Medium-Term Plan 2005 - 2007

WorldFish
CENTER

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Medium Term Plan 2005-2007

WorldFish
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The WorldFish Center: Our Mission and Vision

The WorldFish Center is part of the Future Harvest Alliance of international research centers supported by the Consultative Group on International Agricultural Research (CGIAR).

Our Mission:

To reduce poverty and hunger by improving fisheries and aquaculture

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 are under serious threat. Many forms of aquaculture have yet to be proven sustainable and accessible to the poor.

The WorldFish Center is responding to these challenges 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.

Our Vision:

We will be the science partner of choice for delivering fisheries and aquaculture solutions for developing countries.

Executive Summary

This Medium Term Plan (MTP) describes the World Fish Center's programs and partnerships and explains how they will help to reduce poverty, increase food and nutritional security, and improve 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 2003-2004, particularly the recent interim reports of the Millennium Task Forces, the most recent Human Development Report, the World Bank fisheries approach paper, and the ongoing trends of overexploitation, reduced production and increased demand for fish and other aquatic resources.

This plan highlights the significant achievements of the Center in a number of key areas. These achievements include increases of US$220-400/yr in net returns per farmer in Bangladesh and Vietnam from research on community based fish culture in flooded fields (an approach that has been so successful that it has been copied by numerous neighboring groups); an increase in average fish yields from 300 kg to over 600 kg for farmers in Bangladesh using semi-enclosed water bodies; and an increase in harvest weight by 10% in a single year using the Center's Genetically Improved Farm Tilapia (GIFT) stock.

Scientific and technical achievements during the past year include: the development of a decision support tool (BayFish) using Bayesian modeling to integrate the various factors driving fish production in the Tonle Sap Great Lake of Cambodia; a multi-market fish model, the first of its kind in the fisheries and aquaculture sector, to be used in nine Asian countries; and a global protocol for the assessment and monitoring of coral bleaching, a phenomenon which currently represents a major threat to coral reef ecosystems.

The Center continues to invest in the development of knowledge systems which provide critical information on policy options, lessons learned, and key facts on the biology, status, threats and management of resource systems and fish stocks. This year, through a major grant from the World Bank, the Center was able to comprehensively upgrade three global public good databases (FishBase, ReefBase and Trawlbase).

Some of WorldFish major publications this year include "Fish to 2020" a book published with the International Food Policy Research Institute (IFPRI), a Future Harvest Alliance Partner, a substantial book with 1 110 pages and CD entitled "Assessment, Management and Future Directions for Coastal Fisheries in Asian Countries", and a definitive review of restocking and stock enhancement to be published as a complete volume of Advances in Marine Biology.

This MTP also highlights the Center's ongoing work in Africa, a region in which poverty and food insecurity combine to create a growing need for technical and policy assistance to government agencies and national scientists.

In the previous MTP (2004-2006), a series of 13 MTP Projects (= Thrusts) and 29 Outputs was used to group the Center's planned activities. This year, after careful consideration, WorldFish decided that consolidating our work into a smaller number of MTP projects would more clearly communicate the key elements of our research plan to clients, donors and the public. As a result of this decision, the 13 MTP Projects have now been grouped into 6 MTP projects, equivalent to our 6 existing programs, for 2005-2007. Thus, planned activities in the current MTP represent an evolution of our work program and not a new direction.

Highlights 2003-2004

MTP Project 1: Sustainable Use of Biodiversity and Genetic Resources

- A 10% increase in harvest weight percentage for one generation of the Center's Genetically Improved Farm Tilapia (GIFT) in Malaysia, indicates good prospects for further improvements.

- The successful application of GIFT technology in Africa is resulting in the dissemination of improved fish in Ghana and Malawi to farmers in general and, in Malawi, to Women's Clubs as well. Improved fish have greater survival and growth rates, thus contributing to increased aquaculture productivity in these countries.

- An updated 2004 edition of FishBase, the Center's comprehensive database on fish biology and ecology, was produced in DVD and CD-ROM format. A Chinese language edition of the book was also published. The FishBase website provides access in nine languages and is now the most frequently used Internet resource in the CGIAR with over 11 million user sessions per month.

- In the Laotian Mekong, the migration ecology and hydrological requirements of 110 fish species of the Laotian Mekong have been documented to better assess the consequences of flows modifications on fish production and contribute to informed river basin management.

- A decision-support tool that integrates factors driving fish production has been developed for the Tonle Sap Great Lake in Cambodia, the most intensive freshwater fishery in the world. These factors can now be integrated with water and land management initiatives using this tool.

MTP Project 2: Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management

- In Bangladesh and Vietnam, the seasonal operation of community-based fish culture in fenced seasonally flooded areas has been shown to increase the net return to farmers by US$220-400/yr. The success of the technology (which the Center applied and extended to involve the landless community) is underlined by the fact that numerous neighboring groups have spontaneously formed around the project's trial areas to copy the approach.

- In Bangladesh, Malawi and Cameroon, several thousand new farmers adopted the Center's improved aquaculture approaches on their farms. This increased adoption has led to a significant increase in benefits and was achieved by capacity building and facilitating cooperation between government and non government groups. During the last four years about 133 740 Bangladeshi fish farmers have adopted the technology and their average yield has increased from 1.34 to 2.73 t/ha. These farmers have produced 50 486 t of additional fish at an approximate value of US$47.82 million. In Malawi, the adoption of integrated Agriculture-Aquaculture (IAA) technology has increased farm income by 28%, improved technical efficiency of farming by about 50%, and increased per capita fish consumption by about 160%.

- In the Mekong River Delta, our research has documented and explained the temporal and spatial changes in fish species abundance in human-made canals. This is vital information for the managers of the canals in considering the needs of the landless poor farmers who depend on fisheries in brackish water canals for a major part of their livelihood.

MTP Project 3: Making the Most of the Coast

- The economic feasibility of village enterprises was demonstrated based on the capture and culture of post-larval coral reef fish and invertebrates for the marine aquarium trade. A manual for small-scale operators has been developed to facilitate transfer of this technology for alternative income generation.

- A charity auction of black pearls from the Center's demonstration pearl farm in the Solomon Islands promoted and demonstrated the opportunities to create sustainable alternative livelihoods through pearl farming.

- A publication entitled "Assessment, Management and Future Directions for Coastal Fisheries in Asian Countries" has been published in the form of book and CD containing 35 key papers on the status and management of coastal fisheries in eight countries.

- A seminal review of restocking and stock enhancement of marine invertebrates will be published as a stand-alone volume of Advances in Marine Biology.

- A major new version of ReefBase, the Center's global information system on coral reefs, has been produced. Key features include: 1) updated and more accessible information on coral reef resources, their status and management; 2) a global database on coral bleaching, coral monitoring, and coral reproduction; 3) a web-based Reef Advisory System to present and interpret all Reef Check coral status information; and 4) a global protocol on assessing and monitoring coral bleaching events.

MTP Project 4: Assessing Technological, Institutional and Policy Options that Benefit Poor People

- In Bangladesh, poor fishers gained control over 115 waterbodies covering 16 485 ha in the monsoon season, thus ensuring their livelihood through sustainable management of these resources. Average fish yield/ha has been raised from 300 kg to over 600 kg in semi-closed waterbodies through this project.

- Extensive training on improved management of the water bodies was provided to 3 200 Bangladeshi beneficiaries by 13 non-governmental organization (NGO) partners. A further 501 participants from both governmental and non-governmental organizations received technical training on open water fisheries management.

- The book, "Fish to 2020 – Supply and Demand in Changing Global Markets" was published jointly with IFPRI. The book integrates fish into IFPRI's global food model (IMPACT).

- A multi-market fish sector model for nine Asian countries (AsiaFish) has been developed. The model is the first of its kind in fisheries and the aquaculture sector. Thirty-five partner institutions are using AsiaFish to make projections of fish supply and demand by species groups and income classes.

- A special issue of Aquaculture Economics and Management will be published in 2005 and will include 12 manuscripts on 'strategies and options for sustainable aquaculture development in Asia' prepared by WorldFish scientists and National Aquatic Research Systems (NARS) partners.

- The Center provided support to the Inland Fisheries Research Institute (IFReDI) of Cambodia to become a fully functional national fisheries research institute through

training and capacity building activities. A total of 38 staff of IFReDI were trained in research planning, priority setting and project implementation.

- The Center's work with researchers and government officials from over 30 agencies across the 4 countries of the lower Mekong River Basin has significantly raised awareness of the links between development policies, wetland ecosystems, and rural livelihoods.

MTP Project 5: International Relations and Partnerships

- National research priorities for Bangladesh, Malaysia and Philippines were identified through a series of research planning workshops organized by the Center. Plans have been developed for similar workshops in Indonesia and Vietnam.

- Proceedings of the Center-hosted "Expert Consultation on Biosafety and Environmental Impact of Genetic Enhancement and Introduction of Improved Strains and Alien Species in Africa" were finalized for publication.

- An Expert Consultation on 'Ecological Risk Assessment of Genetically Improved Breeds' was organized and hosted. Recommendations for environmentally safe dissemination of improved fish strains have been published and widely disseminated.

- An advanced course on quantitative genetics and breeding was conducted by WorldFish for scientists from 13 member countries of the International Network for Genetics and Aquaculture (INGA).

MTP Project 6: Information and Communications

- Significant media coverage for the Center was achieved with over 50 reports in national media and 5 press reports with leading international media.

- The Center participated in 4 major international exhibitions including the 7th Convention for Biodiveristy Conference of Parties of the Convention on Biological Diversity (COP7 CBD) in Malaysia, and the 4th World Fisheries Congress in Vancouver.

- A major communications Initiative for "Fish for All" was developed in partnership with Television Trust for the Environment (TVE).

- On-the-job library and information systems training were provided for Cambodian partners and for WorldFish library staff in Malawi.

In 2003 *'Fish For All'*, an awareness raising campaign conceived and coordinated by WorldFish, received the CGIAR Science Award for Outstanding Communication. The award was received by then Director General, Dr Meryl Williams, at the Annual General Meeting of the CGIAR held in Nairobi in October 2003.

'Fish for All' is designed as a credible, global science and policy dialogue on fish-related issues targeted at senior policy-makers, opinion leaders and researchers at various levels. Following the launch at a global summit in Penang in November 2002, a number of initiatives have taken place at national level. These include:

- A "Water and Fish" summit in January 2003 in the Philippines to highlight the national status of water and fish resources and identify major issues and course of action until 2020 to ensure sustainable development of aquatic resources.

- A Fisheries and Aquaculture Workshop in Malaysia during the East Asian Seas Congress 2003. During the workshop, fisheries and aquaculture experts met and reviewed the fisheries and aquaculture situation in the region and made a number of suggestions for the restoration and sustainable development of fisheries and aquaculture.

- A *Fish For All* summit in India in December 2003. The summit was attended by over 200 participants and culminated in a number of recommendations for increasing fish production from 6.2 million tonnes to 8.2 million tonnes by 2007.

Section A. The Research Agenda

1. Challenges and Opportunities

The Global Context: Food, Poverty and the Environment

The WorldFish Center, together with the other Future Harvest Centers of the CGIAR, is committed to poverty reduction and food security. Fishing is the largest extractive use of wildlife in the world, and fish the last major protein source to be harvested from the wild. Our mandate, therefore, calls for a particular commitment to environmental sustainability by maintaining the quality of natural aquatic resource systems that support fish. In this section we review the context for our mission, and highlight the major initiatives and international agreements that have helped to set the global priorities and action agendas that guide our work.

Fish and Food Security

Achieving the Millennium Development Goal of halving the proportion of people suffering from hunger by 2015 is a huge challenge. Food and Agricultural Organization (FAO) has estimated that, if current trends continue, there will still be 600 million hungry people in 2015, compared with 842 million today; however this will be only halfway toward the goal of the Millennium Declaration.

> **"The scale of hunger in today's world is a scandal of enormous proportions. One in seven persons is undernourished, suffering from either chronic or acute hunger, and billions suffer from some form of vitamin and mineral deficiency—hidden hunger. The scandalous aspect of this tragedy is that it is preventable."**
>
> ***(Millennium Project Task Force on Hunger. 2004. Halving Hunger by 2015: A Framework for Action. Interim Report. Millennium Project, New York)***

Fish, as well as other aquatic plants and animals, are a crucial food source for millions of people throughout the world. (Here, we use "fish" as shorthand for the range of living aquatic resources important to people's livelihoods and food security.) In low-income food-deficit countries, fish provide 20% of animal protein in a typical diet versus 13% in industrialized countries.[1] In Asia, the proportion is 30% and in some countries, where fishing is a mainstay of the rural economy, the proportion is much higher: 51% in Bangladesh, 58% in Indonesia, and as high as 75% in Cambodia.[2]

Poor people in developing countries are particularly dependent on fish for income and basic nutrition. In many Asian countries, the proportion of the food budget spent on fish is highest in low income groups. Moreover, fish provide a highly efficient source of micronutrients so that even small quantities consumed regularly have the ability to significantly improve childhood development and other health indicators.

World population will increase from 6 to over 8 billion in the next 25 years. Meat and fish production must double over this period to meet projected demand. In less than 50 years (up to 1999), the world's average per capita consumption of fish increased by more than 70%. By 2030, demand is likely to increase further by nearly 40% of which the bulk will be in developing countries.

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).

Capture fisheries are generally declining and have little scope for future growth since 75% of the wild caught fish come from fish stocks that are even now depleted, over-fished or fully exploited.

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[1] Delgado et al. 2003. Outlook for Fish to 2020. Meeting global demand.
[2] Preliminary estimates from Dey et al. (2004) and Ahmed (1998).

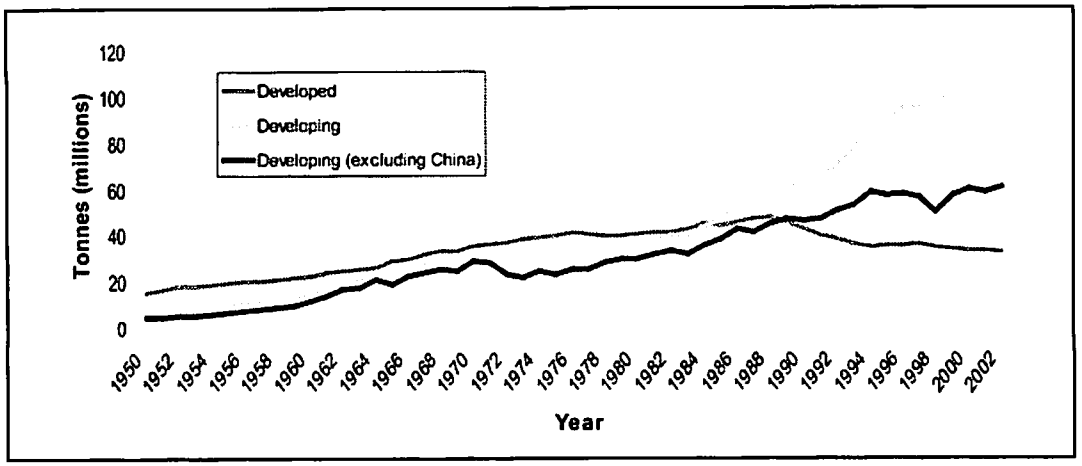

Figure 1. World fish production, developed and developing countries (Source: FAO 2003)

In the future, it is likely that many of these stressed fish stocks will not be able to produce even their current catch, let alone cater to the expected increase in demand. Even under ideal conditions, long term sustainable production from capture fisheries is estimated at about 100 million tonnes. This is just 8 to 9% more than current production.

In 2001, worldwide production of fish, crustaceans and mollusks reached 130.2 million tonnes. More than 76% of that amount was used for direct human consumption. Projections by the FAO suggest that capture fishery production has only limited scope for growth under present conditions. Under a pessimistic scenario, it will decrease significantly from present levels.[3] Aquaculture, by contrast, is providing a steadily increasing proportion of the total fish production, and represents the main area of future growth, according to a global modeling study undertaken by the WorldFish Center and the International Food Policy Research Institute (see Table 1).

Table 1. Projected growth rates for fish as food, 1997-2020

REGION/COUNTRY	ANNUAL GROWTH RATE (%)			
	Total food fish consumption	Total food fish production	Wild production	Aquaculture production
China	2.0	2.0	1.1	2.6
Developing world excluding China	1.9	1.6	1.0	3.6
Developing world	2.0	1.8	1.0	2.8
Developed world	1.5	0.4	0.1	2.1
World	1.5	1.5	0.7	2.8

Source: Delgado C. L., N. Wada, M.W. Rosegrant, S. Meijer and M. Ahmed. 2003. Outlook for fish to 2020. International Food Policy Research Institute, Washington, DC and the WorldFish Center, Penang.

Developing countries contribute almost 90% of global aquaculture production of which Asian countries produce 87%.[4] However pollution, mangrove destruction, fish disease and the use of wild-caught fish as feed for aquaculture species, mean that sustainable growth in this sector is not certain. Currently 34% of the capture fishery production is used for non-human consumption (fish meal). This figure is likely to decrease as the per capita demand increases for fish as food. Thus the future growth of aquaculture may have to depend on the development of alternative sources of fish feed, or the development of herbivorous fish for large-scale aquaculture.

[3] FAO Projection of World Fishery Production in 2010. Accessed July 2004 at http://www.fao.org/fi/highlight/2010.asp

[4] Dey, M, M.A. Rab, F.J. Paraguas, S. Piumsonbun, R. Bhatta, M.D. Alam. M. Ahmed. 2004. Fish consumption in selected Asian countries: a disaggregated analysis by types of fish and classes of consumers. Aquaculture Economics and Management (In press).

