three main thrust areas have been identified for this strategy, building upon the CGIAR's traditional sources of excellence: ICT for Tomorrow's Science; Content for Development; and A CGIAR

Without Boundaries. Keeping in mind efficiencies and cost effectiveness, the program will be guided by principles such as: Integration; Innovation; Linkages; and Learning.
The Center is working closely with the CGIAR Chief Information Officer, who is hosted at the WorldFish Center, to incorporate all relevant aspects of the plan into the activities and facilities of the Center.

Our Priority Areas

Based on the considerations and priorities described in the previous sections we have focused our research into 13 Thrusts (MTP Projects) with specific outputs for each thrust. These are listed below and discussed in more detail in the next section.

1. Conservation of aquatic biological diversity
Output 1: FishBase as a global biodiversity database.
Output 2: Applications of FishBase for developing countries.
Output 3: Decision-making tools utilizing data on species and habitat diversity.
Output 4: Utilization of genetic diversity information for conservation and management of "key" species.

2. Mitigation of adverse impacts of alien species on aquatic ecosystems and biological diversity
Output 1: Development of tools to assess risks and response mechanisms to mitigate the adverse impact of alien species.

3. Genetic improvement and breeding
Output 1: Development of improved strains by national breeding programs.
Output 2: Development and dissemination of methods for genetic improvement.

4. Sustainable freshwater aquaculture systems
Output 1: Thorough understanding of target group needs and constraints.
Output 2: Portfolio of new and improved aquaculture technologies.
Output 3: Sustainable systems and guidelines for the dissemination of aquaculture information and technology to fish farmers.

5. Freshwater fisheries in an integrated land and water management context
Output 1: Thorough understanding of target communities' needs and constraints.
Output 2: Technological options in relation to trade-offs necessitated by the community level at which fishers operate.
Output 3: Appropriate decision-support tools and institutional arrangements for management of freshwater inland fisheries.

6. Restoration of Capture Fisheries
Output 1: Better information on distribution, status and potential production of coastal stocks.
Output 2: Options for increased, sustained and equitable harvests.

7. Environmentally-friendly coastal aquaculture
Output 1: Sustained low-input production systems.

8. Reversing degradation of coastal habitats
Output 1: Interventions to reduce damage to the coastal zone.
Output 2: Knowledge-bases for coastal habitats and options for management.

9. Economic, policy and social analysis and valuation of aquatic resources
Output 1: Appropriate valuation methods of aquatic resources and their values for policy analysis.
Output 2: Models of small-scale fisheries for improved management.

Output 3: Social, economic and policy implications of integrated agriculture-aquaculture technologies (jointly implemented by Policy and Freshwater Programs).
Output 4: Disaggregated market models of fish and seafood products for developing improved policies on food security, poverty reduction and livelihoods.

10. Aquatic resources planning and impact assessment

Output 1: Methodology and operational guidelines for assessing impacts of aquatic resources research and development.
Output 2: Impact assessment of aquatic resources ***research and development.***

11. Legal and institutional analysis for aquatic resources management

Output 1: Methods and framework for participatory, action-oriented research on governance of aquatic resources.
Output 2: Policies and institutional arrangements for governance of aquatic resources.

12. Improved partnerships and capacity building among developing country institutions and agencies

Output 1: Identification of national research priorities and development and strengthening of research partnerships and networks.
Output 2: Enhancement of knowledge and research capabilities of national scientists and institutions.

13. Access to information for sustainable development of fisheries and aquatic resources

Output 1: Sharing information and knowledge, communicating for outcomes and positioning research for sustainable development of fisheries and aquatic resources.

Addressing the big issues: the CGIAR Challenge Programs and System-wide Initiatives

Some of the biggest problems facing the world today are so large and complex that they require a major global or regional effort involving more than just one CGIAR Center, and requiring input from other major research and management agencies in a coordinated long-term effort. Tackling these big issues with major strategically oriented collaborative "Challenge Programs" is a recent CGIAR initiative and an important pillar in the strengthening the CGIAR to meet the food security needs of the world over the next decades.

The WorldFish Center is involved in one active Challenge Program, the Water and Food Program, and is taking the lead in developing a second one, the Coastal Program. In addition the Center participates in one project under a System-Wide Initiative on water management. The status of these important programs is described below.

Challenge Program on Water and Food

Stage of Development

The Challenge Program on Water and Food (CPWF) is one of two Challenge Programs that began in 2003 as the first phase of this new way of working in the CGIAR. The Center has engaged intensively in this process and will play an important role in the management of the Challenge Programs through leadership of Theme 3 on Aquatic Ecosystems and Fisheries. The Center is also a member of the Consortium Steering Committee that oversees the Challenge Program.

Objective

The overall development objective of the CPWF is to increase the productivity of water for food and livelihoods, in a manner that is environmentally sustainable and socially acceptable. In pursuit of this objective, the CPWF will focus on five major themes: 1) crop water productivity improvement; 2) multiple use of upper catchments; 3) aquatic ecosystems and fisheries; 4) integrated basin water management systems; and 5) the global and national food and water system.

WorldFish Center's role

The Center will seek to contribute to all five of the themes, but will coordinate the work to be undertaken on Theme 3, Aquatic Ecosystems and Fisheries, as it is here that most of the Center's own research will be pursued. Work under each of these five themes will, however, be funded primarily through a competitive grants scheme. The decision-making process for project approval and grant allocation will be managed independently in order to provide transparency. This also allows those centers coordinating themes to compete fairly for the funds available for each of these areas.

Work under the Ecosystems and Fisheries theme will focus upon four major research area and questions within these.

1. Policies, Institutions and Governance

Key research questions include:

- What are the factors that influence people's access to, and control over, aquatic ecosystems and their resources?

- What kinds of governance systems and enabling policies and institutions foster equitable and sustainable management of aquatic ecosystems?
- How can capacity be built within national and local institutions to understand the livelihoods of poor people and their use of aquatic ecosystems, and take account of their needs in policy development and governance processes?
- What knowledge systems are needed to help build this capacity and support development and application of these policies, institutions, and governance systems?

2. Valuation of Ecosystem Goods and Services, and the Costs of Degradation.

Key research questions include:

- What are the monetary and non-monetary values of the goods and services provided by different types of aquatic ecosystems, and what proportion of the household and community economy do they comprise?
- What are the social and economic costs of degradation of aquatic ecosystems and decline and loss of their goods and services?
- What are the appropriate tools to generate this information rapidly and for use by poor stakeholders?

3. Environmental Water Requirements

Key research questions include:

- What are the quantitative relationships between hydrological changes (including water quality) and the goods and services of aquatic ecosystems that are of high priority for food security and livelihoods?
- What appropriate methodologies exist or need to be developed for the determination, management and monitoring of environmental flow requirements in the different aquatic ecosystems?
- What are the specific freshwater requirements for coastal ecosystems?
- What quantity (and quality) of water is needed to sustain river fisheries?

4. Improving Water Productivity

Key research questions include:

- When and how can water productivity and livelihoods be improved by integrating fish production and harvest of other aquatic animals and plants into farming and irrigation and flood-prone systems?
- How do the monetary, social and nutritional values of these additional water-use benefits compare with those of crops?
- What new technologies can be designed to improve further the integration of fisheries into farming systems?

Tentative Costs

The total cost of the WFCP is estimated to be US$75 million over 5 years. It is anticipated that of this total, some US$50 million would be available for grant funding over the course of the 5 years. While a pro rata sharing would imply some US$10 million for work on Ecosystems and Fisheries, the final distribution will probably be determined by a number of factors, of which the quality of proposals will be the most important.

Potential collaborators

The CPWF has been developed through an extensive process of consultation and collaboration, and its implementation will build on this. A wide range of partnerships

has already been developed through this process and will be expanded as the Challenge Program moves forward. Strong emphasis is being placed on building three-way partnerships between NARES, IARIs, and CG Centers. Strong links with river basins development authorities are also being developed.

Potential CGIAR linkages

The key linkages will be with the CGIAR centers (i.e., CIAT, IFPRI,IRRI, and IWMI).

Current Status

Achievements in 2003

The main achievements for the Center under the Challenge Program on Water and Food in 2003 have been:

- Participation in Benchmark Basin workshops for the Ganges, Limpopo, Mekong, and Nile Rivers.
- Convening of a workshop under the Challenge Program to further develop the Water Productivity and Fisheries dimension of Theme 3.
- Engagement in 17 Concept Notes submitted under the Challenge Program's Competitive Grant Mechanism, and approval of 11 of these for full proposal development.
- Appointment of Dr. V.V. Sugunan as Team Leader for Theme 3 (as from 1 July 2003).

The Coastal Challenge Program: "Making the Most of the Coast"

Stage of Development

The pre-proposal for another Challenge Program called "Making the Most of the Coast" was rated as meritorious by the Interim Science Council of the CGIAR. The Executive Council of the CGIAR has deferred a decision on whether the pre-proposal will proceed to the stage of development as a full proposal until 2004.

The Challenge Program in brief

The value of the coastal zone - the dynamic interface between the land and sea – cannot be overstated. It provides the natural resource base for much of the economic development required to support 50 per cent of the world's population who live there. However, despite our great dependence on the coastal zone, we have generally failed to manage it in a sustainable and productive way. The result is that many of the earth's coastal resources are in peril. The key problems are habitat degradation, "careless" use of resources, and pollution. This is particularly true for fisheries, where overfishing and use of destructive methods have led to dramatic declines in coastal fish stocks. This is exacerbated by a wide spectrum of land- and sea-based pollution, which further degrades the quality of habitats and renders fish products unsafe for human consumption.

The needs of coastal managers, and the scope for collaborative research to address these, were identified through two rounds of consultations with ~90 agencies, including NARS, CGIAR centers, ASIs, NGOs and international and regional organizations. As a result of this process, WorldFish received clear guidance that the Challenge Program should focus on two themes and six Research Projects. These are:

Theme 1: Reversing degradation of coastal resources

1. Understanding material transfers from watersheds, and reducing "downstream" effects of agriculture and forestry on coastal aquatic ecosystems;
2. Addressing non-optimal use of resources through valuation and "environmental payments"; and
3. Identifying and promoting ways to rehabilitate critical coastal habitats.

Theme 2: Enhancing livelihoods for coastal people

1. Understanding the factors determining livelihoods for poor coastal people;
2. Restoring production from capture fisheries; and
3. Developing technologies for alternative or supplementary livelihoods for coastal people.

A broad and experienced group of agencies has expressed interest in designing and implementing these Research Projects in Southeast Asia and the Pacific. This partnership consists of five CGIAR Centers, eight regional and international organizations, three scientific organizations, the Nature Conservancy, and nine countries. Plans for the development of the full proposal include workshops for the Technical Working Groups to design the Research Projects in detail, and for finalization of the governance arrangements and business plan. The WorldFish Center will co-ordinate the development of the full proposal on behalf of the partnership.

System-wide Initiative on Water Management – Phase 2 (SWIM-2)

This program is under the overall management of IWMI. The WorldFish Center is responsible for one project called: **Increasing water productivity by managing the land-water interface: effective water control for solving conflicts among agriculture-fisheries-aquaculture in coastal zones.**

Background: The tidal saline sub-ecosystem accounts for more than 2 million hectares of rice land in South and Southeast Asia. One strategy for improving agricultural production is to install dikes and sluice gates for salinity protection. Such interventions have both positive and negative impacts on people's livelihoods, depending on resource use types (e.g., agriculture versus fisheries and aquaculture). In the proposed project, an existing water model will be refined so that it can simulate the acidity generation (from soil) and transportation in the canal network. The model will be linked with the analysis of fisheries-relevant water quality parameters, and will incorporate the socio-economic and livelihood analysis into the land-water management scenario analysis. The proposed project will also synthesize the findings in such a way that effective management strategies can be disseminated to other similar coastal areas, not only in Vietnam, but also in other countries such as Indonesia, Malaysia and Thailand, as well as Australia.

The project will have impacts on three groups of beneficiaries: (i) poor rural households whose livelihoods will be improved by minimizing the negative impacts on fisheries resources due to proper resource management in the region; (ii) decision- makers and managers who will be provided with land-water management alternatives and the impact assessment; and (iii) researchers and planners who will receive the analytical system to apply for planning and studies in coastal zones. Additionally, the international workshop will present the findings to researchers and stakeholders in other South and Southeast Asian countries.

The International Rice Research Institute in the Philippines is the main collaborating partner. The Centre for Land Use and Water Resources Research at the University of Newcastle, U.K., will provide additional inputs. Key stakeholders in Vietnam are the Department of Agriculture and Rural Development (DARD), and Department of Fisheries (DOF) of Bac Lieu province, Sub-Institute of Water Resources Planning (SIWRP), Can Tho University (CTU), and the University of Agriculture and Forestry (UAF). A participatory approach will be applied in the project to make use of local expertise and also to guarantee that the findings will be relevant to stakeholders.

The project is currently in start-up mode. Staff members in Vietnam have been identified and work will commence in September 2003.

Our Research Agenda

Summary of Program Achievements and Future Plans

BIODIVERSITY AND GENETIC RESOURCES RESEARCH PROGRAM (BIODIVERSITY AND GENETICS PROGRAM)

The Biodiversity and Genetic Resources Research Program (Biodiversity and Genetics Program) plans and implements research on the conservation and sustainable use of genetic diversity. The overall program goal is to ensure that the benefits of aquatic biodiversity are available for the poor in the developing world in a sustainable manner. The intermediate goals of the Biodiversity and Genetics Program include: 1) Aquatic biodiversity (genetic diversity within species, species diversity and ecological diversity) restored, conserved and used in a sustainable manner, and 2) Farmers realize increased and more efficient fish production in an environmentally sustainable manner.

The main purpose of the Program is to ensure that research institutions, management agencies and NGOs use scientific tools and methods for understanding, conserving and sustainably ensuring aquatic biological diversity. Secondly, that national breeding programs supported by the Center maintain and continuously improve strains for distribution to farmers and take measures to ensure maintained genetic diversity of aquaculture species. The Biodiversity and Genetics Program has the following thrusts: i) the conservation of aquatic biological diversity, ii) mitigation of adverse impacts of alien species on aquatic biological diversity, and iii) genetic improvement and breeding.

WORLDFISH CENTER THRUST 1(=MTP PROJECT 1): Conservation of aquatic biodiversity

Output 1: FishBase as a global biodiversity database

Achievements in 2002-2003:

- Work on harmonizing fish species (nomenclature, habitat, distribution, access to species holotypes, and use of similar database software) in FishBase and Catalog of Fish (CAS) continued to create a definitive global check-list of marine and brackish-water fish.
- FishBase expanded its global geo-referenced species coverage to more than 1.5 million records (from 29 collections) by expanding collections in developing countries, updating existing databases (e.g., MNHN, France; MRAC, Belgium), and repatriating fish biodiversity data to countries in Africa, Asia, the Caribbean and the Pacific.
- By 2003 FishBase covered over 98% of the world's estimated fish species with local names in 413 languages. Over 1.1 million unique users from 187 countries (equivalent to more than 2 million user sessions and 21.9 million web hits) accessed the website in 2002, reaching over 8.5 million hits per month in 2003.
- A DVD version of FishBase ("FishBase 2003") was developed containing all the updated database tables on one disc. This has web links to the FishBase internet version and other global databases. A 2003 version of Species 2000 was also developed on CD-ROM and distributed.
- Cooperative projects resulted in the following: with the Academia Sinica (Taiwan), development of prototype applications of FishBase in Chinese (including translation of the FishBase book); with the Freshwater Biological Association (United Kingdom), development of a web-site and database for aquatic insects (as a precursor to a database on freshwater invertebrates of commercial importance using the FishBase database shell); with five Universities and the National Museum in the Philippines, development of a generic digital network for accessing geo-referenced fish data archived in national collections.

Plans for 2004–2006:

- Core activities identified for maintenance of FishBase will continue. These will include website editing and updating, species nomenclature revisions and additions to ensure accuracy of the database. Collaborative annual work program activities with the FishBase Consortium will complement these to further expand the taxonomic backbone of FishBase and bio-geographic applications.

Output 2: Applications of FishBase for developing countries

Achievements in 2002-2003:

- FishBase tools development expanded to include use of internet-based resources for species mapping; extension of the capture fishery length-frequency analysis wizard to length-converted catch curve analyses; detailed reporting of species introductions by FAO area and country; and adding of fish identification keys included for fish larvae (694 included in FishBase).
- Emphasis was placed on terms of species encoding to tropical species, particularly in Asia (Philippines, China, India, Mekong area), and data related to fisheries management (growth, mortality, diseases, ecology, habitat, diet).
- Site-specific database modules linked to FishBase were developed that provide area (site/ecosystem), project, and biological/ecological profiles that allow FishBase data and tools to be applied at localized geographic scales and linked to governance information.
- Morphology and biology of fish larvae of 1 850 species including 1 389 images (drawings and photographs) of eggs and larvae, eggs of 1 002 species, 39 mini-essays on larval rearing, more than 2 000 references and larval keys were encoded. This information is linked to adult biology in FishBase and would be useful for aquaculture development and research.

Plans for 2004–2006:

- Through joint meetings with national partners (initially in the Philippines) customized FishBase solutions for fisheries and biodiversity management on a thematic approach will be developed and demonstrated. Work on developing similar databases in China, India and the Mekong River region will be initiated. Capacity-strengthening through training (manuals on building country-specific customized databases including data-encoding, validation, database linkages, and related website development) will be implemented. Training of developing country collaborators with special emphasis on Africa and West Asia will be carried out, and customized database work will be initiated in two countries in Africa and West Asia.
- Analytical tools such as “Species / Key Facts” matrices for ecological and community analyses, species introductions, responsible fish trade and analytical tools on species identifications will be further refined. Analytical tools to support management of coral reef areas and coastal zone management involving a total life history approach (including habitat, larval, and proxy information) will be developed in collaboration with the Coastal and Marine Resource Research Program. Spatial (GIS) functions in FishBase towards natural resources modeling, and spatial management (e.g., biogeographic evaluation of species introductions, identification and analysis of conservation “hotspots”) will be expanded. Development of multi-scale (local, national, regional, international) and site-specific database modules linked to FishBase will be developed.
- An international workshop on developing application-based databases for fisheries and aquaculture will be held.

Output 3: Decision-making tools utilizing data on species and habitat diversity

Information on species and habitat diversity for prioritised areas is generated and utilized in developing decision-making tools for conservation and management of aquatic resources.

Achievements in 2002-2003:

- The semi-quantitative model for the management of water flows to optimize aquatic resources production in the Mekong River Basin developed in recent years has been made operational and it is now part of the management activities of the Cambodian Inland Fisheries Research and Development Institute (collaborative project with WorldFish). A paper detailing this model and a review of decision-support tools for floodplain rivers management have also been published.
- For the Mekong River region, primary data generation and analysis have been facilitated through the supervision of two post-graduate students who have been working on: a) definition of fisheries stakeholders in Cambodia to be incorporated into the modeling approach; and b) statistical analysis of 6 years fishery data from the Lao PDR.
- Management of large tropical rivers and floodplains has been promoted through the development of a significant thrust on aquatic resources in the Water and Food Challenge Program, and the successful submission of five project concepts focusing on water management and river conservation, for a total budget of US$ 6.9 million.
- The practical methods and ways of conserving fish biodiversity at the field level have been reviewed in a publication aimed at helping extension activities of NGOs and others involved in rural development.

Plans for 2004-2006:

- For key economically important species of the Mekong River region, information on their bio-ecology will be consolidated using FishBase. Bio-ecological monitoring to assess the present status will be carried out on in collaboration with the Cambodian Inland Fisheries Research and Development Institute. This will lead to a sound bio-ecology information base for key species, which would be used in management programs.
- Species and habitat diversity information along with socio-economic information for selected freshwater sanctuaries will be gathered. Based on these, a generic management plan and decision-making tool will be developed.
- The Bayesian model of Mekong fish resources, their environment and the stakeholders will be fully developed for the Tonle Sap (Great Lake) fisheries in Cambodia. Emphasis will be given to the consultation process for the systematic and collective development of such models. Based on this work, a generic Bayesian model for use in other river basins would be developed.
- Training and capacity building will be emphasized through the provision of assistance and training to national aquatic resources institutes, in particular in the Mekong Basin.
- WorldFish will work with a range of international partners to integrate in-stream flow assessment methodologies with fish-flow models and other decision support tools such as Bayesian models, and develop a set of methodologies that will support water allocation and fishery management decisions in tropical rivers. This will be pursued working in river basins in Africa and Asia.

Output 4: Utilization of genetic diversity information for conservation and management of "key" species

Achievements in 2002–2003:

- For three West African lagoon Tilapia species, based on the identification of distinct population genetic units over their entire distribution range, priority areas for conservation have been delimited in four countries.
- In both *S. melanotheron* and *O. niloticus,* distinct differences in growth were observed between populations that are genetically different and these populations could be used in developing aquaculture programs. The profitability of pen culture of potentially cultivable *Sarotherodon melanotheron* and its' acceptance by the local community was demonstrated.

- Workshop on the effect of farmed fish escapes on wild stocks was conducted in collaboration with the PITP program.

Plans for 2004–2006:

- Genome introgression and changes in the life history traits in natural stocks of common carp (China) and Indian major carp (India) due to the interaction of escaped farmed fish with wild fish will be quantified. This would help in evolving better broodstock management practices and corrective policy measures.
- Characterization of domesticated and selected stocks of carp and tilapia at genetic as well as phenotypic levels will be carried out. With this information it will be possible to prioritize strains that need to be conserved and utilized more extensively for aquaculture and in selection programs.
- Work on the biodiversity of freshwater fish will be continued in West Africa. This will strengthen regional capacity to carry out further biodiversity studies while pursuing more intensive research on the constraints on the use of new species in aquaculture. This will include both technological and market studies.
- Improved tilapia strains will be genetically characterized to generate genetic variability information and specific genetic tags that would be used in genetic improvement programs and in the development of broodstock management strategies.

WORLDFISH CENTER THRUST 2 (=MTP PROJECT 2)
Mitigation of adverse impact of alien species on aquatic biodiversity

Identification of factors leading to freshwater alien species introduction will help in developing strategies aimed at reducing the establishment of alien species. Development of tools to assess risks and evaluate impacts will facilitate the development of guidelines and mechanisms for the introduction of improved strains. Management and policy recommendations will ensure better response mechanisms to handle the adverse impacts of alien species.

Output 1: Development of tools to assess risks and response mechanisms to mitigate the adverse impact of alien species

Achievements in 2002–2003:

- Project on freshwater aquatic alien species started with partners in Malaysia and the Philippines.
- Reports on the status of the impact of aquatic aliens and their utilization initiated.
- The role of two alien species (i.e., flower horn and discus) in the Penang ornamental fish trade and the local knowledge on application of genetic principles in breeding different varieties of these two species were documented.

Plans for 2004–2006:

- Reports on the status of the impact of aquatic aliens and their utilization in Malaysia and the Philippines completed.
- The research plan will include identification of pathways and development of tools to assess risks and any adverse impact on biodiversity. Socio-economic factors influencing alien species establishment will be determined.
- Development with Malaysian partners of a national strategy and guidelines for Malaysia on aquatic alien species. Generic response mechanisms and guidelines on translocations of alien species and minimizing escape of farmed individuals will also be developed.
- As a test case for tropical developing countries, information on the impact of feral populations of tilapia and the alien aquatic weeds in Malaysia will be gathered.

WORLDFISH CENTER THRUST 3 (=MTP PROJECT 3)
Genetic Improvement and Breeding

Output 1: Development of improved strains by national breeding programs

Achievements in 2002-2003:

- Funding for a second phase of the project on the transfer of GIFT technology to Africa was approved by UNDP for two years (from May 2003 to April 2005). This will ensure continuity in the selection programs, and establishment of the dissemination process of the improved fish to farmers.
- The first round of selection of GIFT fish at Jitra has been successfully completed producing about 80 families. A control population has been established, which will enable the estimation of genetic gain.
- The fish tank facility in the headquarters of the WorldFish Center – Penang is now fully operational. Back-up stock for the GIFT selection line at Jitra were transferred to the fish tanks in July 2003 and will be held as insurance against disasters in the former location.
- Following positive feedback from ADB, a fully revised version of the project proposal for a second phase of the activities on "Developing improved carp strains for aquaculture in Asia" has been submitted for funding.

