

The WorldFish Center



Addressing Global Development Needs: Strategic Research by WorldFish and the CGIAR

The work of the Consultative Group on International Agricultural Research (CGIAR) provides a scientific basis for sustainable development. As one of 15 CGIAR research institutes, the WorldFish Center provides expertise on fisheries and aquaculture that helps the CGIAR achieve its mission of reducing hunger and poverty while protecting natural ecosystems on which continued progress depends. This document describes ways in which WorldFish supports the CGIAR's research priorities, which were recently modified to bring them more in line with international efforts aimed at achieving the Millennium Development Goals.

Aligning research priorities is one way the CGIAR centers leverage their resources and heighten their impact. Another way

is through collective action with partners that include countries, international and regional agencies, civil society organizations and the private sector. CGIAR efforts in more than a hundred countries have led to increased agricultural production, higher income, more secure livelihoods and better quality of life for many of the world's poor without compromising critical natural resources.

Impact assessments by WorldFish show how effective this work can be. In a recent analysis to determine estimated return on investment, the results indicated that, on average, every US\$100 invested in WorldFish Center research generates US\$134 per year in benefits for poor people to whom the Center's work is targeted.

CGIAR priority 1— Sustaining biodiversity for current and future generations: Conservation of aquatic genetic resources

Ensuring genetic diversity in populations of fish and other aquatic organisms is necessary for species' long-term survival. WorldFish research has given scientists, resource managers and even poor farmers a variety of tools and technologies designed to help safeguard genetic diversity through sound management of aquatic resources for sustainable use and habitat preservation.

FishBase, a global database developed by WorldFish and more than 900 partners, has become the most widely consulted online source of information about the world's fish (Fishbase has over 20 million user sessions per month), with biological, taxonomical, ecological and even historical information on

more than 28,600 known species. An important "international public good," FishBase has analytic and graphic tools that allow users to convert raw data into detailed assessments of the world's fisheries. Co-developers range from the European Commission and FAO to museums in Sweden, Canada, France, Germany and Central Africa.

Similarly, ReefBase is a powerful tool for monitoring and managing coral reefs. Damage to reefs is not only threatening one of the planet's richest sources of biodiversity, but also has grave implications for the welfare of poor coastal dwellers in many developing countries who depend heavily on reefs for food and income. ReefBase's online GIS-based mapping function enhances the huge database of resources from NASA, NOAA and other major partners, and support from the U.N. Environment Program is a testimony to the site's importance. ReefBase proved indispensable, for example, in assessing the effects of the December 2004 tsunami on coral reefs and neighboring fishing communities. Reefbase has benefited from support from both the Netherlands and Swedish governments.

Eight nations of Asia have been WorldFish partners in a project aimed at improving the management of fish populations and other aquatic resources in the region. The need is vital because demand for fish in Asia is high, and growing, while the productivity of capture fisheries is declining steadily. Funded by the

Asian Development Bank, the project led to the development of the Fisheries Resource Information System and Tool, or FiRST, which enables researchers and resource managers to analyze fish abundance and diversity in South and Southeast Asian waters -- based on data from 80 years of trawl catches in the region -- as the basis for sustainable use policies.

A suite of modeling tools called BayFish is helping researchers, conservationists and government officials in the Greater Mekong region determine the hydrological and environmental requirements needed to sustain inland fish production and protect local wetlands in the face of rapid development. Such tools are helpful in planning decisions, such as measuring the trade-offs between the preservation of mangrove forests and the expansion of shrimp aquaculture in Vietnam. A variation of BayFish was developed to guide decisions about water and land use options in and around Cambodia's Tonle Sap Lake, the most intensively fished lake in the world.

Another WorldFish product designed to promote sustainable use and the conservation of genetic aquatic resources are transferable technologies for community-based management of fisheries. Such efforts in Bangladesh, supported currently by the U.K. Department for International Development (DfID) and with initial funding from the Ford Foundation, have demonstrated what highly successful stewards rural people can be when given the know-how to control surrounding waterways with fish production and conservation in mind. In one project, which the CGIAR has called an "eminently replicable model for contemporary rural development," 30,000 households in Bangladesh voluntarily agreed to implement measures such as fish sanctuaries, seasonal fishing restrictions and restocking programs to safeguard ongoing fish supply and restore degraded habitats. Results after five years showed that fish production rose by as much as six-fold, and in some cases the diversity of fish in local waters increased by up to 30 percent.