Table 2. Projected total change in prices under different scenarios, 1997-2020

COMMODITY	PROJECTED TOTAL CHANGE IN PRICES (%)			
	Most likely (baseline)	Faster aquaculture expansion	Slower aquaculture expansion	Ecological collapse
Low-value food fish	6	-12	25	35
High-value finfish	15	9	19	69
Crustaceans	16	4	26	70
Mollusks	4	-16	25	26
Beef	-3	5	-2	1
Pig meat	-3	4	-1	4
Sheep meat	-3	5	-1	2
Poultry meat	-2	5	0	7
Eggs	-3	5	-2	3
Milk	-8	10	-8	-5

Source: Delgado et al. 2003. Outlook for Fish to 2020, Meeting Global Demand. Projections for 2020 are from IFPRI's IMPACT model (July 2002)

Whereas meat prices have fallen by half in real terms since the 1970s and are expected to continue to decline, fish prices are projected to rise over the coming two decades, including prices for low-value food fish that the poor consume (see Table 2).

Much depends on the rate of aquaculture expansion, and on the state of ecosystems that underpin fish production. The risk is that, as production continues to fall short of demand, rising prices will reduce fish consumption by the very groups who need it most.

The challenge of securing adequate supplies of fish for the world's poor is especially acute in those areas where hunger is most prevalent. Sub-Saharan Africa accounts for 198 million of the undernourished (Figure 2) and represents 75% of all undernourished children in the developing countries. India accounts for 214 million, and the Asia and Pacific regions (other than India and China) for 156 million. The prevalence of hunger is particularly high among small farmers, herders, fishers and those who rely on the natural resource base. These communities account for about 20% of underweight children below five years of age. The Hunger Task Force, set up to produce a plan to achieve the Millennium Development Goal on hunger, has highlighted the connection between fisheries and food security in these regions as a key issue requiring further research[5].

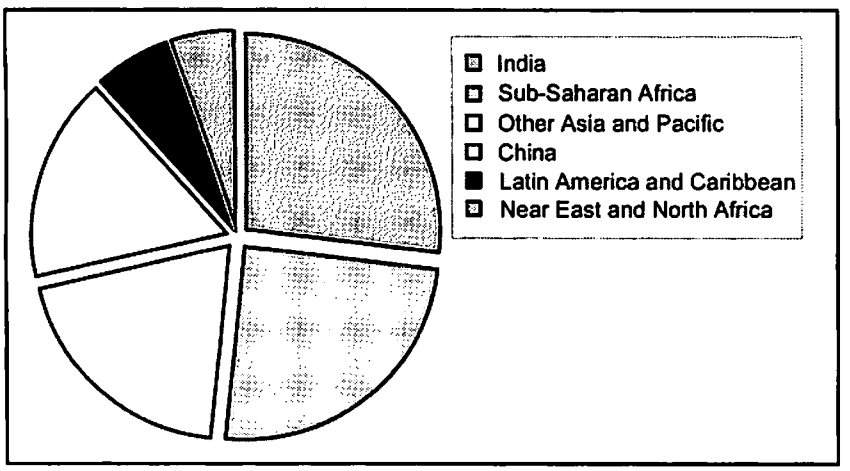

Figure 2. Location of undernourishment in the developing world (Source: SOFI 2003)

[5] Millennium Project Task Force on Hunger, 2004. Halving hunger by 2015: A framework for action. Interim Report. Millennium Project, New York.

Fish and Poverty

The distribution of poor people is concentrated in tropical developing countries and, most acutely, in sub-Saharan Africa. The World Bank estimates that the proportion of population in poverty in developing countries (<US$1/day) may fall from 32% in 1990 to 13.2% in 2015, thus meeting the Millennium Goal on poverty. However, halving the absolute number of poor people (the goal adopted at the World Food Summit) will not be achieved under current trends which predict a 41% decline by 2015.[6] Economic growth alone is not sufficient to achieve effective development and eliminate hunger and poverty.

Reducing poverty requires a focus on livelihoods, not just income, and recognizing the diversity of livelihood strategies that small-scale fishers, fish-farmers, and processors employ. In most regions, fishing livelihoods are under threat from overfishing that reduces stocks, from commercial exploitation that constrains access to fisheries by the poorest, and from pollution, habitat destruction, and associated changes in land use that undermine ecosystem productivity. The failure to sustainably manage these common pool resources has three key consequences: it reduces food supply, shrinks employment opportunities (for fisherfolk as well as farmers and others who supplement their incomes and diets through part-time fishing), and creates conflicts that can unravel social progress in other domains (such as health and education).

Between 1970 and 1990 the number of fishers and fish farmers has doubled, mostly in Asian countries where four fifths of all fishers dwell. Globally, an estimated 200 million are employed in fishing and fish processing; the vast majority of these are small-scale operators.

Fish are also an increasingly important export commodity in developing countries (Figure 3).[7] Fish products, especially from aquaculture, contribute significantly to gross domestic product (GDP) and foreign exchange earnings in low-income Asian countries. The markets for high-valued fish are often vulnerable to trade policies and import requirements of their customers from the developed world. In addition, they often rely on imported fish gears or feeds. Fish trade between developing countries is also growing in importance, however. By 2020, developing countries will produce and consume nearly 80% of the world's fish.[8] In many countries, small-scale fishers are both politically and economically marginalized which means that targeted policy measures are needed to ensure that growing trade opportunities will benefit the poor.

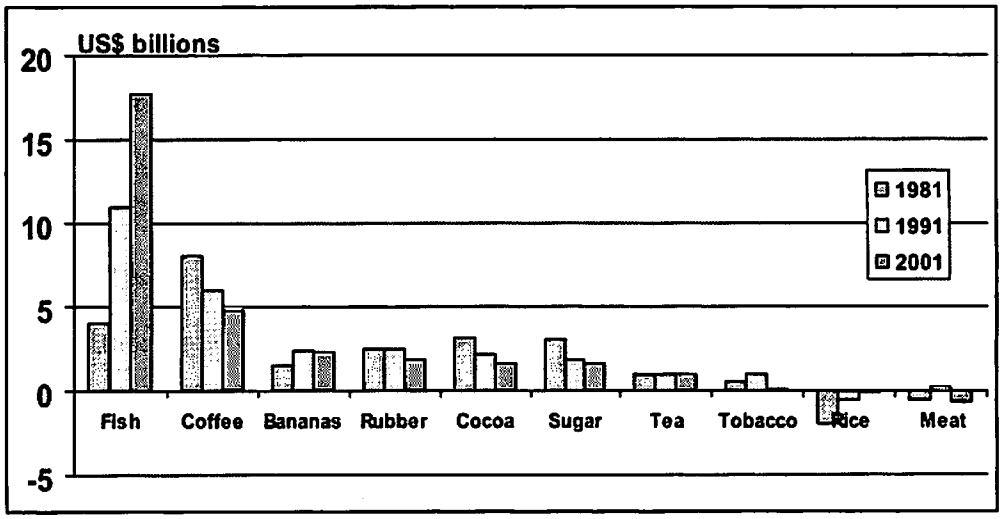

Figure 3. Net-exports of fish and selected agricultural commodities by developing countries (Source: FAO 2003)

[6] FAO. 2003. World agriculture: Towards 2015/2030. Earthscan Publications.
[7] FAO. 2003. Overview of fish production, utilization, consumption and trade. By Stefania Vannuccini, FAO, Fishery Information, Data and Statistics Unit.
[8] Delgado et al. 2003. Outlook for Fish to 2020. Meeting global demand.

Fish and Environmental Sustainability

Today, fishing is the largest extractive use of wildlife in the world. Because of this, the links between fisheries productivity and ecosystem health are even more immediate than in most other areas of food production. The sensitivity of aquaculture to environmental change has also become more apparent in recent years, as well as its capacity to cause environmental damage if not managed responsibly.

The recent report of the Millennium Task Force on Environmental Sustainability identified several fundamental requirements for achieving that Millennium Development Goal. These apply equally to the fisheries and aquaculture sectors.[9] They include stakeholder recognition of the importance of environmental sustainability to poverty reduction; implementation of substantive environmental safeguards; incorporation of sustainability criteria into economic and trade policies; international agreements and enforcement that guarantee equitable resource allocation; and, development planning based on realistic estimates of future population growth and distribution. The report proposes five categories of activities to address these issues, all of which are relevant to the WorldFish Center and are included in the current plan:

- Environmental knowledge for sound decision making.
- Capacity development for environmental management.
- Environmental management at the landscape level.
- Market based strategies to internalize value of ecosystems.
- Environmental management and governance at the international level.

The Global Environmental Outlook Report or GEO 3 (2002) produced by the United Nations Environment Program (UNEP) highlights the urgency of an integrated approach to water resources management in freshwater systems, the need to protect marine and coastal environments, and the heightened vulnerability of the poor to environmental change.[10] Trends affecting coastal communities in Asia and the Caribbean illustrate these concerns. Urbanization, industrialization and tourism, coupled with a growing coastal population, have degraded many Asian coastal areas. More than 60% 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 rising population, increasing inequality of incomes, limited planning (especially in urban areas) and the high dependence of many economies on exploiting natural resources. More than 300 million hactares of land have been degraded and almost 30% of the reefs in the Caribbean are considered to be at risk.

Achieving environmentally sustainable productivity gains in the face of natural and human induced climate change presents an additional challenge. Agricultural ecosystems as well as specific products are likely to be affected in a variety of ways by climate change, but there are few definitive predictions on where and by how much production will be affected. A recent report from FAO[11] indicates that the following fisheries are most responsive to climatic variation in descending order of sensitivity:

(a) freshwater fisheries in small rivers and lakes, in regions with larger temperature and precipitation change;
(b) fisheries within Exclusive Economic Zones (EEZ), particularly where access regulation mechanisms artificially reduce the mobility of fishing groups and fleets and their abilities to adjust to fluctuations in stock distribution and abundance;
(c) fisheries in large rivers and lakes;

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[9] Millennium Project Task Force on Environmental Sustainability. 2004. Interim Report. Millennium Project. UNDP, New York.
[10] UNEP.2002. Global Environment Outlook 3. Past, present and future perspectives. UNEP, Earthscan.
[11] Sharp, G.D. 2003. Future climate change and regional fisheries: A collaborative analysis. FAO Fisheries Technical Paper, No. 452. FAO, Rome. 75 p.

(d) fisheries in estuaries, particularly where there are species migration or spawn dispersal paths or in estuaries impacted by sea-level rise or decreased river flow; and
(e) high-seas fisheries.

The fisheries that are most sensitive to climate change include those affected by human interventions such as dam construction, diminished access to up- or down-river migrations, filling in of wetlands, and other issues of human population growth and habitat manipulation, particularly expanding agricultural water use and urbanization.

The whole fisheries ecosystem may be at risk from some aspects of climate change. The most recent International Panel on Climate Change reports highlight coral reefs and mangrove systems as vulnerable to climate change via temperature mediated coral bleaching and sea-level rise respectively. While the long-term impacts on fisheries production are not certain, it is likely that in the medium term (20-50 years) there may be substantial losses in productivity from some areas. Thus developing countries in sub-Saharan Africa, Asia and the Pacific urgently need assistance to increase and maintain fisheries based livelihoods.

Raising productivity, particularly in aquaculture, also requires special precautions to manage against risks from the introduction of alien species into new habitats and escapes of alien stocks from controlled environments into natural ecosystems. It is imperative that the Center's own work in the selective breeding and dissemination of improved fish strains for aquaculture continues to be guided by appropriate safeguards. It is equally important that WorldFish works to ensure that precautionary principles and multilateral environmental agreements such as the Convention on Biodiversity and the Biosafety Protocol are globally respected.

Facing the Challenges: The Role of Development-Focused Research and Capacity-Building

How can we ensure adequate fish resources in the future to feed the growing number of people who depend on them for sustenance and nutrition? Will poor people in developing countries continue to sustain and improve their livelihoods through fishing and fish farming? Can we improve the contribution of fish to food security and livelihoods in a sustainable way without harming the environment?

The challenges are enormous but so are the opportunities to measurably influence trends in global food security and poverty reduction through fish-based development solutions. Unfortunately, governments and leaders at all levels often still do not perceive fisheries and aquatic resources as a high priority.

In the new fisheries sector approach paper, *Saving Fish and Fishers*, the World Bank has highlighted the need for increased strategic investments in response to the global fisheries crisis. The paper states that a 'governance revolution' is needed to redress the root cause of the current crisis. A Global Forum for Sustainable Fisheries is proposed that will help harness political and financial support from the international community and bring on board the technical expertise needed to guide investments. A combination of improved governance and good development practice is required. Likewise, the Hunger Task Force has concluded that a general consensus exists on the range of effective technical actions that can reduce hunger. However, there is also a consensus that technical actions invariably fail unless policy changes remove constraints to progress and create capacity in order to expand the scale of successful hunger-reduction actions.

Development-focused research and capacity building has a pivotal role to play in identifying and promoting livelihood options to benefit the poor, and in bringing about the needed "governance

revolution" so that the benefits are indeed realized. Increased efforts are needed at multiple scales to address such challenges as:

- At the **local level**, identifying the conditions for successful community-based fisheries management and sustainable aquaculture, and the combinations of technical, legal and institutional support needed to make such approaches successful.

- At the level of **basins and coastal zones**, promoting decision-making processes to handle the competing demands of agricultural, industrial, and infrastructure developments that directly or indirectly affect aquatic resources, and integrating science into management decisions, including assessment of fish stocks and their responses to fishing efforts and ecosystem changes at various scales.

- At the **national level**, influencing how policies on such matters as technology investment, trade, and private sector development in the fisheries sector are formulated so that poor people's interests and resource sustainability are prioritized.

- In **international arenas**, ensuring that relevant aspects of the multilateral environmental agreements in such domains as biodiversity and biosafety are respected in the fisheries sector, and identifying what mechanisms work to ensure that intergovernmental accords or industry codes of conduct are adhered to by private and public sector agencies.

As the sole Future Harvest Center focused entirely on living aquatic resources, with 25 years of experience and a strong network of national and regional partners in the developing world, WorldFish is well positioned to address many of the challenges presented here. In the following section, we describe the Center's mission and values, multidisciplinary skill sets, and approach to collaborative research and capacity building in key geographic areas. The subsequent section details our research agenda, which represents the match between the WorldFish Center's own institutional strengths and the demands of the global context in which we work.

2. The WorldFish Center

A. Who we are and what we do best

Who we are

The WorldFish Center is part of the Future Harvest Alliance of international research centers supported by the Consultative Group on International Agricultural Research. Our mission is *"To reduce poverty and hunger by improving fisheries and aquaculture."* Working with national governments and non-governmental partners, we have mapped out distinct, coordinated, global efforts that reach out to the poor and champion the use of fish and other aquatic resources for poverty reduction and food security.

Our over-riding focus is on how we can contribute to achieving the Millennium Development Goals and those emanating from the World Summit on Sustainable Development. Providing a holistic approach, WorldFish research and development tackles the issues of poverty and fisheries on a global scale yet addresses them at the grassroots level.

What we do best

The WorldFish Center both facilitates and conducts research. Our greatest strength lies in applying state-of-the-art technical expertise in aquaculture, genetics, natural resource management and socio-economics appropriate to the institutional conditions in developing countries. A core plank of our philosophy is that our expertise be applied in ways that build

capacity at all levels within national systems. Another major strength of WorldFish is its capacity and experience in establishing networks and partnerships with both developed and developing world institutions to achieve our mission.

Our core technical competencies are:

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

- We have proven expertise in fish sector modeling for analysis of the supply of and demand for fish, valuation of aquatic resources, livelihood analysis and impact assessment.

- Our scientists are linked with developing country policy-makers and planners in an active fisheries social science network.

- We use synergies between socio-economic research and the network of policy-makers to assist developing countries 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 has significant global experience in fisheries co-management and has developed core competencies in institutional analysis for the improved governance of aquatic resources.

- Our research results on methods to facilitate consensus-building and the processes involved in undertaking participatory action have been used to improve planning at local and national levels for aquatic resources management.

- We have also developed improved 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 receiving approximately 11 million hits per month. It provides information and independent analytical tools for scientists and managers.

- ReefBase covers over 10 000 coral reefs and their resources. Available knowledge about coral reefs has been gathered into one information repository to facilitate analyses and monitoring of coral reef health.

- FiRST (Fisheries Resource Information System and Tools), also known as TrawlBase 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

- The Center is well placed to make appraisals of the abundance, size structure, and species composition of multi-species tropical coastal fisheries. We also have strengths in assessing the stock structure, biology and ecology of key species.

- 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) approaches designed 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

- WorldFish has developed a unique capability for responding to the management needs of developing countries with respect to their river systems. By modeling nutrient cycles and resource flows within watersheds, we have developed a range of tactical options for the mitigation of negative impacts on fisheries due to changes in watershed management. This capability is currently being applied to the Mekong River Basin. A complementary approach is being implemented in the endorheic catchment of Lake Chilwa in Malawi and Mozambique.

vi. Methods for developing improved fish strains for aquaculture

- WorldFish has world-class expertise in selective fish breeding and has made substantial contributions to methods for improving tropical fish strains by developing genetic selection programs.

- 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.