Plans for 2004-2006:

- The transfer of selective breeding (GIFT) technology for aquaculture improvement from the Philippines to Sub-Saharan Africa and Egypt will continue with increased emphasis on the multiplication and dissemination of improved fish to farmers.
- The project on "Development of carp strains for aquaculture in Asia (Second Phase)" will be initiated with a planning workshop for collaborating partners. The establishment of a dissemination strategy for the improved strains will be a major focus of the study.
- A proposal for the development of improved of freshwater prawn strains will be jointly prepared with partners from Bangladesh, India, Malaysia, and Thailand.
- Research will be initiated on the feasibility of incorporating delayed female reproduction as an additional trait in the breeding objective of the Nile tilapia selection program with the aim of delaying overcrowding during the grow out phase.
- Initiate research on the development of sex control technologies that are appropriate for the production of all-male progeny in tilapia in small-scale farmers' production systems.
- Further develop the concept and a proposal for funding the establishment of an International Breeding Center at the WorldFish Center to support aquaculture developing country geneticists and their countries' genetic improvement programs.

Output 2: Development and dissemination of methods for genetic improvement

Achievements in 2002-2003:

- Red Tilapia stock from three sources were identified and assembled at Jitra Research Station for the purpose of comparing them with GIFT stock.
- The process of dissemination of GIFT fish to Malaysian farmers is getting underway, with considerable interest displayed by the private sector as well as by agencies of the Government of Malaysia. Fish are being transferred to a number of locations for multiplication, evaluation and further dissemination.
- A three-week workshop on quantitative genetics and statistical analysis of fish breeding data was held in October 2002 in Bangkok. There were 29 participants from African, Asian and Pacific Island partner countries. Most participants had the

opportunity to work on data from the fish improvement programs there are conducting in their home countries.
- A manual on GIFT technology is in the final stages of preparation before going to print.

Plans for 2004-2006:

- Continue with the genetic enhancement program of Nile tilapia in Malaysia and proceed with the evaluation of F1 crossbred clones as a means of evaluating genetic change, and of YY-males for the creation of all-male progeny for growing out in the production system.
- Progress on confirming the selective breeding program of Nile tilapia in Egypt for high and low input pond environments as a component of integrated farming.
- Begin research on the estimation of genetic parameters for cold tolerance in tilapia in Egypt with a view to incorporate the trait to the breeding objective.
- Develop methodology for the improvement of carcass and flesh quality in Tilapia
- Develop guidelines on the maintenance of stock quality and avoidance of inbreeding and inadvertent selection in hatcheries.
- Develop a general approach to the dissemination of improved stock, to be customized according to the specific situation of each country.
- Organize and implement courses on genetic improvement of aquatic species at a number of levels (including training at a very high level) suitable for participants with a differing amount of previous training in quantitative genetics.
- Publication of manuals on fish genetic improvement that may be used later in training courses and as reference guides for those involved in the conduct of practical programs.

THE FRESHWATER RESOURCES RESEARCH PROGRAM (FRESHWATER PROGRAM)

The Program seeks to improve the livelihoods of fishers, fish-farmers and consumers of freshwater living aquatic resources. The program is built from a series of activities aimed at increasing the productivity, sustainability and profitability of freshwater aquaculture and the improved management of lakes, reservoirs, small water bodies, rivers and floodplains. Based on a review of human needs and the biophysical potential for positive gains from research, Africa and Asia currently dominate the activity portfolio. The overall strategy for realizing the goal of sustainably improved management of freshwater resources is based on holistic analysis and pragmatic problem-solving.

FRRP has two main thrusts aimed at: (1) increasing the productivity and sustainability of freshwater aquaculture within the context of African and Asian farming systems; and 2) improving the knowledge base and management of freshwater living aquatic resources within the context of changing watersheds. The activities in these thrusts contribute to six overall outputs, i.e., three per thrust.

WORLDFISH CENTER THRUST 4 (=MTP PROJECT 4)
Strategies and options for realizing gains from sustainable freshwater aquaculture systems

Output 1: Thorough understanding of target group needs and constraints

Achievements in 2002–2003:

- *On-farm Research*: In Malawi, new adopters of aquaculture are those farmers who have access to land in lowland areas along natural water courses (e.g., *dambos* or *dimba* gardens) or in lowland depressions holding water seasonally, and are located

in the vicinity of their homesteads. Access to information on appropriate techniques of low-risk entry-level technology (usually through IAA = integrated aquaculture-agriculture) is essential for the successful adoption and subsequent improvement of the new farm component. Impacts of ongoing interventions with these households will be determined in the coming years, based on these data. In southern Malawi, almost 300 farmers are being monitored to determine the contribution of IAA to their livelihoods and the effect of improvements to their aquaculture operations.

- *On-farm Research*: In Cameroon, a strategy to study the effects of population density and market access on aquaculture adoption and the extent to which this improves their livelihoods is being implemented. One hundred farmers are being monitored. A range of additional studies by local partners are being undertaken, which will provide further key information for our understanding of the local contextual factors of aquaculture adoption and diffusion.
- *On-farm Research*: In Bangladesh, data of detailed whole-farm surveys of 200 households that adopted rice-fish culture or carp polyculture were partly analyzed and will also serve as a baseline for future assessments of the impact and sustainability of the adoption. Wealth-ranked adoption studies of improved IAA technologies were initiated in over 200 households.

Plans for 2004–2006:

- During this Medium Term Plan period, the Malawi site will expand the implementation of the Research Extension and Training (RET) approach to cover the major aquaculture areas in Malawi and newly initiated activities in Zambia will be further supported.
- In Mozambique, pending continued funding, the RET approach and aquaculture development activities will be initiated in Manica Province.
- In Cameroon, in the final year of the project in 2005, an impact evaluation will be conducted on the households in different market access and population density categories.
- In Egypt, a study of the socio-economic constraints to aquaculture will be undertaken.
- In Bangladesh, wealth-ranking exercises will be implemented to select 360 households in four separate wealth strata, with which household-level assessments will be conducted using the Research Tools for Natural Resource Management Monitoring and Evaluation (RESTORE) approach. These will serve as the baseline for subsequent improved aquaculture technology adoption trials, depending on the needs, constraints, and selection of the cooperating farmers.
- In Vietnam, farm households with homestead garden-ponds will be assessed using the RESTORE approach and additional assessments will be conducted on the theoretical suitability of improved aquaculture technologies.

Output 2: Portfolio of new and improved aquaculture technologies

Achievements in 2002–2003:

- *Production Research*: In Egypt/Abbassa, the new method of natural spawning of African catfish achieved through manipulation of the environment (water level, shelter) was further validated on-station and on-farm. Further research is now being conducted in Abbassa, Yaounde, and Domasi on identifying the nature of the spawning cues, in order to derive a reliable technique for reproduction of catfish under low-technology conditions.
- *IAA Technology Research*: In Malawi, a study was completed on the identification of factors regulating nitrogen retention in IAA systems and an open day for farmers was held at the Domasi station. In Cameroon, 20 sponsored research projects have examined a wide range of topics related to the intensification of small-scale integrated aquaculture systems. In Bangladesh, twelve sponsored studies conducted through national partners on components of IAA and cultured fish utilization and quality were completed (e.g., *Azolla* in rice-fish culture, and *Macrobrachium-carp* polyculture). In Egypt, a number of different options were examined in 2001 in the experimental production ponds at Abbassa to test pond management practices that will help

farmers to reduce costs, diversify production practices, and exploit market opportunities for various sizes of fish and at various times of the year.

Plans for 2004–2006:

- In Egypt, work is ongoing to study the role of fishponds in the nutrient dynamics of mixed farming systems. An evaluation of the impact of tilapia in low and high environments on the nutrient dynamics of the pond will be undertaken. The schedule of pond experiments at Abbassa will be implemented until 2005. This work aims to:
  - quantify the temporal variation in nutrient availability and requirements in east-African land-based agriculture on the basis of existing literature and data.
  - characterise nutrient dynamics in different tilapia culture environments (including high and low input systems and different strains of tilapia).
  - quantitatively describe the process of sludge formation and evaluate the value of sludge as a fertilizer in land-based agriculture.

- Further work in Egypt will study fish farming economics and assess the overall supply and demand of fish in Egypt. The objectives of this work are to:
  - understand the farm economics of different aquaculture practices and levels in Egypt, based on the current prices for inputs and fish.
  - assess the impact of future projections of supply and demand for fish, and the availability and costs of inputs, for the profitability and economic sustainability of these different systems.
  - demonstrate the economic conditions under which aquaculture can continue to play its central role in food security and livelihood support in Egypt.
  - identify market conditions under which future investment in aquaculture in Egypt will be fully viable.
  - assess the demand for fish and fish products from different sources (national aquaculture and capture fisheries and imports) through the course of the year, taking account of consumer preferences at different social and income levels.
  - determine the factors responsible for the decline in fish sale prices, in particular distinguishing between changing consumer preferences and market reaction to increasing supply.
- Together with partner institutions in Bangladesh, research will be conducted to solve production bottlenecks and clarify key aspects of IAA systems as identified with target beneficiaries to benefit them. Technologies appropriate to economic strata of target farmers will be tested on-farm in comparison with different sites and monitored with the RESTORE tool over three years.
- In Vietnam, farmer-selected technologies for homestead garden ponds (e.g., polyculture of carp species with Nile tilapia (GIFT strain), freshwater prawn or marble goby will be tested in on-farm trials. Shrimp-fish polyculture options will be evaluated in low-salinity (< 12 ppt) brackish water ponds in order to achieve greater species diversity and resilience of operations, among others, against disease outbreaks and economic loss.

Output 3: Sustainable systems and guidelines for the dissemination of aquaculture information and technology to fish farmers

Achievements in 2002–2003:

- *Extension*: In Bangladesh, several thousand new farmers implemented either project-supported on-farm aquaculture demonstrations in ponds or flooded rice fields, or non-sponsored trials of improved aquaculture technologies based on training given to them by the Center-trained NGO extensionists. Additionally, more than 100 field-days and rallies were organized for interested neighbors of demonstration farmers.
- *Training*: In Bangladesh, more than 100 field workers from 18 NGOs were trained; more than 80 senior NGO staff received training courses in the suitable, affordable, and farmer-friendly aquaculture technologies developed by the Center and its partners.

- *Training*: In Malawi, three training courses on participatory research and extension were held for government and NGO researchers and extensionists including three participants from Zambia. In collaboration with the Malawi Department of Fisheries, and the Zambia Department of Fisheries, a one-week tour of existing farms in southern Malawi was organized for 14 farmers from eastern Zambia.
- *Training*: In Bangladesh, a RESTORE training course was held in Dhaka during 3-5 September 2002 for 14 Center and partner staff. The approach is being implemented as a key component of its on-farm research activities. In Malawi, a RESTORE training course was held in Domasi from 3 to 6 December 2002 for 12 staff members and partners, including two participants from Zambia. The process is an established tool in on-farm research and monitoring activities on IAA in Malawi conducted by the Center and its government and NGO partners.
- *Training*: In Egypt the following courses were conducted:
  - Application of Nutritional Principles and Practices in Various Farming Systems (11-14 March 2002) in collaboration with MSSP for 19 Egyptian participants.
  - Tilapia culture in fresh and brackish water (21 April – 2 May 2002) in collaboration with FAO, Near East Office, for five participants from three Arab countries.

Plans for 2004–2006:

- In Malawi, training on participatory aquaculture research and extension for NGO personnel will be carried out.
- In Egypt the successful program of training for farmers and cooperatives will be continued. This will place increasing emphasis on new technologies being developed by the Center that improve the cost-effectiveness of investments in pond aquaculture. Regional training courses for NARS staff will also be continued.
- In Bangladesh, over 500 extension workers and senior NGO staff of cooperating NGOs will be trained. The training program comprises foundation training, three to five refresher training courses and on-the-job training in participatory extension approaches, as well as technical, financial, organizational and gender issues. Ultimately, 7 000 additional farmers will benefit every year directly from training and support from the partner NGOs, and an additional number are expected to benefit through adoption of improved aquaculture technologies imparted by staff of associate NGOs whose extensionists have received training from the Center, but no financial support. This will generate good understanding of the sustainable pathways for improved aquaculture technology diffusion and the criteria for adoption.
- In Vietnam, in cooperation with the Department of Fisheries of Bac Lieu Province in the Mekong Delta, and the University of Cantho, efficient dissemination of IAA options to target farmers will be implemented.
- During the MTP period, the BMZ-funded "Recommendation Domains" project will be implemented, which will identify characteristics of successful aquaculture development pathways and conditions, and formulate these into a useful tool for wider application.
- Two recently completed publications in collaboration with FAO and IIRR summarizing existing technologies for smallholder aquaculture will be e-published on the Internet and through CD-ROM. They will be translated into French and Spanish.

WORLDFISH CENTER THRUST 5 (=MTP PROJECT 5)
Freshwater fisheries in an integrated land and water management context

Output 1: Thorough understanding of target communities' needs and constraints

Achievements in 2002–2003:

- *Fish-in-Watersheds Research*: In Malawi, the importance of integrated watershed management for fish resources in the Lake Chilwa catchment was studied. Improved erosion-reducing land management options were tested and their effects documented. Techniques for enhancement of fish production from the lake through managed brush-parks were tested and show higher potential harvests.

- *Fish-in-Floodplains Research*: In Bangladesh and Vietnam, socio-economic surveys of communities revealed their economic status and use of floodplains during the dry season for rice production, and during the flood season for fishing and opportunities for fish culture.
- *Fish-in-River Deltas Research*: In the Mekong River Delta, surveys of fish markets, trawl surveys of fish abundance, plankton, benthos, and water chemistry revealed the seasonality of fish species composition and their abundance in human-made canals, based on freshwater flow amounts and controlled operation of sluice gates regulating saltwater inflow. Landless poor farmers depend on fisheries in brackish water canals for a major part of their livelihood. However, fish availability depends on managing sluice gate openings to supply saline water, thus making the fish and other resources available to the landless part-time fishers. Recommendations were formulated for policy-makers for water flow management under multiple-use objectives.

Plans for 2004–2006:

- During the MTP period, a project will begin in Malawi and Mozambique that will employ GIS mapping of historical land use changes and will conduct water quality monitoring in the Mnembo Catchment, Mozambique. Furthermore, geostatistical mapping of the temporal and spatial distribution of *Barbus* species (locally known as "matemba") around the mouth of the Mnembo River in Lake Chilwa (Malawi and Mozambique) will be conducted.
- In Bangladesh and eastern India, further studies on community-based fish culture in seasonally fenced areas will be conducted.
- In Bac Lieu province of Vietnam in the Mekong Delta, monitoring of actual catch and effort of different fishing gears, and salinity and pH of canal water before, during and after sluice gate opening will provide data for better understanding of the role of brackish water fisheries for the landless poor. These are mainly in the saline-dependent acid-sulphate soil area in the western part of the province, which is in contrast to the freshwater-sufficient areas in the eastern part with alluvial soil. Data will feed into the existing Vietnam River Systems and Plains (VRSAP) water and salinity flow model, and will enable the estimation of fish abundance dependent on brackish water inflow amounts.

Output 2: Technological options in relation to trade-offs necessitated by the community level at which fishers operate

Achievements in 2002–2003:

- *Community-Based Research*: Research in Bangladesh and Vietnam proved that the seasonal operation of community-based fish culture in fenced flooded areas proved socially and economically viable. We observed increases in the net return to farmers of US$220-400/y, which resulted from fish yields of 1 000 -1 550 kg/ha/flood season in the alternating fish-after-rice system, and 490-615 kg/ha/flood season in the concurrent fish-in-deepwater-rice system. The success of the technology was underlined by the fact that numerous neighboring groups were spontaneously formed around the project's trial areas; these groups copied the principle of the approach and then established their own areas and arrangements.
- *Brushparks in Lakes*: In Lake Chilwa, Malawi, community-operated fenced brushparks were field tested for the first time.

Plans for 2004–2006:

- During the MTP period, a new research initiative will be implemented in Bangladesh to improve fish production (naturally occurring and stocked) in seasonally fenced areas. In eastern India, as a new site for FRRP and in collaboration with the national partners in West Bengal, trials will be conducted on community-based fish culture in seasonally flooded and fenced areas, following the achievements and experiences gained from recent work in Bangladesh and Vietnam.

- In Lake Chilwa, Malawi, the approach on community-operated fenced brush-parks will be refined to achieve higher fish yields through the fenced brush-parks that serve as periphyton-grazing substrates and predation/catch-protection shelters.
- In the Mekong River Delta of Vietnam, the management options for the sluice gate operation for brackish water inflow will be assessed with regard to optimized fish production through catch in canals, in relation to the competing needs of other stakeholders.

Output 3: Appropriate decision-support tools and institutional arrangements for management of freshwater inland fisheries

Achievements in 2002–2003:

- In Bangladesh, community-based fish culture trials revealed stable institutional arrangements developed and agreed upon by landowners and landless who formed groups for the specific purpose of joint management of the fenced and stocked area for the duration of the floods. These areas were as follows: moderate size of enclosed area of 2-10ha; moderate size of membership of 10-30 members; and sharing arrangements (in %) of 30:30:30:10 for participating landowners, non-participating landowners, landless and fund replenishment, respectively.
- A new project assessing the "adaptive learning" approach for community-based fish culture in eastern India commenced in 2003.
- The Center convened a workshop on in-stream flow requirements for tropical river fisheries in Cape Town in 2002. On the basis of this a research agenda has been developed and first steps have been taken in establishing an international consortium of research partners that will work further on these issues over the next 3 years.

Plans for 2004–2006:

- During the MTP period, social science studies will examine the adoption patterns and agreed institutional arrangements among communities already implementing the community-based fish culture approach. The expansion of this approach in Bangladesh will be monitored. A similar research project is planned for West Africa.
- In the Mekong River Delta of Vietnam, modeling of fish availability, as a function of flood control measures through sluice gate operation to enable brackish water inflow versus freshwater will produce guidelines to manage the water supply for the benefit of the poor. The aim is to enable brackish water canal fishing by the most poor, and low-intensity brackish water shrimp culture (in polyculture with fish) by the less poor and other stakeholders.
- In Africa, emphasis will be given to river and lake fisheries. Activities will focus on the governance, value, flow requirements, and management approaches to increase the benefits of fisheries in lakes and reservoirs and small water bodies.

6.1.3 COASTAL AND MARINE RESOURCES RESEARCH PROGRAM (COASTAL PROGRAM)

The Coastal and Marine Resources Research Program strives to equip developing countries with the means to implement the FAO's Code of Conduct for Responsible Fisheries and Ecosystem Approach to Fisheries, and fulfill commitments made to restore capture fisheries at WSSD in Johannesburg in 2002. In particular, the program endeavors to assist managers to increase the productivity of inshore fisheries resources on a sustainable basis by rebuilding stocks to more productive levels; increasing the productivity of fisheries resources and the opportunities for alternative livelihoods through the application of aquaculture; and reversing the degradation of the habitats that support fisheries.

The program focuses on inshore fisheries, particularly those associated with coral reefs and shallow soft sediments in Asia, Southeast Asia, and the Pacific. There have been three recent changes in emphasis within the Program. The first has been the decision to expand the scope

of research on inshore fisheries in Asia and Southeast Asia to: a) improve the understanding of the spatial structure of fish stocks and the various factors that influence production of key species; and b) determine how to reconcile the need to limit catches to rebuild fisheries with equitable access and distribution of benefits among the different sectors in a way that does not jeopardize the recovery of stocks. The second has been to change the nature of ReefBase so that it functions as a global information system on the status and management of coral reefs. The third has been to integrate some of the project activities within the Program in large grant applications with multiple partners, e.g., the International Coral Reef Action Network (ICRAN) initiative funded by the United Nations Foundation (UNF), the Targeted Research on Coral Reefs supported by the Global Environmental Facility (GEF), and the CGIAR Challenge Program Pre-proposal to reverse degradation of coastal resources and enhance livelihoods entitled "Making the Most of the Coast".

WORLDFISH CENTER THRUST 6 (=MTP PROJECT 6)
Restoration of Capture Fisheries

Output 1: Better information on distribution, status and potential production of coastal stocks

Achievements in 2002–2003:

- The WorldFish Center continued to raise awareness of the serious plight of coastal fisheries in Asia and Southeast Asia, disseminated during the "International Workshop on Management of Tropical Coastal Fisheries in Asia" in 2001, by arranging national consultations with Bangladesh, Malaysia, and the Philippines. At these consultations, WorldFish highlighted the decline in coastal fishery resources throughout the region to 10-30 per cent of the original unfished levels, the sharp decrease in relative abundance of the more valuable fish, such as groupers, snappers, sharks and rays, and potential management actions to address the problems. In Malaysia, this consultation has resulted in a proposed "Integrated Fisheries Management and Rehabilitation Program", with a national level, multi-agency steering committee to oversee its implementation.
- The proceedings of the "International Workshop on Management of Tropical Coastal Fisheries in Asia" were published in 2003. The proceedings contain 33 papers from eight partner countries documenting the resource and socio-economic status of coastal fisheries and reviewing the policy and institutional environment of the countries. The papers also document the key issues and opportunities facing coastal fisheries management and the recommended action plans developed at national level consultations.
- The Center has continued to develop the Fisheries Resource Information System and Tools (FiRST) software and database, an output of the "Sustainable management of coastal fish stocks in Asia project". This regional database covers South and Southeast Asian countries and contains historic research survey data that provide a measure of the status of coastal fish stocks, independent of commercial fishery data. This is valuable for establishing baselines for stock management and recovery. In 2003 the Center undertook targeted software upgrades to increase the power and utility of FiRST for current and future partner countries and also expand the coverage of the database. The Center and the World Bank have supported this work, as part of the Global Public Goods: Databases initiative. An important stage in the reprogramming was the workshop conducted with participants from ten partner countries. This workshop enabled partners to discuss their needs and uses for the FiRST software and database.
- WorldFish has pursued funding opportunities for the continuation of the work that was initiated in the "Sustainable management of coastal fish stocks in Asia project". Our partners requested that we seek further support for this work to ensure that the recommendations made during the first phase are implemented. A proposal was developed in collaboration with PRIAP for a regional project focusing on Southeast Asia and this was submitted to the Asian Development Bank.

Plans for 2004–2006:

- Assist national fisheries agencies to use stock assessments and indicators to identify the fishing capacity and effort that needs to be removed to restore the spawning biomass of important species to their potential, sustained levels of production.
- Initiate more comprehensive research on the stock delineation of valuable coral reef and inshore fish and invertebrates in Asia and the Pacific as the basis for co-operative, trans-boundary management.
- Form a network of all groups working on population genetics of coastal fisheries to co-ordinate the production of "resource maps" to aid co-operative management.
- Assist national fisheries agencies to understand all components of the production cycle of key species, including spawning areas, distribution of larval stages, water quality requirements, nursery habitats, migration patterns, and feeding grounds.
- Pursue collaborations with the "Census of Marine Life" initiative to further expand the FiRST database and develop ecosystem models that will assist countries to address the ecosystem level effects of fishing and move towards ecosystem level management.

Output 2: Options for increased, sustained and equitable harvests

Achievements in 2002–2003:

- Development of technology for restocking over-exploited coral reef invertebrates, to provide managers with a practical way of fast-tracking the recovery of spawning biomass, if necessary. In Vietnam, substantial progress has been made in methods for scaling up the production of juveniles in the nursery phase. Research to develop optimal strategies for releasing cultured juveniles in the wild in New Caledonia demonstrated that juveniles may have high initial survival and growth if the optimal habitats are identified. Further experiments showed how best to transport the juveniles to the release sites and that the time of releasing juveniles is not so important when the right habitat features of these sites are chosen. Juvenile sea cucumbers were grown successfully with young shrimp, providing hope for a potential co-culture in earthen ponds. Variability in results between sites in some cases shows that multiple protected areas need to be planned for restocking activities on a large scale. Work is ongoing to assess the status of multi-species fisheries of sea cucumbers and to advise provincial governments in New Caledonia of the fishing potential and suitable management.
- A keynote address on the research required to assess the potential for a restocking campaign to help restore the "Chambo" in Lake Malawi was presented at the national workshop on the restoration of the fishery.