More than 50 partners, including development agencies, government research institutes, environmental groups, NGOs and other organizations, have been pivotal to the success of WorldFish's work in Bangladesh. Participatory management models emerging from this and similar projects are being examined for their applicability to fish-dependent communities in other countries. The International Fund for Agricultural Development, for example, is helping to fund the transfer of knowledge from the work in Bangladesh to fisheries communities in Vietnam. Can Tho University and the provincial Department of Agriculture and Rural Development are implementing the approaches

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in An Giang province, to support the regional government's promotion of fish sanctuaries.

The development of risk assessment procedures aimed at protecting aquatic biodiversity is part of all research by WorldFish and its partners to improve fish-farming methods and maximize productivity.

In promoting the development of improved fish and invertebrate strains for aquaculture, diversification of farmed aquatic species and developing aquaculture techniques to maximize fish production per unit aquatic productivity, which we know greatly increase fish production and profitability, risk assessment procedures are being developed with partners to ensure that aquatic biodiversity is protected. The maintenance and enhancement of yields from aquaculture staples such as carp and tilapias are recognized as priorities by the WorldFish Center and International Network on Genetics in Aquaculture (INGA) as a number of recent studies have shown

that poor broodstock and hatchery management is a widespread problem that results in poor quality and performing seed. The WorldFish Center has been tackling this problem through its training courses, promotion of workshops and symposia with INGA colleagues and dissemination of targeted information.

The International Network on Genetics in Aquaculture (INGA), coordinated with assistance from the WorldFish Center, has been highly instrumental in disseminating the GIFT technology, aiding the development of national fish-breeding programs, and working to ensure biosafety procedures and safeguard genetic biodiversity. In 2005, the WorldFish Center was named a finalist for a Global Technology Award in recognition of its development of the GIFT technology, which was lauded for its huge potential to help combat world poverty, hunger, and malnutrition.

**CGIAR priority 2 —
Producing more and better
food at lower cost through
genetic improvement**

The widespread adoption of localized aquaculture in developing countries has been possible thanks to genetically improved strains of fish that thrive in pond conditions. In a decade-long research project, WorldFish and a large network of scientific partners, used selective-breeding techniques to develop a superior strain of Nile tilapia (*Oreochromis niloticus*) that grows 60 to 85 percent faster, is more disease resistance, has a 50 percent higher survival rate to adulthood and can reach market weight with 20 to 30 percent lower production costs. For small-scale fish farmers, this means greater yields and higher profits.

Genetically improved farmed tilapia, or "GIFT" fish, are now being farmed in 13 countries in Asia alone. A recent Asian Development Bank survey found that in 2003, GIFT and GIFT-derived strains accounted for 68 percent of total tilapia seed production in the Philippines and nearly half in Thailand. Relatively cheap and easy to produce, GIFT fish enable poor rural families to better feed and support themselves.

The International Network on Genetics in Aquaculture (INGA), coordinated with WorldFish assistance and with support from the Norwegian Government, UN Development Program and Canada's International Development Research Center, has been indispensable in disseminating the GIFT technology to developing countries and aiding them in the development of their own national fish-breeding programs. At least 15 countries in Asia, Africa and Latin America are now using the methods to produce improved strains of native species including tilapia, carp, catfish and silver barb for use in aquaculture.

Joint initiatives of WorldFish and INGA include the development of policies and training aimed at ensuring biosafety in fish genetic research and safeguarding the genetic diversity of native aquatic species. In line with their core commitment to maintaining and enhancing the productivity of fish species popular in aquaculture, WorldFish and INGA also provide information and training on sound breeding and hatchery methods that avert the decline of stock over generations under small-scale fish-farming conditions.

In 2005, the GIFT technology was named by the Tech Museum of Innovation, in San Jose, California, as one of the world's outstanding technological achievements benefiting humanity. Partners in the Tech Awards program, which include U.N. agencies, universities, the World Bank Institute and private companies, lauded the GIFT technology for its huge potential to help combat world poverty, hunger and malnutrition.

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CGIAR priority 3 — Reducing rural poverty through agricultural diversification and emerging opportunities for high-value commodities and products: Enhancing income through increased productivity of fisheries and aquaculture

Innovative technologies of low-input aquaculture developed by WorldFish and its partners have been shown to reduce hunger and poverty, improve nutrition and food security, increase agricultural productivity and promote economic development. Besides offering direct benefits to poor rural families, this kind of fish production helps ease pressures on threatened natural fisheries.