- In addition to the technical expertise associated with genetic improvement, we are also able to assess market requirements, evaluate new strains under different farm conditions, quantify the impact of improved strains, and develop dissemination mechanisms for farmers.

vii. Development and evaluation of 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 also have long-term working knowledge at the field level of tools and protocols that bring researchers, farmers and extension personnel together to overcome 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.

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.

B. Our Research Priorities

Although international agricultural research has made tremendous contributions to global food security, there is a continuing need to improve its effectiveness and efficiency. This requires prioritization of research activities that yield the greatest benefits relative to cost. While all planning involves identification of priorities, *priority setting* refers to the application of systematic, quantitative procedures. This quantitative approach is now emerging as a standard preparation for many research organizations.

A priority setting framework has four basic elements:

- defined units of assessment;
- a statement of the scope of assessment;
- specified assessment criteria; and
- defined assessment methods.

The units of assessment are combinations of regions and resource systems. For WorldFish these regions and resource systems are shown in the following table.

Geographic Regions	Resource Systems
East Asia	Ponds
Latin America	Lakes
Southeast Asia (mainland countries)	Rivers, streams and floodplains
Southeast Asia (island countries)	Coastal Waters, estuaries and lagoons
South Asia	Soft-bottom shelves
Sub-Saharan Africa	Upwelling shelves
West Asia and North Africa (WANA)	Open oceans
Small Island Developing States (SIDS)	Coral Reefs

The scope of the assessment is to ordinally rank the 40 region-resource system units.
Criteria for assessment are:

- economic impact;
- equity impact;
- environmental impact;
- capacity building;
- policy influence.

Application of these criteria involves a combination of methods based on economic surplus, congruence, and scoring. Congruence (using the Human Development Index indicator of the United Nations Development Program) is used to gauge a component of the equity impact. Economic surplus meanwhile is applied to economic impact. This requires the construction of baseline supply and demand models as well as *ex ante* estimates of research impact. Finally, the assessment is undertaken by applying a scoring to the region-system units using criteria and sub-criteria corresponding to equity, environment, capacity, and policy. Both the *ex ante* impact estimates and region-system scores are based on expert opinion elicited through structured interviews.

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 (1999)

The priorities identified in the current Strategic Plan are as follows:
A re-assessment of priorities is currently being undertaken based on the foregoing framework. A report detailing the results of the analysis is due for completion by late-2004.

C. Our Partners

The scope of our mission requires that we are strategically partnered in our research and development activities. Through our partnership approach we aim to:

- develop strong national research and development systems;
- better utilize the scarce resources available for research;
- achieve quicker gains from research results; and
- match complementary skills.

Our partners include national aquatic research organizations, non-governmental organizations, the private sector, universities/academic institutions, advanced scientific institutions, and regional and international organizations. In 2004, WorldFish had ongoing collaboration with 320 partner institutions from developing and developed countries (Figures 4 and 5).

To strengthen our partnerships with developing countries and to ensure we are meeting their needs, we have held regular meetings since 1996 with partner institutions to identify priority areas for collaboration. These consultations provide key input to the development of our strategy and our research plan. Starting from 2002, the Center has assisted partner countries to identify their research priorities and develop national research plans. In 2004, we held consultation meetings with the governments of Indonesia and Vietnam to identify fisheries research needs and assist in prioritization.

Capacity building among developing country institutions is an essential part of developing and maintaining our partnerships. Since 1977, we have conducted formal and informal training programs in our areas of expertise and 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.

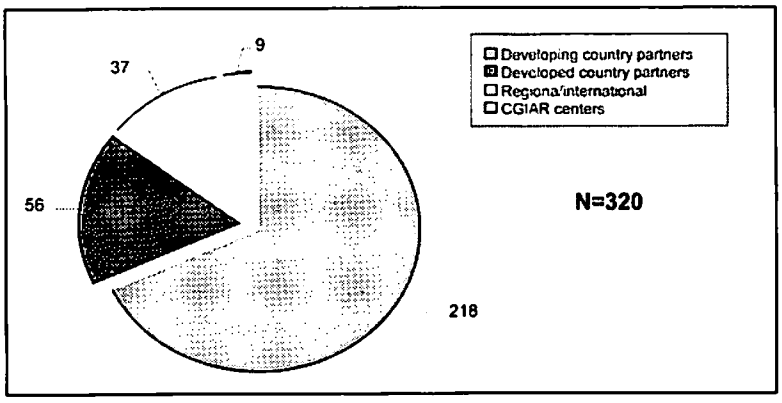


Figure 4. Partners of the WorldFish Center in 2004 by category

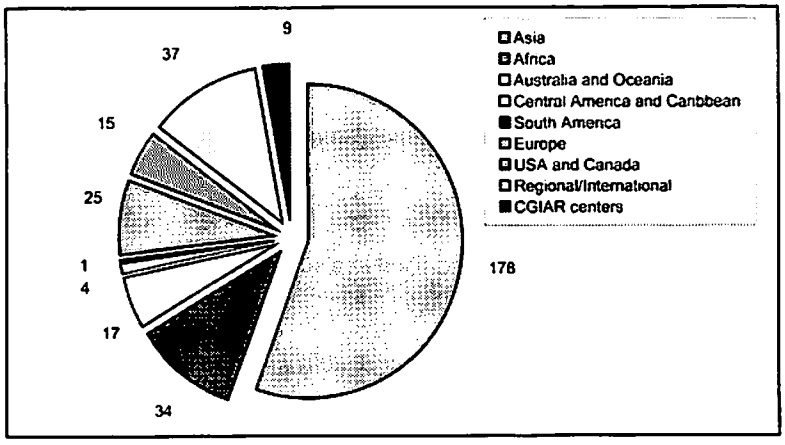


Figure 5. Partners of the WorldFish Center in 2004 by origin

D. WorldFish Strategy and Programs

Our overall strategy as a Future Harvest Center is to use science for developing solutions to reduce poverty with a strong network of partners.

In preparing our workplan for 2005-2007, we have carefully examined where and how we can maximize our impact among poor communities in developing countries.

To undertake this analysis we adopted the following principles:

1. Target specific activities where we can work within the **context** of global and regional issues and initiatives.
2. Take advantage of our **strengths and core competencies.**
3. Work **across disciplines** to tackle complex problems.
4. Work in **partnership** with other research and government agencies in key regions and countries.
5. Review our work and refine **priorities** based on an **analysis of past impacts** and successes and **anticipated needs.**

6. **Cluster** our work into areas where we can maximize our impact through the combined effort of our scientists.

7. Ensure that 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.**

Our operational strategy for the period 2005-2007 is to implement a portfolio of research and research-related activities within six distinct program areas equivalent to the six MTP Projects. Each MTP Project has been defined to allow more synergy amongst intended outcomes and to sharpen impact.

MTP Project 1: Sustainable Use of Biodiversity and Genetic Resources

Goal

To ensure that aquatic ecosystems and their animal genetic resources are sustainably managed and used to benefit the poor.

Outcomes

- Aquatic ecosystems are conserved and used in a sustainable manner through innovative applications of knowledge on biodiversity.

- Aquaculture production increased in a sustainable manner through the use of superior fish strains.

MTP Project 2: Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management

Goal

To improve livelihoods of beneficiaries (poor fishers, fish farmers and consumers) dependent on freshwater living aquatic resources.

Outcomes

- Increased productivity and sustainability of freshwater aquaculture within the context of African and Asian farming systems.

- Improved knowledge base and management of freshwater living aquatic resources within the context of changing watersheds.

MTP Project 3: Making the Most of the Coast

Goal

To enhance livelihoods for the poor of coastal areas by improving productivity of fisheries resources in a sustainable way.

Outcomes

- Restoration of marine capture fisheries.

- Development of environmentally friendly aquaculture.

- Reversing degradation of coastal habitats to provide healthy ecosystems to support capture fisheries and aquaculture.

MTP Project 4: Assessing Technological, Institutional and Policy Options that Benefit Poor People

(Policy Program)

Goal

To ensure sustainable livelihoods and food availability among the poor in developing countries through effective policies and institutions, and appropriate technologies.

Outcomes

- Increased fish supply and economic benefits from fish obtained by providing options derived through assessment of economic, social and environmental policy issues.

- Options developed for sustainable fisheries governance from local to regional scales from legal and institutional assessments.

- Impacts of technological innovation and fisheries research assessed and risks measured to guide prioritization of future research.

MTP Project 5: International Relations and Partnerships

Goal

To enhance partnerships with national agencies in developing countries, advanced scientific institutions and regional and international organizations, to ensure relevance of our research to developing country needs, and to build capacity among developing country institutions.

Outcomes

- Improved partnerships and capacity building among developing country NARS.

MTP Project 6: Information and Communications

Goal

To maximize the WorldFish Center's impact in developing countries and stimulate demand for our research products through effective communication and dissemination of research results to stakeholders.

Outcomes

- WorldFish research results are cost effectively captured, appropriately packaged and disseminated to target audiences in developing countries (e.g., collaborators, NARS, governments, community groups, etc.).

- Increased awareness of global living aquatic resources issues, and of the WorldFish Center's organizational profile and role in sustainable development of fisheries and aquatic resources.

Revisions from the MTP 2004-2006

In the MTP for 2005-2007, WorldFish has not undertaken any major revisions to the overall goals, activities and outcomes of projects. In the previous two Plans, we grouped activities into 13 MTP Projects (= Thrusts) and 29 Outputs. After careful consideration WorldFish decided that a smaller number of MTP Projects would enable us to better communicate the key elements of our research plan to clients, donors and the public. We have therefore grouped the 13 Thrusts from the previous MTP into our 6 existing programs, and designated these as our 6 MTP projects for 2005-2007. The planned activities in the current MTP therefore represent an evolution of our work program following on the previous MTPs rather than any new direction. The table below shows how the previous MTP Projects (= thrusts) have been grouped into the current 6 MTP Projects (= programs).

E. Geographies of Impact

As a small to medium sized Future Harvest Center, it is imperative that the WorldFish Center's limited resources be focused on a selected number of geographies to create maximum impact within a defined period. Currently, the Center has identified four geographies where it concentrates its efforts: Africa, South and Southeast Asia, the Greater Mekong region, and the Pacific. Our work in Africa is highlighted here as an example of our regional efforts involving all six Focal Areas.

Africa: A Geography with Pressing Needs

African fisheries and aquaculture are at a turning point. The fish sector makes vital contributions to food and nutrition security of 200 million Africans and provides income for over 10 million engaged in fish production, processing and trade. Fish has become a leading export commodity for Africa with an annual export value of US$2.7 billion. Yet these benefits are at risk as the exploitation of natural fish stocks is reaching limits and aquaculture production has not yet fulfilled its potential.

MTP 2005-2007 MTP Project (= Program)		MTP 2004-2006 MTP Project (= Thrust)	
1	Sustainable Use of Biodiversity and Genetic Resources (Biodiversity Program)	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
2	Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management (Freshwater Program)	4	Strategies and options for realizing gains from sustainable freshwater aquaculture systems
		5	Freshwater fisheries in an integrated land and water management context
3	Making the Most of the Coast (Coastal Program)	6	Restoration of capture fisheries
		7	Environmentally-friendly coastal aquaculture
		8	Reversing degradation of coastal habitats
4	Assessing Technological, Institutional and Policy Options That Benefit Poor People (Policy Program)	9	Economic, policy and social analysis and valuation of aquatic ecosystems
		10	Aquatic resources planning and impact assessment
		11	Legal and institutional analysis for aquatic resources management
5	International Relations and Partnerships	12	Improved partnerships and capacity-building among developing country institutions and agencies
6	Information and Communications	13	Access to information for sustainable development of fisheries and aquatic resources

In a recent study by the International Food Policy Research Institute and the WorldFish Center, analysis of future demand and supply of fish suggests that if per capita consumption is to be maintained at present levels up to the year 2020, capture fisheries need to be sustained and, where possible, enhanced. In Sub-Saharan Africa (SSA) alone, aquaculture must develop rapidly by at least 260% over the course of the next 16 years.

In addition, studies by FAO have shown that there is considerable physical potential to respond to the growing demand for fish by improving aquaculture production. For SSA it is estimated that 9.2 million km², or 31% of the land area, is suitable for smallholder fish farming. Only 0.5% of this area would be required to produce 35% of the region's increased fish requirements up to the year 2010. At present, however, this potential for aquaculture remains largely untapped. There is urgent need to develop guidelines and policies that create a conducive aquaculture investment climate and, at the same time, provide safeguards against environmental and social risks. Moreover, while trade in fish products has increased substantially over the past two decades, much more can be done to foster both external and internal markets.

In response to this analysis, the WorldFish Center is focusing on seven principal areas of work in Africa.

Policy

To foster and guide increased investment in fisheries and aquaculture, special attention is being given to raising awareness of the contribution of fish to national policy goals. Building on initial research in 2004, a series of policy workshops and an accompanying research program is planned for 2005-2007. This will include a major regional conference under the auspices of The New Partnership for Africa's Development (NEPAD) followed by sub-regional and national workshops.

Markets and Marketing

There is an urgent need to improve understanding of how national and regional markets respond to changing demand and supply of fish. Building on earlier studies in Cameroon and initial analysis of the development of markets in Egypt and six countries in Sub-Saharan Africa, the Center is studying medium term scenarios for change in rural and urban fish markets and their impact on fisheries and aquaculture. This will be complemented by studies of the potential for increased wealth generation through improved processing and marketing of fish at local and national levels. These studies will be designed to provide guidance to national governments, the development assistance community, and the private sector on future investments in aquaculture and fisheries.

Institutions and Governance

Over the next three years the Center will develop research activities on the governance arrangements for small-scale fisheries in rivers, lakes and reservoirs, and inshore coastal systems. This will include research into the types of governance systems that are most effective in specific institutional and ecological contexts, and the type and form of information that is of most value in supporting pro-poor governance and policy processes. Similarly the increasing role of the private sector in aquaculture development will be a major focus of attention.

Restoring, Maintaining and Enhancing the Resource Base

The Center is working with regional partners to develop improved modeling tools that can be used to manage river fisheries in the face of competing demands for water and increased number of fishers. Similarly the Center is continuing work with the Department of Fisheries in Malawi to provide the technologies and information necessary to support their pioneering investment to restore stocks and increase production of Chambo, the country's main food fish. The potential role of reservoirs and small water bodies in fish production will also be investigated.

WorldFish will also continue research in Malawi and Mozambique on the effect of land use, river flow and water quality on fisheries productivity in Lake Chilwa.

Aquaculture and Food Security

The Center's research in Malawi has shown that aquaculture can make a significant contribution to improved food production and income generation, and that aquaculture can contribute to improved land and water management on small farms and irrigation schemes. The Center is building upon this work to increase our support for the development of small-scale aquaculture in sub-Saharan Africa. This will focus upon understanding the diversity of social, economic, institutional and biophysical conditions under which small-scale aquaculture is a viable livelihood option, and identify those inputs that are required to achieve sustainable adoption of this farming approach.

Aquaculture Technologies

The Center has placed increasing emphasis on the development of new aquaculture technologies in Africa and West Asia including research on new hatchery technologies, fish health and disease control, improved pond production systems such as selected fertilization, feeding and stocking strategies, and long term genetic management and breeding programs designed to maintain and develop strains of fish (at present mainly tilapias) that grow more rapidly in local pond conditions. This research will continue over the course of 2005-2007 with increased emphasis on developing new research partners in new countries, working with the private sector, and developing technologies for new species such as African Catfish.

Capacity Building

A major focus of the Center's regional program is to develop regional research and management capacity in fisheries and aquaculture. In response to growing demand for support from NARS and other partners, WorldFish is planning to develop an African Center for Aquaculture Research and Capacity Building. This will build upon existing WorldFish facilities in Egypt and Malawi and will work through a number of key training nodes in countries where aquaculture is developing most rapidly.

F. The Center Performance Indicators

WorldFish has a formal Evaluation Policy which sets out internal responsibilities for evaluations, and how they will be conducted and measured to assess performance. We have designed performance indicators to parallel the World Bank requirement for Future Harvest Centers. In 2004, the WorldFish Board approved a proposal to develop a center-wide database on indicators for WorldFish to allow internal monitoring and evaluation in anticipation of further requests by the World Bank, other CGIAR donors and in preparation for the next scheduled WorldFish External Program and Management Review. The major categories of indicators being developed are: Financial Health; Outputs; Institutional Health/Governance; Partnerships; and Impacts.

We are currently finalizing a set of operational indicators. We recognize, however, that the use of Performance Indicators is evolutionary and we will monitor progress to make the necessary adjustments.

G. CGIAR Challenge Programs and System-wide Initiatives

The WorldFish Center is involved in the Water and Food Challenge Program, and participates in one project under a System-Wide Initiative on Water Management as described below.

Challenge Program on Water and Food

The Challenge Program on Water and Food (CPWF) is one of two Challenge Programs begun in 2003. 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.

The Center seeks to contribute to all five of the themes, and is coordinating Theme 3, Aquatic Ecosystems and Fisheries. The work under the Aquatic Ecosystems and Fisheries theme focuses upon four major research areas:

1. Policies, Institutions and Governance.
2. Valuation of Ecosystem Goods and Services, and the Costs of Degradation.
3. Environmental Water Requirements.
4. Improving Water Productivity.

The CPWF has been developed through an extensive process of consultation and collaboration. A wide range of partnerships has already been developed and strong emphasis is being placed on building three-way partnerships between National Aquatic Research and Extension Systems (NARES), Advanced Research Institutions (ARIs), and CG Centers and also with river basins development authorities. The key linkages will be with other Future Harvest Centers (i.e., CIAT, IFPRI, IRRI, and IWMI). WorldFish is also a member of the Consortium Steering Committee that oversees the Challenge Program.