Plans for 2004–2006:

- Publication of a major review of restocking and stock enhancement of marine invertebrates for "Advances in Marine Biology."
- Test which sizes of juvenile sea cucumbers are most cost-effective for restocking programs and at which densities these can be successfully released without adversely affecting survival.
- Assess in earthen ponds the potential for growing hatchery-produced sea cucumbers with large shrimp, as a way to reduce pond waste products and provide a by-crop for this aquaculture industry.
- Disseminate the methods for propagating and releasing sea cucumbers, and managing restocking programs, at the FAO Workshop on Advances in Sea Cucumber Aquaculture and Management in China in 2003.
- Assist selected countries in Southeast Asia to assess the potential for using restocking to fast-track the recovery of fisheries for sea cucumbers and transfer the technology where needed.

- Test the potential of marine protected areas (MPAs) as a fisheries management tool by: 1) developing a proposal for a large-scale test of the hypothesis in collaboration with the Government of Malaysia, and 2) assessing the time required for the re-establishment of adequate spawning biomass for a range of invertebrates following closure to fishing in the Arnavon Islands Marine Conservation Area, Solomon Islands.
- Identify any mismatches between the distribution of fishing effort for major coastal species, and the pattern of exploitation required to safeguard the production cycle and distribute the benefits equitably.
- Transfer the methods developed under the project on "Sustainable Management of Coastal Fish Stocks in Asia" to Oman to meet their request for assistance in management of coastal fisheries.

WORLDFISH CENTER THRUST 7(=MTP PROJECT 7)
Environmentally-friendly coastal aquaculture

Output 1: Sustained low-input production systems

Achievements for 2002–2003:

- Research in the Solomon Islands on capturing wild post-larval coral reef fish and invertebrates, and rearing them in captivity, continued to show much promise for the development of a viable artisanal fishery capable of meeting many of the demands of the marine aquarium industry in an environmentally-friendly way: many species have now been reared to market size within 4-6 weeks of capture and sites have been identified within the Solomon Islands for the transfer of technology to village communities.

Plans for 2004-2006:

- Produce a book on the "Status and Potential of Aquaculture in the Pacific".
- Secure funding to implement the Center's role as the provider of technology for the development of aquaculture in the Pacific.
- Identify the potential range of coastal aquaculture enterprises, and the factors that currently inhabit poorer communities from taking part.
- Assess the feasibility of farming herbivorous and omnivorous fish in coastal waters using feeds based on terrestrial crops. This strategic research is designed to reduce reliance on fish-meal-based feeds and reduce the environmental impacts of aquaculture by lowering nutrient loads.

WORLDFISH CENTER THRUST 8 (=MTP PROJECT 8)
Reversing degradation of coastal habitats

Output 1: Interventions to reduce damage to the coastal zone

Achievements in 2002-2003:

- The action phase of the International Coral Reef Action Network project to reverse the degradation of coral reefs established 17 "demonstration" sites, i.e., areas where coral reefs are being managed sustainably in a variety of ways. The good practices developed at these demonstration sites are being transferred to 14 "target" sites.
- The WorldFish Center is the executing agency for the preliminary Global Environmental Facility (GEF) proposal called–"Investigations of the Impacts of Localized Stress and Compounding Effects of Climate Change on the Sustainability of Coral Reef Ecosystems and the Implications for Management". This project is based on working groups to identify and implement research on major coral reef issues, particularly bleaching, connectivity, remediation, remote sensing, and disease. The full proposal will be submitted by the end of 2003.

- The Challenge Program pre-proposal called “Making the Most of the Coast” was rated as “meritorious” by the Interim Science Council. The Executive Council of the CGIAR has deferred a decision on how to develop this particular Challenge Program further until 2004.

Plans for 2004–2006:

- Assist in the preparation and implementation of the full proposal (if approved) for a Challenge Program on reversing habitat degradation and enhancing livelihoods in the coastal zone (“Making the Most of the Coast”), and contribute fisheries activities to the Challenge Program on Climate Change.
- Continue to support the work of the demonstration and target sites for the ICRAN project in east Africa, the Caribbean, Southeast Asia and the Pacific.
- Assist partners to execute and implement the full proposal for the GEF targeted research proposal on coral reefs and contribute to the working groups on coral bleaching, connectivity, and remediation of coral reefs.
- Enhance the coordination of coral reef monitoring activities and status reporting in Southeast Asia though the work of a newly appointed Regional GCRMN Coordinator at the WorldFish Center.

Output 2: Knowledge-bases for coastal habitats and options for management

Achievements in 2002–2003:

- The ReefBase website now includes substantial data on the resources, status, threats and management of coral reefs worldwide, together with an interactive mapping facility to display much of this information. This material includes the national status reports produced by the Global Coral Reef Monitoring Network for more than 50 countries and all of the information from the GCRMN status report for 2002. A comprehensive database on coral bleaching has been added to ReefBase that is now being used to develop joint products on thermal hotspots and coral bleaching with the US National Oceanographic and Atmospheric Administration. A new version of the website has been developed that provides greatly enhanced mapping interface and new user facilities.

Plans for 2004–2006:

- Expand and update its information on coral reef status, threats and management to include comprehensive and current information for all countries with reef resources, including quantitative data on coral cover, fish abundance from GCRMN monitoring programs.
- Create an online data access and summary analysis facility for all reef level data derived from the Global Coral Reef Monitoring Network.
- Work with national counterparts to create coral reef information systems for each country or region that incorporate links between detailed national data and the summary global information in ReefBase.
- Develop specialized themes for data acquisition and summary, including management of coral reef fisheries and aquaculture, coral bleaching, economic valuations, and MPA management.
- Develop focused theme pages on coral reef fisheries and socio-economic aspects of coral reefs.

POLICY RESEARCH AND IMPACT ASSESSMENT PROGRAM (POLICY PROGRAM)

WORLDFISH CENTER THRUST 9 (=MTP PROJECT 9)
Economic, policy, and social analysis and valuation of aquatic resources in developing countries

The goal of this thrust is to value aquatic resources so that these are effectively incorporated in development planning. This thrust focuses on policy institutions, values and markets of aquatic resources and products, and the socio-economic aspects of aquaculture and fisheries.

Output 1: Appropriate valuation methods of aquatic resources and their values for policy analysis

Achievements in 2002-2003:

- Estimation of coral reef values using meta-analysis, benefit transfer, and case studies have been conducted for Southeast Asia and the Caribbean.
- Economic valuation of inland fisheries conducted at Tonle Sap, Cambodia, completed.
- Methodologies and approach for eliciting economic values of aquatic resources and its contribution to livelihoods in selected areas of the Mekong River region adapted, designed and applied.
- Role of aquatic resources in rural livelihoods of selected areas of the Mekong River region documented.
- Work on economic valuation of wetlands and their resources in the Mekong River region has resulted in increased awareness among officials in multiple sectoral agencies in Cambodia, the Lao PDR, Thailand, and Vietnam.
- Work on aquatic resources valuation has provided inputs for implementation of national and regional programs of the ADB, DFID, MRC, and IUCN.

Plans for 2004-2006:

- Work on economic valuation and policy analysis in Southeast Asia, the Caribbean and meso-America, East Africa, and the South Pacific for sustainable management of coral reefs will be continued.
- Work on economic valuation of aquatic resources in selected areas of the Mekong River region will be continued.

Output 2: Models of small-scale fisheries for improved management

Achievements in 2002-2003:

- Collaborated with an international expert group on managing excess capacity in fisheries.
- Data on capacity of small-scale fisheries in Indonesia, Malaysia, the Philippines, and Thailand were collected.
- Reviewed and revised as appropriate the bioeconomic models for the analysis of fisheries capacity in Southeast Asia.

Plans for 2004–2006:

- Bio-economic models and analysis will be adapted and extended as appropriate to the Mekong River region, China and South Asia; strategies and options will be developed for managing capacity issues in those countries.
- A regional workshop will be organized to present the results of the bio-economic modeling exercise to policy-makers in 2005.

- Policy briefs and recommendations for technology adoption and optimal resource allocation in the milkfish industry in Indonesia and the Philippines will be published.

Output 3: Social, economic and policy implications of integrated agriculture-aquaculture technologies (jointly implemented by Policy and Freshwater Programs)

Achievements in 2002–2003:

- Studies to analyze the economics of existing and emerging integrated agriculture-aquaculture (IAA) technologies in Bangladesh and Malawi were initiated.
- Detailed analyses of the socio-economic profiles of various IAA technologies in Bangladesh were conducted and their roles in alleviating poverty and improving food security were assessed.
- Proposals on assessing the impacts of IAA technologies for selected countries in Africa and Asia were developed.

Plans for 2004–2006:

- Detailed studies on the socio-economics of IAA technologies in five countries of Africa (Cameroon, Egypt, and Malawi) and Asia (Bangladesh and Thailand) will be conducted, including: a) stakeholder analysis of user needs; b) economic analysis of alternative resource use options; c) analysis of factors affecting adoption and diffusion of various IAA technologies; and d) ex-ante analysis of potential adoption and impact of various pipeline IAA technologies.

Output 4: Disaggregated market models of fish and seafood products for developing improved policies on food security, poverty reduction, and livelihoods

Achievements in 2002-2003:

- The Center and the International Food Policy Research Institute (IFPRI), in collaboration with FAO, incorporated fish into the IMPACT global food model.
- The book entitled “Fish to 2020: Supply and Demand in a Changing World” was launched in November 2002, at the WorldFish Center, Penang, Malaysia. This book was jointly published by the Center and IFPRI.
- A detailed and disaggregated assessment of fish supply and demand in nine major fish producing and consuming countries of Asia (i.e., Bangladesh, China, India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand, and Vietnam) was made.
- The fish sector models for nine Asian countries were developed and projections made for the supply and demand for different fish species.
- Preliminary pro-poor aquaculture technologies, fishing practices and post-harvest technologies were identified and prioritized in nine Asian countries.
- Two special sessions on “Strategies and Options for Sustainable Aquaculture Development in Asia” in the World Aquaculture Society Conference during 23-27 April 2002, Beijing, China, and “Fish in Food Security and Income in Developing Countries: Role of Growing Aquaculture and Changing Trade Regime” in the International Institute of Fisheries Economics and Trade (IIFET) Conference during 19-22 August 2002, New Zealand, were organized.
- Work on assessing marketing opportunities, trade pattern, distributional channels, and post harvest operations for fish and fisheries products in the Tonle Sap Basin, Cambodia, was initiated.

Plans for 2004–2006:

- Assistance to nine Asian countries in developing country-specific action plans for poverty reduction among poor fish producers and consumers will be extended.
- Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poorer households in Asia will be recommended.
- New detailed studies on fish demand and supply in Africa and West Asia will be initiated and funding proposals for submission to a range of donors will be developed.

- The WorldFish Model will be developed by the end of the MTP, with incorporation of results of the disaggregated analysis of fish supply and demand in Africa and Asia.
- Assessment of marketing opportunities, trade patterns, distributional channels, and post-harvest operations for fish and fisheries products in Tonle Sap Basin, Cambodia, will be continued.A socio-economic database on world fisheries and aquaculture (WorldFish Statistics) will be developed.
- Maps of fish consumption by species group and income class will be generated.

WORLDFISH CENTER THRUST 10 (=MTP PROJECT 10)
Aquatic resources planning and impact assessment

This thrust focuses on the development and application of methodologies and frameworks for analyzing impacts of aquatic resource research.

Output 1: Methodology and operational guidelines for assessing the impact of aquatic resources research and development

Achievements in 2002–2003:

- A framework for assessing priorities of the WorldFish Center's research was developed.
- A framework for assessing the impact of IAA technologies was developed.

Plans for 2004–2006:

- Work on the development of appropriate methodology for assessing the impact of INRM research will be continued.
- Work on the development of an integrated framework for assessing economic and environmental impacts of aquatic resources research and development will be initiated.

Output 2: Impact assessment of aquatic resources research and development

Achievements in 2002–2003:

- A common research framework for monitoring and impact assessment of community-based fisheries management (CBFM) projects was agreed upon with partners.
- A common framework for participatory monitoring of aquatic resources use was implemented in Bangladesh and Vietnam.
- Training and technical support was provided to communities and partners on a fish sanctuary and conservation proposal in the Lao PDR and Vietnam.
- In Bangladesh, an impact survey for 15 sites (previous phase) was completed and a survey of 12 control sites (current phase) was conducted. A household census and baseline survey were completed for 125 water bodies and 17 control sites. In Vietnam, a household survey was conducted at the An Giang site.
- Baseline reports and formats for fisheries and household impact monitoring in Bangladesh and Vietnam were prepared.
- A project on the assessment of impacts of aquaculture production and marketing on livelihoods has been initiated in Bangladesh.
- A first-round survey of local community organization and institutional performance monitoring was conducted in Bangladesh.

Plans for 2004–2006:

- Impacts of community-based fisheries management in Bangladesh and the Mekong River region will be evaluated in terms of household assets and access to resources, fish catches and fish consumption, income-expenditure patterns, and institutional performance.

- A system for ex-post impact assessment with external auditing inputs will be developed and used in Bangladesh and Malawi.
- The potential impact of carp genetic research in Asia will be assessed.
- The impacts of integrated agriculture-aquaculture research in selected countries of Africa and Asia (i.e., Bangladesh, Malawi and Cameroon) will be analyzed.
- The impact of aquaculture production and marketing on livelihoods will be assessed in selected Asian countries.

WORLDFISH CENTER THRUST 11 (=MTP PROJECT 11)
Legal and institutional analysis for aquatic resources management

This thrust focuses on the analysis of the institutions for improved governance of aquatic resources. Participatory action research is used to improve planning for management of aquatic resources at local and national levels.

Output 1: Methods and framework for participatory, action-oriented research on governance of aquatic resources

Achievements in 2002–2003:

- Policy processes and mechanisms for incorporating economic values identified and assessed in selected areas of the Mekong River region.
- Focus group workshops and key informants interviews on the contribution of aquatic resources and constraints to access of resources by poor stakeholders in selected areas of the Mekong River region undertaken.
- An international training course on co-management was provided to participants from Africa and Asia.
- A manual for coastal managers for participatory monitoring of coastal environments was developed and published.
- An international workshop to present the results of the research on co-management will be held at the end of 2003.
- Capacity building on policy dialogue and co-management of fisheries provided to the staff of the Inland Fisheries Development Institute (IFREDI) of Cambodia.
- The CAPRi working paper on consensus building methods was published.
- Over 90 water body management committees were established in Bangladesh.

Plans for 2004-2006:

- Mechanisms for incorporating economic values into policy processes will be continued.
- Incorporation of economic values into community participatory plans will be initiated and implemented.
- Further examination of policy uptake processes in the greater Mekong River region will be undertaken.
- Empowerment and scale issues in co-management will be examined in the Mekong and Southern African regions.

Output 2: Policies and institutional arrangements for governance of aquatic resources

Achievements in 2002-2003:

- Case studies on co-management and role of traditional authorities were completed in Malawi, Mozambique, and Zambia.
- Studies on compliance with regulations and impact of co-management on compliance completed in Indonesia, the Philippines, and Thailand.
- Transaction costs of floodplain management institutions in Bangladesh were studied and documented.

- Work on conflicts in fisheries and security issues started with the funding of two new projects.
- The institutional arrangements for governing wetlands in Cambodia, the Lao PDR, Thailand, and Vietnam were examined and working groups formed to collect information on wetlands. Each of the country working groups is producing synthesis reports. A regional workshop will provide a basis for comparing experience and drawing up policy conclusions.
- The study on policy process in inland fisheries of Bangladesh was completed.
- Paper on lessons from CBFM in Bangladesh was accepted for publication.

Plans for 2004-2006:

- A paper on governance of aquatic resources based on a decade of research experience from the WorldFish Center's research is being developed for publication.
- Lessons from the worldwide study on co-management will be published during this period based on the outcomes of the international workshop planned for the end of 2003.
- Uptake strategies for conflict management in the fisheries of Bangladesh, Cambodia, and India are to be tested and good practice guidelines for managing conflict and policy briefings to be produced and promoted in partner countries and disseminated internationally.
- Regional security aspects of fisheries conflicts and capacity reduction approaches to be examined in Cambodia, the Philippines, and Thailand.

OFFICE OF THE ASSISTANT DIRECTOR GENERAL-INTERNATIONAL RELATIONS AND PARTNERSHIPS

The Office of the Assistant Director General-International Relations and Partnerships is responsible for planning and management of international and country program relations and developing new and strengthening existing partnerships to improve the relevance, efficiency and effectiveness of the WorldFish Center's programs. The Office also leads the planning, management and further development of the Center's training policies and needs-based training programs.

The main thrust of the Office is improved partnerships and capacity building among developing country institutions.

WORLDFISH CENTER THRUST 12 (=MTP Project 12)
Improved partnerships and capacity building among developing country NARS

Output 1: Identification of national research priorities and development/strengthening of research partnerships and networks

Achievements in 2002-2003:

- New collaborations and strengthened research partnerships were developed with national institutions in Bangladesh, Cambodia, China, Indonesia, Malaysia, and the Philippines, and with regional and international organizations. Workshops were held in Bangladesh, Malaysia, and the Philippines to identify national research priorities.
- The 3rd Group of Fisheries and Aquatic Research (GoFAR) meeting was held in conjunction with the *Fish for All* Summit, November 2002.
- The proceedings of the "Expert Consultation on Biosafety and Environmental Impact of Genetic Enhancement and Introduction of Improved Strains/Alien Species in Africa" were published and widely disseminated to policy-makers and planners, and scientists.
- A framework for ecological risk assessment and guidelines for environmentally safe dissemination of improved fish breeds was developed.

- The 7th INGA Steering Committee meeting of INGA and Expert Consultation on "Ecological Risk Assessment of Genetically Improved Breeds" was organized.
- Issues and constraints were identified and recommendations were formulated for the maintenance and dissemination of improved fish breeds in member countries of INGA and countries have also been assisted in the development of national plans for the dissemination of improved fish breeds.
- Transfers of fish germplasm for direct use in aquaculture or utilization in breeding programs were coordinated.
- Enhancement of synergy between genetic research is being undertaken at advanced scientific institutions and developing country institutions.
- Scientists from 13 member countries of INGA attended the third course on quantitative genetics and breeding, and cross-country visits of scientists were organized.
- Data and information were collected on effects of evolving public-private partnerships on research and developmental activities in tilapia genetics and delivery of tilapia genetic research outputs to end-users.
- Recommendations for better linkages between private and public sectors in dissemination of genetic research outputs to end-users were formulated.
- A revised version of the Partners' database was established.

Plans for 2004-2006:

- During this period, the program will continue to forge new partnerships and further strengthen existing partnerships and networks. Regular meetings with national institutions and other stakeholders will be conducted in various countries and regions to assist them in research prioritization and identification of research areas for collaboration. The program will also organize the Asia-Pacific Group of Fisheries and Aquatic Research (GoFAR) meetings, Steering Committee Meetings of INGA, and training workshops for partner capacity enhancement. It will also continue to provide assistance in the implementation of national fish breeding programs and in the development and implementation of national plans and strategies for the management and dissemination of improved fish breeds.

Output 2: Enhancement of knowledge and research capabilities of national scientists and institutions

Achievements in 2002-2003:

- A strategy for the World Fish Center training program to enhance the research capabilities of developing country fisheries scientists and institutions was formulated and implemented.
- With members of the Task Force, guidelines, procedures for selection, and appointments of Visiting Scientists, Post-doctoral fellows, Ph.D. scholars and Research Interns at WorldFish Center were developed.
- Needs-based curricula for coastal zone management training programs were implemented in Indonesia and Vietnam.
- There was a systematic evaluation of the training courses (delivery and impact) on coastal zone management from which validated recommendations were consequently incorporated.
- A comprehensive, new database on training programs undertaken by the Center and partners was developed.

Plans for 2004-2006:

- During the MTP period, the World Fish Center will endeavor to achieve the national capacity development goals through implementation of short training programs on the topics that are within the areas of specialization of the Center. Using the guidelines and procedures developed by the Task Force, qualified NARS scientists and experts, M.Sc. and Ph.D. students and post-doctoral fellows will be given the opportunity to work with

WorldFish scientists in specialized areas and contribute to the Center's research programs through research internships for a specific period. These efforts will be complemented by other activities of the new training unit that include the establishment of a training database and archiving of training materials.

- Establishment and operationalization of the Southeast Asian Regional Training Center for Integrated Coastal Zone Management in the Philippines. The Center will build on the experience gained from previous training projects and strengthen the existing links with the UNDP Sea Coast Training Program. This center would service a diverse range of training needs relating to coastal zone management and coordinate the ICRAN coral reef training activities.

ICLARM Thrust13 (=MTP Project 13)
Access to information for the sustainable development of fisheries and aquatic resources

Output 1: Sharing information and knowledge, communicating outcomes and positioning research for the sustainable development of fisheries and aquatic resources

Achievements in 2002-2003:

- The new name and logo for the Center was launched. Wide communication of the changes was conducted and the corporate imagery developed, along with new corporate materials.
- Significant media coverage was achieved for the Center in Malaysia (over 18 reports) and internationally (over 42 reports).
- Participation in many displays - 4 in Malaysia and 8 internationally through the CGIAR system-wide activities.
- Participated heavily in the *Fish for All* initiative including developing the brand, creating a new website, assisting the launch of the initiative, achieving significant national and international media coverage, and developing a communications concept paper called "Fish Unlimited".
- Published 16 WorldFish publications and cleared 15 articles for submission externally.
- Continued making developments towards an e-library.

Plans for 2004-2006:

- The Center will continue to improve its information services for partners and stakeholders as well as its own staff around the world. Cooperation and resource sharing with other information providers worldwide will broaden and deepen the availability and range of information resources. Strategies to provide access to information through web-based technologies will increasingly enable users to retrieve information at their desktops. Information and communications will increasingly be tailored and delivered to meet their specific needs.
- The Center will continue to provide the support role for the *Fish for All* initiative.

Revisions from the MPT 2003-2005

Minor Revisions to the Thrusts and Outputs
As a result of further planning within the Coastal and Marine Resources Research Program, there have been some minor changes to the Thrusts and Outputs in the MTP for 2004. There has been no change in the total number of Thrusts and Outputs, simply some reallocated outputs and activities to achieve a better logic for the Thrusts, which have been renamed to better reflect the integrity and logic of each thrust within the goals of the program (see table below for details). These changes indicate the increased effort being made to assist nations to restore capture fisheries following WSSD. They also separate the work that we are leading on restocking coastal fisheries (now included in Thrust 6 Output 2) from the development of environmentally-friendly aquaculture (now a Thrust in its own right). To reflect the fact that the work the Center is doing on training in coastal zone management has now been included under Thrust 12 (Improved partnerships and capacity building among developing country NARS), there is Output 2 (Enhancement of knowledge and research capabilities of national scientists and institutions).

2003		**2004**	
Thrust 6	Increased and sustained coastal fisheries production	**Thrust 6**	Restoration of capture fisheries
O1	Guidelines for sustained, equitable harvests of wild stocks	O1	*Better information on distribution, status and potential production of coastal stocks*
O2	Aquaculture-based technology to increase the productivity of coastal fisheries	O2	*Options for increased, sustained and equitable harvests*
Thrust 7	Restoration and protection of coastal habitats	**Thrust 7**	Environmentally-friendly coastal aquaculture
O1	Interventions to reduce damage to the coastal zone	O1	*Sustained low-input production systems*
Thrust 8	Knowledge-bases and training for improved management of coastal resources	**Thrust 8**	Reversing degradation of coastal habitats
O1	Knowledge-bases for coastal resources, technology to improve production, and options for management	O1	*Interventions to reduce damage to the coastal zone*
O2	Training materials to improve capacity for assessment of fisheries and habitats and decision analysis	O2	*Knowledge-bases for coastal habitats and options for management*

Section B Financing the Agenda

7. FINANCING THE AGENDA

7.1 2002 Results and 2003 Development

The 2002 expenditure level was US$ 13.03 million of gross expenditures and US$ 12.28 million net of recovery of indirect cost. About 87% of 2002 resources were utilized for programmatic activities. The WorldFish Center (ICLARM) ended the year with a surplus of US$ 0.32 million.