Adapted for a variety of conditions, the WorldFish technologies can be integrated into traditional small-holder farms, combined with rice farming or even carried out in backyard ponds, making them widely accessible to the poor.

Research is underway to develop variations that address the labor constraints, livelihood challenges and nutritional needs of AIDS-affected families, particularly in sub-Saharan Africa.

Over the last two decades, the rural poor in Bangladesh have converted more than a million formerly unproductive bodies of water into fish-production ponds using the WorldFish methods.

Aquaculture development has benefited from strong partnership with USAID and the Asian Development Bank. The techniques have been especially popular among women in Bangladesh, who now make up 60 percent of all the country's fish farmers. Many rice farmers in Bangladesh and other parts of South and Southeast Asia in partnership with the International Fund for Agriculture Development, have discovered they can increase farm profits dramatically by raising fish in fallow periods. Aquaculture projects have benefited from funding from Germany's BMZ which enabled development of indicators for sustainable development of integration of aquaculture with agriculture.

Small-scale fisheries contribute significantly to the food security, nutritional requirements and economic status of poor people in developing countries, yet managing such fisheries to maximize their benefits through ecologically sound practices is problematic because of their considerable diversity. In partnership with the FAO and other agencies, WorldFish is developing a frame-

A recent impact assessment of a 15-year WorldFish project in Malawi quantified the multiple benefits that come from integrating aquaculture into traditional subsistence farming. Researchers found that

the addition of fish cultivation made small farms 10 percent more productive and 50 percent more technically efficient, and reduced nitrogen loss in soil. (Nutrient recycling and crop diversification accounted for the higher productivity.) Direct benefits to families included a 28 percent boost in household income and a 160 percent rise in per capita consumption of fresh fish, which translated into 15 percent lower malnutrition in children. The findings also revealed that farms where the integrated agriculture-aquaculture methods were in use were more resilient during drought, achieving 18 percent higher productivity under such conditions than conventional farms.

These small-scale technologies, developed in partnership with the Malawi Government, the University of Malawi and several community-based organizations, are changing the nature of farming in Malawi. In the 1980s, when the research project began, the country had only about 400 fish farmers; today, there are more than 4,000, and fish production through aquaculture increased 22 percent a year from 1996 to 2001.

An analysis based on yield data from the Malawi study projected that sub-Saharan Africa could produce an extra 3.75 million tons of fish a year if the integrated agriculture-aquaculture technologies were practiced on as little as one percent of the 250 million acres the FAO has identified as suitable for the approach. That potential gain, which is four times the total catch of all inland capture fisheries in Africa, would go a long way toward helping to meet a soaring demand for fish that is already vastly outpacing supply across the region.

CGIAR priority 4 — Promoting poverty alleviation and sustainable management of water, land and forest resources: Sustaining and managing aquatic ecosystems for food and livelihoods

work that will aid efforts to exploit small-scale fisheries as engines for development and social change by offering guidance on what approaches

work best and how to overcome constraints that hinder performance.

To help address the livelihood needs of fish-dependent communities, WorldFish also has

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developed and tested sustainable methods for producing high-value aquatic species and other marine products for world markets. Several pilot projects indicate that artisanal mariculture ventures like these could offer viable livelihood options especially in island communities of the Indo-Pacific region and other places where isolation, collapsed fishing industries and political instability have left impoverished villagers with few sources of jobs and income. Australia, New Zealand and the Solomon Islands are among the major partners in this work.

In the Solomon Islands, a global "biodiversity hotspot," villagers are learning alternative ways of producing prized reef organisms for the international aquarium trade, a \$300-million-a-year industry. Traditionally, aquarium-bound reef fish and invertebrates are captured at a mature stage, often through harmful use of dynamite and poisons. An alternative harvesting approach developed by WorldFish entails capturing cleaner shrimp, spiny lobsters and other specimens early in their life cycles, when a normally high rate of mortality would otherwise occur, and then rearing them to a size suitable for the aquarium trade. Research results from this project suggest that a single family could operate a profitable small business by cultivating 150 marine specimens a month. With support from the World Bank, research is underway in several rainforest communities of Cameroon to find out whether similar methods could be used to produce exotic river fish species for aquariums in accordance with international standards of fair trade and environmental sustainability.

Another project is laying the seeds for the production of black pearls in the Solomons, Fiji and Tonga – an activity previously restricted mainly to regions of Polynesia and Australia. After WorldFish scientists introduced methods for collecting and culturing black-lipped pearl oysters in the Solomons, a demonstration farm produced high-quality black pearls that have been used in jewelry sold at international auctions. An analysis showed that a single pearl farm could eventually bring a hundred families as much as US\$2,000 a year.