As of September 2004, the Center is directly involved in implementing or leading four projects within the Water and Food Challenge Program. These are listed below together with the name of the Center's MPT project under which they are carried out.

	Project Title	Role of WorldFish	Lead Center	WorldFish MTP Project(s) under which the project falls
1	Improved fisheries management in tropical reservoirs	Main partner	WorldFish	MTP Project 2: Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management. MTP Project 4: Assessing Technological, Institutional and Policy Options That Benefit Poor People.
2	Community-based fish culture in irrigation systems and seasonal floodplains	Leading partner	WorldFish	MTP Project 2: Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management. MTP Project 4: Assessing Technological, Institutional and Policy Options That Benefit Poor People.
3	Managing water and land resources for sustainable livelihoods at the interface between fresh and saline water environments	Partner	IRRI	MTP Project 2: Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management.
4	Enhancing diverse wetland benefits in the upper Nile and Volta basins through integrated catchment management	Partner	IWMI	MTP Project 4: Assessing Technological, Institutional and Policy Options That Benefit Poor People.

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 the project, "*Increasing water productivity by managing the land-water interface: effective water control for solving conflicts among agriculture-fisheries-aquaculture in coastal zones.*" This project is housed within the Center's Freshwater Program (MTP project: "Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management).

The tidal saline sub-ecosystem accounts for more than 2 million hactares of rice land in South and Southeast Asia. One strategy for improving agricultural production is to install dikes and sluice gates for salinity protection. 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 in Vietnam, 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 impact assessment; and (iii) researchers and planners who will receive the analytical system to apply for planning and studies in coastal zones. Additionally, an 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 commenced in October 2003. A meeting was held with key partners in December 2003 where agreement was reached on the methodology for the sampling network and fisheries assessment, staff involvement, and a detailed work program. The first water quality sampling commenced in January 2004, and data on the canal system and operation, as well as land use data has been collected. Water quality data analysis has also commenced. A fisheries survey was conducted in June 2004. Planning is underway for an International Workshop on "Effective land-water interface management for solving agricultural-fishery-aquaculture conflicts in coastal areas" in February 2005, for which over 40 abstracts have been received.

3. Our Research Agenda

MTP Project 1:

Sustainable Use of Biodiversity and Genetic Resources

(Biodiversity Program)

Description

This project on Sustainable Use of Biodiversity and Genetic Resources adopts an ecosystem-based research approach aimed at balancing the requirements for conservation and sustainable use of genetic, species and ecosystem diversity. The overall goal is to ensure that the benefits of aquatic biodiversity are available to the poor in the developing world in a sustainable manner. Based on the requirements of developing countries, the project strives to develop and provide scientific tools, expertise and capacity building to research institutions, management agencies and NGOs, thus contributing to the understanding, conservation and sustainable utilization of aquatic biological diversity. In this respect, the national breeding programs supported by the Center maintain and continuously improve fish strains for distribution to farmers, while taking measures to ensure that genetic diversity of aquaculture species is not lost.

The project aims to meet the above goals through the following specific activities: (1) development of FishBase, the global public goods information system on fish, and integrating decision and management support, tools, capacity and modules for country-specific applications; (2) development of decision-support tools for the sustainable management of freshwater flood plain systems to balance the diverse pressures of land and water use; (3) development of national frameworks and capacity building to assess risks and response mechanisms to mitigate adverse impact of alien species and to enable increased aquaculture production through well managed introductions of improved strains; and (4) evaluation, maintenance and continuous improvement of fish strains for distribution to farmers in developing countries, while minimizing the risk of loss of genetic variability.

Goal	To ensure that aquatic ecosystems and their animal genetic resources are sustainably managed and used to benefit the poor.
Outcomes	1. Aquatic ecosystems are conserved and used in a sustainable manner through innovative applications of knowledge on biodiversity. 2. Aquaculture production increased in a sustainable manner through the use of superior fish strains.
Objectives	• To develop and apply decision support systems and tools for conservation and sustainable use of aquatic ecosystems by the poor. • To evaluate aquatic animal species and strains for culture, and to develop and disseminate improved aquaculture strains for the benefit of poor fish farmers.
Outputs	Outputs for Outcome 1 1. Global biodiversity conservation support through FishBase information and tools. 2. Knowledge on fish species ecology and habitat requirements required for fisheries management. 3. Decision support tools utilizing data on species and habitat diversity for management of flood plain aquatic resources. Outputs for Outcome 2 4. National capacity to assess risks, mitigate adverse impact of alien species and to enable growth of well managed aquaculture production through introductions of improved strains. 5. Improved methods for genetic improvement and their dissemination. 6. National breeding programs identify, prioritize and develop species and strains for aquaculture. 7. Enhanced NARS' staff capacity for genetic resource management.

Impacts	• Enhanced availability of comprehensive information on over 28 500 fish species and their habitats through FishBase, a global biodiversity conservation database which serves as a decision support and management tool. The scope will be broadened from taxonomy and biology to resources management and biodiversity conservation. Access to FishBase by developing country stakeholders will be improved and the range of users broadened to NARS and management bodies. • National partners better equipped to manage flood plain aquatic resources through the use of developed decision-support systems. • Plans for introduction of alien species are carried out in a more objective scientific manner and the growth of aquaculture is enabled through better managed introductions of improved strains. • The availability of improved carp and tilapia strains will result in greater and more consistent aquaculture production, and in improved income among small-scale farmers. This will impact positively upon food security and poverty alleviation. • NARS' scientists have the required capacity in the genetics area to undertake programs on genetic improvement on their own.
Achievements (2003-2004)	• FishBase was updated by production of a 2004 edition (DVD and CD-ROM) covering an additional 3 500 species and increasing collaborators by 100% from the 2000 edition. Special emphasis was given to developing country content. • FishBase (www.fishbase.org) is the most frequently used internet resource in the CGIAR and currently has over 2.9 million users per year (2003) with more than 11 million user sessions per month in 2004. • Multi-lingual access to FishBase was significantly increased with a Chinese language edition of the book, and main web pages made accessible in 9 languages and local names in 12 non-Roman scripts. • New analytical tools developed were Fish Catch Length-Frequency Analysis; monitoring species introductions between FAO regions; electronic species identification keys. • Other technical advances include: DiGIR provider to other global information systems (OBIS, GBIF); data syndication using XML technology; and prototypes of national portals for site-specific ecosystem information. • Partnerships established with 12 new museums and institutions in 7 countries for geo-referenced information: FishBase now hosts 1.9 million geo-referenced records from 39 fish reference collections in 17 countries, representing over 85% of species in FishBase. • Migration ecology and hydrological requirements of 110 fish species of the Laotian Mekong were detailed. • Decisions-support tool integrating the factors driving fish production developed for the Tonle Sap Great Lake in Cambodia. • Professional training of five Cambodian fish biologists in research methods, data analysis and modeling. • Collaborative arrangements with respective government bodies have been initiated to work on compilation and evaluation of existing institutional, policy and legal framework on aquatic alien species in Malaysia and the Philippines. • New analytical routines have been developed in FishBase to provide for aquatic alien species, more detailed reporting and possible level of threat. • GIFT transferred to Malaysia has shown a 10% response to selection in harvest weight in one generation, and a heritability of 0.34, with scope for further genetic gain. • The Carp Genetic Improvement Project has begun, and continuing on earlier work, is further improving the strains for dissemination to farmers. • The successful application of GIFT technology in Africa is resulted in the dissemination of improved fish in Ghana and Malawi. Women's Clubs culturing our project's fish is a special feature in Malawi.

Planned Activities (2005-2007)	• Expand global biodiversity coverage of FishBase especially for under-represented and threatened species. • Increase in development of FishBase analytical tools and applications for responsible fisheries and aquaculture. • Increase technical collaboration with developing countries in the work of the FishBase Consortium, and in capacity-strengthening develop main FishBase functions as spatial information system. • Incorporate FishBase design, linkages, tools and applications in developing country national information systems. • One regional developing country establishes FishBase-linked encoding center. • FishBase becomes integrated with other taxa information systems and used in ecosystem-based approaches to management. • Develop bio-ecological information modules on Mekong fish species and a generic model for use in tropical floodplain rivers. • Develop methods to integrate in-stream flow methodologies with fish-flow models and other decision support tools. • Integrate research results into Mekong River fisheries management policies. • Integrate freshwater sanctuary research plan with fisheries management. • Initiate work on the evaluation of DNA markers for use as tags in alien species and genetic improvement programs. • Develop a prototype of tools to assess risks and evaluate adverse impacts due to alien species. • Consult with all stakeholders for development of national institutional, policy and legal framework for alien species. • Conduct training workshop on assessment of risks and evaluation of adverse impacts due to alien species. • Evaluate merit of YY male technology and use of F1 clones and other methods of estimating genetic change. • Initiate selection for traits other than growth in GIFT. Finalize strategy and work-plan on the integration of molecular and quantitative genetics in improvement programs. • In Bangladesh, China, India, Indonesia, Thailand and Vietnam, genetic evaluation of the 2004 generation of Carp takes place, and enhances capacity of staff in the genetics area. • In Egypt, Ghana and Malawi, consolidate improved selection lines of Tilapia, and develop a multiplication and dissemination strategy. • Estimate genetic parameters and response to selection in high and low input environments in Egypt.
Cost USD Millions	2005: 1.84 2006: 1.93 2007: 2.09
Users	FishBase: decision-makers, resource managers and scientists in NARS (government and university), NGOs, representative organizations of aquatic-dependent communities and, through them, fishers, farmers and consumers of aquatic produce in the developing world. Mekong: basin agencies (e.g., Mekong River Commission), National Departments of Fisheries and management bodies (e.g., National Mekong Committees), line agencies of the Mekong countries and conservation and fisheries-oriented NGOs. Alien species and genetic improvement activities: research and extension officers in national institutions (e.g., Departments of Fisheries, Universities), International Network on Genetics in Aquaculture (INGA) members, hatchery managers and fish farmers in developing countries.

Partners	FishBase: FishBase Consortium (Muséum National d'Histoire Naturelle, Paris; Musée Royal d'Afrique Centrale, Belgium; Swedish National Museum; University of Kiel, Germany; the University of British Columbia, Canada; FAO of the United Nations), national fishery departments, research institutes and universities. Mekong: IRRI, IWMI. Alien species: Alien Species and Global Invasive Species Program, Convention on Biodiversity, IUCN, *Invasive Species Program*, US Geological Survey, FAO, NACA and organizations in INGA member countries. Genetic improvement: NARS – Bangladesh, China, India, Indonesia, Malaysia, Philippines, Thailand, Vietnam, Egypt, Ghana, Côte d'Ivoire and Malawi; ARI – the Universities of Swansea, Stirling, and Wageningen. New partnerships are to be developed in Africa, Latin America and West Asia.
CGIAR linkages	CGIAR's ICT-KM initiatives and projects, e.g., Consortium for Spatial Information (CSI), Integrated Natural Resources Management and agro biodiversity initiatives of CGIAR, System-Widen Genetics Program, IRRI, IWMI and ILRI.
Investors	Potential investors include: FishBase: The European Commission, Deutsche Gesellschaft für Technische Zusammenarbeit GmbH – GTZ (Germany), FishBase Consortium members, National governments, Global Environment Facility (UNEP), Japan Bank for International Cooperation, DFID and DANIDA. Mekong: Asian Development Bank. Alien Species: Global Environmental Facility. Genetic improvement projects: DFID, UNDP TCDC, Asian Development Bank and University of Wageningen.
Milestones 2005 **Output being addressed is given in parentheses**	• Expanded FishBase coverage of essential conservation and management information on threatened and priority species identified by developing countries. (Output 1) • Development of FishBase-linked analytical tools for monitoring trophic changes in capture fisheries and integrated aquaculture development. (Output 1) • Active contribution of developing countries to define and implement FishBase work along with Consortium. (Output 1) • Development of a project to convert ecological information into packages useful to decision making. (Output 2) • Two publications on the ecology of important fish species in the Mekong Basin are produced. (Output 2) • A paper synthesizing lessons learnt from the development of several models of inland fish production is produced and presented in an international symposium. (Output 3) • Fish production model(s) are integrated in at least one broader decision support tools for basin wide water management. (Output 3) • Development of tools to assess risks and evaluate adverse impacts due to alien species initiated. (Output 4) • Merit of YY male technology and use of F1 clones and other methods of estimating genetic change evaluated. (Output 5) • Consolidation of improved selection lines of Tilapia in Egypt, Ghana and Malawi. (Output 6, 7) • Genetic evaluation of the 2004 generation of Carp in Bangladesh, China, India, Indonesia, Thailand and Vietnam. (Output 6, 7)

MTP Project 2:

Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management

(Freshwater Program)

Description

This project on Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management seeks to improve the livelihoods of poor fishers, fish-farmers and consumers of freshwater living aquatic resources by developing and disseminating appropriate aquaculture technologies and management options for inland fisheries. 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.

Goal	To improve livelihoods of beneficiaries (poor fishers, fish farmers and consumers) dependent on freshwater living aquatic resources.
Outcomes	1. Increased productivity and sustainability of freshwater aquaculture within the context of African and Asian farming systems. 2. Improved knowledge and management of freshwater living aquatic resources within the context of changing watersheds.
Objectives	• To demonstrate in a range of scenarios that small-scale farmers in Africa and Asia can benefit from adopting aquaculture technologies on a sustained basis, and characterize the specific conditions and enabling environments for scaling up. • To identify and characterize protocols of best practice for NARS and NGOs to introduce aquaculture to farmers as an option for enterprise diversification and for fostering the diffusion process efficiently and effectively. • To understand evolution of on-farm aquaculture technology from simple and robust integrated forms (at start-up stage) towards higher productivity and commercial competitiveness. • To contribute to the development of a portfolio of options for integrated land and water management with a particular focus on living aquatic resources and their role for the poor. • To synthesize knowledge on efficient and effective policies and local governance strategies, and contribute to testing improved approaches in selected locations and conditions. • To conduct specific studies in critical, poverty-prioritized areas, of the biology, ecological roles and economic and social values of fish and fishery resources to enable better management and policy decisions.
Outputs	Outputs for Outcome 1 1. Methods and cost efficient approaches to achieve understanding of target communities' needs and constraints; application of these to a portfolio of selected locations to gain new knowledge of strategic importance. 2. Improved portfolio of sustainable and appropriate technologies and strategies (e.g., watershed and fish stock management/enhancement, water management). 3. Methods and indicators for the participatory diagnosis, planning of new interventions, and monitoring and evaluating of farm diversification through adoption of aquaculture and gradual technology improvement; application and verification of these methods in selected locations and their dissemination to NARS and NGOs and other prospective applicants.

Outputs	4. Assessment of socioeconomic and environmental impacts of improved appropriate freshwater aquaculture technologies (integrated agriculture-aquaculture and community-based fish culture) and strategies in Africa and Asia. 5. Methods for the assessment, modeling and prediction of high potential aquaculture development areas and systems for use by partners in their countries; demonstrate this through a network of partners in selected countries. 6. Analysis of dissemination pathways and assessment of adoption of freshwater aquaculture technologies and production and marketing of freshwater aquaculture products in Asia and Africa. Outputs for Outcome 2 7. Assessment of the efficiency and impact of improved policies and local governance strategies. 8. Understanding of ecological relationships among living aquatic resources in lentic and lotic systems. 9. Species identification and the characterization of their ecological and socioeconomic roles and values.
Impacts	• Increased, sustainable fish supply from aquaculture and sustained inland fisheries to meet increasing market demand and ensure food security among the poor. • 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. • Improved management of aquatic resources with better knowledge and more participatory resources management among inland small-scale fisheries operators (full-time and part-time). • Increased capacity of national and local institutions (i.e., NARS and NGOs) in aquaculture and sustainable inland fisheries research, development and dissemination. • Aquaculture adoption and technology improvement, and sustainable inland fisheries management institutionalized in selected countries and regions through wider use of participatory approaches to on-farm research. • Reduced poverty and improved quality of life among rural households (producers and consumers) through better adoption of improved freshwater aquaculture-agricultural technologies. • Improved institutional linkages and increased awareness among stake-holders on the generation and dissemination of freshwater aquaculture technologies.
Achievements (2003-2004)	• *On-farm Research*: In Malawi, Cameroon and Bangladesh, farm household monitoring of new adopters of aquaculture was conducted. Analyses consider the effects of technologies, support systems, wealth strata, population density and market access on aquaculture adoption and the extent to which this improves adopters' lives. • Various research activities on component technologies were conducted, e.g., on natural spawning of African catfish, identification of factors regulating nitrogen retention in IAA systems, utilization of *Azolla* in rice-fish and pond polyculture culture, all leading to significant production increases on farms. • *Extension*: In Bangladesh, Malawi and Cameroon, several thousand new farmers adopted improved aquaculture approaches on their farms, with a significant initial increase in benefits. Different knowledge transfer approaches are being evaluated under different scenarios.