The 2002 grant income from donors amounted to US$ 12.50 million in addition to US$ 0.11 million of earned income. The reduction in Center income is due to the decline in international interest rates. Recovery of indirect costs from restricted projects amounted to US$ 0.75million.

Grant income for 2003 is projected at US$ 17.44 million in addition to US$ 0.10 million in earned income. The earned income is projected to decline sharply due to the decline in global interest rates.

The 2003 expenditures are estimated at US$ 17.42 million compared to actual spending of US$ 12.28 million for 2002. The increase is mostly in project funding. More projects were generated in 2003. The Center is expected to end the year with a slight surplus.

Resource allocation to programs for 2003 is projected to be around 78% of the total resource available:

Table VI: Comparison of 2002* performance and 2003 current estimate

	2002 Actual* (US$ million)	2003 Estimate (US$ million)
Sources of Funds		
Donor Funding	12.50	17.44
Earned Income	0.11	0.10
Total	**12.61**	**17.54**
Application of Funds		
Programmatic	10.65	15.80
Management and General Expenses	2.24	2.34
Depreciation	0.14	0.29
Less: Overhead Recoveries	(0.75)	(1.01)
Net Expenditures	**12.28**	**17.42**
Unexpended Balance	**0.33**	**0.12**

* Targeted project funding which follows the matching principle was underspent by approximately US$ 2.88 million in 2002. Actual targeted grant income for the year (2002) was substantially higher.

The 2002 spending and 2003 current planned resource allocation by CGIAR activity are summarized below:

Table VII: Actual and planned resources allocation by CGIAR activity for 2002 and 2003

	US$ (million)		
	2002 Actual	2003	
		Estimate	%
Increasing Productivity	2.20	2.84	16
Protecting the Environment	5.08	6.32	36
Saving Biodiversity	0.09	0.10	1
Improving Policies	3.46	6.26	36
Strengthening NARS	1.45	1.90	11
Total	12.28	17.42	100

For the 2003 resources, 36% are allocated to protecting the environment, 36% to improving policies, 16 % to increasing productivity and 11% to strengthening NARS. These allocations are consistent with the Center's long-term strategic direction.

Table VIII: Allocation of resources by outputs (Logical Framework Format) US$ (million)

	US$ (million)		
	2002 Actual	2003	
		Estimate	%
Germplasm Improvement	0.56	0.69	4
Germplasm Collection	0.09	0.10	1
Sustainable Production	6.72	8.47	48
Policy	3.46	6.26	36
Enhancing NARS	1.45	1.90	11
Total	12.28	17.42	100

7.1.1 Funding Trends

With continued efforts in fund raising and the harnessing of greater public awareness on the importance of aquatic resources management amongst its community of donors and partners, the Center has consistently increased its share of resources within the CGIAR System since 1993. Funding has increased, in nominal terms, from US$ 9.60 million in 1996 to US$ 17.44 million in 2003 (expected), an increase during the period of over 80 %.

In line with the revised fund raising strategy, sharper research focus, the establishment of the Regional Center for Africa and West Asia as well as the establishment of state of the art headquarters research facilities in Penang, Malaysia, the Center expects a reasonable steady growth in funding beyond the year 2004.

7.1.2 Inflation and Exchange Rates

The RM (Malaysian Ringgit) is presently fixed at the exchange rate of RM 3.80 to one US$. There is no indication that the RM will be liberalized in the near future. If the RM is liberalized its impact on the budget will be assessed.

Actual inflation in 2002 was around 2.8% and is forecasted to be between 2.5-3.0% in 2003-2004. The Center will monitor actual inflation in 2003 and assess its impact on the purchasing power of the budget.

Inflation on the US$ expenditures is expected to be around 1.5-3% for 2003-2004.

7.1.3 Depreciation of Fixed Assets

The actual depreciation of existing WorldFish Center fixed assets for 2002 was US$ 0.14 million as against US$ 0.09 million in 2001. Most of the Center assets were recently purchased, and no investments were made in large equipment items except those for the laboratories. The value of buildings and other immovable assets are recorded (memo entry) and monitored separately.

7.1.4 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 2002 was US$ 1.99 million, appropriated by the Board of Trustee for fixed assets renewal.

7.1.5 Capital Investments

The Malaysian Government has made available to the WorldFish Center on a long-term (60 years) nominal lease 5.2 ha of land with buildings on the land. The renovation of these buildings to international standards was completed in May 2001 and the move to the new headquarters was made in June 2001. The cost of renovation and setting up of the facility including office furniture and equipment amounted to US$ 3.80 million, listed down as follows:

	US$ (M)
Building renovation	2.64
Project management	0.24
Equipment and furniture	0.49
Other capital needs	0.43
Total	3.80

The renovation cost was spread over two years 2000 and 2001. The investment in immovable assets is kept as memo entry in the books for control purposes.

7.1.6 Working Capital (Days)

The working capital as of 31 December 2002 can support operations for 272 days compared to CGIAR norm of 120 days of operations.

7.1.7 Liquidity

The Center's liquidity continues to improve.

Table IX: Liquidity ratio analysis

	2001	2002	2003 Projected
Current Ratio (times)	2.13	2.08	2.32
Quick Ratio (times)	2.13	2.08	2.32
Cash to current assets (%)	51	53	56
Cash to Current Liabilities (%)	109	110	132

The Center is continuing its efforts to improve its liquidity position to absorb minor unexpected shocks and possible cash shortages. The Center is focusing attention on refining the cash flow by programming operating and capital expenditures to improve overall liquidity and spending patterns.

7.1.8 **Equity:** Longer term management of resources

Minimum equity (net assets less fixed assets) of 25% to cover three months of operations is required for research operations as determined by the CGIAR. The Center Equity for 2002 was at 70% or 8.4 months of operations compared to System proposed standard of 25% or 3 months of operations.

7.2 2004 - 2006 PLANS

7.2.1 Funding Requirements and Financing Plans

The funding level for the first year of the MTP 2004 – 2006 was based on a carefully projected core and project funding. In 2003 the level of funding is slightly higher due to the inclusion of carry over project unexpended funds from 2002.

The expected level of donor funding for 2003 is projected at US$ 17.44 million million, in addition to earned income of US$ 0.10 million and indirect cost recoveries from restricted projects of US$ 1.0 million. The Center's projected operating levels (net of indirect cost recoveries) for 2003 to 2006 are:

Table X: ICLARM – The WorldFish Center Operating Levels

	US$ (million)			
	2003	2004	2005	2006
Projected Donor Funding	17.44	15.41	15.88	16.35

A combined growth and inflation rate of 3.00 % was incorporated into the plans for the years 2005 and 2006 which is a conservative growth rate considering the Center's historical annual funding increase since 1992.

Earned income: Earned income is expected to be at the level of US$ 0.10 million for the duration of the plan. The decrease is due to the sharp drop in global interest rates. Improvements in interest rates are not expected to come soon.

Indirect Cost Recovery: Most donors are resistant to meeting real costs (full cost of operations-direct and indirect) of projects. Indirect cost recovery is a critical component for financing the Center's non-research activities and operations that are essential and critical support services to research. The Center has embarked on a full cost recovery system similar to the private sector which will be tested by the end of 2003. The Center's indirect cost recovery is expected to be around US$ 1.01 million for 2003. This is a marked improvement over previous years but indirect cost recovery is still well below the full costs of targeted research projects.

7.2.2 Operating Budget 2004-2006

The research activities and allocation of resources were determined by an in depth review of World Fish Center programs and research projects at special program retreats, and a Center-wide review by Board and management was conducted. The five programs were allocated over 85% of total resources consistent with the Center's priorities and strategies. The allocation of funds to the projects, sources of funding, and linkage with the CGIAR research agenda within the newly adopted log frame are reflected in the main budget tables.

Allocation of resources by object of expenditures (cost structure): The WorldFish Center carefully monitors the cost structure of operations to ensure that fixed costs are kept within a reasonable proportion of the annual budget. Approximately 39-46% of the resources are allocated to personnel costs for the years 2003-2006 (Budget Table 6).

Allocation of resources by CGIAR undertaking: The allocation of resources to CGIAR undertakings is in accordance with the Center's research directions and consistent with CGIAR strategies and priorities (Budget Table 2).

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 (Budget Table 5).

Personnel input: Center-hired Internationally Recruited staff (IRS) level is estimated at around 38 positions including post-doctoral fellows and visiting scientists.

Additional positions are planned subject to funding availability in 2004 and beyond (Budget Table 9).

Regionally Recruited Staff (RRS) level is approximately 13 positions. The RRS represents the Philippine senior national staff relocated to the new Penang headquarters in February 2000 and few other positions at other regional research sites.

Nationally Recruited Staff (NRS) overall level will reach in 2004 around 251 for all Center sites.

7.2.3 Capital Budget

The major capital requirements have been met. These include the renovation of the headquarters in Penang which was completed with office furniture and equipment at a cost of US$ 3.80 million. A fish tank research facility is now linked to the research laboratories at the headquarters and was completed in 2002. An expansion of the conference and meeting facilities is underway and will be completed in 2003, this is required for the increased meetings and workshops with national system scientists and partner institutions. The Center will be budgeting modest amounts for laboratory and research equipment purchases as follows.

Table XI: ICLARM- The WorldFish Center capital requirements 2004 – 2006, US$ (million)

	2004	2005	2006
Capital Needs (US$ K)	200	225	250

7.2.4 Financial Ratios

Management has been putting special efforts into improving and sustaining the liquidity position of the Center. The liquidity position of The WorldFish Center has been improving over the years as discussed earlier.

7.2.5 Inflation and Exchange Rates

Combined annual weighted inflation in developed countries is projected to be around 2.5-3.5% while local inflation is estimated to fluctuate between 2.5-3.0% –during the plan period. The Malaysian Ringgit (RM) is fixed at the rate of RM 3.80 for one US$. There are no indications that the RM will be liberalized in the near future. 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 had slightly declined against major currencies, which has resulted in a positive impact on non-US dollar denominated contributions for 2003 (to July 2003).

7.2.6 Financing Plan 2004

The confirmed and high probability funding for financing the Center operations in 2004 amounts to US$ 15.41 million. Included in this amount is US$ 1.0 million from the World Bank.

The projected unrestricted funding amounts to US$5.63million and restricted/project funding is projected at the level of US$ 9.78 million. Unrestricted funding of the Center has declined in 2003 to around 32% of total funding which is affecting the Center operating flexibility.

The Center earned income is projected at US$ 0.10 million, substantially lower than previous years due to the sharp drop in the global interest rates.

Table 7a provides details of the funding and donor support for 2004 agenda.

Financing of 2004 Plan

	US$ (M)	**%**
Unrestricted support	5.63	37
Targeted /restricted Funding	9.78	63
Subtotal	15.41	100
Center earned income	0.10	1
Total revenue	15.51	101
Surplus in operations	(0.10)	(1)
Expenditure in 2004	**15.41**	**100**

7.2.7 Summary of Financing Plan

The resource requirements over the plan period are based on the 2003 Budget level and the best estimate of resources for 2004 which is the basis for this plan period. The plan is increased by a combined annual growth and inflation rate of 3.0% for years 2005 and 2006.

Financial Tables for 2004-2006

Table 1. WORLDFISH CENTER - 2004 RESEARCH AGENDA REQUIREMENTS BY CGIAR OUTPUT

(expenditure in US $ million)

	MTP Projects	Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS	PROJECT TOTALS
001.	Conservation of Aquatic Biodiversity			0.91	0.13	0.18	**1.22**
002.	Mitigation Against Adverse Impact of Alien Species on Aquatic Biodiversity			0.16	0.02	0.03	**0.21**
003.	Genetic Improvement and Breeding	0.85	0.05			0.16	**1.06**
004.	Strategies and Options for Realizing Gains from Sustainable Freshwater Aquaculture Systems			3.46			**3.46**
005.	Freshwater Fisheries in an Integrated Land and Water Management Context			1.51			**1.51**
006.	Increased and Sustained Coastal Fisheries Production			1.31			**1.31**
007.	Restoration and Protection of Coastal Habitats	0.03	0.02	0.25			**0.30**
008.	Knowledge Bases and Training for Improved Management of Coastal Resources		0.05	0.87		0.10	**1.02**
009.	Economic, Policy and Social Analysis and Valuation of Aquatic Resources in Developing Countries				0.94		**0.94**
010.	Aquatic Resources Planning and Impact Assessment				0.48		**0.48**
011.	Legal and Institutional Analysis for Aquatic Resources Management				2.66		**2.66**
012.	Improved Partnerships and Capacity Building Among Developing Country NARS	0.07				0.59	**0.66**
013.	Access to Information for Sustainable Development of Fisheries and Aquatic Resources	0.06				0.52	**0.58**
	OUTPUT TOTALS	**1.01**	**0.12**	**8.47**	**4.23**	**1.58**	**15.41**

Table 2. WORLDFISH CENTER RESEARCH AGENDA - ALLOCATION OF RESOURCES, 2002 to 2006
(expenditure in US $ million)

Allocation of Resources by Outputs
Logical Framework Format

Outputs:	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
Germplasm Improvement *(Activity: Germplasm Enhancement & Breeding, plus Networks as appropriate)*	**0.56**	**0.69**	**1.01**	**1.04**	**1.06**
Germplasm Collection *(Activity: Saving Biodiversity, plus Networks as appropriate)*	**0.09**	**0.10**	**0.12**	**0.11**	**0.12**
Sustainable Production *(Activity: Production Systems Dev & Mgmt, Protecting the Environment, plus Networks as appropriate)*	**6.72**	**8.47**	**8.47**	**8.72**	**8.99**
Policy *(Activity: Improving Policies, plus Networks as appropriate)*	**3.46**	**6.26**	**4.23**	**4.36**	**4.48**
Enhancing NARS *(Activity: Strengthening NARS - the three sub-activities, plus Networks as appropriate)*	**1.45**	**1.90**	**1.58**	**1.65**	**1.70**
TOTAL	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Allocation of Resources by CGIAR Activity

	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
Increasing Productivity	**2.20**	**2.84**	**3.13**	**3.22**	**3.32**
of which:					
Germplasm Enhancement & Breeding	0.56	0.69	1.01	1.04	1.06
Production Systems Development & Management	1.64	2.15	2.12	2.18	2.26
Protecting the Environment	**5.08**	**6.32**	**6.35**	**6.54**	**6.73**
Saving Biodiversity	**0.09**	**0.10**	**0.12**	**0.12**	**0.12**
Improving Policies	**3.46**	**6.26**	**4.23**	**4.36**	**4.48**
Strengthening NARS	**1.45**	**1.90**	**1.58**	**1.64**	**1.70**
of which:					
Training and Professional Development	0.41	0.48	0.44	0.47	0.49
Documentation, Publications, Info. Dissemination	0.55	0.76	0.56	0.58	0.59
Organization & Management Counselling					
Networks	0.49	0.66	0.58	0.59	0.62
TOTAL	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Table 3. WORLDFISH CENTER RESEARCH AGENDA PROJECT & OUTPUT COST SUMMARY, 2002 to 2006
(in US $ million)

		2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
001.	Conservation of Aquatic Biodiversity	1.22	0.98	1.22	1.26	1.30
002.	Mitigation Against Adverse Impact of Alien Species on Aquatic Biodiversity	0.23	0.26	0.21	0.21	0.22
003.	Genetic Improvement and Breeding	0.50	0.58	1.06	1.09	1.12
004.	Strategies and Options for Realizing Gains from Sustainable Freshwater	2.62	3.89	3.46	3.57	3.67
	Aquaculture Systems					
005.	Freshwater Fisheries in an Integrated Land and Water Management Context	0.48	0.60	1.51	1.55	1.60
006.	Increased and Sustained Coastal Fisheries Production	1.61	1.80	1.31	1.35	1.39
007.	Restoration and Protection of Coastal Habitats	0.38	0.61	0.30	0.31	0.32
008.	Knowledge Bases and Training for Improved Management of Coastal Resources	0.70	0.88	1.02	1.05	1.08
009.	Economic, Policy and Social Analysis and Valuation of Aquatic Resources in	0.87	1.21	0.94	0.97	0.99
	Developing Countries					
010.	Aquatic Resources Planning and Impact Assessment	0.54	1.46	0.48	0.50	0.51
011.	Legal and Institutional Analysis for Aquatic Resources Management	1.91	3.46	2.66	2.74	2.83
012.	Improved Partnerships and Capacity Building Among Developing Country NARS	0.64	1.15	0.66	0.68	0.70
013.	Access to Information for Sustainable Development of Fisheries and Aquatic	0.58	0.54	0.58	0.60	0.62
	Resources					
	Total	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Summary by CGIAR Output:

	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
Germplasm Improvement	**0.56**	**0.69**	**1.01**	**1.04**	**1.06**
Germplasm Collection	**0.09**	**0.10**	**0.12**	**0.11**	**0.12**
Sustainable Production	**6.72**	**8.47**	**8.47**	**8.72**	**8.99**
Policy	**3.46**	**6.26**	**4.23**	**4.36**	**4.48**
Enhancing NARS	**1.45**	**1.90**	**1.58**	**1.65**	**1.70**
Total	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Institutional Cost Components:

	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
Direct Project Costs	**13.03**	**18.43**	**16.21**	**16.70**	**17.20**
Indirect Project Costs (Overhead)	**(0.75)**	**(1.01)**	**(0.80)**	**(0.82)**	**(0.85)**
Total Project Costs					
Total	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Table 4. WORLDFISH CENTER ALLOCATION OF PROJECT COSTS TO CGIAR ACTIVITIES, 2002 TO 2006

(in US $ million)

Project	Activity	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
	Enhancement & Breeding (crops, etc)					
	Production Systems (crops, etc)					
	Protecting the Environment					
001. Conservation of Aquatic Biodiversity	Production Systems	0.25	0.19	0.24	0.25	0.26
	Improving Policies					
	Protecting the Environment	0.67	0.54	0.67	0.69	0.71
	Improving Policies	0.12	0.10	0.13	0.13	0.13
	Strengthening NARS-Training	0.18	0.15	0.18	0.19	0.20
		1.22	**0.98**	**1.22**	**1.26**	**1.30**
002. Mitigation Against Adverse Impact of Alien Species on Aquatic Biodiversity	Production Systems	0.05	0.05	0.04	0.04	0.05
	Protecting the Environment	0.13	0.14	0.12	0.12	0.12
	Improving Policies	0.02	0.03	0.02	0.02	0.02
	Strengthening NARS-Training	0.03	0.04	0.03	0.03	0.03
		0.23	**0.26**	**0.21**	**0.21**	**0.22**
003. Genetic Improvement and Breeding	Enhancement & Breeding	0.40	0.46	0.85	0.87	0.90
	Saving Biodiversity	0.03	0.03	0.05	0.06	0.05
	Strengthening NARS-Networks	0.07	0.09	0.16	0.16	0.17
		0.50	**0.58**	**1.06**	**1.09**	**1.12**
004. Strategies and Options for Realizing Gains from Sustainable Freshwater Aquaculture Systems	Production Systems	0.79	1.17	1.04	1.07	1.10
	Protecting the Environment	1.83	2.72	2.42	2.50	2.57
		2.62	**3.89**	**3.46**	**3.57**	**3.67**
005. Freshwater Fisheries in and Integrated Land and Water Management Context	Production Systems	0.14	0.18	0.45	0.47	0.48
	Protecting the Environment	0.34	0.42	1.06	1.09	1.12
	Total	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Summary by Undertaking:

	2002 (actual)	2003 (actual)	2004 (proposal)	2005 (plan)	2006 (plan)
Increasing Productivity	**2.20**	**2.84**	**3.13**	**3.22**	**3.32**
Protecting the Environment	**5.08**	**6.32**	**6.35**	**6.54**	**6.73**
Saving Biodiversity	**0.09**	**0.10**	**0.12**	**0.12**	**0.12**
Improving Policies	**3.46**	**6.26**	**4.23**	**4.36**	**4.48**
Strengthening NARS	**1.45**	**1.90**	**1.58**	**1.64**	**1.70**
Total	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Summary by Output:

	2002 (actual)	2003 (actual)	2004 (proposal)	2005 (plan)	2006 (plan)
Germplasm Improvement	**0.56**	**0.69**	**1.01**	**1.04**	**1.06**
Germplasm Collection	**0.09**	**0.10**	**0.12**	**0.11**	**0.12**
Sustainable Production	**6.72**	**8.47**	**8.47**	**8.72**	**8.99**
Policy	**3.46**	**6.26**	**4.23**	**4.36**	**4.48**
Enhancing NARS	**1.45**	**1.90**	**1.58**	**1.65**	**1.70**
Total	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Table 5. WORLDFISH CENTER RESEARCH AGENDA, 2002 to 2006

Investments by Sector, Commodity, and Region (in US $ million)

PRODUCTION SECTORS & COMMODITIES	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
1/ ***Germplasm Improvement***					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	0.56	0.69	1.01	1.04	1.06
TOTAL	**0.56**	**0.69**	**1.01**	**1.04**	**1.06**
2/ ***Sustaianble Production***					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	6.72	8.47	8.47	8.72	8.99
TOTAL	**6.72**	**8.47**	**8.47**	**8.72**	**8.99**
3/ ***Total Research Agenda***					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	12.28	17.42	15.41	15.88	16.35
TOTAL	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

REGION	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
Sub-Saharan Africa (SSA)	**3.68**	**5.23**	**4.62**	**4.76**	**4.90**
Asia	**7.12**	**10.10**	**8.94**	**9.21**	**9.48**
Latin American and the Caribbean (LAC)	**0.50**	**0.70**	**0.62**	**0.64**	**0.65**
West Asia and North Africa (WANA)	**0.98**	**1.39**	**1.23**	**1.27**	**1.32**
TOTAL	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**

Table 6. WORLDFISH CENTER RESEARCH AGENDA, 2002 - 2006

Expenditure by Object of Expenditures, Capital Investments and Capital Fund (in US $ million)

OBJECT OF EXPENDITURE	2002 (actual)	2003 (estimate)	2004 (proposal)	2005 (plan)	2006 (plan)
Personnel	5.25	6.77	7.13	7.34	7.56
Supplies and Services	5.88	9.44	6.63	6.83	7.03
Operational Travel	1.01	0.92	1.36	1.41	1.45
Depreciation	0.14	0.29	0.29	0.30	0.31
TOTAL	**12.28**	**17.42**	**15.41**	**15.88**	**16.35**
CAPITAL INVESTMENTS	**2002 (actual)**	**2003 (estimate)**	**2004 (proposal)**	**2005 (plan)**	**2006 (plan)**
Physical Facilities					
Research					
Training					
Administration					
Housing					
Auxiliary Units					
sub-total	**0.22**	**0.22**	**0.20**	**0.23**	**0.25**
Infrastructure & Leasehold					
Furnishing & Equipment					
Farming					
Laboratory & Scientific					
Office					
Housing					
Auxiliary Units					
Computers					
Vehicles					
Aircraft					
sub-total					
TOTAL	**0.22**	**0.22**	**0.20**	**0.23**	**0.25**
CAPITAL FUND CASH RECONCILIATION*	**2002 (actual)**	**2003 (estimate)**	**2004 (proposal)**	**2005 (plan)**	**2006 (plan)**
Balance, January 1	1.30	1.43	1.50	1.59	1.66
plus: annual depreciation charge	0.29	0.29	0.29	0.30	0.31
plus / minus: disposal gains/(losses)**					
plus / minus: other					
minus: asset acquisition costs	(0.16)	(0.22)	(0.20)	(0.23)	(0.25)
equals: Balance, December 31	**1.43**	**1.50**	**1.59**	**1.66**	**1.72**

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

** Net of depreciation

September, 2002

Table 7. WORLDFISH CENTER RESEARCH AGENDA FINANCING SUMMARY, 2002- 2003

(in US $ million)

Member	2002 (actual)		2003 (est)	
Unrestricted Contributions	(US$)	(national currency)	(US$)	(national currency)
Australia	0.21	A$0.40	0.24	A$0.45
Belgium	0.09	EURO0.09	0.10	EURO0.09
Canada	0.22	C$0.34	0.46	C$0.63
China	0.01	US$0.01	0.01	US$0.01
Denmark	0.52	DKK4.00	0.46	DKK3.00
Egypt	0.30	US$0.30	0.30	US$0.30
European Union	0.97	EURO0.93		
BMZ, Germany	0.23	EURO0.24	0.27	EURO0.24
India	0.04	US$0.04	0.04	US$0.04
Japan	0.25	YEN31.0	0.26	YEN31.0
Netherlands	0.84	EURO0.91	1.00	EURO0.91
Norway	0.33	NOK2.50	0.34	NOK2.50
Philippines	0.03	PHP1.46	0.02	PHP1.07
Sweden	0.27	SEK2.70	0.32	SEK2.70
Thailand	0.02	US$0.02	0.02	US$0.02
United States Agency for International Development	0.67	US$0.67	0.68	US$0.68
World Bank	1.05	US$1.05	1.00	US$1.00
subtotal	**6.05**		**5.52**	

Targeted Contributions	2002 (actual)		2003 (est)	
	(US$)	(national currency)	(US$)	(national currency)
APAARI	0.01			
Asian Development Bank	0.26		1.08	
AUSAID	(0.00)			
Australia	0.30		0.26	
Belgium				
California Academy of Sciences	0.08			
Canada (CCLF)	0.01		0.02	
CGIAR	0.02			
DANIDA	0.04			
DA-BFAR	0.00			
DFID	1.70		3.74	
* European Union			0.93	
FAO	0.05		0.01	
Ford Foundation			0.07	
Germany BMZ/GTZ	0.45		0.57	
GEF	0.13			
IDRC	0.06		0.03	
IFAD	0.09		0.19	
IFPRI				
Japan				
McArthur Foundation	0.14		0.31	
New Zealand ODA	0.13		0.16	
Netherlands				
NORAD	0.23		0.23	
Oxfam	0.06		0.00	
Packard	0.11		0.13	
Rockefeller Brothers				
Sweden - SIDA	0.62		0.44	
SW-PRGA				
TAC Special Fund	0.03			
UBC	0.01		0.01	
UNEP			0.55	
UNFIP	0.35			
UNDP/TCDC	0.10		0.03	
USAID	1.25		1.88	
Others (INREF, Provinces of New Caledonia, MRAG, CTA, Wageningen Uni)	0.22		0.43	
World Bank			0.85	
subtotal	**6.45**		**11.92**	
TOTAL CONTRIBUTIONS	**12.50**		**17.44**	

Summary Statement of Activity	**2002 (actual)**		**2003 (est)**	
Investor Grants	**12.50**		**17.44**	
+ Center Income (other revenues)	**0.11**		**0.10**	
= Total Revenues	**12.61**		**17.54**	
Less:				
Total Expenses	**12.28**		**17.42**	
Surplus (Deficit) of total revenues over total expenses	**0.33**		**0.12**	

* Reclassified to Restricted Core starting 2003.

Table 7a. WORLDFISH CENTER RESEARCH AGENDA FINANCING SUMMARY, 2003- 2004

(in US $ million)

(FINANCING PLAN)

Member	2003 (est)		2004 (proposal)	
Unrestricted Contributions	(US$)	(national currency)	(US$)	(national currency)
Australia	0.24	A$0.45	0.28	A$0.45
Belgium	0.10	EURO0.09	0.10	EURO0.09
Canada	0.46	C$0.63	0.43	C$0.63
China	0.01	US$0.01	0.01	US$0.01
Denmark	0.46	DKK3.00	0.44	DKK3.00
Egypt	0.30	US$0.30	0.30	US$0.30
BMZ, Germany	0.27	EURO0.24	0.20	EURO0.18
India	0.04	US$0.04	0.04	US$0.04
Japan	0.26	YEN31.0	0.26	YEN30.0
Netherlands	1.00	EURO0.91	1.00	EURO0.91
Norway	0.34	NOK2.50	0.52	NOK3.70
Philippines	0.02	PHP1.07	0.02	US$0.02
Sweden	0.32	SEK2.70	0.33	SEK2.70
Thailand	0.02	US$0.02	0.02	US$0.02
United States Agency for International Development	0.68	US$0.68	0.68	US$0.68
World Bank	1.00	US$1.00	1.00	US$1.00
subtotal	**5.52**		**5.63**	

Targeted Contributions	2003 (est)		2004 (proposal)	
	(US$)	(national currency)	(US$)	(national currency)
APAARI				
Asian Development Bank	1.08		1.56	
AUSAID	0.00			
Australia	0.26		0.15	
Belgium				
California Academy of Sciences				
Canada (CCLF)	0.02		0.03	
CGIAR			0.28	
DANIDA				
DA-BFAR			0.21	
DFID	3.74		2.30	
* European Union	0.93		0.92	
FAO	0.01			
Ford Foundation	0.07		0.08	
Germany BMZ/GTZ	0.57		0.83	
GEF			0.25	
IDRC	0.03		0.01	
IFAD	0.19		0.15	
IFPRI				
Japan				
McArthur Foundation	0.31		0.22	
New Zealand ODA	0.16		0.04	
Netherlands				
NORAD	0.23			
Oxfam	0.00			
Packard	0.13			
Rockefeller Brothers				
Sweden - SIDA	0.44			
SW-PRGA				
TAC Special Fund				
UBC	0.01			
UNEP	0.55			
UNFIP				
UNDP/TCDC	0.03		0.06	
USAID	1.88		1.23	
Others (INREF, Egypt, Provinces of New Caledonia, French Pacific Fund, Crawford Fund, MRAG, Cencus of Marine Life, Sloan Fdtn, Conservation Food & Health Fdtn, NFR, WWF)	0.43		0.54	
World Bank	0.85			
Challenge Program	0.00		0.92	
subtotal	**11.92**		**9.78**	

TOTAL CONTRIBUTIONS	**17.44**		**15.41**	

Summary Statement of Activity	2003 (estimate)		2004 (proposal)	
Investor Grants	**17.44**		**15.41**	
+ Center Income (other revenues)	**0.10**		**0.10**	
= Total Revenues	**17.54**		**15.51**	
Less:				
Total Expenses	**17.42**		**15.41**	
Surplus (Deficit) of total revenues over total expenses	**0.12**		**0.10**	

* Reclassified to Restricted Core starting 2003.

TABLE 8a. WORLDFISH CENTER ALLOCATION OF MEMBER FINANCING TO PROJECTS BY OUTPUT FOR THE YEAR 2002

(in $ million)

	Project	Member	Total
001.	Conservation of Aquatic Biodiversity	DFID	**0.00**
		CG-TAC	**0.03**
		GTZ	**0.44**
		CAS	**0.08**
		USAID	**0.00**
		UBC	**0.01**
		Others	**0.02**
		Unrestricted+center inc.	**0.64**
		Total Project	**1.22**
002.	Mitigation Against Adverse Impact of Alien Species on Aquatic Biodiversity (New Emphasis)	Unrestricted+center inc.	**0.23**
		Total Project	**0.23**
003.	Genetic Improvement and Breeding	ADB	**0.00**
		DFID	**0.13**
		UNDP	**0.10**
		FAO	**0.01**
		Wageningen Uni	**0.02**
		Unrestricted+center inc.	**0.24**
		Total Project	**0.50**
004.	Strategies and Options for Realizing Gains from Sustainable Freshwater Aquaculture Systems	USAID	**1.25**
		DFID	**0.34**
		BMZ-GTZ	**0.00**
		Unrestricted+center inc.	**1.03**
		Total Project	**2.62**
005.	Freshwater Fisheries in an Integrated Land and Water Management Context (New Emphasis)	DFID	**0.01**
		CGIAR	**0.00**
		CCLF	**0.01**
		FAO	**0.00**
		Others	**0.00**
		Unrestricted+center inc.	**0.46**
		Total Project	**0.48**
006.	Increased and Sustained Coastal Fisheries Production (Redefined)	USAID	**0.00**
		DA-BFAR	**0.00**
		ACIAR	**0.26**
		NZODA	**0.00**
		NZMFAT	**0.11**
		SIDA	**0.00**
		UNFIP	**0.07**
		GEF	**0.07**
		DANIDA	**0.02**
		Others	**0.09**
		Unrestricted+center inc.	**1.00**
		Total Project	**1.62**

007.	Restoration and Protection of Coastal Habitats (Redefined)	UNFIP	**0.07**
		NZMFAT	**0.03**
		GEF	**0.07**
		FAO	**0.00**
		Unrestricted+center inc.	**0.21**
		Total Project	**0.38**
008.	Knowledge Bases and Training for Improved Management of Coastal Resources (Redefined)	MacArthur Foundation	**0.14**
		Packard	**0.11**
		UNFIP	**0.21**
		Unrestricted+center inc.	**0.24**
		Total Project	**0.70**
009.	Economic, Policy and Social Analysis and Valuation of Aquatic Resources in Developing Countries	ADB	**0.26**
		DANIDA	**0.01**
		IDRC	**0.02**
		DFID	**0.00**
		ACIAR	**0.04**
		SIDA	**0.24**
		Others	**0.01**
		Unrestricted+center inc.	**0.29**
		Total Project	**0.87**
010.	Aquatic Resources Planning and Impact Assessment	SIDA	**0.09**
		DFID	**0.26**
		OXFAM	**0.06**
		CGIAR	**0.00**
		IFAD	**0.02**
		Unrestricted+center inc.	**0.11**
		Total Project	**0.54**
011.	Legal and Institutional Analysis for Aquatic Resources Management	DANIDA	**0.01**
		DFID	**0.95**
		IDRC	**0.02**
		CGIAR	**0.01**
		IFAD	**0.07**
		MRAG	**0.09**
		SIDA	**0.27**
		Unrestricted+center inc.	**0.49**
		Total Project	**1.91**
012.	Improved Partnerships and Capacity Building Among Developing Country NARS (Redefined)	NORAD	**0.23**
		AUSAID	**0.00**
		APAARI	**0.01**
		IDRC	**0.02**
		FAO	**0.04**
		DFID	**0.01**
		NZODA	**0.00**
		SIDA	**0.01**
		Others	**0.02**
		Unrestricted+center inc.	**0.30**
		Total Project	**0.64**
013.	Access to Information for Sustainable Development of Fisheries and Aquatic Resources (Redefined)	Unrestricted+center inc.	**0.58**
		Total Project	**0.58**

Center Totals

	Total
Total Targeted Funding	**6.45**
Total Unrestricted Funding	**5.71**
Total Center Income	**0.11**
Total Allocations	**12.28**

TABLE 8b. WORLDFISH CENTER ALLOCATION OF MEMBER FINANCING TO PROJECTS BY OUTPUT FOR THE YEAR 2003

(in $ million)

	Project	Member	Total
001.	Conservation of Aquatic Biodiversity	EU	**0.30**
		ADB	**0.08**
		BMZ/GTZ	**0.05**
		UBC	**0.01**
		WB	**0.20**
		Others	**0.04**
		Unrestricted+center inc.	**0.30**
		Total Project	**0.98**
002.	Mitigation Against Adverse Impact of Alien Species on Aquatic Biodiversity (New Emphasis)	EU	**0.02**
		BMZ/GTZ	**0.04**
		Unrestricted+center inc.	**0.20**
		Total Project	**0.26**
003.	Genetic Improvement and Breeding	EU	**0.27**
		ADB	
		DFID	**0.13**
		INREF	**0.06**
		UNDP-TCDC	**0.03**
		Unrestricted+center inc.	**0.08**
		Total Project	**0.58**
004.	Strategies and Options for Realizing Gains from Sustainable Freshwater Aquaculture Systems	DFID	**0.40**
		USAID	**1.88**
		BMZ-GTZ	**0.48**
		Unrestricted+center inc.	**1.13**
		Total Project	**3.89**
005.	Freshwater Fisheries in an Integrated Land and Water Management Context (New Emphasis)	DFID	**0.12**
		CCLF	**0.02**
		Unrestricted+center inc.	**0.45**
		Total Project	**0.60**
006.	Increased and Sustained Coastal Fisheries Production (Redefined)	ACIAR	**0.19**
		NZMFAT	**0.13**
		UNEP	**0.10**
		EU	**0.07**
		WB	**0.30**
		AUSAID	
		DFID	
		Others	**0.25**
		Unrestricted+center inc.	**0.76**
		Total Project	**1.80**
007.	Restoration and Protection of Coastal Habitats (Redefined)	NZMFAT	**0.03**
		UNEP	**0.10**
		WB	**0.12**
		EU	**0.03**
		AIMS	**0.07**
		Others	**0.04**
		Unrestricted+center inc.	**0.22**
		Total Project	**0.61**

008.	Knowledge Bases and Training for Improved Management of Coastal Resources (Redefined)	UNEP	**0.30**
		MacArthur Foundation	**0.15**
		EU	**0.07**
		WB	**0.22**
		DFID	
		Unrestricted+center inc.	**0.15**
		Total Project	**0.88**
009.	Economic, Policy and Social Analysis and Valuation of Aquatic Resources in Developing Countries	ADB	**0.60**
		Ford Foundation	**0.01**
		SIDA	**0.14**
		UNEP	**0.05**
		DFID	**0.12**
		Unrestricted+center inc.	**0.29**
		Total Project	**1.21**
010.	Aquatic Resources Planning and Impact Assessment	ADB	**0.40**
		SIDA	**0.05**
		Ford Foundation	**0.01**
		DFID	**0.69**
		IFAD	**0.04**
		OXFAM	**0.00**
		Unrestricted+center inc.	**0.27**
		Total Project	**1.46**
011.	Legal and Institutional Analysis for Aquatic Resources Management	DFID	**2.25**
		IFAD	**0.15**
		SIDA	**0.16**
		MRAG	**0.05**
		Ford Foundation	**0.05**
		FAO	**0.01**
		Unrestricted+center inc.	**0.80**
		Total Project	**3.46**
012.	Improved Partnerships and Capacity Building Among Developing Country NARS (Redefined)	NORAD	**0.23**
		EU	**0.17**
		IDRC	**0.03**
		Packard	**0.13**
		MacArthur Foundation	**0.16**
		DFID	**0.02**
		SIDA	**0.09**
		Unrestricted+center inc.	**0.31**
		Total Project	**1.15**
013.	Access to Information for Sustainable Development of Fisheries and Aquatic Resources (Redefined)	Bill Gates Foundation	**0.00**
		Unrestricted+center inc.	**0.54**
		Total Project	**0.54**

Center Totals

	Total
Total Targeted Funding	**11.92**
Total Unrestricted Funding	**5.40**
Total Center Income	**0.10**
Total Allocations	**17.42**

TABLE 8c. WORLDFISH CENTER ALLOCATION OF MEMBER FINANCING TO PROJECTS BY OUTPUT FOR THE YEAR 2004

(in $ million)

	Project	Member	Total
001.	Conservation of Aquatic Biodiversity	EU	**0.30**
		TAC	**0.00**
		GTZ	**0.26**
		CAS	**0.00**
		USAID	**0.00**
		BFAR	**0.11**
		DFID	**0.00**
		CGIAR	**0.16**
		Unrestricted+center inc.	**0.38**
		Total Project	**1.22**
002.	Mitigation Against Adverse Impact of Alien Species on Aquatic Biodiversity (New Emphasis)	EU	**0.02**
		Unrestricted+center inc.	**0.18**
		Total Project	**0.20**
003.	Genetic Improvement and Breeding	ADB	**0.39**
		EU	**0.27**
		DFID	**0.05**
		UNDP	**0.06**
		Others	**0.08**
		Unrestricted+center inc.	**0.21**
		Total Project	**1.06**
004.	Strategies and Options for Realizing Gains from Sustainable Freshwater Aquaculture Systems	USAID	**1.23**
		BMZ/GTZ	**0.57**
		IFAD	**0.00**
		DANIDA	**0.00**
		DFID	**0.39**
		Others	**0.01**
		Unrestricted+center inc.	**1.25**
		Total Project	**3.46**
005.	Freshwater Fisheries in an Integrated Land and Water Management Context (New Emphasis)	DFID	**0.14**
		BMZ/GTZ	**0.00**
		Challenge Program	**0.92**
		CCLF	**0.03**
		Others	**0.01**
		Unrestricted+center inc.	**0.41**
		Total Project	**1.51**
006.	Increased and Sustained Coastal Fisheries Production (Redefined)	ADB	**0.38**
		ACIAR	**0.10**
		NZMFAT	**0.03**
		EU	**0.07**
		Challenge Program	**0.00**
		GEF	**0.00**
		Others	**0.11**
		Unrestricted+center inc.	**0.62**
		Total Project	**1.31**
007.	Restoration and Protection of Coastal Habitats (Redefined)	EU	**0.03**
		NZMFAT	**0.01**
		Challenge Program	**0.00**
		GEF	**0.00**
		AIMS (Australia)	**0.00**
		Unrestricted+center inc.	**0.26**
		Total Project	**0.30**

008.	Knowledge Bases and Training for Improved Management of Coastal Resources (Redefined)	EU	**0.07**
		AIMS (Australia)	**0.05**
		BFAR	**0.10**
		GEF	**0.25**
		Others	**0.32**
		Unrestricted+center inc.	**0.23**
		Total Project	**1.02**
009.	Economic, Policy and Social Analysis and Valuation of Aquatic Resources in Developing Countries	ADB	**0.46**
		UNEP	**0.00**
		SIDA	**0.00**
		DFID	**0.15**
		Ford Fdtn	**0.01**
		CGIAR	**0.02**
		Unrestricted+center inc.	**0.30**
		Total Project	**0.94**
010.	Aquatic Resources Planning and Impact Assessment	GGIAR	**0.02**
		DFID	**0.29**
		IFAD	**0.03**
		Ford Fdtn	**0.01**
		Unrestricted+center inc.	**0.13**
		Total Project	**0.48**
011.	Legal and Institutional Analysis for Aquatic Resources Management	IFAD	**0.12**
		DFID	**1.27**
		ADB	**0.33**
		Ford Fdtn	**0.06**
		CGIAR	**0.08**
		Unrestricted+center inc.	**0.81**
		Total Project	**2.67**
012.	Improved Partnerships and Capacity Building Among Developing Country NARS (Redefined)	EU	**0.16**
		McArthur	**0.22**
		ACIAR	**0.00**
		IDRC	**0.01**
		Others	**0.01**
		Unrestricted+center inc.	**0.26**
		Total Project	**0.66**
013.	Access to Information for Sustainable Development of Fisheries and Aquatic Resources (Redefined)	Unrestricted+center inc.	**0.58**
		Total Project	**0.58**

Center Totals

	Total
Total Targeted Funding	**9.78**
Total Unrestricted Funding	**5.53**
Total Center Income	**0.10**
Total Allocations	**15.41**

Table 9. WORLDFISH CENTER RESEARCH AGENDA STAFF COMPOSITION, 2002 to 2006

	2002 (actual)		2003 (estimates)		2004 (proposal)		2005 (plan)		2006 (plan)	
	Hired by:		Hired by:		Hired by:		Hired by:		Hired by:	
	center	other	center	other	center	other	center	other	center	other
Internationally-Recruited Staff (IRS)										
Research and Research Support	28	1	32		32		33		33	
of which:										
Post-doctoral Fellows										
Associate Professionals										
Training / Communications	1		1		1		1		1	
of which:										
Post-doctoral Fellows										
Associate Professionals										
Research Management	5		5		5		5		5	
of which:										
Post-doctoral Fellows										
Associate Professionals										
Total IRS	**34**		**38**		**38**		**39**		**39**	
Regionally-Recruited Staff (RRS)										
Research and Research Support	9		10		10		10		10	
of which:										
Post-doctoral Fellows										
Associate Professionals										
Training / Communications	1		1		1		1		1	
of which:										
Post-doctoral Fellows										
Associate Professionals										
Research Management	2		2		2		2		2	
of which:										
Post-doctoral Fellows										
Associate Professionals										
Total RRS	**12**		**13**		**13**		**13**		**13**	
Support Staff	**241**		**254**		**251**		**255**		**255**	
TOTAL STAFF	**287**	**1**	**305**		**302**		**307**		**307**	

Table 10. WORLDFISH CENTER - FINANCIAL POSITION: STATEMENT OF CASH FLOWS, 2002 and 2003 (US$ 000)

2002	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Opening Cash Balance	7,175	7,733	7,991	7,764	8,131	8,159	7,743	7,407	8,691	8,233	8,906	9,857
Receipts												
Grants:												
Unrestricted	1,185	-	339	861	300	440	562	960	306	1,054	1,105	364
Restricted	-	1,326	388	400	638	225	23	1,307	434	500	926	288
Earned Income	10	9	8	9	9	10	8	10	9	9	10	9
Disbursements												
Operations *	637	1,077	962	904	918	1,091	929	993	1,207	890	1,091	1,586
Capital Acquisition												
Other												
Ending Cash Balance	7,733	7,991	7,764	8,131	8,159	7,743	7,407	8,691	8,233	8,906	9,857	8,932

* Includes HQ Renovation and minor capital

2003	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Opening Cash Balance	8,932	10,271	10,519	10,896	10,468	10,034	10,070	8,897	9,363	8,967	9,432	8,462
Receipts												
Grants:												
Unrestricted	997	8	813	-	256	502	-	1,012	-	1,485	16	2,076
Restricted	956	1,139	985	444	615	672	384	1,419	1,201	997	1,120	507
Earned Income	10	8	9	10	10	8	7	5	8	7	8	10
Disbursements												
Operations	624	907	1,430	882	1,316	1,146	1,564	1,970	1,605	2,024	2,114	1,843
Capital Acquisition												
Other												
Ending Cash Balance	10,271	10,519	10,896	10,468	10,034	10,070	8,897	9,363	8,967	9,432	8,462	9,212

CURRENCY STRUCTURE OF EXPENDITURES

	2002 (actual)			2003 (proposal)			2004 (proposal)		
Currency	Amount	$ value	% share	Amount	$ value	% share	Amount	$ value	% share
US Dollar		9.79	65%		10.45	60%		8.94	58%
Malaysian Ringgit		3.76	25%		4.36	25%		4.16	27%
Others		1.51	10%		2.61	15%		2.31	15%
TOTAL		15.06	100%		17.42	100%		15.42	100%

Table 11. WORLDFISH CENTER STATEMENT OF FINANCIAL POSITION, 2002 to 2006

(in $'000)

Assets	2002 (actual)	2003 (est)	2004 (proposal)	2005 (plan)	2006 (plan)
Current Assets					
Cash & Cash Equivalents	8,932	9,212	9,270	9,470	10,100
Accounts Receivable					
Donors	3,700	3,370	3,230	3,100	3,050
Employees	114	115	115	90	130
Others	1,765	1,600	1,600	1,500	1,400
Inventories	2	3	5	8	10
Prepaid Expenses		0	0	0	0
Other Current Assets	2,443	2,010	1,900	1,800	1,500
Total Current Assets	**16,956**	**16,310**	**16,120**	**15,968**	**16,190**
Total Fixed Assets - Net	**356**	**450**	**700**	**750**	**800**
Other Assets	**325**	**350**	**400**	**450**	**550**
Total Assets	**17,637**	**17,110**	**17,220**	**17,168**	**17,540**
Liabilities and Net Assets					
Current Liabilities					
Bank Indebtedness					
Accounts Payable					
Donors	3,590	2,900	3,100	2,900	2,500
Employees	79	90	85	90	100
Others	896	1,100	700	750	850
Advances from Donors	0	0	0	0	0
In-Trust Accounts	858	628	700	850	875
Accruals and Provisions	2,715	2,285	2,500	2,800	3,100
Total Current Liabilities	**8,138**	**7,003**	**7,085**	**7,390**	**7,425**
Long-Term Liabilities	501	300	400	500	600
Total Liabilities	**8,639**	**7,303**	**7,485**	**7,890**	**8,025**
Unrestriced Net Assets					
Appropriated	1,994	2,500	2,600	2,700	2,800
Unappropriate	7,004	7,307	7,135	6,578	6,715
Total Net Assets	**8,998**	**9,807**	**9,735**	**9,278**	**9,515**
Total Liabilities & Net Assets	**17,637**	**17,110**	**17,220**	**17,168**	**17,540**

Appendices

Program Details

BIODIVERSITY AND GENETIC RESOURCES RESEARCH PROGRAM (BIODIVERSITY AND GENETICS PROGRAM)

Thrust 1 (=MTP Project 1)*: Conservation of aquatic diversity*

Purpose/Objective

1. Aquatic biodiversity (genetic diversity within species, species diversity and ecological diversity) is restored, conserved, and used in a sustainable manner.