	• *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*: 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/yr, 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. • 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 2-10 ha; 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. • *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 livelihoods.
Planned Activities (2005-2007)	• In Bangladesh, research will be conducted with partner institutions to solve production bottlenecks and clarify key aspects of IAA systems. Over 500 extension workers and senior staff of cooperating NGOs will be trained. Further key support measures for the evolving "aquaculture industry" with increasing levels of technology will be studied and implemented, e.g., quality provision of fingerlings from decentralized hatcheries in larger individual sizes, with a focus on maximum benefits for the poor producers and consumers. • 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 for 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. • Studies will identify recommendation domains for aquaculture development in Cameroon, Malawi, Bangladesh and Thailand, based on characteristics of successful development pathways and conditions in these and other countries. A useful tool will be formulated for wider application based on these results. • In Malawi and Mozambique, employ GIS mapping of historical land use changes and 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. • The role and comparative value of African inland fisheries (e.g., fisheries, small water body, lake, floodplain and rainforest river fisheries) will be further studied, and management options towards win-win solutions will be evaluated among stakeholders.
Cost **USD Millions**	2005: 5.00 2006: 5.25 2007: 5.67
Users	NARES, NGOs, policy makers, government agency managers, resource managers, farmers and fishers, development workers, scientists, international and regional bodies in Africa and Asia.
Partners	Bangladesh: NARS (BFRI, 35 NGOs). Cameroon: NARS (MINEPIA). Egypt: NARS. India: NARS (ICAR, CIFRI, DoA-WBengal, NGOs). Malawi: NARS (DoF, Chancellor College of U. Malawi, various NGOs). Vietnam: NARS (UCantho, others).
CGIAR linkages	ICRAF, IITA, IRRI, IWMI, WARDA.
Investors	BMZ, Challenge Program on Water and Food, CIDA, Comprehensive Assessment of Water and Agriculture (SWIM2), DFID, ICRC, USAID, Wageningen Agricultural University, the WorldFish Center core donors.
Milestones **2005** **Outputs being addressed are given in parentheses**	• Completion of project in Cameroon, analysis of data, final report to donor, draft technical reports and peer reviewed publications. (Outputs 1-9) • Completion of analyses on IAA impact on adopting farm households in Malawi; draft technical reports and peer reviewed publications. (Outputs 1, 3-6) • Analyses of results of adoption of IAA and impact on different strata of farm households in Bangladesh completed; draft technical report and peer reviewed publications. (Outputs 1-6) • Completion of Like Chilwa (Malawi) watershed study on effects ofland use on migration success of Barbus species important for artisinal fisheries and supply of more than 20% of fish catch in Malawi. (Outputs 8, 9)

MTP Project 3:

Making the Most of the Coast

(Coastal Program)

Description

This project on Making the Most of the Coast 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 at WSSD in Johannesburg in 2002 to restore capture fisheries. In particular, the program endeavors to assist managers to increase the productivity of coastal 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 aquaculture, and reversing degradation of habitats that support fisheries. The program focuses on inshore fisheries, particularly those associated with coral reefs and coastal areas in Asia, Southeast Asia, and the Pacific.

Following an insightful Center Commissioned External Review (CCER) of the Program in late 2003, a new major initiative on coral reefs livelihoods is being developed to unify many of the activities within the Program. This initiative will help communities and local government agencies select the most appropriate and sustainable livelihood options based on coral reef fisheries resources. Developed in close collaboration with the Policy Research and Impact Assessment Research Program, it will include inputs from stakeholders in Southeast Asia, the Pacific, East Africa and the Caribbean, and also result in new partnerships with NGOs and development agencies.

Goal	To enhance livelihoods for the poor of coastal areas by improving productivity of fisheries resources in a sustainable way.
Outcomes	1. Restoration of marine capture fisheries. 2. Development of environmentally friendly aquaculture. 3. Reversing degradation of coastal habitats to provide healthy ecosystems to support capture fisheries and aquaculture.
Objectives	• To improve the productivity of coastal fisheries in developing countries, particularly the small-scale sector, by: 1) assessing the stock structure and status of capture fisheries; 2) identifying and testing interventions to restore, improve and sustain yields; 3) recognizing how to distribute the benefits equitably; and 4) providing communities and all levels of government with the information they need to make wise decisions to manage and allocate coastal fisheries resources. • To increase the options for meeting predicted demands for food fish and tropical marine ornamental fish through new forms of environmentally friendly aquaculture. • To integrate and disseminate the wide range of research and information on coral reefs and develop a generic approach to guide communities and governments identify the most appropriate local livelihood options based on coral reefs and associated fisheries resources.
Outputs	Outputs for Outcome 1 1. An information system for fisheries resources in developing countries documenting: 1) resource maps of stock structure of key species; 2) status of capture fisheries; 3) interventions to restore, improve and sustain productivity; 4) measures needed to distribute the benefits equitably; and 5) policy options to assist partner countries to improve management of coastal fisheries.

	Outputs for Outcome 2 1. Methods for mass-production and optimal release of hatchery-reared sea cucumbers to rebuild severely overexploited fisheries, and demonstration of the feasibility of restocking through a mass-release. 2. Analysis of the best candidate marine herbivorous fish species for coastal aquaculture to meet future demands for lower-cost fish. 3. Methods for farming coral reef species and collecting them from the wild in eco-friendly, certified ways to supply the marine aquarium trade. Outputs for Outcome 3 4. An expanded version of the ReefBase information system including: 1) a model for a generic approach to identifying the most appropriate livelihoods for people who depend on coral reefs; 2) an inventory and analysis of the lessons learned from coral reef management projects initiated by the GEF; and 3) a coral reef monitoring management system to promote standardized and effective storage, analysis, display and management of data on the status of reefs. 5. Training materials to improve capacity of partners in restoration and management of capture fisheries, environmentally friendly aquaculture, and improved management of coral reefs.
Impacts	• Increased awareness of the importance of coastal small-scale fisheries for livelihoods and food security. • Increased national capacity for sustainable management of small-scale coastal fisheries to optimize their contribution to livelihoods and food security. • New, lower-cost options for coastal aquaculture to help meet the demands for fish in 2020. • Increased, sustained livelihoods based on coral reef resources including jobs involved in eco-labeled fisheries and aquaculture for marine aquarium products.
Achievements (2003-2004)	• Publication of the book and CD entitled "Assessment, Management and Future Directions for Coastal Fisheries in Asian Countries", containing 35 papers. Release of the 2004 version of the Fisheries Resource System and Tools (FiRST) software with improved summary, analysis procedures and mapping module. • An extensive review of restocking and stock enhancement of marine invertebrates to be published as a stand alone volume of Advances in Marine Biology. • A Global Protocol for Assessment and Monitoring of Coral Bleaching jointly published by WWF and WorldFish and launched at the 10th International Coral Reef Symposium in Okinawa. • Completion of initial research on assessing the potential for restocking sea cucumbers including stock delineation, methods for scaling-up production of juveniles, development of tags to identify released juveniles, and identification of the best transport methods, habitats and periods for release. • Promotion on sustainable livelihood opportunities through pearl farming was carried out by auctioning black pearls from the demonstration pearl farm in the Solomon Islands. • Demonstration of the economic feasibility of village enterprises based on the capture and culture of post-larval coral reef fish and invertebrates for the marine aquarium trade, and production of a manual for small-scale operators.

	• A new version of ReefBase, including: 1) updated and more accessible information on coral reef resources, their status, and management; 2) a global database on coral bleaching and coral reproduction; and 3) a web-based Reef Advisory System to present and interpret all Reef Check coral status information. • International Workshop on Coral Reef Monitoring Data, resulting in better collaboration and data sharing among reef monitoring programs, and a workshop CD ROM containing a range of coral reef monitoring information.
Planned Activities (2005-2007)	• Continue the development of the fisheries resources information system, and establishment of network to identify biologically meaningful management units for coastal fisheries based on stock delineation. • Complete the assessment of the potential for restocking sea cucumbers by mass-producing juveniles in co-culture with shrimp and conducting a mass-release of juveniles using optimal release strategies. The feasibility of using sea cucumbers for bioremediation of shrimp ponds will be tested as part of this process. • Develop a generic approach for community-based management of sea cucumber fisheries for the Pacific by working with villagers in Solomon Islands to: 1) identify the status of stocks; 2) recommend the levels of fishing needed to restore stocks and yield regular future harvests; and 3) obtain the best prices for their catches through improved processing methods. • Expand the uptake of sustainable methods for supplying the marine aquarium trade with cultured specimens and fish caught from the wild using methods certified by the Marine Aquarium Council. • Support initiation of commercial pearl farming in Solomon Islands by developing grow-out methods that allow villages to participate widely in the industry. • Support partners in Southeast Asia to organize a workshop on meeting future demands for fish through coastal aquaculture, including the identification of a suitable herbivorous marine fish. • Conduct an international workshop on developing a generic approach for identifying the most appropriate livelihood options for local communities dependent on coral reefs. • Expand ReefBase to provide the information system needed to improve livelihood options for people who depend on coral reefs, and initiate a project to provide much broader coverage of information from the Pacific.
Milestones 2005 **Outputs being addressed are given in parentheses**	• Finalization of multi-partner project proposal for assessment and role of small-scale fisheries, and implementation of initial activities in at least two countries. (Output 1) • Production of a special issue of the journal 'Fisheries Research' on the potential, progress and problems of restocking and stock enhancement of coastal fisheries. (Output 1) • Establishment of a post larval fish capture/culture demonstration site elsewhere in Solomon Islands. (Output 2) • Assessment of growth and survival of sea cucumbers in bioremediation ponds for shrimp culture. (Output 2) • A management plan for the sea cucumber fishery prepared for a suitable site in the Solomon Islands. (Output 2) • A pilot-scale mass-release of juvenile sandfish completed in New Caledonia. (Output 2) • Detailed coral reef status reports for all Southeast Asian countries published. (Output 5) • A regional node for ReefBase established in Noumea, with local data collation offices in West Samoa, Fiji and Moorea. (Output 5)

Cost **USD Millions**	2005: 2.29 2006: 2.40 2007: 2.59
Users	International and regional fisheries and aquaculture agencies (e.g., FAO, UNEP, NACA, SEAFDEC, SPC, SPREP), ARIs, national fisheries agencies, local government, NGOs, and fishing/coastal communities.
Partners	Australia: Commonwealth Scientific and Industrial Research Organisation, Marine Research (CSIRO); Queensland Department of Primary Industries (QDPI). Bangladesh: Bangladesh Fisheries Research Institute (BFRI); Department of Fisheries (DOF); University of Chittagong. Brunei: DOF. Fiji: University of the South Pacific. India: Central Marine Fisheries Research Institute (CMFRI); Indian Council for Agricultural Research (ICAR). Indonesia: Central Research Institute for Fisheries (CRIFI); Directorate of Fisheries Resource Management; Research Center for Oceanography (LIPI). Malaysia: DOF; Fisheries Research Institute (FRI); University of Malaysia Sabah (UMS). New Caledonia: Secretariat of the Pacific Community; New Caledonia Provinces; IFREMER; French Delegation for the Pacific. Philippines: Bureau of Fisheries and Aquatic Resources (BFAR); University of the Philippines in the Visayas (UPV); Silliman University Angelo King Center for Research on Environment and Management (SUAKCREM); Philippine Council for Aquatic and Marine Research and Development (PCMARD). Solomon Islands: Department of Fisheries and Marine Resources; WWF. Sri Lanka: Ministry of Fisheries and Aquatic Resources Development. Thailand: DOF; Southern Marine Fisheries Development Center (SMFDEC); Aquatic Resources Research Institute (ARRI). Vietnam: Ministry of Fisheries; Research Institute for Marine Products (RIMP); Research Institute for Oceanography (RIO).
CGIAR linkages	Other CG Centers, Global Public Good Databases project.
Investors	ACIAR, ADB, AusAID, Agence Française de Développement (AFD), EU, NZAID, NOAA, UNEP, UNF.

MTP Project 4:

Assessing Technological, Institutional and Policy Options that Benefit Poor People

(Policy Program)

Description

This project on Assessing Technological, Institutional and Policy Options that Benefit Poor People conducts analyses on the socioeconomic, environmental and legal and institutional factors affecting the improved governance of coastal and inland aquatic resources, uptake and promotion of sustainable aquaculture technologies, and increased supply of fish in developing countries. It emphasizes development of national and regional collaborative projects with government agencies, NGOs and policy researchers in developing countries, and advanced scientific institutes for creation of impact pathways for management options and adoption of technologies. The overall strategy of the Program is to provide the policy basis for targeted development and dissemination of technologies, and creation of participatory, responsible and accountable legal and institutional regimes to create a win-win situation for oceans, fishers and other poor communities.

Goal	To ensure sustainable livelihoods and food availability among the poor in developing countries through effective policies and institutions, and appropriate technologies.
Outcomes	1. Increased fish supply and economic benefits from fish obtained by providing options derived through assessment of economic, social and environmental policy issues. 2. Options developed for sustainable fisheries governance from local to regional scales, and from legal and institutional assessments. 3. Impacts of technological innovation and fisheries research assessed and risks measured to guide prioritization of future research.
Objectives	• To provide multiple values and benefits of aquatic resources for better policy planning and decision making in the various regions. • To determine effective methods and indicators of small-scale fisheries and to facilitate its replication in relevant regions. • To determine stakeholder participatory processes for the development of effective policies for food security, poverty reduction and better livelihoods. • To support national partners develop and implement innovative strategies for community and co-management, conflict resolution, integrated resource management, and related policies that promote sustainable livelihoods. • To identify and assess a broad range of institutional and policy reform experiences across regions, and facilitate exchange of lessons to accelerate improvements in aquatic resources governance. • To assess the nature of emerging aquaculture and fisheries technologies and their impacts on livelihoods, food security, equity, sustainability and institutions.

Outputs	Outputs for Outcome 1 1. Aquatic resource values and valuation methods to improve development plans and policies that impact upon the aquatic resources sector and people dependent on the resources. 2. Projections and modeling methods to improve resource allocation in development plans and policies. Outputs for Outcome 2 3. Methods and indicators for improved management of small- scale fisheries. 4. A cross-regional network of partners that contribute to, use, and promote a suite of resources (case studies, issue briefs, handbook, web resources) for fisheries governance in the context of integrated coastal zone management, and river and lake basin management. Outputs for Outcome 3 5. Analysis of socioeconomic and environmental impacts of freshwater aquaculture technologies (integrated agriculture and aquaculture and community based fish culture) in Asia and Africa. 6. Analysis of dissemination pathways and assessment of adoption of freshwater aquaculture technologies and production and marketing of freshwater aquaculture products in Asia and Africa.
Impacts	• Enhanced community livelihoods and improved sustainability of aquatic resources supported by holistic policy decisions based on stakeholder values and their participation in decision making. • Increased sustainable fish supply to meet increasing market demand and ensure food security among the poor. • Balanced international trade policies that facilitate equitable benefits for the poor and sustainable use of aquatic resources in developing countries. • Capacity strengthened among local institutions through national government agencies and NGOs on policy formulation for sustainable aquatic resources management. • Participatory approaches to governance and policy reform in aquatic resources management institutionalized in selected countries and regions. • Reduced poverty and improved quality of life among rural households (producers and consumers) through better adoption of improved freshwater aquaculture-agricultural technologies. • Improved institutional linkages and increased awareness among stakeholders for the generation and dissemination of freshwater aquaculture technologies.
Achievements (2003-2004)	• Role of aquatic resources in rural livelihoods, marketing opportunities, trade patterns, distributional channels and post-harvest operations for fish and fisheries products in Mekong Region were assessed. • Assistance to nine Asian countries in developing county- specific action plans for poverty reduction among poor fish producers and consumers will be extended. • Lessons on fisheries co-management consolidated from cross-regional comparative study and promoted through partner networks. • Legal and institutional analysis on wetlands governance concluded in the Mekong region. • *Ex-post* impact assessment of integrated agriculture and aquaculture technology development and dissemination in Malawi was undertaken. • Framework and methodology for prioritization of the WorldFish Center's research activities were implemented. • Prioritization of aquaculture and post-harvest technologies and fishing practices in Asia.

Planned Activities (2005-2007)	• Policy analyses and economic valuation of coral reefs and inland aquatic resources in Asia, Africa and Caribbean. • Completion of Asian fish supply, demand and trade model, and assessment of technological and policy options for fisheries and aquaculture in Africa. • Strategies for better management of fisheries conflicts assessed and promoted through cross-regional initiatives. • Policy and institutional reforms that improve the success of community-based fisheries management demonstrated and promoted. • Impact of aquaculture production and marketing on livelihoods will be assessed in selected Asian countries. • Detailed studies on the socioeconomics of IAA technologies in the four countries of Africa (Cameroon and Malawi) and Asia (Bangladesh and Thailand) will be conducted, including: a) stakeholder analysis of user needs; b) economic analysis of alternative resources 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. • Adoption and impact of genetically improved carp species will be assessed in selected Asian countries. • Impacts of community-based fisheries management will be evaluated in South Asia and the Mekong River region.
Milestones 2005 **Outputs being addressed are given in parentheses**	• Impact of different technological options and trade policies on growth, equity and food security analyzed in selected Asian countries. (Outputs 1, 3) • Constraint analysis and adoption studies of aquaculture technologies in selected Asian and African countries reviewed and reported. (Outputs 1, 5, 6) • Lessons for policy reform documented from action research on community-based fisheries management in more than 100 sites in Bangladesh and in selected sites in the Mekong River region. (Outputs 2, 4)
Cost USD Millions	2005: 4.22 2006: 4.43 2007: 4.79
Users	Policy makers, government agency managers, NARS, NGOs, regional and international bodies, resource managers, fishers, development workers and scientists in Asia, Sub-Saharan Africa, and the Caribbean.
Partners	NARS (South Asia: Bangladesh, India, Sri Lanka; Mekong Region: Cambodia, Laos, Vietnam; Southeast Asia: Thailand, Malaysia, Philippines, Indonesia, China; Sub-Saharan Africa: Malawi, Mozambique, Zambia, Nigeria, Uganda, Kenya), 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	IFPRI, IMPACT PRGA-CIAT, IITA, IRRI (potential), System-wide CAPRI initiative; IWMI, ICRAF, IFPRI.
Investors	ADB, BMZ, CORDIO, DFID, IDRC, IFAD, Oxfam, Sida, USAID, Ford Foundation.