The objective of this thrust is the development and wider use of scientific tools and methods for understanding, conserving, and sustainably using aquatic biological diversity by research institutions, management agencies, and NGOs from developing countries. For freshwater systems, the development of management models as decision-support tools will be a key area. The thrust will also be on development of counter-measures to threats of aquatic diversity based on information collected on the species biology, habitat requirements and genetics.

Gains/Impacts

1. FishBase evolves from a global biodiversity database to a management tool with options and modules for country-specific applications. Its scope is broadened from taxonomy and biology to resources management and biodiversity conservation. The diffusion of FishBase is improved and the range of its users is broadened to NARS and management bodies from developing countries.
2. Based on information collected in multiple disciplines such as biology, sociology, economics, etc., identification and operation of freshwater sanctuaries are carried out in a scientific manner. This leads to the promotion and implementation of freshwater sanctuaries as a way to protect heavily threatened biodiversity in rivers and wetlands.
3. The computer-based decision-support systems developed to assist in the management of freshwater resources are implemented and tested in Africa and Southeast Asia before distribution to the national partners.

Output 1: FishBase as a global biodiversity database

Activities:

1. Maintenance and dissemination of FishBase as a Global Biodiversity Database on the worldwide web by the WorldFish Center
2. Expansion and further refinement of FishBase in collaboration with FishBase Consortium Milestones:

Milestones

Year	Milestones
2004	• Maintenance plan for all WorldFish Center databases on web implemented. • Set of collaborative activities related to FishBase with FishBase Consortium implemented.
2005	• FishBase maintained on web. • One regional developing country FishBase encoding center established • Continued collaboration on FishBase and expansion of FishBase. Consortium to include developing country participation.
2006	• FishBase maintained on web. • Continued collaboration on FishBase and expansion of FishBase. Consortium to include developing country participation.

Output 2: Applications of FishBase for developing countries

Activities:
1. Development of customized country FishBase solutions starting with the Philippines
2. Development of customized country FishBase solutions for other countries
3. Development of analytical and decision-support tools utilizing FishBase Milestones:

Milestones

Year	Milestones
2004	• Combined program of work with partners in the Philippines. • Training manuals on building country-specific customized databases (data-encoding, validation, database linkages, related website) developed. • Training initiated for developing country NARS collaborators with special emphasis on Africa. • Training on building country-specific customized databases and work on China and India databases continued. • International workshop on developing application based databases for fisheries and aquaculture conducted. • Database for aquatic invertebrates, especially commercial shell-fish in these countries initiated based on the use, experience, and structure of FishBase • Analytical tools towards the management of protected coral reef areas, in collaboration with the ReefBase team developed. Analytical tools on species identifications developed. • Spatial (GIS) functions in FishBase towards natural resources modeling, and spatial management (e.g., bio-geographic evaluation of species introductions, identification, and analysis of conservation "hotspots" expanded).
2005	• Development of customized database linked to FishBase in the Philippines. Theme-based applications developed and demonstrated. • Development of customized country databases linked to FishBase in two countries in Africa and West Asia initiated. • Analytical tools on coastal zone management and fisheries management developed.
2006	• Development of customized database linked to FishBase in India, China, and Mekong River region. Theme-based applications developed and demonstrated. • Development of customized country databases linked to FishBase in additional countries in Africa and West Asia developed. • Analytical tools on coastal zone management and fisheries management refined.

Collaborators
Museums and centers of taxonomic expertise worldwide: the British Museum (Natural History), London; the Musée National d'Histoire Naturelle, Paris; the Musée Royal d'Afrique Centrale, Tervuren; the University of Kiel, Germany; the University of British Columbia, Canada; the World Conservation Union (IUCN); the FAO, Italy; the University of the Philippines System; and Iranian Fisheries Research Organization.

Output 3: Decision-making tools utilizing data on species and habitat diversity

Activities:
1. Development of a management plan for freshwater sanctuaries.
2. Development of decision-support systems for the management of freshwater resources.

Milestones:

Year	Milestones
2004	• Consolidation of information on bio-ecology of key economically important species of the Mekong River region. • The Bayesian model of Mekong fish resources will be further developed by inclusion of the stakeholders' perceptions. • Consultation process for the use of such models at different levels developed. • Project on freshwater aquatic sanctuaries developed. • Contribution to the development of a management model integrating environmental flow requirements, floodplain fisheries, and decision support tools in the Tonle Sap area (Cambodia). • Training and capacity building for national aquatic resources institutes, in particular in the Mekong Basin on bio-ecology and modeling. • Development of methods to integrate in-stream flow assessment methodologies with fish-flow models and other decision support tools.
2005	• Reference fish collection set up at the Cambodian Inland Fisheries Research and Development Institute for the continued studies on management of inland fisheries. • Development of a generic Bayesian model for use in other river basins. • Review of high priority conservation areas for tilapia species in Africa and recommendations for conservation measures. • Development of a plan and decision-making tool for the management of fresh water sanctuaries based on species, habitat diversity information, and socio-economic factors. • Creation of a user-friendly package combining different modeling approaches at different scales; training and distribution in Africa, South America, and Southeast Asia.
2006	• Field-testing of decision-making tools for the management of fresh water sanctuaries. • Successful extension of the work on bio-ecology and modeling to cover all the Mekong countries. • Initiation of a project on the conservation of tilapia germplasm in Africa.

Collaborators

- Regional organizations, networks and NARS in the ACP countries, the Mekong River Commission and riparian NARS in the Mekong River region;
- Students from the Institut Francophone d'Informatique (Hanoi), University Paris VI, University Paul Sabatier (France);
- University of Cape Town (South Africa), Griffith University (Australia), Imperial College (London) for environmental modeling; and
- NGO's such as GAPE (Global Association for People and the Environment, the Lao PDR).

CGIAR linkages

International Water Management Institute, International Rice Research Institute, International Food Policy Research Institute, and Centro Internacional de Agricultura Tropical (collaboration through the Water and Food Challenge Program)

Output 4: Utilization of genetic diversity information for conservation and management of "key" species

Activities:

1. Use of genetic markers as tools in genetic improvement programs.
2. Quantification of the impact of farmed fish escapes on wild stocks of carp.
3. Genetic and phenotypic characterization of domesticated and selected stocks of carp and tilapia.

Milestones:

Year	Milestones
2004	• Work initiated on the evaluation of DNA markers for use as tags in genetic improvement programs. • Work initiated using genetic markers on quantifying introgression of farmed genome of common carp (China) and rohu (India) on natural stocks. • Genetic diversity information on new species used for aquaculture in West Africa generated.
2005	• Effect of farmed fish on life history traits of escaped farmed fish quantified. • Initiation of project on genetic and phenotypic characterization of domesticated and selected stocks of carp and tilapia. • Evaluation of DNA markers as tools to quantify inbreeding in hatchery stocks. • Evaluation of genetic diversity information on new species used for aquaculture in West Africa for their use in aquaculture development.
2006	• Based on genetic and phenotypic parameters, identification of strains that needs to be conserved and utilized more extensively for aquaculture and selection programs. • Development of a strategy for conservation and more efficient use of domesticated stocks. • Development of guidelines on mitigation of impact of escapes of farmed fish.

Costs for Thrust 1 (US$ million):
2004: 1.22
2005: 1.26
2006: 1.30

Users:
The users will be decision-makers and policy-makers concerned with living aquatic resources and their environments and scientists in national institutions, in particular those participating in the International Network on Genetics in Aquaculture (INGA).

Collaborators:
NARS: specifically, organizations in INGA member countries, such as in Africa (Côte d'Ivoire, Egypt, Ghana, and Malawi) and Asia (Bangladesh, China, India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam).
Linkages:
None specifically, but the Center's work in this thrust area will also be reported to the Systemwide Genetic Resources Program (SGRP).

Financing Plan:
Funds will be requested from FFID, IDRC and other donors as well as the WorldFish Center core funds.

Thrust 2(=MTP Project 2): Mitigation of adverse impact of alien species on aquatic Diversity

Purpose / Objectives
1. To safeguard against the adverse impact of alien species on aquatic biodiversity.
2. To help countries to develop mechanisms for evaluating the introduction of alien species for aquaculture.

Alien species have both positive and negative impacts. A significant amount of aquaculture production is based on alien species and the new improved strains are alien to many countries. In some countries, the ornamental trade is based totally on alien species.

Concerning the negative impacts, invasive alien species have been identified as one of the main threats to biodiversity. There are many pathways through which alien species get established; some of these are intentional and others unintentional. With increased awareness, intentional introductions have been reduced. Among the unintentional introductions, ballast water and escapees from aquaculture are the main routes for the establishment of alien species. However, not all species introduced for aquaculture become established in nature and invasive. The absence of adequate tools to assess the risks and evaluate any adverse impacts of alien species at genetic, species, community and habitat levels makes it difficult to draw up guidelines for the safe introduction of alien species for aquaculture. Most of the developing countries are ill equipped to address problems arising from alien species introduction, due to the absence of a national strategy, institutional mechanisms, policy support, and appropriate legal instruments. The purpose of this thrust is to carry out research to mitigate the adverse impact of alien species and to better equip the developing countries to handle alien species.

Gains / Impacts

1. With the help of tools to evaluate the impact of aquatic alien species, it would be possible to screen proposals for the introduction of alien species in a more objective scientific manner than the present ad –hoc, subjective way of handling them.
2. Countries that are pro-active against invasive alien species would be better equipped with response mechanisms.
3. The risk of introducing improved fish strains for aquaculture will be greatly reduced.

Output 1: Development of tools to assess risks and response mechanisms to mitigate adverse impact of alien species

Activities:

1. Identification of factors leading to freshwater alien species introduction and development of tools to assess risks and evaluate impact.
2. Development of national strategies and guidelines on aquatic alien species.

Milestones:

Year	Milestones
2004	• Requirements and partners identified in the Philippines through interactions. • Development of a national strategy and guidelines for Malaysia on aquatic alien species jointly with Malaysian partners initiated. • Multi-country project on alien species submitted for funding. • Information on the impact of feral populations of tilapia and the alien aquatic weeds in Malaysia available.
2005	• Guidelines on translocations of alien species and minimizing escape of farmed individuals developed. • Socio-economic factors influencing alien species establishment identified. • Development of tools to assess risks and evaluate adverse impacts due to alien species.
2006	• Further development of tools to assess risks and evaluate adverse impacts due to alien species. • Economic costs of invasive alien species and mitigation measures available and used in policy decisions. • Response mechanisms to mitigate adverse impacts of alien species on aquatic biodiversity developed.

Costs for Thrust 2 (US$ million):

2004: 0.21
2005: 0.21
2006: 0.22

Users:
The users will be decision-makers and policy-makers concerned with living aquatic resources and their environments and scientists in national institutions, in particular those participating in the International Network on Genetics in Aquaculture (INGA).

Collaborators:
NARS: specifically, organizations in the INGA member countries, such as in Africa (Côte d'Ivoire, Egypt, Ghana, and Malawi) and in Asia (Bangladesh, China, India, Indonesia, Malaysia, the Philippines, Thailand, Vietnam), and the Global Invasive Species Program (GISP).

Linkages:
None specifically, but the Center's work in this thrust area will also be reported to the System-wide Genetic Resources Program (SGRP). Links will also be explored with other CGIAR institutes having programs on alien species.

Financing Plan:
This is a new thrust area and funds will be requested under the Global Environment Facility (GEF) WorldFish Center core funds.

Thrust 3(=MTP Project 3): Genetic Enhancement and Breeding

Purpose / Objectives
1. To maintain and continuously improve fish strains for distribution to farmers, by developing and supporting National Breeding Programs
2. To minimize the risk of long-term loss of genetic variability of aquaculture species, by ensuring national breeding programs adequately manage the population size and control inbreeding. Use of genetically improved stocks to increase aquaculture production in developing countries has been limited. Most aquaculture stocks in current use are genetically similar or inferior to wild, undomesticated stocks. The potential for improvement among these stocks is virtually untouched. The project focus so far has been on tilapias and carps, which together form the mainstay of many resource-poor small-scale farmers throughout the developing world. Quite likely this will broaden to include species such as freshwater prawns, in which several Asian partner countries have expressed great interest. Currently, the project is developing research methods and strategies for the domestication and genetic improvement of tilapia and carp germplasm, and is assessing their potential socio-economic and environmental impacts. In this way, it is contributing to the initiation of national fish breeding programs. In cases where programs are already underway, the project will support and refine existing breeding programs, and ensure that farmers and consumers capture the benefits. Socio-economic impact studies, choice of farming systems, and selection of traits for improvement will contribute to the provision of genetically enhanced carp and tilapia for agriculture, and help transfer the technology to the collaborating countries' scientists, extension officers and, most importantly, to farmers.

In our endeavors to achieve genetic improvement for production traits, balancing short and long-term genetic gains is important. Excessive emphasis on short-term gains can result in reduced population size and prevalent inbreeding, which in turn can negatively impact upon the prospects of long-term genetic improvement.

Gains / Impacts

The provision of better breeding stock to the world's major carp and tilapia farming countries and of methods for their safe and productive deployment, is expected to result in a more stable fish production, and consequently in improved income among small-scale farmers. This can be expected to impact upon food security and poverty alleviation. The gains will be measured by socio-economic and environmental surveys jointly conducted with our collaborators.

Output 1: Development of improved fish strains by national breeding programs

Activities:

1. Transfer of selective breeding (GIFT) technology for aquaculture improvement from the Philippines to Sub-Saharan Africa and Egypt
2. Development of carp strains for aquaculture in Asia (Second Phase)
3. Development of improved of freshwater prawn strains
4. Selection of tilapia incorporating delayed female reproduction as an additional trait in the breeding objective
5. Development of technologies for the production of all-male progeny in tilapia
6. Establishment of an International Breeding Center at the WorldFish Center to support aquaculture developing country geneticists.

Milestones:

Year	Milestones
2004	• Second phase of the project "Transfer of GIFT technology to Africa"emphasizing aspects of dissemination of the improved stock to farmers continues • Evaluation of 2nd generation of selection completed in African partner countries • Project on "Developing improved carp strains for aquaculture in Asia" initiated with a planning workshop of collaborative partners • Proposal on genetic improvement of freshwater prawn submitted • Proposal on the estimation of genetic parameters and selection for delayed female reproduction in tilapia submitted • Proposal on the development of technology for the production of all-male tilapia progeny submitted • Proposal for funding an International Breeding Center at the WorldFish Center submitted.
2005	• Methodology for multi-trait selection evaluated and multi-location evaluation of improved strains of carp carried out • Aquaculture geneticists from developing countries utilize the expertise and facilities of the International Breeding Center to analyze their data • Work on selection of freshwater prawn initiated • Collaborative work on tilapia reproduction with Gottingen University underway.
2006	• Improved strains of tilapia developed by four collaborating African partners ready for dissemination • Improved strains of carp developed by six collaborating Asian partners ready for dissemination • Genetic improvement program on freshwater prawn begins • Approaches to control tilapia reproduction and produce all-male progeny tested.

Output 2: Development and dissemination of methods for genetic improvement

Activities:

1. Genetic enhancement of Nile tilapia and utilization of F1 cross-bred clones and YY males
2. Selective breeding of tilapia for high and low input pond environments as a component of integrated farming
4. Estimate genetic parameters for cold tolerance in tilapia in Egypt
5. Develop methodology for the improvement of carcass and flesh quality in tilapia
6. Develop guidelines on the maintenance of stock quality and avoidance of inbreeding and inadvertent selection in hatcheries
7. Develop a general approach to the dissemination of improved stock, to be customized according to the specific situation of each country
8. Training courses on genetic improvement
9. Publication of manuals on fish genetic improvement.

Milestones:

Year	Milestones
2004	• Conduct further selection based on breeding values; compare the GIFT strain to local strains in a range of environments • Value of F1 clones as control in a genetic improvement program assessed. • Merit of YY male technology assessed in a commercial situation • Genetic parameters in high and low input environments in experimental ponds in Egypt estimated • Methodology to record cold tolerance developed • Carcass and flesh quality compared among tilapia strains • Progeny with different degrees of inbreeding compared for growth rate and survival • Two workshops run (one in Africa and another in Asia) on the application of quantitative genetics to fish genetic improvement.
2005	• Innovative approaches for selective breeding and recording economically important traits (e.g., disease resistance) tested • Selection for cold tolerance begins on tilapia in Egypt • First genetic parameters for carcass and flesh quality estimated in tilapia • Fish populations of different size are established to estimate the accumulation of inbreeding in practical situations • Evaluation of 3rd generation of selection lines in high and low pond production environments completed • Manual on broodstock management published • At least two persons complete their post-graduate studies in animal breeding and genetics in the context of the Center's Program.
2006	• Molecular techniques (e.g., MAS) are assessed and incorporated to breeding programs where appropriate • Selected tilapia strains disseminated to farmers • Evaluation of 4th generation of selection lines in high and low pond production environments completed • Selection for cold tolerance in tilapia continues in Egypt • The possibility of incorporating carcass and flesh quality to the breeding objective of tilapia is examined • The effect of inbreeding and population size in tilapia is estimated • Organize regional workshops to disseminate findings and recommendations • Production of a publication describing the strategy followed in the dissemination of improved stock, illustrated with examples developed so far • Training program on quantitative genetics conducted, incorporating the most recent findings emanating from the WorldFish Center's genetic research and development program.

Costs for Thrust 3 (US$ million):
2004: 1.06
2005: 1.09
2006: 1.12

Users:
Scientists and extension officers in national institutions, in particular those participating in the International Network on Genetics in Aquaculture; and fish farmers in developing countries.

Collaborators:
NARS: specifically, organizations in the INGA member countries, such as in Africa (Côte d'Ivoire, Egypt, Ghana, and Malawi) and in Asia (Bangladesh, China, India, Indonesia, Malaysia, the Philippines, Thailand, Vietnam).

ARI: Norwegian Institute of Aquaculture Research (AKVAFORSK), the Universities of Swansea, Stirling, Gottingen and Wageningen, and other European and US institutes concerned with germplasm enhancement and genetic marker development for fish species. New partnerships will be developed initially in Africa and West Asia through the INGA network.

System Linkages:
None specifically, but the Center's work in genetic enhancement is also reported to the SGRP and intellectual property issues in aquaculture discussed with the Central Advisory Service.

Financing Plan:
DFID, UNDP TCDC, Asian Development Bank collaborative project funds from the University of Wageningen, USAID through Auburn University. Potentially Government of Norway, IDRC through INGA network. WorldFish Center core funds.

FRESHWATER RESOURCES RESEARCH PROGRAM (FRESHWATER PROGRAM)

Thrust 4(=MTP Project 4): Strategies and options for realizing gains from sustainable freshwater aquaculture systems

Objectives:
1. To enable small-scale farmers in Africa and Asia to practice appropriate aquaculture on a sustained basis.
2. To strengthen NARS to promote appropriate aquaculture technologies through efficient and efficacious diffusion pathways.

Gains
1. Improved management of smallholder farms through better and widely available knowledge on the possibilities of integrating aquaculture into their farms for greater diversification and nutrient use efficiency.
2. Improved application of technical know-how of appropriate integrated agriculture-aquaculture development.
3. Reduced poverty and improved quality of life among farmers through increased productivity from farms with aquaculture as a new component.
4. Increased productivity of fish from aquaculture to meet market demand ensuring the contribution of fish to food security.

Output 1: Thorough understanding of target group needs and constraints

Activities:
1. Malawi regional office for aquaculture support to SACCAR countries; Malawi aquaculture project for small-scale farm diversification
2. Mozambique, Zambia, and outreach activities from Malawi
3. Cameroon aquaculture project in the peri-urban-to-forest-margins transect
4. Bangladesh sustainable aquaculture project
5. Vietnam smallholder livelihoods project in the Mekong River Delta

Milestones:

Year	Milestones
2004	• Malawi site will expand the implementation of the RET approach to cover the major aquaculture areas in Malawi and newly initiated activities in Zambia will be further supported. • In Mozambique, the RET approach and aquaculture development activities initiated in Manica Province. • In Bangladesh, 360 households selected in four separate wealth strata, monitored to determine the extent of improved aquaculture technology adoption trials, depending on the needs, constraints, and

	selection of the cooperating farmers. • In Bangladesh, the impact of IAA on different income groups quantified and efficiency of dissemination pathways determined. • In Vietnam, farm households with homestead garden-ponds assessed using the RESTORE approach and additional studies on the theoretical suitability of improved aquaculture technologies conducted
2005	• In Cameroon, in the final year of the project in 2005, an impact evaluation will be conducted on the impact of IAA adoption on small farm households in terms of different combinations of market access and population density categories. • Comparative analyses of long-term data from Cameroon, Ghana, and Malawi will enable the determination of the key factors governing the needs and constraints of target farmers and consumers for fish from aquaculture in Africa.

Output 2: Portfolio of new and improved aquaculture technologies

Activities:
1. Malawi aquaculture project for small farm diversification
2. Egypt on-station, on-farm and socio-economic research
3. Cameroon aquaculture project in peri-urban-to-forest-margins transect
4. Bangladesh sustainable aquaculture project
5. Vietnam smallholder livelihoods project in the Mekong River Delta

Milestones:

Year	Milestones
2004	• Together with partner institutions, research will be conducted in **Bangladesh** to solve production bottlenecks and clarify key aspects of IAA systems as identified with target beneficiaries to benefit them. Technologies appropriate to economic strata of target farmers will be tested on-farm in comparison across different sites and monitored with the RESTORE tool over three years. • In Bangladesh specific on-farm and on-station studies on technology verification through sponsored research by NARS partners on specific technology improvements will be conducted. • In **Egypt**, work studies conducted on the role of fishponds in the nutrient dynamics of mixed farming systems, and will evaluate the impact of tilapia in low- and high-input environments on the nutrient dynamics of the pond. • Further work in Egypt will study fish farming economics and assess overall supply and demand of fish in the country, and identify market conditions under which future investment in aquaculture in Egypt will be fully viable. • In addition, work will specifically assess the demand for fish and fish products from different sources in Egypt (national aquaculture, capture fisheries, and imports) through the course of the year, taking account of consumer preferences at different social and income levels; and determine the factors responsible for the decline in fish sale prices, in particular, distinguishing between changing consumer preferences and market reaction to increasing supply. • In **Vietnam**, farmer-selected technologies for homestead garden ponds (e.g., polyculture of carp species with Nile tilapia (GIFT strain), freshwater prawn or marble goby will be tested in on-farm trials. Shrimp-fish polyculture options will be evaluated in low-salinity (< 12 ppt) brackish water ponds in order to achieve greater species diversity and resilience of operations, among others against disease outbreaks and economic loss. • In Malawi, research will investigate the water use efficiency of integrated agriculture-aquaculture systems in comparison to other small farm enterprises, towards understanding of drought resilience. In addition, the study in Malawi on the identification of factors regulating nitrogen retention

	in IAA systems will be completed.
2005	• In Cameroon conclusions will be drawn from studies on the use of farm wastes specific to existing farming systems in the humid forest zone (i.e., existing and potential plant materials, and animal manure) as nutrient inputs to ponds for profitability and sustainability, and on the reproduction and pond rearing of indigenous species.
2006	• From the wealth-stratified adoption studies, further specific research can be formulated to target the improvement of those technologies that are adopted and self-disseminated by the poor and have the greatest impact on them.

Output 3: Sustainable systems, and guidelines for the dissemination of aquaculture information and technology to fish farmers

Activities:
1. Malawi regional office for aquaculture support the SACCAR countries; Malawi aquaculture project for small farm diversification.
2. Mozambique, Zambia and outreach activities from Malawi.
3. Cameroon aquaculture project in the peri-urban-to-forest-margins transect.
4. Bangladesh sustainable aquaculture project; large-scale training and extension effort.
5. Vietnam smallholder livelihoods project in the Mekong River Delta.
6. "Recommendation Domains" project.

Milestones:

Year	Milestones
2004	• In Malawi, training on participatory aquaculture research and extension for NGO personnel carried out. • In Bangladesh, over 500 extension workers and senior NGO staff of cooperating NGOs will be trained. 7 000 additional farmers will benefit every year directly from training and support from the partner NGOs, and an additional number are expected to benefit through the adoption of improved aquaculture technologies imparted by staff of associate NGOs whose extensionists have received training from the Center, but no financial support. • In Vietnam, in cooperation with the Department of Fisheries of Bac Lieu Province in the Mekong River Delta, and the University of Cantho, efficient dissemination of IAA options to target farmers will be implemented. • During the MTP period, the BMZ-funded "Recommendation Domains" project will be implemented, which will identify characteristics of successful aquaculture development pathways and conditions and formulate these are useful tools for wider applications. • Web-based and CD-ROM-based versions of two recent publications with FAO and IIRR, summarizing existing technologies for smallholder aquaculture will be prepared. • Socio-economic analysis of existing and emerging aquaculture technologies in Bangladesh, Cameroon, and Malawi reported. • Constraints analysis and adoption studies of aquaculture technologies in Bangladesh, Cameroon and Malawi reviewed and reported.
2005	• Cameroon: recommendations from analyses of impact survey from the final year of the project.
2006	• Recommendations will be formulated for policy-makers and extension initiatives as to the features of user-appropriate poverty-impacting technologies and consumer needs of aquaculture-produced fish.

Costs for Thrust 4 (US$ million):
2004: 3.46
2005: 3.57
2006: 3.67

Users:
Policy-makers, government agency managers, NARS, NGOs, resource managers, fish farmers, development workers, scientists, international and regional bodies in Sub-Saharan Africa and Asia.

Collaborators:
NARS in Africa and Asia, ASIs in Germany, the Netherlands, UK Canada and USA; FAO HQ and regional offices in Africa and Asia-Pacific.

CGIAR Linkages:
ICRAF, IITA, and IRRI

Funding sources by donor name:
WorldFish Center unrestricted core funds, BMZ, Wageningen Agricultural University, CIDA, DFID, IDRC, USAID, and others to be identified.

Thrust 5 (=MTP Project 5): Freshwater fisheries in an integrated land and water management context

Purposes/Objectives:
1. To make available an improved portfolio of sustainable and appropriate technology options for integrated land and water management.
2. To produce improved knowledge of efficient and efficacious policies and local governance strategies.
3. To generate improved understanding of fish and fishery resources (biology, ecological roles, and economic and social values).

Gains
1. Improved management of aquatic resources with better knowledge and more participatory resources management among inland small-scale fisheries operators (full-time and part-time).
2. Improve governance to provide incentives for the application of technological know-how for integrated agriculture-aquaculture development.
3. Reduce poverty and improve the quality of life among fishers and farmers through increased productivity.
4. Increase productivity of fish to meet market demand ensuring contribution of fish to food security.

Output 1: Thorough understanding of target communities' needs and constraints

Activities:
1. Research on communities of inland fishers in Africa (i.e., Cameroon and Malawi) and Asia (Bangladesh and Vietnam)

Milestones:

Year	Milestones
2004	• In Malawi and Mozambique GIS mapping of historical land use changes will be employed and water quality monitoring in the Mnembo Catchment, Mozambique, will be conducted. Geostatistical mapping of the temporal and spatial distribution of Barbus species (locally known as "matemba") around the mouth of the Mnembo River in Lake Chilwa (Malawi and Mozambique) will be conducted. • Also in Malawi and Mozambique, studies will assess the catch from

	Lake Chilwa on the Malawian and Mozambican sides and relate them to land use activities in the corresponding catchments. • In the Mekong River Delta in Vietnam, studies will be completed in 2003 and recommendations for policy-makers for water flow management under multiple-use objectives formulated. Monitoring of actual catch and effort of different fishing gears, and salinity and pH of canal water before, during and after sluice gate opening will provide data for better understanding of the role of brackish water fisheries for landless poor. • In Bangladesh detailed studies will be initiated of communities' perceptions and constraints in respect to their access to indigenous fish species in fenced-off areas of community-based fish culture in floodplains. • In collaboration with local partners, a project proposal will be designed for eastern India and funding sought.
2005	• In Cameroon, studies will be completed on the existing management of riverine fisheries communities and options for improvement. • In Malawi and Mozambique, data analysis will commence on the fish catch versus land use characteristics of Lake Chilwa.
2006	• Comparative analyses of the situations, needs, and constraints of inland fishers in Africa and Asia will provide more detailed understanding and design of interventions targeting poor fishers.

Output 2: Technological options in relation to trade-offs necessitated by the community-level at which fishers operate

Activities

1. Research on communities of inland fishers in Africa (i.e., Cameroon and Malawi) and in Asia (Bangladesh and Vietnam).

Milestones:

Year	Milestones
2004	• In Malawi, different land use management options will be monitored and related to the corresponding fish abundance in the rivers and bays of Lake Chilwa. • In Bangladesh, a new research initiative into the improvement of fish production (naturally occurring and stocked) in seasonally fenced areas will be implemented. • In eastern India, as a new site for FRRP and in collaboration with the national partners in West Bengal, trials will be conducted on community-based fish culture in seasonally flooded and fenced areas, following the achievements and experiences gained from recent work in In Vietnam in the Mekong River Delta, a monitoring program on fish catch in canals versus water quality and a range of management parameters will be implemented. • Also in the Mekong River Delta in Vietnam, the management options for the sluice gate operation for brackish water inflow will be assessed towards optimized fish production through catch in canals, in relation to the other competing needs of other stakeholders.
2005	• Cameroon, studies of different management strategies of riverine fisheries will be completed. • In Bangladesh and eastern India (given adequate funding), results from trials of improved management of community-based fisheries and aquaculture in the same fenced-off water bodies will be available.
2006	• Comparative studies of different management strategies of river floodplain and small water body fisheries will provide better guidelines for improved management and enable trials of their implementation.

Output 3: Appropriate decision-support tools and institutional arrangements for management of freshwater inland fisheries

Activities:

1. Research on communities of inland fishers in Africa (i.e., Cameroon and Malawi)and Asia (Bangladesh and Vietnam).

Milestones:

Year	Milestones
2004	• Social science studies will study the adoption patterns and agreed institutional arrangements among communities already implementing the community-based fish culture approach. The expansion of this community-based aquaculture approach in Bangladesh and Vietnam will be monitored. A similar research project is planned for eastern India. • In the Mekong River Delta of Vietnam, modeling of fish availability as a function of flood control measures through sluice gate operations to enable brackish water inflow versus freshwater will produce guidelines to manage the water supply to benefit the poor. The aim is to enable brackish water canal fishery by the poor and low-intensity brackish water shrimp culture (in polyculture with fish) by the average poor and other stakeholders. • In Cameroon, different management options in riverine fisheries will be tested.
2005	• In Bangladesh and eastern India, results from community-based fisheries and aquaculture in the same stocked and fenced areas will be available; this includes information on the production of “native” small indigenous species fished by the poor throughout the year, and of improved stocking strategies of aquaculture species jointly managed by the communities (which include the poor landless fishers). • In Vietnam in the Mekong River Delta, studies and management trials will be established on the canal fishery in relation to the managed influx of saltwater that is pulsed by the periodic opening of sluice gates; agricultural land use options (integrated rice-fish-shrimp farming) will be tested; results will be included in an existing model maintained by IRRI.
2006	• Initial results from trials of community-based fish culture in Africa and Asia will enable the formulation of preliminary guidelines for widespread dissemination and adoption of the approach.

Costs for Thrust 5 (US$ million):
2004: 1.51
2005: 1.55
2006: 1.60

Users:
Resource managers, full-time and part-time fishers and farmers, policy-makers, NGOs, development workers, scientists in Asia, Sub-Saharan Africa, NARS, government agency managers, development workers, and regional and international bodies.

Collaborators:
WorldFish Center’s Research Programs, NARS and NGOs in Sub-Saharan Africa and South and Southeast Asia; ASIs in Canada, Germany, U.K., and U.S.A.

CGIAR Linkages:
IITA, IRRI, IWMI

Funding sources by donor name:
WorldFish Center unrestricted core funds, BMZ, CIDA-CCLF, DFID, and others to be determined

COASTAL AND MARINE RESOURCES RESEARCH PROGRAM (COASTAL PROGRAM)

Thrust 6 (=MTP Project 6): Restoration of Capture Fisheries

Objectives:
To restore coastal capture fisheries to more productive levels.

Gains/Impacts:
Improved livelihood opportunities for coastal dwellers and all coastal fisheries sectors.
Improved availability of fish for consumers.

Output 1: Better information on the distribution, status, and potential production of coastal stocks

Activities:
1. Genetic analysis of stocks at different scales to identify whether they transcend administrative boundaries and require co-operative management.
2. Analysis of the factors underpinning the production cycle of major species in coastal fisheries.
3. Assessments of species composition and status (size structure and abundance) of multispecies fisheries.

Milestones:

Year	Milestones
2004	• Genetic analysis of stocks of selected commercially important fish and invertebrates in Southeast Asia. • Arrangements to form a network of institutions involved in population genetics of fish in Asia to co-ordinate production of "resource maps" as the basis for co-operative management. • Major research results from TrawlBase Phase 1 submitted for publication in scientific journals. • Initiation of TrawlBase Phase 2, focusing on Indonesia, Malaysia and the Philippines, with an emphasis on increasing the spatial and temporal coverage of the trawl survey database. • Consultations with countries in the Caribbean to determine how best to assist them to improve the management of coastal fisheries, including the application of rectangular escape gaps and increased mesh size in fish traps, and identifying alternative livelihoods for fishers while inshore stocks are rebuilt through selected management measures.
2005	• Analysis of stock structure of additional species in Southeast Asia, including spiny lobsters. • Identification of species jointly exploited by different fisheries sectors in Southeast Asia and begin the synthesis of knowledge on factors underpinning the production of these species. • Identification of spawning biomass needed to restore stocks of key species in selected countries in Asia and Southeast Asia to productive levels, and potential impediments to the restoration resulting from current exploitation rates and patterns by different sectors. • Inclusion of data from Australia in TrawlBase and participation of Australian scientists in national training workshops on stock assessment. • Transfer of TrawlBase methods to Oman. • Establishment of joint activities with the Secretariat of the Pacific Community (SPC) on the management of coral reef fisheries in the Pacific. • Initiation of new projects on fisheries management in the Caribbean (to be determined after consultation).

2006	• Preliminary interpretation of the genetic population structure of different life history "types" of fish and invertebrates as the basis for co-operative management of stocks in Southeast Asia. • National workshops to review resource analyses results using TrawlBase Phase 2 data and to assess their management implications.

Output 2: Options for increased, sustained, and equitable harvests

Activities:
1. Analysis of the catch levels required to restore stocks, maintain the productivity of key species at optimum levels, and distribute the resource equitably among sectors.
2. Methods to improve productivity of wild stocks through restocking and stock enhancement.
3. Assessment of the role of marine protected areas as fisheries management tools.

Milestones:

Year	Milestones
2004	• Transfer methods for the hatchery production of sea cucumbers to selected countries in Southeast Asia. • Publication of a major review of restocking and stock enhancement of marine invertebrates for Advances in Marine Biology and development of guidelines for future research by the WorldFish Center on restocking and stock enhancement. • Surveys of the abundance and size structure of invertebrates in the Arnavon Islands Marine Conservation Area in the Solomon Islands six years after declaration of the MCA.
2005	• Development of a proposal for a large-scale test of the effectiveness of MPAs as a fisheries management tool in collaboration with the Government of Malaysia and other partners.
2006	• Larger scale releases of juvenile cultured sea cucumbers in the wild to restore stocks in New Caledonia. • Preliminary drafting of national action programs and regional collaborative support activities for sustainable management of coastal fisheries resources under TrawlBase Phase 2. • Improved capabilities of the national partners in coastal fisheries research and management.

Costs for Thrust 6 (US$ million):
2004: 1.31
2005: 1.35
2006: 1.39

Users:
Managers and policy-makers for coastal fisheries will have clear targets for setting the catch levels, and the distribution of catches, required to restore harvests to more productive levels and distribute the gains equitably among sectors. Managers will also have better information on the basic biology and extent of key species, and a greater range of possible interventions for restoring stocks and to their potential capacity for production.

Collaborators:
NARS and NGOs in Bangladesh, India, Indonesia, Malaysia, the Philippines, Sri Lanka, Taiwan, Thailand, Vietnam, New Caledonia and Oman; ASIs in Australia, Canada and Denmark, and regional and global programs of FAO, SEAFDEC, SPC, and TNC.

CGIAR Linkages:
Aspects of this project will overlap strongly with the proposed Challenge Program on "Making the Most of the Coast" to be done in collaboration with CIFOR, ICRAF, IRRI, and IWMI. We will also collaborate with other CGIAR Centers on the Challenge Program on "Climate Change", which has a component on the effects on coral bleaching and the distribution of fish.

Funding Sources:
Australian Centre for International Agricultural Research
AusAID
NZAID
Provincial Governments of New Caledonia
WorldFish Center

Thrust 7 (=MTP Project 7): Environmentally-friendly Coastal Aquaculture

Objectives:
1. To increase production of fisheries resources on a sustainable basis.
2. To create alternative livelihoods for fishers displaced by effort reduction schemes.

Gains/Impact:
Improved availability of fish for consumers. Reduced dislocation of coastal dwellers during the restoration of capture fisheries.

Output 1: Sustained low-input production systems

Activities:
1. Analysis of the potential range of coastal aquaculture enterprises and blockages to entry by the poor.
2. Development of low input, low-cost and low-impact production methods suitable for adoption by coastal dwellers.

Milestones:

Year	Milestones
2004	• Production of a book on the "Status and Potential of Aquaculture in the Pacific". • Acquisition of funding to implement the Center's role as the provider of technology for the development of aquaculture in the Pacific, including methods for the capture and culture of post-larval fish. • Transfer of the demonstration pearl farm in the Solomon Islands to the government and private sector, if an appropriate investor is identified. • Application for funds to analyse the nature of coastal aquaculture in Southeast Asia and blockages to entry by the poor. • Submission of proposal on the capture and culture of spiny lobster (puerulus) larvae in the Caribbean.
2005	• Initiation of new aquaculture projects in the Pacific in line with regional priorities and in partnership with SPC, USP, and national agencies. • Transfer of low-cost aquaculture methods to Papua New Guinea. • Implementation of research on aquaculture to create alternative livelihoods as part of a Challenge Program. • Initiation of work on spiny lobsters in the Caribbean.
2006	• Commencement of additional collaborative aquaculture projects with the provincial governments in New Caledonia to improve the livelihood of the Melanesian communities. • Initiative evaluations of the most suitable herbivorous and omnivorous fish species for coastal aquaculture, and appropriate partners. • Continuation of work on spiny lobsters in the Caribbean.

Costs for Thrust 7 (US$ million):
2004: 0.30
2005: 0.31
2006: 0.32

Users:
Managers and policy-makers responsible for ensuring the continued supply of seafood products; the creation of additional and alternative livelihoods for coastal dwellers, and environmentally sustainable use of the coastal zone.

CGIAR Linkages:
Aspects of this project will overlap strongly with the proposed Challenge Program on "Making the Most of the Coast" to be done in collaboration with CIFOR, ICRAF, IRRI, and IWMI. We will also collaborate with other CGIAR Centers on the Challenge Program on "Climate Change," which has a component on the effects on coral bleaching and the distribution of fish.

Funding Sources:
Australian Center for International Agricultural Research
AusAID
NZAID
WorldFish Center

Thrust 8 (=MTP Project 8): Reversing degradation of coastal habitats

Objectives:
1. To identify risks to the integrity of the coastal zone and develop effective systems for restoration and protection.
2. To equip all stakeholders with the information they need to evaluate alternative options for managing coastal fisheries resources effectively.

Gains/Impact:
Increased area and quality of coastal habitats supporting fisheries, resulting in greater levels of production. Improved access to information for managers and policy-makers responsible for the coastal zone.

Output 1: Interventions to reduce damage to the coastal zone

Activities:
1. Analysis of unaddressed impacts on coastal aquatic habitats stemming from watershed management, agriculture, forestry, and fishing.
2. Evaluation of interventions to mitigate such impacts and restore habitats.

Milestones:

Year	Milestones
2004	• Continue to support the ICRAN target and demonstration sites in East Africa, Southeast Asia, the Pacific, and the Caribbean • Complete Reefs at Risk analysis for the Caribbean with WRI • Coordinate the production of a GCRMN status report for Southeast Asia, and promote the adoption of standardized data management and analysis procedures for monitoring. • Implement the full proposal for the GEF targeted research proposal on coral reefs and contribute to the working groups on coral bleaching and remediation of coral reefs. • Collaborate with key partners to resubmit the Challenge Program "Making the Most of the Coast" to identify how to reduce the impact of agriculture, forestry, and watershed management on fish habitats in the coastal zone.
2005	• Implement the "Coastal" Challenge Program (if approved). • Develop data and information collaborations and links between GCRMN projects in Southeast Asia • Implement the full proposal for the GEF targeted research proposal on coral reefs and contribute to the working groups on coral bleaching and remediation of coral reefs.

2006	• Contribute the fisheries activities to the Challenge Program on "Climate Change" (if approved). • Coordinate the production of a GCRMN status report for Southeast Asia • Implement the "Coastal" Challenge Program (if approved). • Implement the full proposal for the GEF targeted research proposal on coral reefs and contribute to the working groups on coral bleaching and remediation of coral reefs.

Output 2: Knowledge-bases for coastal habitats and options for management

Activities:
1. ReefBase

Milestones:

Year	Milestones
2004	• Expansion of ReefBase to update information on coral reef status, threats and management to include comprehensive and current information for all countries with reef resources, and data from ReefCheck and selected GCRMN programs. • Development of specialized themes for data acquisition and summary in ReefBase, including coral bleaching, economic valuations, and reef fisheries. • Creation of an online data access and summary analysis facility in ReefBase for all reef level data derived from the Global Coral Reef Monitoring Network (GCRMN).
2005	• Creation of coral reef information systems for two countries or regions to incorporate links between detailed national data and the summary global information in ReefBase. • Incorporation of major reef fisheries data sets into ReefBase and analysis of trends and patterns in these data.
2006	• Creation of additional national level coral reef information systems in collaboration with relevant national agencies. • Incorporation of major socio-economic data sets into ReefBase and analysis of trends and patterns in these data. • Development of widely accepted data protocols and standards for coral reef information, and of widely applicable indicators of coral reef status and management effectiveness.

Costs for Thrust 8 (US$ million):
2004: 1.02
2005: 1.05
2006: 1.08

Users:
Managers and policy-makers responsible for maintaining the integrity of the coastal zone will have an improved understanding of the factors that degrade coastal habitats, improved access to information, new options for reducing the impact of activities such as agriculture and forestry in watersheds, and materials for training local area managers in effective management practices. The emphasis of coral reefs, through ICRAN, the targeted research program and ReefBase will ensure that information for improved management of these productive yet fragile ecosystems is available. The use of the demonstration – target site approach will also enable people at the village level to benefit from the outputs of the project.

Collaborators:
CGIAR Centers, regional fisheries and environmental management programs, GCRMN, TNC, UNEP, WRI, WWF; NARS, ASIs in Australia

CGIAR Linkages:
Aspects of this project will overlap strongly with the proposed Challenge Program on "Making the Most of the Coast" to be done in collaboration with IRRI, ICRAF, CIFOR and IWMI. We will also collaborate with other CGIAR Centers on the Challenge Program on "Climate Change," which has a component on the effects on coral bleaching and the distribution of fish.

Funding Sources:
United Nations Foundation
United Nations Development Program
WorldFish Center

POLICY RESEARCH AND IMPACT ASSESSMENT PROGRAM (Policy Program)

Thrust 9 (=MTP Project 9): Economic, policy and social analysis, and valuation of aquatic resources in developing countries

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 that are available from the fisheries sector.

Gains
1. Improve the management of aquatic resources with better knowledge and more participatory resources management among coastal communities and small-scale fisheries operators.
2. Improve governance to provide incentives for the application of technological know-how for integrated agriculture-aquaculture development.
3. Reduce poverty and improve the quality of life among fishers and farmers through increased productivity.
4. Increase productivity of fish to meet market demand ensuring contribution of fish to food security.
5. Improve international trade policies enabling sustainable supplies of aquatic resources in developing countries.

Output 1: Appropriate valuation methods of aquatic resources and their values for policy analysis

Activities:
1. Policy analyses and economic valuation of coral reefs
2. Economic valuation of wetland resources
3. Economic valuation of carp species in Asia

Milestones:

Year	Milestones
2004	• Recommended valuation methods disseminated. • Policy analysis and strategies for climate change adaptation recommended to regional agencies and stakeholders. • Seasonal socio-economic values of aquatic resources in Cambodia estimated. • Seasonal constraints to access aquatic resources by different stakeholders analyzed. • Secondary data on wetland resources and their users in selected Asian countries and coral reefs in the Caribbean and meso-American countries compiled. • Contribution of aquatic resources to livelihood in Africa (e.g. Cameroon, Malawi, and Mozambique) and Asia (Bangladesh and the Mekong River region) assessed.

	• Policy recommendations for more efficient use of floodplains in the Mekong River region disseminated to national partners and government agencies of riparian countries. • Analytical techniques on the measurement of values of various aquatic resources assessed and databases on these methodologies (e.g., coral reefs, floodplains, wetlands, fish genetic resources and aquatic biodiversity) continued.
2005	• Livelihoods dependent on coral reef ecosystems better understood and policy recommendations drafted and shared with stakeholders and regional agencies, in particular those located in the Caribbean, East Africa, East and Southeast Asia, and the South Pacific. • Analytical frameworks on values of aquatic resources including carp genetic resources and Mekong wetlands conceptualized. • Information on economic values of different stocks of major carp species of genetic materials collected. • Values of aquatic resources incorporated into policy-making and implementation processes in the Mekong River region
2006	• Capacity building for aquatic resources valuation developed in the Mekong River region. • Regional workshop on aquatic resources valuation carried out. • Results of aquatic resources valuation published and disseminated to policy-makers in the region.

Output 2: Models of small-scale fisheries for improved management

Activities:
1. Development of methods for measuring fishing capacity
2. Measurement of fishing capacity in Asian countries
3. Dialogue with policy-makers and donor agencies on approaches for managing capacity in fisheries.

Milestones:

Year	Milestones
2004	• Policy briefs and policy recommendations for technology adoption and optimal resource allocation in the milkfish industry in the Indonesia and the Philippines published, and report prepared. • Expert meeting on managing fishing capacity in small-scale fisheries carried out.
2005	• Demonstration sites in three Asian countries for managing fishing capacity set up. • Analysis of alternative livelihoods for coastal communities in three Southeast Asian countries completed.
2006	• Demonstration sites in two African countries for managing fishing capacity set up. • Analysis of alternative livelihoods for coastal communities in two African countries completed.

Output 3: Social, economic, and policy implications of integrated agriculture-aquaculture technologies (jointly implemented by Policy and Freshwater Programs)

Activities:
1. Studies on adoption patterns of IAA technologies in Bangladesh, Cameroon and Malawi
2. Develop the methodology for assessing the impact of INRM research

Milestones:

Year	Milestones
2004	• Socio-economic analysis of existing and emerging aquaculture

	technologies in Malawi reported. • Constraint analysis and adoption studies of aquaculture technologies in Bangladesh and Malawi reviewed and reported.
2005	• Socio-economic analysis of existing and emerging aquaculture technologies in Cameroon reported. • Constraint analysis and adoption studies of aquaculture technologies in Cameroon reviewed and reported.
2006	• Policy analysis of aquaculture development and appropriate recommendations provided.