MTP Project 5:

International Relations and Partnerships

Description

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

Goal	To enhance partnerships with national agencies in developing countries, advanced scientific institutions and regional and international organizations, ensure relevance of our research to developing country needs, and build capacity among developing country institutions.
Outcomes	Improved partnerships and capacity building among developing country NARS.
Objectives	• To strengthen existing collaborations and develop new partnerships with NARS, NGOs, regional/international organizations, advanced scientific institutions and the private sectors. • To build a critical mass of science capacity in developing countries. • To strengthen the capacity of developing country scientists in genetic enhancement of aquaculture species through networking.
Outputs	Sustained partnerships and research collaborations based on developing country needs and the strategic interests of the WorldFish Center.
Impacts	• Better informed NARS scientists and managers and thus improved aquatic resources management. • Human resources development in developing countries through networking and partnerships.
Achievements (2003-2004)	• Identification of national research priorities for Bangladesh, Malaysia and Philippines through research planning workshops. Plans developed for similar workshops in Indonesia and Vietnam. • Institutions and areas for research collaboration identified through consultation meetings held with advanced scientific institutions in Denmark, UK and Norway. • Proceedings of "Expert Consultation on Biosafety and Environmental Impact of Genetic Enhancement and Introduction of Improved Strains and Alien Species in Africa" finalized for publication. • Expert Consultation on 'Ecological Risk Assessment of Genetically Improved Breeds' organized. Recommendations for environmentally safe dissemination of improved fish strains published and widely disseminated. • Assistance provided to member countries of INGA in development of national plans for dissemination of improved fish breeds. • Recommendations formulated for better linkages between private and public sectors in fish genetic research, and dissemination of genetic research outputs to end-users. • Enhancement of synergy between genetic research being undertaken at advanced scientific institutions and developing country institutions. • Guidelines and procedures for selection and appointments of Visiting Scientists, Post-doctoral Fellows, Ph.D scholars and Research Interns at the WorldFish Center were formulated. • Needs-based curricula for coastal zone management training programs in Vietnam and Indonesia implemented. • Capacity enhanced of scientists from 13 member countries of INGA through their participation in advanced course on quantitative genetics and breeding organized by the WorldFish Center/INGA. • Training program on broodstock management and sex reversal of tilapia organized for non-government and government extension workers in Bangladesh, Malaysia and Vietnam.

Planned Activities (2005-2007)	• Forge new partnerships and further strengthen existing partnerships and networks. • Hold Steering Committee meetings of INGA and training workshops for partner capacity enhancement. Assistance will be provided to member countries of INGA on development/implementation of national plans/ strategies for dissemination of improved fish strains. • Research internships will be provided to qualified NARS scientists/experts, M.S./Ph.D students and Post- doctoral Fellows to work with the WorldFish Center scientists to enhance national capacity and contribute to the Center's research programs. • Establishment and operationalization of the Southeast Asian Regional Training Center for Integrated Coastal Zone Management in the Philippines. This center would service a diverse range of training needs relating to coastal zone management and coordinate the ICRAN coral reef training activities.
Cost USD Millions	2005: 0.51 2006: 0.54 2007: 0.58
Users	NARS scientists and managers, policy makers and donors.
Partners	NARS in Asia, Africa and the Pacific, ARIs, regional and international organizations.
CGIAR linkages	SGRP for INGA.
Investors	Norway, core funds, IDRC, Packard Foundation, MacArthur Foundation.
Milestones 2005 Outputs being addressed are given in parentheses	• Partnerships with NARS, ASIs, IARCs increased. • Meetings organized with NARS institutions/stakeholders in Vietnam and Indonesia to assist in research prioritization. • Under INGA Institutional collaboration established for regional project on genetic improvement of freshwater prawns. • 8th INGA Steering Committee Meeting held. • Coastal Zone Management training courses organized in two countries. • At least four research interns and two Visiting Scientists/Post doctoral fellows at the Center. • Training support unit established. • Training database updated.

MTP Project 6:

Information and Communications

Description

The Information and Communications Project (ICP) provides information and communication services to partners and stakeholders including WorldFish staff around the world. The ICP focuses on knowledge management and dissemination activities such as online and print publications, library and information services, strategic marketing and public awareness.

Goal	To maximize the WorldFish Center's impact in developing countries and stimulate demand for our research products through effective communication and dissemination of research results to stakeholders.
Outcomes	1. WorldFish research results are cost effectively captured, appropriately packaged and disseminated to target audiences in developing countries (e.g., collaborators, NARS, governments, community groups, etc.). 2. Increased awareness of global living aquatic resources issues, and of the WorldFish Center's organizational profile and role in sustainable development of fisheries and aquatic resources.
Objectives	• To communicate and disseminate the Center's research results to targeted potential users through a range of appropriate media and methods. • To support resource mobilization, investor relations and marketing initiatives to ensure visibility and sustainability of the Center's programs. • To facilitate a knowledge sharing culture and effective internal communications across programs and locations in keeping with the 'One WorldFish' concept.
Outputs	Easily accessible and usable information and knowledge products on sustainable fisheries and aquaculture delivered to target users in developing countries
Impacts	• Better informed NARS scientists and managers, and national policymakers who can contribute to improved aquatic resources management. • Global research results captured electronically, tailored to fit stakeholder needs and disseminated widely through a variety of channels. • The WorldFish Center has higher profile as a global center of scientific excellence with investors, research partners and media.
Achievements (2003-2004)	• Published 25 WorldFish corporate and technical publications. • Achieved significant media coverage (over 50 reports) in national media and 5 press reports with leading international media. • Participated in four major international exhibitions including CBD COP7 in Malaysia and Fourth World Fisheries Congress in Vancouver. • Developed a CGIAR System-wide project on web usage analysis under the ICT-KM project. • The Center' publications digitized for preservation and dissemination purposes. Three library operating procedure manuals prepared and an online facility for book renewals and checking of loan records developed. • Online access to CGIAR journals subscription for HQ and Abbassa site staff provided. • Linkages from the Center electronic documents to the library's databases created. • On-the-job library and information systems training provided for Cambodian national research partner organization and WorldFish library staff in Malawi.

Planned Activities (2005-2007)	• Implementation of a Center-wide Communications Strategy to foster a knowledge sharing culture and practices amongst internal and external stakeholders. • Lead the ICT-KM Program Web Usage Analysis project, and participation in the system wide ICT-KM 'Content for Development' initiatives on E-Publishing, Virtual Library and the Virtual Resources Center. • Further automation of library services and increased access provided to WorldFish research through electronic publications, databases and the website. • Develop procedures with the Resource Mobilization Office to incorporate dissemination strategies and methods into research project proposals. • Implement improved business processes (e.g., publications workflow) and the use of new technologies for procedural and efficiency gains. • Provide user-friendly formats and access to information through ICT tools such as interactive website and CD ROMs, downloadable publications and databases, and a digital image bank. • Joint development of WorldFish marketing strategy with the Resource Mobilization Office.
Cost USD Millions	2005: 0.75 2006: 0.79 2007: 0.85
Users	Global community concerned with aquatic resources research and management, NARS scientists and managers, policy-makers and donors.
Partners	NARS, ARIs, regional and international organizations involved in living aquatic resources management worldwide, other CGIAR Centers, FAO, regional aquaculture and fisheries information centers.
CGIAR linkages	ICT-KM Program (Thrust 2 projects), Marketing Group, Information Professionals Group.
Investors	The WorldFish Center core funds, ICT-KM Program.
Milestones 2005 **Outputs being addressed are given in parentheses**	• Information services in the WorldFish Center outreach sites and information sharing with partners strengthened. • WorldFish website restructured and redesigned and Web Content Management System established. • Communications and resource mobilization strategy for *"Fish for All"* finalized and plan developed for mainstreaming into WorldFish activities. • Information Architecture project resourced and implementation begun. • News coverage of the Center, and the number of regular opinion-editorial features in the regional and international media increased. • ICT-KM web usage analysis project inception study completed and pilot phase designed.

Section B. Financing the Agenda

4.1 2003 Results and 2004 Development

The 2003 expenditure level was US$16.43 million of gross expenditures and US$15.66 million net of recovery of indirect cost. About 80% of 2003 resources were utilized for programmatic activities. The WorldFish Center (ICLARM) ended the year with a surplus of US$0.34 million.

The 2003 grant income from donors amounted to US$14.64 million in addition to US$1.36 million of earned income. The addition in Center income is due to more funded projects incurred during the year. Recovery of indirect costs from funded projects amounted to US$0.77 million.

Grant income for 2004 is projected at US$16.67 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 2004 expenditures are estimated at US$16.48 million compared to actual spending of US$15.66 million for 2003. The increase is mostly in project funding. More projects were generated in 2004. The Center is expected to end the year with a slight surplus.

Resource allocation to programs for 2004 is projected to be around 81% of the total resource available.

Table 3. Comparison of 2003* performance and 2004 current estimate

	2003 Actual* (US$ million)	2004 Estimate (US$ million)
Sources of Funds		
Donor Funding	14.64	16.67
Earned Income	1.36	0.10
Total	**16.00**	**16.67**
Application of Funds		
Programmatic	12.50	13.51
Management and General Expenses	3.74	3.40
Depreciation	0.19	0.29
Less: Overhead Recoveries	(0.77)	(0.72)
Net Expenditures	**15.66**	**16.48**
Unexpended Balance	**0.34**	**0.29**

*** Targeted project funding which follows the matching principle was underspent by approximately US$ 3.36 million in 2003. Actual targeted grant income for the year (2003) was substantially higher.**

The 2003 spending and 2004 current planned resource allocation by CGIAR activity are summarized in the following page.

Table 4. Actual and planned resources allocation by CGIAR activity for 2003 and 2004

	US$ (million)		
	2003 Actual	2004	
		Estimate	%
Increasing Productivity	3.10	2.57	15
Protecting the Environment	5.99	4.89	30
Saving Biodiversity	0.20	0.12	1
Improving Policies	4.26	7.58	46
Strengthening NARS	2.11	1.32	8
Total	15.66	16.48	100

For the 2004 resources, 30% were allocated to protecting the environment, 46% to improving policies, 15% to increasing productivity and 8% to strengthening NARS. These allocations are consistent with the Center's long-term strategic direction.

Table 5. Allocation of resources by outputs (Logical Framework Format) US$ (million)

	US$ (million)		
	2003 Actual	2004	
		Estimate	%
Germplasm Improvement	0.78	0.63	4
Germplasm Collection	0.20	0.12	1
Sustainable Production	8.31	6.83	41
Policy	4.26	7.58	46
Enhancing NARS	2.11	1.32	8
Total	15.66	16.48	100

4.1.1 Funding Trends

With continued efforts in fund raising and harnessing 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$16.67 million in 2004 (expected), an increase during the period of over 74%.

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 2005.

4.1.2 Inflation and Exchange Rates

The RM (Malaysian Ringgit) is presently fixed at the exchange rate of RM 3.80 to US$1. 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 2003 was around 3% and is forecasted to be between 4.1-5.0% in 2004-2005. The Center will monitor actual inflation in 2004 and assess its impact on the purchasing power of the budget.

Inflation on the US$ expenditures is expected to be around 1.9-3% for 2004-2005.

4.1.3 Depreciation of Fixed Assets

The actual depreciation of existing the WorldFish Center fixed assets for 2003 was US$0.19 million as against US$0.14 million in 2002. 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.

4.1.4 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 2003 was US$1.41 million, appropriated by the Board of Trustee for fixed assets renewal.

4.1.5 Working Capital (Days)

The working capital as of 31 December 2003 can support operations for 220 days compared to CGIAR norm of 120 days of operations.

4.1.6 Liquidity

The Center's liquidity continues to improve.

Table 6. Liquidity ratio analysis

	2002	2003	2004 Projected
Current Ratio (times)	2.08	2.12	2.18
Quick Ratio (times)	2.08	2.12	2.18
Cash to Current Assets (%)	53	48	52
Cash to Current Liabilities (%)	109	102	113
Total	15.66	16.48	100

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.

4.1.7 Equity: Longer term management of resources

Minimum equity (net assets less fixed assets) of 25% to cover 3 months of operations is required for research operations as determined by the CGIAR. The Center equity for 2003 was at 61% or 7.3 months of operations compared to System proposed standard of 25% or 3 months of operations.

4.2 2005-2007 Plans

4.2.1 Funding Requirements and Financing Plans

The funding level for the first year of the MTP 2005-2007 was based on a carefully projected core and project funding. In 2004 the level of funding is slightly higher due to the inclusion of carry over project unexpended funds from 2003.

The expected level of donor funding for 2004 is projected at US$16.67 million, in addition to earned income of US$0.10 million and indirect cost recoveries from funded projects of US$0.72 million. The Center's projected operating levels (net of indirect cost recoveries) for 2004 to 2007 are:

Table 7. ICLARM – The WorldFish Center Operating Levels

	US$ (million)			
	2004	2005	2006	2007
Projected Donor Funding	16.67	14.68	15.41	16.64

A combined growth and inflation rate of 5% and 8% was incorporated into the plans for the years 2006 and 2007 respectively 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 2004. The Center's indirect cost recovery is expected to be

around US$0.72 million for 2004. This is an equivalent amount compared to previous years but indirect cost recovery is still well below the full costs of targeted research projects.

4.2.2 Operating Budget 2005-2007

The research activities and allocation of resources were determined by an in depth review of the WorldFish Center programs and research projects at special program retreats, and a Center-wide review by Board and management was conducted. The six programs were allocated over 77% 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 Financial 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 37-51% of the resources are allocated to personnel costs for the years 2003-2006 (Financial 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 (Financial 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 (Financial Table 5).

Personnel input: Center-hired Internationally Recruited staff (IRS) level is estimated at around 37 positions including post-doctoral fellows and visiting scientists. Additional positions are planned subject to funding availability in 2005 and beyond (Financial Table 9).

Regionally Recruited Staff (RRS) level is approximately 9 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 around 266 in 2005 for all Center sites.

4.2.3 Capital Budget

The major capital requirements have been met. An expansion of the conference and meeting facilities was completed in 2003. This has 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 8. ICLARM - The WorldFish Center capital requirements 2005-2007, US$ (million)

	2005	2006	2007
Capital Needs (US$ K)	200	225	250

4.2.4 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.

4.2.5 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 4.0-5.0% during the plan period. The Malaysian Ringgit (RM) is fixed at the rate of RM 3.80 for US$1. 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 2004 (to June 2004).

4.2.6 Financing Plan 2005

The confirmed and high probability funding for financing the Center operations in 2005 amounts to US$14.68 million. Included in this amount is US$1.0 million from the World Bank.

The projected core funding amounts to US$6.56 million and project funding is projected at the level of US$8.12 million. Core funding of the Center has increased to 39% of total funding level in 2004.

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.

Financial Table 7a provides details of the funding and donor support for 2005 agenda.

Financing of 2005 Plan

	US$ (M)	%
Core support	6.56	45
Targeted /restricted Funding	8.12	55
Subtotal	14.68	100
Center earned income	0.10	1
Total revenue	14.78	101
Surplus in operations	(0.17)	(1)
Expenditure in 2005	**14.61**	**100**

4.2.7 Summary of Financing Plan

The resource requirements over the plan period are based on the 2004 Budget level and the best estimate of resources for 2005 which is the basis for this plan period. The plan is increased by a combined annual growth and inflation rate of 5% and 8% for years 2006 and 2007 respectively.