Output 4: Disaggregated market models of fish and seafood for developing improved policies on food security, poverty reduction and livelihood

Activities:
1. Incorporation of fish into IFPRI's World Food Model
2. Disaggregated analysis of fish supply and demand in Africa and Asia
3. Projection of fish supply and demand in Asia by species group
4. Analysis of trade pattern, marketing and distribution, and post-harvest operation of aquatic resources in Africa and Asia.
5. Development and maintenance of a socio-economic database of fisheries and aquaculture sector.

Milestones:

Year	Milestones
2004	• Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poorer households in Asia recommended. • A socio-economic database on world fisheries and aquaculture (WorldFish Statistics) developed. • Maps of fish consumption by species group and income class developed. • Survey of fish producers and consumers in Egypt and selected countries of West Asia initiated. • A study on the production, consumption, and accessibility of fisheries products in Sub-Saharan Africa initiated. • 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 selected countries of West Asia and North Africa (WANA) identified.
2005	• Impacts of international trade regimes (e.g., WTO, eco-labeling, certification schemes) on aquatic resources sustainability, markets, and welfare assessed. • Relative contribution of different types of aquaculture and capture fisheries on growth, equity, and food security analyzed. • Economic profile of aquaculture and fisheries technologies in selected countries of WANA reviewed and analyzed. • Policies, institutions, and support services for fisheries and aquaculture in selected countries of WANA reviewed and analyzed. • Results of the study on production, consumption, marketing, and trade of fish and seafood in selected countries of WANA compiled
2006	• Demand-supply elasticities by fish groups estimated and country- specific fish-sector models for selected countries of WANA developed. • Strategies and options for increasing and sustaining fisheries and aquaculture production to benefit poor households in selected countries in WANA recommended. • Disaggregated WorldFish Model developed.

Costs for Thrust 9 (US$ million):
2004: 0.94
2005: 0.97
2006: 0.99

Users:
Policy-makers, government agency managers, NARS, NGOs, regional and international bodies, resource managers, fishers, development workers, scientists in Asia, Sub-Saharan Africa, and the Caribbean.

Collaborators:
NARS, government organizations, NGOs, CEMARE, FAO, ICRAN, INFOFISH, IFPRI, IUCN, MACC, MRC, WRI, WWF, UNEP Regional Seas Program in Southeast Asia, the Caribbean, East Africa and South Pacific, ARIs in Canada, Caribbean, Denmark, U.K. and U.S.A.

CGIAR Linkages:
Links to IFPRI's World Food Model
"IMPACT", PRGA-CIAT, IITA, IRRI (potential)

Funding sources by donor name:
WorldFish Center unrestricted core fund, ADB, BMZ, CORDIO, DFID, IDRC, IFAD, Oxfam, Sida, USAID, and others to be identified.

Thrust 10 (=MTP Project 10): Aquatic resources planning and impact assessment

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

Gains
1. Improve impact assessment policies and methods
2. Increase stakeholders and coastal communities participation in the decision-making process
3. Increase awareness among stakeholders and coastal communities on the importance of conservation and the sustainable management of aquatic resources.

Output 1: Methodology and operational guidelines for assessing the impact of aquatic resources research and development

Activities:
1. Development of methodology and framework for assessing the impact of aquatic resource research (both ex-ante and ex-post)
2. Identification of indicators for assessing the impact of aquatic resource research.

Milestones:

Year	Milestones
2004	• Integrated framework for assessing the economic and environmental impacts of aquatic resources research and development conceptualized • Methodologies for assessing the contribution of aquatic resources to livelihoods reviewed and improved. • Methodologies for assessing the impacts of INRM developed and tested in Bangladesh and Malawi. • Methods for impact assessment of improved carp species designed and implemented.
2005	• Methodologies for assessing the impacts of INRM developed and tested in Cameroon and Malawi.

	• Indicators for assessing the impacts of aquatic resources development projects on poverty developed. • Indicators for assessing the impacts of INRM developed. • Sustainability indicators for aquatic resources developed. • Guidance provided to formulate new projects that include impact monitoring indicators.
2006	• Methodologies for assessing the impacts of INRM developed and tested in Cameroon and Malawi (continuation) • Guidance provided to formulate new projects that include impact monitoring indicators (continuation).

Output 2: Impact assessment of aquatic resources research and development

Activities:

1. Impact assessment of community-based fisheries management in Bangladesh and Mekong River region
2. Impact assessment of aquatic resources management in deep flooded areas of Bangladesh and the Mekong River region
3. Capacity building of Mekong regional partners on participatory community monitoring in natural resources management (NRM)
4. Impact of INRM research in Bangladesh, Cameroon and Malawi
5. Impact assessment of improved carp species.

Milestones:

Year	Milestones
2004	• Impacts of aquaculture and NRM research in Bangladesh assessed. • Impacts of CBFM in Bangladesh and the Mekong River region assessed using improved methodologies. • Impact of aquaculture production and marketing on livelihoods in selected Asian countries assessed.
2005	• Impacts of CBFM in Bangladesh, the Lao PDR, and Vietnam assessed. • Impact of devolution and co-management of aquatic resources assessed in Africa (i.e., Malawi and Mozambique) and in Asia (i.e., Bangladesh, Cambodia, Indonesia, the Philippines, Thailand and Vietnam). • Impact of aquaculture and NRM research in selected African countries (e.g., Cameroon and Malawi) assessed. • Impact of aquaculture production and marketing on livelihoods in selected Asian countries assessed (continuation). • Impact of improved carp species in Asia assessed.
2006	• Impact of participatory development and dissemination of aquaculture technologies in Bangladesh assessed. • Impact of participatory aquatic resources management assessed in the Mekong River region. • Socio-economic monitoring protocols for aquatic environments developed and implemented in at least two countries in the Southeast Asian region. • Final evaluation of CBFM project impacts carried out covering over 100 sites in Bangladesh. • Impacts of CBFM in Bangladesh and Vietnam assessed.

Costs for Thrust 10 (US$ million):
2004: 0.48
2005: 0.50
2006: 0.51

Users:
WorldFish Center scientific staff, Board and management, donors, NARS, policy-makers, government agency managers, NGOs, and regional and international bodies.

Collaborators:
WorldFish Center Research Programs, ASIs, ISNAR, NGOs, SEAFDEC-Aquaculture Department, and NARS in South and Southeast Asia and the Pacific.

CGIAR Linkages:
INRM group, SPIA

Funding sources by donor name:
WorldFish Center unrestricted core funds, DFID, IFAD, and others to be identified.

Thrust 11 (=MTP Project 11): Legal and institutional analysis for aquatic resources management

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

Gains:
1. Increased participation among stakeholders in the decision-making process in aquatic resources management.
2. Strengthening of institutional partners such as government organizations, NGOs, and local institutions.
3. Capacity building among national institutions on policy formulation for sustainable aquatic resources management.

Output 1: Methods and framework for participatory action-oriented research on governance of aquatic resources

Activities:
1. Institutional analysis of wetland management in the Mekong River region
2. Workshops to improve national legal and institutional frameworks and to increase local capacity to manage wetlands and their resources
3. Document case studies on the applicability of co-management as a sustainable, efficient and equitable resource management strategy
4. Development of model(s) for participatory policy analysis of aquatic resources management.

Milestones:

Year	Milestones
2004	• Research results from the co-management project disseminated in Africa and Asia. • Socio-economic monitoring programs developed for selected MPAs in meso-America and the findings shared and disseminated among MPA managers in the region. • Mid-term review of CBFM in Bangladesh conducted. • Study of conflict and conflict resolution methods developed for fisheries in Bangladesh. • Livelihood options and future income opportunities for the next generation of fishing communities in Bangladesh assessed and implemented. • Changes in social capital and attitudes to cooperation among stakeholder groups in the pilot areas in Bangladesh and the Mekong

	River region assessed. • Models for participatory policy analysis of aquatic resources management developed and tested in Cambodia.
2005	• Expert meeting on devolution and governance of aquatic resources. • State-of-the-art conference on institutional analysis of aquatic resources management. • Workshop to disseminate models for participatory policy analysis of aquatic resources management to countries in the Mekong River region. • Participatory monitoring systems of aquatic resource use developed and tested in Bangladesh and the Mekong River region.
2006	• Uptake of conflict resolutions methods promoted in at least three countries in the Southeast Asian region. • Dialogue on conflict resolution in aquatic resources management developed and established with policy-makers in the Southeast Asian region. • Models of conflict resolution and improved governance developed and disseminated in the Southeast Asian region. • National workshop on CBFM held in Bangladesh.

Output 2: Policies and institutional arrangements for governance of aquatic resources

Activities:
1. Develop a process for livelihood strategy analysis and participatory planning
2. Assess fishery policy formulation process
3. Survey the media access of the fishers' communities
4. Monitor the process, performance and impact of different governance models
5. Workshops to disseminate information on the applicability of co-management for policy-makers and resource managers
6. Provide technical assistance to the co-management initiatives of NARS partners.

Milestones:

Year	**Milestones**
2004	• Action research on CBFM in more than 100 sites in Bangladesh and in selected sites in the Mekong River region continued. • Livelihood options and future income opportunities for the next generation of fishing communities in Bangladesh assessed and applied. • Ways to link local community management over larger linked fisheries comprising rivers, floodplains and other wetlands in Bangladesh and the Mekong River region identified. • Conflict management approaches and consensus-building tested in Bangladesh, India and Cambodia • Local institutions and planning processes for integrated floodplain management tested in Bangladesh and findings disseminated.
2005	• Action research on CBFM in more than 100 sites in Bangladesh and in selected sites in the Mekong River region continued. • Resilience of governance models evaluated in Africa and Asia. • Compliance, legitimacy and governance issues tested in three African countries. • Expert models of governance for use at the local level developed. • Policies for CBFM generated and disseminated.
2006	• Database for co-management developed and implemented in Bangladesh and Cambodia. • Issues of decentralization and effective governance to meet international regulations addressed. • Comparative analysis of CBFM experience in Bangladesh and lessons drawn for scaling up

Costs for Thrust 11 (US$ million):
2004: 2.66
2005: 2.74
2006: 2.83

Users:
Resource managers, fishers, policy-makers, NGOs, development workers, scientists in Sub-Saharan Africa, the Caribbean, and Asia.

Collaborators:
NARS and NGOs in Bangladesh, Cambodia, Indonesia, the Lao PDR, Malaysia, Malawi, Mozambique, the Philippines, South Africa, Thailand, Vietnam, Zambia, Zimbabwe, ARIs in Canada, Caribbean, Denmark, U.K. and U.S.A., the Mekong River Commission, AIT-Aqua Outreach, IUCN-Cambodia, Prince of Songkhla University, and Wetlands International

CGIAR Linkages:
System-wide project on common property and collective action research (CAPRi), IFPRI

Funding sources by donor name:
WorldFish Center unrestricted core funding, Danida, DFID, NOAA, and Sida

Users:
WorldFish Center scientific staff, Board and management, donors, and NARS

INTERNATIONAL RELATIONS AND PARTNERSHIPS

Thrust 12(=MTP Project 12): Improved Partnerships and Capacity Building Among Developing Country NARS

Purposes/Objectives:
1. To strengthen existing collaborations and develop new partnerships with NARS, NGOs, regional and international organizations, advanced scientific institutions and the private sectors
2. To build a critical mass of science capacity in developing countries

Gains:
1. Increased production of aquatic organisms through improved breeds and farming systems developed
2. Conservation and improved management of aquatic resources
3. Better informed NARS scientists and managers and thus improved aquatic resources management
4. Human resources development in developing countries through networking and partnerships.

Output 1: Identification of NARS research priorities and development and strengthening of research partnerships and networks

Activities:
1. International Partnerships
2. International Network on Genetics in Aquaculture (INGA)
3. Public-Private Partnerships in Fish Genetic Research
4. Network of Tropical Aquaculture and Fisheries Professionals (NTAFP)

Milestones

Year	Milestones
2004	*International Partnerships:* • Partnerships with NARS, ASIs, and IARCs strengthened and new partnerships developed;

Year	Milestones
	• Meetings with NARS institutions in various countries organized to assist them in prioritization and establish collaborations; • Assistance provided in capacity building of NARS scientists; • Fourth meeting of Group of Fisheries and Aquatic Research (GoFAR) organized; • Partnerships database maintained. *INGA:* • Identification of new areas for regional collaboration • INGA member countries assisted with implementation of national breeding programs and development of national plans for dissemination and management of improved fish breeds; • Capacity of INGA member country scientists on breeding and genetics enhanced; • Publication of proceedings of "Ecological Risk Assessment of Genetically Improved Fish" • Germplasm exchange among member countries facilitated and coordinated; Public-Private Partnership in Fish Genetic Research • Recommendations for better linkages between private and public sectors in fish genetic research and dissemination of genetic research outputs to end-users formulated. • Workshop to disseminate research results, lessons learned conducted and information disseminated widely through publication. *NTAFP*: • Outputs of NTAFP members enhanced through publication of research findings in *NAGA* (Fishbyte/Aquabyte sections) and assistance in information searches; • Communications among fisheries professionals enhanced.
2005	*International Partnerships*: • Partnerships with NARS, ASIs, and IARCs strengthened and new partnerships developed; • Meeting with NARS institutions in Vietnam/Mekong River Basin countries to identify research priorities and establish collaborations; • Assistance provided in capacity building of NARS scientists. *INGA:* • Annual INGA Steering Committee meeting organized; • Germplasm exchange among member countries facilitated and coordinated; • INGA member countries assisted with implementation of national breeding programs and plans and strategies for the dissemination and management of improved fish breeds; • Capacity of INGA member country scientists on breeding and genetics enhanced. *NTAFP:* • Outputs of NTAFP members enhanced through publication of research findings in *NAGA* (Fishbyte/Aquabyte sections) and assistance in information searches; • Communications among fisheries professionals enhanced.
2006	*International Partnerships*: • Partnerships with NARS, ASIs, and IARCs strengthened and new partnerships developed; • NARS research agenda and priority identified and research collaborations established; • Assistance provided in capacity building of NARS scientists. *INGA:* • Annual INGA Steering Committee Meeting organized; • Germplasm exchange among member countries facilitated and coordinated; • INGA member countries assisted with implementation of national breeding programs;

Year	Milestones
	• Capacity of INGA member country scientists on breeding and genetics enhanced. *NTAFP:* • Outputs of NTAFP members enhanced through publication of research findings in *NAGA* (Fishbyte/Aquabyte sections) and assistance in information searches; • Communications among fisheries professionals enhanced.

Output 2: Enhancement of knowledge and research capabilities of national scientists and institutions

Activities:
1. Training on Coastal Management
2. Training and other Capacity Building Programs

Milestones

Year	Milestones
2004	**Training on Coastal Management** • Establishment of a Regional Training Center in the Philippines for integrated coastal zone management to strengthen links with the UNDP Train-Sea-Coast Program. • Development of additional training courses on coastal zone management with national counterparts in other countries. • Training of trainers • Webpage design and launching. **Training and other capacity building programs** • Implementation of research internship programs for visiting scientists, post doctoral fellows and M.Sc./Ph.D. students • Implementation of short and long-term training programs • Training database updated
2005	**Training in Coastal Management** • Operationalization of a Regional Training Center in the Philippines for integrated coastal zone management • Further training programs on coastal zone management with national counterparts and within other Southeast Asian countries delivered. **Training and other capacity building programs** • Implementation of short and long-term training programs • Implementation of research internship programs for visiting scientists, post doctoral fellows and M.Sc./Ph.D. students • Training database updated
2006	**Training in Coastal Management** • Deliver further training programs on coastal zone management within other Southeast Asian countries **Training and other capacity building programs** • Implementation of short and long-term training programs • Training database updated.

Costs for Thrust 12 (US $ million):
2004: 0.66
2005: 0.68
2006: 0.70

Users:
Global community concerned with aquatic resources research and management; NARS scientists and managers; policy-makers and donors

Collaborators:
NARS from developing countries and advanced scientific institutions, regional and international organizations involved in living aquatic resources management worldwide.

CGIAR linkages:
SGRP for INGA; none specifically for training, but the Center contributes to the CGIAR thrust on NARS capacity building.

Funding sources by donor name:
The Government of Norway has provided support to INGA until end 2003; WorldFish Center core funds are the major source of support for the program's partnerships and capacity building activities; the David and Lucile Packard Foundation and the John D. and Catherine T. MacArthur Foundation have provided funds for training activities on Coastal Management.

Thrust 13 (=MTP Project 13): Access to information for sustainable development of fisheries and aquatic resources.

Objectives:
1. Assist with the dissemination of the Center's research results to the targeted potential users of the information and relevant stakeholder communities.
2. Dissemination of living aquatic resources information, particularly to developing countries.
3. Raise awareness of global living aquatic resources issues and of the role of research in sustainable development of fisheries and aquatic resources, to all stakeholder groups (e.g., collaborators, NARS, governments, community groups, etc.)

Gains:
1. Increased likelihood of uptake of research results.
2. Greater sharing of information and understanding of living aquatic resources information, to all stakeholder groups.

Output 1: Sharing information and knowledge, communicating outcomes and positioning research for sustainable development of fisheries and aquatic resources

Activities:
1. Information Services
2. Communications Unit
3. E-Communications Unit
4. Public Awareness

Milestones:

Year	Milestones
2004	*Information Services:* • Strengthen cooperation and resource-sharing with other fisheries and aquatic libraries worldwide and participation in CGIAR virtual library. • Procedure manuals that will function as reference guides for library operating procedures prepared. • Increase the digital collections of the Center's previously published publications. • Increase subscriptions to electronic information resources. • Conduct information services training course. • Information services in the WorldFish Center sites strengthened. • Information services to the Center's partners provided.

	Communications Unit: • Organize presentation skills and Powerpoint training to improve communication skills. • Advise all contributors to *NAGA* of the acceptance or rejection of their manuscripts within four months. • Develop an online interactive information system for managing NAGA contributions. *E-Communications Unit*: • Enable online enquiry, feedback and subscription mechanism at the website to receive public queries to the Center's research and request for information resources. • Develop e-forum at the website for dialogue on fisheries and aquatic resources issues. • Provide complete information on the Center's research and wider coverage of all regional offices work. *Public Awareness:* • Develop coverage of the Center in the regional and international media. • Develop regular opinion-editorial features in the regional and international media. • Develop two background stories for "Future Harvest." • Develop information brochures for all regional offices. • Strengthen communications for "Fish for All" and resource mobilization strategy.
2005	*Information Services:* • Develop library web pages as a gateway to specialized high quality sources of information. • Develop value-added information products. • Develop impact metrics for the Center's publications. • Develop information service policies for research offices. • Conduct information services training course. • Host ASFA Board Meeting and encourage countries in the region to become partners. • Information services to the Center's partners provided. *Communications Unit:* • Organize skills development training to improve communication. *E-Communications Unit:* • Enable and develop the Center's website to provide accessible and specialized information on global fisheries and aquatic resource management outputs by the Center. • Where appropriate, provide full range of Center's information resources in electronic media format of CD-ROMs to disseminate, thus reducing costs for both users and the Center. *Public Awareness:* • Increase news coverage of the Center, and the number of regular opinion-editorial features in the regional and international media. • Strengthen communications for "Fish for All" and resource mobilization strategy.
2006	*Information Services:* • Strengthen cooperation and resource-sharing with other fisheries and aquatic libraries worldwide and participation in CGIAR virtual library. • Develop value-added information products. • Information services in the WorldFish Center sites strengthened.

	• Information services to Center's partners provided. *E-Communications Unit:* • Implement Web-Content Management System for the Center's website. The Web-Content Management System automates publications of contents to the website from the users' end while complete control of uploading is maintained by the webmaster. *Communications Unit:* • To develop an on-line publication request system *Public Awareness:* • Increase news coverage and opinion-editorial features in the national, regional and international media. • Generate greater awareness of the Center's impacts on poverty eradication and food security. • Promote the impact of "Fish for All" to the global community. • Increase communications support for resource mobilization strategies.

Costs for Thrust 13 US$ (million):
2004: 0.58
2005: 0.60
2006: 0.62

Users:
Global community concerned with aquatic resources research and management; NARS scientists and managers; policy-makers and donors.

Collaborators:
NARS, advanced scientific institutions, regional and international organizations involved in living aquatic resources management worldwide. Information sources such as other CGIAR Centers, FAO, regional aquaculture and fisheries information centers.

CGIAR linkages:
Marketing Group and Information Professionals Group.

Funding sources by donor name:
WorldFish Center core funds.

Acronyms

ACIAR	Australian Centre for International Agricultural Research
ACP	Africa, Caribbean and Pacific
AGM	annual general meeting
AKVAFORSK	Norwegian Institute of Aquaculture Research
ARI	Advanced Research Institutions
ASI	Advanced Scientific Institutions
AusAID	Australian Agency for International Development
BMZ	Bundesministerium für Wirtschaftliche Zusammernarbeit und Entwicklung
BVI	British Virgin Islands
CAPRi	System-wide Initiative on Property Rights and Collective Agreements
CAS	catalogue of fishes
CBFM	community based fisheries management
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIDA	Canadian International Development Agency
CIFOR	Center for International Forestry Research
CIMMYT	International Maize and Wheat Improvement Center
CIRAD	Coopération Internationale en Recherche Agronomique pour le Développement
CORDIO	Coral Reef Degradation in the Indian Ocean
CP	Challenge Program
Danida	Danish International Development Assistance
DFID	Department of International Development, UK
DSAP	Development of Sustainable Aquaculture Project
FAO	Food and Agriculture Organization
GAPE	Global Association for People and the Environment, Laos
GCRMN	Global Coral Reef Monitoring Network
GEF	Global Environmental Facility
GIFT	genetically improved farmed tilapia
GIS	Geographic Information System
GISP	Global Invasive Species Program
GoFAR	Group of Fisheries and Aquatic Research
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IAA	integrated aquaculture and agriculture
IARC	International Agricultural Research Centre
ICARDA	International Center for Agricultural Research in Dry Areas
ICM	integrated coastal management
ICRAF	International Center for Research in Agroforestry
ICRAN	International Coral Reef Action Network
ICRISAT	International Crops Research Institute for the Semi-arid Tropics
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IFREMER	Institut Francais de Recherche pour l'Exploitation de la Mer (French Research Institute for the Exploitation of the Sea)
IIFET	International Institute of Fisheries Economics and Trade
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute

IMPACT	International Model for Policy Analysis of Agricultural Commodities and Trade
INGA	International Network on Genetics in Aquaculture
INRM	integrated natural resource management
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
IRS	internationally recruited staff
ITMEMS	International Tropical Marine Ecosystem Management Symposium
IUCN	World Conservation Union
IWMI	International Water Management Institute
LMEs	large marine ecosystems
MCA	Marine Conservation Area
MNHN	Museum National d'Histoire Naturelle
MPA	marine protected area
MSSP	Multi-Sector Support Program
MTP	Medium Term Plan
NARES	National Aquatic Research and Extension Systems
NARS	National Aquatic Research Systems
NOAA	National Oceanographic and Atmospheric Administration
NRM	National Resources Management
NRS	nationally recruited staff
NTAFP	Network of Tropical Aquaculture and Fisheries Professionals
NZAID	New Zealand Agency for International Development
OECD	Organisation for Economic Cooperation and Development
RESTORE	research tools for natural resource management monitoring and evaluation
RET	research extension and training
RRS	regionally recruited staff
SACCAR	Southern African Center for Cooperation in Agricultural and Natural Resources Research and Training
SEAFDEC	Southeast Asian Fisheries Development Centre
SEARCA	Southeast Asian Regional Center for Graduate Study and Research in Agriculture
SFIS	Selective Fisheries Information Service
SGRP	System-wide Genetic Resources Program
Sida	Swedish International Development Cooperation Agency
SPC	Secretariat of the Pacific Community
SSA	sub-Saharan Africa
TCDC	Technical Cooperation among Developing Countries
TNC	The Nature Conservancy
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNEP-WCMC	United Nations Environmental Program-World Conservation Monitoring Centre
UNF	United Nations Foundation
USAID	United States Agency for International Development
USP	University of the South Pacific
VRSAP	Vietnam river systems and plains
WARDA	West Africa Rice Development Association
WFCP	Water and Food Challenge Program
WRI	World Resources Institute
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization
WWF	World Wildlife Fund