Section C. Financial Tables for 2005–2007

Table 1. The WorldFish Center - 2005 Research agenda requirements by CGIAR output
(expenditure in US $ million)

	MTP Projects	Germplasm Improvement	Germplasm Collection	Sustainable Production	Policy	Enhancing NARS	PROJECT TOTALS
001	Sustainable Use of Biodiversity and Genetic Resources	0.50	0.03	0.91	0.13	0.27	**1.84**
002	Improved livelihoods through appropriate inland aquaculture technologies and fisheries management			5.00			**5.00**
003	Making the Most of the Coast	0.07	0.11	2.04		0.07	**2.29**
004	Assessing technological, institutional and policy options that benefit poor people				4.22		**4.22**
005	Improved partnerships and capacity-building among developing country institutions and agencies	0.05				0.46	**0.51**
006	Access to information for sustainable development of fisheries and aquatic resources	0.07				0.68	**0.75**
	OUTPUT TOTALS	**0.69**	**0.14**	**7.95**	**4.35**	**1.48**	**14.61**

Table 2. The WorldFish Center research agenda - allocation of resources, 2003-2007

(expenditure in US $ million)

Allocation of Resources by Outputs Logical Framework Format

Outputs	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Germplasm Improvement *(Activity: Germplasm Enhancement & Breeding, plus Networks as appropriate)*	0.78	0.63	0.69	0.72	0.79
Germplasm Collection *(Activity: Saving Biodiversity, plus Networks as appropriate)*	0.20	0.12	0.14	0.15	0.16
Sustainable Production *(Activity: Production Systems Dev & Mgmt, Protecting the Environment, plus Networks as appropriate)*	8.31	6.83	7.95	8.36	9.01
Policy *(Activity: Improving Policies, plus Networks as appropriate)*	4.26	7.58	4.35	4.56	4.94
Enhancing NARS *(Activity: Strengthening NARS - the three sub-activities, plus Networks as appropriate)*	2.11	1.32	1.48	1.55	1.67
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Allocation of Resources by CGIAR Activity

	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Increasing Productivity *of which:*	**3.10**	**2.57**	**2.95**	**3.10**	**3.35**
Germplasm Enhancement & Breeding	0.78	0.63	0.69	0.72	0.79
Production Systems Development & Management	2.32	1.94	2.26	2.38	2.56
Protecting the Environment	**5.59**	**4.89**	**5.69**	**5.98**	**6.45**
Saving Biodiversity	**0.20**	**0.12**	**0.14**	**0.15**	**0.16**
Improving Policies	**4.26**	**7.58**	**4.35**	**4.56**	**4.93**
Strengthening NARS *of which:*	**2.11**	**1.32**	**1.48**	**1.55**	**1.68**
Training and Professional Development	0.50	0.35	0.39	0.41	0.44
Documentation, Publications, Info. Dissemination	0.86	0.50	0.57	0.59	0.65
Organization & Management Counselling					
Networks	0.75	0.47	0.52	0.55	0.59
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Table 3. The WorldFish Center research agenda - project & output cost summary, 2003-2007
(In US $ million)

		2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
001	Sustainable Use of Biodiversity and Genetic Resources	1.83	1.67	1.84	1.93	20.9
002	Improved Livelihoods through Appropriate Inland Aquaculture Technologies and Fisheries Management	4.44	4.29	5.00	5.25	5.67
003	Making the Most of the Coast	3.33	1.93	2.29	2.40	2.59
004	Assessing Technological, Institutional and Policy Options that Benefit the Poor People	4.13	7.46	4.22	4.43	4.79
005	Improved Partnerships and Capacity Building Among Developing Country Institutions and Agencies	1.23	0.55	0.51	0.54	0.58
006	Access to Information for Sustainable Development of Fisheries and Aquatic Resources	0.70	0.58	0.75	0.79	0.85
	TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Summary by CGIAR Output	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Germplasm Improvement	0.78	0.63	0.69	0.72	0.79
Germplasm Collection	0.20	0.12	0.14	0.15	0.16
Sustainable Production	8.31	6.83	7.95	8.36	9.01
Policy	4.26	7.58	4.35	4.56	4.94
Enhancing NARS	2.11	1.32	1.48	1.55	1.67
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Institutional Cost Components	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Direct Project Costs	16.43	17.20	14.99	16.10	17.35
Indirect Project Cost (Overhead)	-0.77	-0.72	-0.38	-0.76	-0.78
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Table 4. The WorldFish Center allocation of project cost to CGIAR activities, 2003-2007
(In US $ million)

		2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
001	**Sustainable Use of Biodiversity and Genetic Resources**					
	Enhancement & Breeding	0.49	0.45	0.50	0.52	0.56
	Production Systems	0.23	0.21	0.23	0.25	0.27
	Protecting the Environment	0.68	0.61	0.68	0.71	0.77
	Improving Policies	0.13	0.12	0.13	0.13	0.15
	Saving Biodiversity	0.03	0.03	0.03	0.03	0.03
	Strengthening NARS-Training	0.18	0.17	0.18	0.19	0.21
	Strengthening NARS-Networks	0.09	0.08	0.09	0.10	0.10
		1.83	**1.67**	**1.84**	**1.93**	**2.09**
002	**Improved Livelihoods through Appropriate Inland Aquaculture Technologies and Fisheries Management**					
	Production Systems	1.33	1.29	1.50	1.57	1.70
	Protecting the Environment	3.11	3.00	3.50	3.68	3.97
		4.44	**4.29**	**5.00**	**5.25**	**5.67**
003	**Making the Most of the Coast**					
	Production Systems	0.76	0.44	0.53	0.55	0.59
	Enhancement & Breeding	0.10	0.06	0.07	0.07	0.08
	Protecting the Environment	2.20	1.27	1.51	1.59	1.71
	Saving Biodiversity	0.17	0.10	1.11	0.12	0.13
	Strengthening NARS-Training	0.10	0.06	0.07	0.07	0.08
		3.33	**1.93**	**2.29**	**2.40**	**2.59**
004	**Assessing Technological, Institutional and Policy Options that Benefit the Poor People**					
	Improving Policies	**4.13**	**7.46**	**4.22**	**4.43**	**4.79**
005	**Improved Partnerships and Capacity Building Among Developing Country Institutions and Agencies**					
		0.12	0.06	0.05	0.06	0.06
	Enhancement & Breeding	0.55	0.24	0.23	0.24	0.26
	Strengthening NARS - Information	0.14	0.06	0.06	0.06	0.06
	Strengthening NARS - Training	0.42	0.19	0.17	0.18	0.20
	Strengthening NARS - Networks	**1.23**	**0.55**	**0.51**	**0.54**	**0.58**
006	**Access to Information for Sustainable Development of Fisheries and Aquatic Resources**					
		0.07	0.06	0.07	0.08	0.09
	Enhancement & Breeding	0.31	0.26	0.34	0.35	0.38
	Strengthening NARS - Information	0.08	0.06	0.08	0.09	0.09
	Strengthening NARS - Training	0.24	0.20	0.26	0.27	0.29
	Strengthening NARS - Networks	**0.70**	**0.58**	**0.75**	**0.79**	**0.85**
	TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Summary by Undertaking	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Increasing Productivity	3.10	2.57	2.95	3.10	3.35
Protecting the Environment	5.99	4.89	5.69	5.98	6.45
Saving Biodiversity	0.20	0.12	0.14	0.15	0.16
Improving Policies	4.26	7.58	4.35	4.56	4.93
Strengthening NARS	2.11	1.32	1.48	1.55	1.68
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Summary by Output	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Germplasm Improvement	0.78	0.63	0.69	0.72	0.79
Germplasm Collection	0.20	0.12	0.14	0.15	0.16
Sustainable Production	8.31	6.83	7.95	8.36	9.01
Policy	4.26	7.58	4.35	4.56	4.94
Enhancing NARS	2.11	1.32	1.48	1.55	1.67
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Table 5. The WorldFish Center research agenda, 2003-2007

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

Produvction Sectors & Commodities	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
1 **Germplasm Improvement**					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	0.78	0.63	0.69	0.72	0.79
TOTAL	**0.78**	**0.63**	**0.69**	**0.72**	**0.79**
2 **Sustainble Production**					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	8.31	6.83	7.95	8.36	9.01
TOTAL	**8.31**	**6.83**	**7.95**	**8.36**	**9.01**
3 **Total Research Agenda**					
Crops					
Commodity A					
Commodity B					
Commodity C					
Commodity D					
Livestock					
Trees					
Fish	15.66	16.48	14.61	15.34	16.57
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**
Region	**2003 (actual)**	**2004 (estimate)**	**2005 (proposal)**	**2006 (plan)**	**2007 (plan)**
Sub-Saharan Africa (SSA)	**4.70**	**4.94**	**4.38**	**4.60**	**4.97**
Asia	**9.08**	**9.56**	**8.48**	**8.90**	**9.61**
Latin American and the Caribbean (LAC)	**0.63**	**0.66**	**0.58**	**0.61**	**0.66**
West Asia and North Africa (WANA)	**1.25**	**1.32**	**1.17**	**1.23**	**1.33**
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**

Table 6. The WorldFish Center research agenda, 2003-2007

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

Object of Expenditure	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Personnel	5.86	6.96	7.50	7.88	8.51
Supplies & Services	8.28	8.25	6.07	6.37	6.88
Operational Travel	1.33	0.98	0.75	0.79	0.85
Depreciation	0.19	0.29	0.29	0.30	0.33
TOTAL	**15.66**	**16.48**	**14.61**	**15.34**	**16.57**
Capital Investments	**2003 (actual)**	**2004 (estimate)**	**2005 (proposal)**	**2006 (plan)**	**2007 (plan)**
Physical Facilities					
Research					
Training					
Administration					
Housing					
Auxiliary Units					
subtotal	**0.21**	**0.22**	**0.20**	**0.21**	**0.22**
Infrastructure & Leasehold					
Furnishing & Equipment					
Farming					
Laboratory & Scientific					
Office					
Housing					
Auxiliary Units					
Computers					
Vehicles					
Aircraft					
subtotal					
TOTAL	**0.21**	**0.22**	**0.20**	**0.21**	**0.22**
Capital Fund Cash Reconciliation*	**2003 (actual)**	**2004 (estimate)**	**2005 (proposal)**	**2006 (plan)**	**2007 (plan)**
Balance, January 1	1.43	1.41	1.48	1.57	1.66
plus: annual depreciation charge	0.19	0.29	0.29	0.30	0.33
plus/minus: disposal gain/(losses)**					
plus/minus: other	(0.21)	(0.22)	(0.20)	(0.21)	(0.22)
minus: asset acquisition costs					
equals: Balance, December 31	**1.41**	**1.48**	**1.57**	**1.66**	**1.77**

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

** Net of depreciation

Table 7a. The WorldFish Center research agenda - Financing summary, 2003-2004

(in US $ million)

Member	2003 (actual)		2004 (est)	
Unrestricted Contributions	(US$)	(national currency)	(US$)	(national currency)
Australia	0.24	A$0.45	0.30	A$0.45
Belgium	0.11	EURO0.09	0.10	EURO0.08
Canada	0.44	C$0.63	0.59	C$0.80
China	0.01	US$0.01	0.01	US$0.01
Denmark	0.44	DKK3.00	0.49	DKK3.00
Egypt	0.30	US$0.30	0.30	US$0.30
BMZ, Germany	0.29	EURO0.25	0.30	EURO0.25
India	0.04	US$0.04	0.04	US$0.04
Japan	0.23	YEN30.6	0.23	YEN25.0
Netherlands	0.99	EURO0.91	1.16	EURO0.95
Norway	0.51	NOK3.7	0.55	NOK3.7
Philippines	0.02	PHP1.17	0.02	PHP1.17
Sweden	0.31	SEK2.70	0.36	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
NZAID			0.10	US$0.1
UK			0.31	GBP0.17
World Bank	1.00	US$1.0	1.00	US$1.00
subtotal	**5.63**		**6.56**	

	2003 (actual)		2004 (est)	
Targeted contribution	(US$)	(national currency)	(US$)	(national currency)
APAARI				
Asian Development Bank	0.79		1.03	
AUSAID				
Australia	0.19		0.17	
California Academy of Sciences				
Canada (CCLF)	0.05		0.01	
CGIAR	0.16		0.22	
DANIDA				
DA-BFAR				
DFID	1.90		4.35	
European Union	1.00		0.76	
FAO	0.01			
Ford Foundation	0.02		0.13	
GEF	0.36		0.12	
Germany BMZ/GTZ	0.11		0.84	
IDRC	0.03		0.02	
IFAD	0.08		0.23	
IFPRI				
Japan				
McArthur Foundation	0.29			
New Zealand ODA	0.13		0.05	
Netherlands				
NORAD	0.23			
Oxfam	0.02		0.06	
Packard	0.16			
Rockefeller Brothers				
Sweden - SIDA	0.33		0.25	
TAC Special Fund				
UBC	0.01			
UNEP			0.02	
UNFIP	0.32			
UNDP/TCDC	0.01		0.05	
USAID	1.64		1.44	
Others (Uni of Kiel, DSE, OBIS, IST Taiwan, Wageningen U, FPF, Provinces of New Caledonia, Crawford, NFR, WWF Indo, AIMS, JMOE, Environ. Defense, Western Pacific Regional, Rockefeller, NMFS)	0.40		0.36	
World Bank	0.77			
subtotal	**9.01**		**10.11**	
Total Contributions	**14.64**		**16.67**	

Summary Statement of Activity	2003 (actual)		2004 (est)	
Investor Grants	**14.64**		**16.67**	
+ Center Income (other revenues)	**1.36**		**0.10**	
= Total Revenues	**16.00**		**16.77**	
Less:				
Total Expenses	**15.66**		**16.48**	
Surplus (Deficit) of total revenues over total expenses	**0.34**		**0.29**	

* Reclassified to Restricted Core starting 2003.

Table 7b. The WorldFish Center research agenda - Financing summary, 2004-2005

(in US $ million)

(Financing Plan)

Member	2004 (est)		2005 (proposal)	
Unrestricted Contributions	(US$)	(national currency)	(US$)	(national currency)
Australia	0.30	A$0.45	0.29	A$0.45
Belgium	0.10	EURO0.08	0.10	EURO0.08
Canada	0.59	C$0.80	0.60	C$0.80
China	0.01	US$0.01	0.01	US$0.01
Denmark	0.49	DKK3.00	0.00	-
Egypt	0.30	US$0.30	0.30	US$0.30
BMZ, Germany	0.30	EURO0.25	0.30	EURO0.25
India	0.04	US$0.04	0.04	US$0.04
Japan	0.23	YEN25.0	0.23	YEN25.0
Netherlands	1.16	EURO0.95	1.17	EURO0.95
Norway	0.55	NOK3.7	0.55	NOK3.7
Philippines	0.02	PHP1.17	0.02	PHP1.17
Sweden	0.36	SEK2.70	0.36	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
NZAID	0.10	US$0.1	0.10	US$0.1
UK	0.31	GBP0.17	0.79	GBP0.44
World Bank	1.00	US$1.0	1.00	US$1.00
subtotal	**5.63**		**6.56**	

	2004 (est)		2005 (proposal)	
Targeted contribution	(US$)	(national currency)	(US$)	(national currency)
APAARI				
Asian Development Bank	1.03		0.77	
AUSAID				
Australia	0.17		0.14	
Belgium				
California Academy of Sciences				
Canada (CCLF)	0.01		0.01	
CGIAR	0.22		0.42	
DANIDA				
DA-BFAR				
DFID	4.35		1.91	
European Union	0.76		0.76	
FAO			0.01	
Ford Foundation	0.13		0.05	
GEF	0.84		0.98	
Germany BMZ/GTZ	0.12		0.29	
IDRC	0.02		0.14	
IFAD	0.23		0.12	
IFPRI				
Japan				
McArthur Foundation				
New Zealand ODA	0.05		0.44	
Netherlands				
NORAD			0.05	
Oxfam	0.06			
Packard				
Rockefeller Brothers				
Sweden - SIDA	0.25		0.13	
SW-PRGA				
TAC Special Fund				
UBC				
UNEP	0.02		0.04	
UNFIP				
UNDP/TCDC	0.05		0.01	
USAID	1.44		0.97	
Others (Uni of Kiel, DSE, OBIS, IST Taiwan, Wageningen U, FPF, Provinces of New Caledonia, Crawford, NFR, WWF Indo, AIMS, JMOE, Environ. Defense, Western Pacific Regional, Rockefeller, NMFS)	0.36		0.83	
World Bank			0.05	
Challenge Program	0.00			
subtotal	**10.11**		**8.12**	
Total Contributions	**16.67**		**14.68**	

Summary Satement of Activity	2004 (est)		2005 (proposal)	
Investor Grants	**16.67**		**14.68**	
+ Center income (other revenues)	**0.10**		**0.10**	
= Total Revenues	**16.77**		**14.78**	
Less:				
Total Expenses	**16.48**		**16.61**	
Surplus (Deficit) of total revenues over total expenses	**0.29**		**0.17**	

* Reclassified to Restricted Core starting 2003.

Table 8a. The WorldFish Center allocation of member financing to projects by output for year 2003
(in US $ million)

	Project	Member	Total
001	Sustainable Use of Biodiversity and Genetics Resources	ADB	0.00
		DFID	0.08
		CGIAR	0.00
		EU	0.65
		GTZ	0.01
		UNDP	0.01
		UBC	0.01
		World Bank	0.22
		Others	0.07
		Unrestricted+center inc.	0.78
		Total Project	1.83
002	Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management	DFID	0.30
		BMZ-GTZ	0.10
		CCLF	0.05
		CGIAR	0.16
		EU	0.10
		USAID	1.63
		World Bank	0.02
		Unrestricted+center inc.	2.08
		Total Project	4.44
003	Making the Most of the Coast	USAID	0.01
		ACIAR	0.17
		EU	0.23
		CGIAR	0.00
		MacArthur Foundation	0.15
		NZMFAT	0.13
		UNFIP	0.30
		GEF	0.35
		World Bank	0.47
		Others	0.29
		Unrestricted+center inc.	1.23
		Total Project	3.33
004	Assessing Technological, Institutional and Policy Options That Benefit Poor People	ADB	0.79
		FAO	0.01
		DFID	1.50
		FORD FOUNDATION	0.02
		ACIAR	0.01
		SIDA	0.33
		OXFAM	0.02
		CGIAR	0.00
		IFAD	0.08
		UNFIP	0.03
		World Bank	0.06
		Others	0.04
		Unrestricted+center inc.	1.24
		Total Project	4.13
005	Improved Partnerships and Capacity Building Among Developing Country Institutions and Agencies	NORAD	0.23
		IDRC	0.03
		EU	0.02
		CGIAR	0.00
		MacArthur Foundation	0.14
		Packard	0.16
		DFID	0.02
		IFAR	0.01
		Unrestricted+center inc.	0.62
		Total Project	1.23
006	Access to Information for Sustainable Development of Fisheries and Aquatic Resources	CGIAR	0.00
		Unrestricted+center inc.	0.70
		Total Project	0.70

Center Totals	Total
Total Targeted Funding	9.01
Total Unrestricted Funding	5.29
Total Center Income	1.36
Total Allocations	15.66

Table 8b. The WorldFish Center allocation of member financing to projects by output for year 2004

(in US $ million)

Project		Member	Total
001	Sustainable Use of Biodiversity and Genetics Resources	EU	0.55
		ADB	0.25
		DFID	0.10
		INREF	0.11
		UNDP-TCDC	0.05
		Others	0.06
		Unrestricted+center inc.	0.55
		Total Project	1.67
002	Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management	DFID	0.45
		CCLF	0.01
		USAID	1.42
		BMZ-GTZ	0.84
		CGIAR	0.19
		Unrestricted+center inc.	1.38
		Total Project	4.29
003	Making the Most of the Coast	UNEP	0.02
		ACIAR	0.17
		EU	0.17
		GEF	0.12
		NZMFAT	0.05
		Others	0.17
		Unrestricted+center inc.	1.23
		Total Project	1.93
004	Assessing Technological, Institutional and Policy Options That Benefit Poor People	DFID	3.80
		IFAD	0.23
		SIDA	0.25
		Ford Foundation	0.13
		CGIAR	0.03
		ADB	0.78
		USAID	0.02
		OXFAM	0.06
		Others	0.02
		Unrestricted+center inc.	2.14
		Total Project	7.46
005	Improved Partnerships and Capacity Building Among Developing Country Institutions and Agencies	IDRC	0.02
		EU	0.04
		Unrestricted+center inc.	0.49
		Total Project	0.55
006	Access to Information for Sustainable Development of Fisheries and Aquatic Resources	Unrestricted+center inc.	0.58
		Total Project	0.58

Center Totals	Total
Total Targeted Funding	10.11
Total Unrestricted Funding	6.27
Total Center Income	0.10
Total Allocations	16.48

Table 8c. The WorldFish Center allocation of member financing to projects by output for year 2005
(in US $ million)

	Project	Member	Total
001	Sustainable Use of Biodiversity and Genetics Resources	EU	0.55
		ADB	0.36
		DFID	0.04
		INREF	0.06
		CGIAR	0.03
		World Bank	0.05
		UNDP-TCDC	0.01
		GEF	0.14
		UNEP	0.04
		BMZ-GTZ	0.11
		USAID	0.14
		Others	0.17
		Unrestricted+center inc.	0.14
		Total Project	1.84
002	Improved Livelihoods Through Appropriate Inland Aquaculture Technologies and Fisheries Management	DFID	0.20
		CCLF	0.01
		USAID	0.75
		BMZ-GTZ	0.80
		CGIAR	0.39
		Unrestricted+center inc.	2.85
		Total Project	5.00
003	Making the Most of the Coast	ACIAR	0.14
		EU	0.17
		NZAid	0.44
		ADB	0.26
		GEF	0.10
		GTZ	0.07
		FAO	0.01
		DfID	0.03
		Others	0.40
		Unrestricted+center inc.	0.67
		Total Project	2.29
004	Assessing Technological, Institutional and Policy Options That Benefit Poor People	DFID	1.64
		IFAD	0.12
		Ford Foundation	0.05
		ADB	0.15
		NORAD	0.03
		SIDA	0.13
		IDRC	0.14
		Others	0.20
		Unrestricted+center inc.	1.76
		Total Project	4.22
005	Improved Partnerships and Capacity Building Among Developing Country Institutions and Agencies	EU	0.04
		GEF	0.05
		NORAD	0.02
		USAID	0.08
		Unrestricted+center inc.	0.32
		Total Project	0.51
006	Access to Information for Sustainable Development of Fisheries and Aquatic Resources	Unrestricted+center inc.	0.75
		Total Project	0.75

Center Totals	**Total**
Total Targeted Funding	8.12
Total Unrestricted Funding	6.39
Total Center Income	0.10
Total Allocations	14.61

Table 9. The WorldFish Center research agenda staff composition, 2003-2007

	2003 (actual)		2004 (estimate)		2005 (proposal)		2006 (plan)		2007 (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		31		31		32		32	
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**		**37**		**37**		**38**		**38**	
Regionally-Recruited Staff (RRS)										
Research and Research Support	8		6		6		6		6	
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	**11**		**9**		**9**		**9**		**9**	
Support Staff	**256**		**266**		**266**		**269**		**269**	
TOTAL STAFF	**301**		**312**		**312**		**316**		**316**	

Table 10. The WorldFish Center - Financial position: statement of cash flows, 2003 and 2004
(US $'000)

2003	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Opening Cash Balance	8,932	10,821	10,823	11,526	10,955	10,486	11,136	11,089	11,254	11,429	10,618	10,367
Receipts												
Grants:												
Unrestricted	1,519	-	1,110	-	151	1,084	106	968	947	6	870	229
Restricted	955	869	985	444	651	672	742	388	423	526	68	1,029
Earned Income	39	40	37	42	45	40	45	41	46	48	37	35
Disburstments												
Operations *	642	907	1,429	1,057	1,316	1,146	940	1,232	1,241	1,391	1,226	3,150
Capital Acquisition												
Other												
Ending Cash Balance	10,821	10,823	11,526	10,955	10,486	11,136	11,089	11,254	11,429	10,618	10,367	8,510

* Includes HQ Renovation and minor capital

2004	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Opening Cash Balance	8,510	8,258	8,784	8,135	7,629	7,481	7,275	6,721	7,957	7,951	9,290	9,773
Receipts												
Grants:												
Unrestricted	295	700	-	200	100	934	-	1,012	-	1,485	875	2,076
Restricted	347	1,045	634	351	870	255	384	1,419	1,201	1,232	1,120	507
Earned Income	8	10	7	10	10	10	7	5	8	7	8	10
Disburstments												
Operations	902	1,229	1,290	1,067	1,128	1,405	945	1,200	1,215	1,385	1,520	3,200
Capital Acquisition												
Other												
Ending Cash Balance	8,258	8,784	8,135	7,629	7,481	7,275	6,721	7,957	7,951	9,290	9,773	9,166

Currency Structure of Expenditures

	2003 (actual)			2004 (proposal)			2005 (proposal)		
Currency	Amount	$ value	% share	Amount	$ value	% share	Amount	$ value	% share
US Dollar		8.39	57%		8.57	52%		7.45	51%
Malaysian Ringgit		2.35	15%		2.47	15%		2.48	17%
Others		4.38	28%		5.44	33%		4.68	32%
Total		15.66	100%		16.48	100%		14.61	100%

Table 11. The WorldFish Center statement of financial position, 2003-2007
(US $ '000)

Asset	2003 (actual)	2004 (estimate)	2005 (proposal)	2006 (plan)	2007 (plan)
Current Assets					
Cash & Cash Equivalents	8,510	9,166	9,200	9,500	9,800
Accounts Receivable					
Donors	4,328	4,212	3,800	3,550	3,600
Employees	118	117	115	110	120
Others	1,374	1,350	1,400	1450	1,450
Inventories	0	3	5	7	9
Prepaid Expenses		0	0	0	0
Other Current Assets	3,591	2,713	2,200	2,105	2,005
Total Current Assets	**17,831**	**17,561**	**16,720**	**16,722**	**16,984**
Total Fixed Assets - Net	**394**	**420**	**700**	**720**	**750**
Other Assets	**79**	**85**	**95**	**120**	**230**
Total Assets	**18,304**	**18,066**	**17,515**	**17,562**	**17,964**
Liabilities and Net Assets					
Current Liabilities					
Bank Indebtedness					
Accounts Payable					
Donors	4,128	4,022	3,100	2,900	2,500
Employees	79	85	85	90	100
Others	1,413	1,200	700	750	850
Advances from Donors	0	0	0	0	0
In-Trust Accounts	369	465	700	850	875
Accruals and Provisions	2,388	2,292	2,500	2,800	3,100
Total Current Liabilities	**8,377**	**8,064**	**7,085**	**7,390**	**7,425**
Long-Term Liabilities	359	400	400	500	600
Total Liabilities	**8,736**	**8,464**	**7,485**	**7,890**	**8,025**
Unrestriced Net Assets					
Appropriated	2,670	2,600	2,770	2,700	2,800
Unappropriate	6,898	7,002	7,260	6,972	7,139
Total Net Assets	**9,568**	**9,602**	**10,030**	**9,672**	**9,939**
Total Liabilities & Net Assets	**18,304**	**18,066**	**17,515**	**17,562**	**17,964**

Appendix 1. Acronyms

ACIAR	Australian Centre for International Agricultural Research
ACP	Africa, Caribbean and Pacific
ADB	Asian Development Bank
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
CBD	Convention on Biological Diversity
CBFM	community based fisheries management
CEMARE	Centre for the Economics and Management of Aquatic Resources
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
DOF	Department of Fisheries
DiGIR	Distributed Generic Information Retrieval
DNA	deoxyribonucleic acid
DSAP	Development of Sustainable Aquaculture Project
EU	European Union
FAO	Food and Agriculture Organization
GAPE	Global Association for People and the Environment, Laos
GBIF	Global Biodiversity Information Facility
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
ICT-KM	Information and Communications Technology and Knowledge Management
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
MRC	Mekong River Commission
MSSP	Multi-Sector Support Program
MTP	Medium Term Plan
NACA	Network of Aquaculture Centres in Asia-Pacific
NARES	National Aquatic Research and Extension Systems
NARS	National Aquatic Research Systems
NEPAD	The New Partnership for Africa's Development
NGOs	Non-Governmental Organizations
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
OBIS	Ocean Biogeographic Information System
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
SPREP	South Pacific Regional Environmental Programme
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

The WorldFish Center and the Millennium Development Goals

The Millennium Development Goals, adopted by the United Nations General Assembly and embraced by the international development community, represents a set of ambitious, measurable targets for development progress by 2015. How does our work contribute to the Millennium Development Goals?

- Eradicate extreme poverty and hunger.

  Fishing communities are among the poorest sectors of the population in the developing world. We work to increase access by the poor to fish for food and livelihoods, promote technology that increases the income of poor households, and help the poor reap benefits from fish trade.

- Promote gender equality and empower women.

  Seventy percent of the world's food-insecure people are women. We promote women's equal access to and full participation in decision making regarding aquatic resources management, and develop integrated aquaculture-agriculture technologies that increase women's income.

- Reduce child mortality.

  Fish provides essential micronutrients in the diet of rural households. In Malawi, our research has shown that malnutrition among children under five years old in fish farming households is 17% less than in households that do not farm fish.

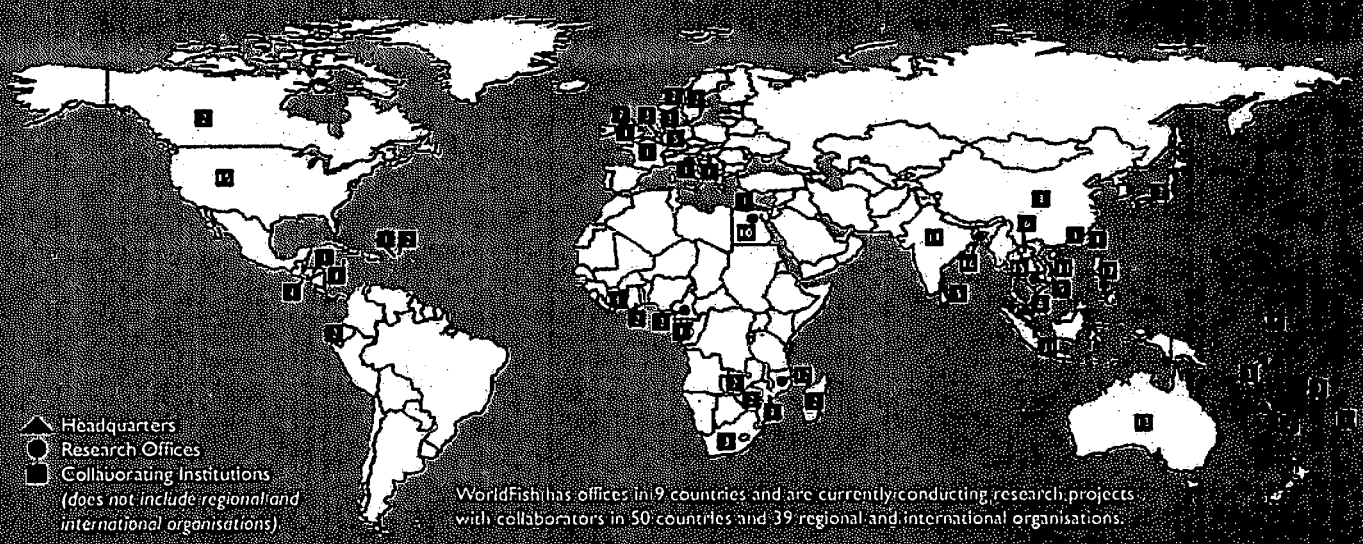
- Ensure environmental sustainability.

  The productivity and health of aquatic resource systems is directly affected not only by fishing activities but also by infrastructure development, pollution, and competition for resources from other sectors of the economy. We work to restore degraded aquatic ecosystems, protect aquatic biodiversity, and raise policy makers awareness of the value of fish in development decisions.

- Develop a global partnership for development.

  Ensuring equitable access to fish for food and livelihoods and sustainable management of aquatic resources is beyond the capacity of single nations or agencies. Through the global *Fish for All* initiative, we are working with world leaders to catalyze action and increase investment in fish-based solutions to reduce poverty, improve health, and sustain livelihoods.

Our work contributes to the other Millennium Development Goals as well: Better nutrition through fish consumption helps cope with the disease burden faced by women to *improve maternal health*. Because poor fishing communities are especially vulnerable to HIV/AIDS, improving the socioeconomic status of these communities can contribute to the goal of *combating HIV/AIDS and other diseases*. Finally, increasing income among fishing households (and especially among women) is demonstrated to increase investment in children's education, contributing to the goal of achieving *universal primary education*.



WorldFish has offices in 9 countries and are currently conducting research projects with collaborators in 50 countries and 39 regional and international organisations.

MALAYSIA (Headquarters)
OFFICE Jalan Batu Maung, Batu Maung,
11960 Bayan Lepas, Penang, Malaysia
MAIL PO Box 500, GPO 10670 Penang
PHONE (+60-4) 626 1606 FAX (+60-4) 626 5530
EMAIL worldfishcenter@cgiar.org

WorldFish Center - PHILIPPINES
OFFICE Khush Hall, IRRI College, Los Baños, Laguna 4031, Philippines
MAIL MCPO Box 2631, 0718 Makati City, Philippines
PHONE (+63-2) 845 0563, 536 2701 FAX (+63-2) 891 1292, 536 0202
EMAIL worldfish-philippines@cgiar.org

WorldFish Center - BANGLADESH
MAIL House 22B, Road 7, Block-F, Banani, Dhaka 1213, Bangladesh
PHONE (+880-2) 881 3250, 881 4624 FAX (+880-2) 881 1151
EMAIL worldfish-bangladesh@cgiar.org

WorldFish Center - MALAWI
OFFICE National Aquaculture Center, Zomba, Malawi
MAIL PO Box 229, Zomba, Malawi
PHONE (+265) 01536 298, 01536 313 FAX (+265) 01536 274
EMAIL worldfish-malawi@cgiar.org

WorldFish Center - PACIFIC
MAIL c/o The Secretariat of the Pacific Community,
B.P. D5, 98848 Noumea Cedex, New Caledonia
PHONE (+687) 262 000 FAX (+687) 263 818
EMAIL worldfish-newcaledonia@cgiar.org

WorldFish Center - EGYPT
ABASSA RESEARCH CENTER
WorldFish Center, Abassa, Abou Hammad, Sharkia, Egypt
PHONE (+20-55) 340 8165 FAX (+20-55) 340 5578
CAIRO OFFICE 3, Abou El Feda Street, Zamalek, Cairo 11211 Egypt
MAIL PO Box 1261 Maadi, Cairo, Egypt
PHONE (+202) 736 4114 FAX (+202) 736 4112
EMAIL worldfish-egypt@cgiar.org

WorldFish Center - SOLOMON ISLANDS
GIZO OFFICE PO Box 77, Gizo, Solomon Islands
PHONE (+677) 600 22 FAX (+677) 605 34
HONIARA OFFICE PO Box 438, Honiara, Solomon Islands
PHONE (+677) 250 90 FAX (+677) 232 96
EMAIL worldfish-solomon@cgiar.org

WorldFish Center - CAMEROON
OFFICE IITA-Humid Forest Station, BP 2008 (Messa), Yaounde, Cameroon
MAIL IITA-Cameroon c/o L.W.Lambourn & Co. Ltd. Carolyn House,
26 Dingwall Road, Croydon CR9 3EE, England, United Kingdom
PHONE (+237) 2237 434, 2237 522 FAX (+237) 2237 437
EMAIL worldfish-cameroon@cgiar.org

WorldFish Center - CAMBODIA
MAIL c/o Department of Fisheries, 186, Norodom Blvd.,
Phnom Penh, Cambodia
PHONE/FAX (+855-23) 993 598
EMAIL worldfish-cambodia@cgiar.org

To order and for more information on WorldFish Center publications, please contact:

The Communications Unit
P.O. Box 500, GPO, 10670 Penang, Malaysia
Tel: (+60-4) 626 1606
Fax: (+60-4) 626 5530
Email: worldfishcenter@cgiar.org