WorldFish's efforts to help developing countries sustain and manage aquatic systems for food and livelihoods include working to restore severely

depleted populations of sea cucumbers. An ecologically important species in coastal waters, sea cucumbers are so commercially valuable – fetching nearly \$200 per kilogram in Asian markets – that stocks have been all but wiped out in some Asia-Pacific regions. Vietnam, the Philippines, Indonesia, Papua New Guinea, the Solomon Islands, New Caledonia and Kiribati are among the nations that stand to benefit from this work.

Since the 2004 Asian tsunami, with support from Germany's BMZ, Australian Center for International Agriculture Research and the Ford Foundation, WorldFish and five partners organized as CONSRN (Consortium to Restore Shattered Livelihoods in Tsunami-Devastated Nations) have been advising affected countries in the region on ways of steering rehabilitation toward a more ecologically sustainable path. The aim is to help poor coastal communities look beyond the restoration of fisheries and establish more diverse and resilient sources of food and livelihoods.

Along with its partners in a CGIAR Challenge Program, the WorldFish Center is investigating and promoting the use of saline water in crop and livestock production, especially for fish production. Saline water is far more available around the world than freshwater, particularly in regions with low rainfall and high temperatures, and exploiting this resource will be increasingly necessary to meet the food and livelihood needs of a growing global population. In one recent initiative, WorldFish provided training courses aimed at helping Palestinians grow fish in standing bodies of saline water. Guidance in methods for overcoming low productivity in reservoir-based fish production is another strand of WorldFish expertise and assistance.

WorldFish's efforts to help developing countries sustain and manage aquatic systems for food and livelihoods.



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CGIAR priority 5 — Improving policies and facilitating institutional innovation to support sustainable reduction of poverty and hunger

WorldFish engages in a variety of activities to help developing countries strategically analyze their fisheries and aquaculture prospects in relation to national development priorities. Technical assistance has included, for example, evaluating the costs of implementing Hazard Analysis Critical Control Point (HACCP)

systems and determining whether compliance with these food safety standards is likely to promote or hurt aspiring exporters' access to world markets. A project titled "Fish Fights over Fish Rights" is leading to policy guidelines and strategies for minimizing conflicts related to increased competition for access to steadily declining stocks

of fish. This research was initiated after a study of population, consumption and environmental trends in coastal areas revealed a rise in such conflicts.

Building scientific capacity in developing countries is a central part of WorldFish's mission. A recently completed high-impact project in this area was 18 months of technical assistance provided to Cambodia's Inland Fisheries Research and Development Institute (IFReDI). Done in partnership with the Government of Cambodia, the Asian Development Bank and the Danish International Development Agency, the project helped build the new institute from the ground up by providing knowledge and skills in institutional management, scientific research, technology transfer and policy development. The need for this expertise is acute in Cambodia, where inland fisheries play an important role in feeding the country's population and newly enacted laws called for greater community involvement in fisheries management.

In partnership with the Swedish International Development Agency and scientists from the WorldFish Center working collaboratively with researchers and officials from over 30 organizations in the four countries, succeeded in significantly raising awareness of the value of aquatic resources to food security, livelihoods, and national economic development in the region. The Center has also built capacity among national agencies to assess the trade-offs from alternative development policies, and promote

institutional changes that enable intersectoral cooperation to address the challenges facing communities that depend on aquatic resources.

Sub-Saharan Africa has become a priority region for WorldFish Center activities as countries in the region seek ways of better exploiting fisheries and aquaculture for food security and economic development. Strengthening artisanal fisheries that benefit particularly women and other part-time subsistence fishers is a major focus of the Center's work in the region, where fishing activities are largely dispersed among many small-scale producers. Other areas of research include fisheries valuation, governance, co-management and community health issues (most notably in relation to HIV/AIDS).

The fishery sector contributes vitally to the food and nutritional needs of 200 million Africans, and 30 to 45 million derive their livelihoods from fishing and related activities. But although fish has become a leading export commodity for Africa, with an annual export value of US\$2.7 billion, productivity has started to lag. Aquaculture also lags seriously, providing less than 2 percent of fish production in sub-Saharan Africa, compared with an average of 38 percent worldwide.

In 2005 WorldFish teamed up with the New Partnership for Africa's Development and FAO to mobilize ongoing support for greater regional investment in fisheries and aquaculture. The summit and related campaign, titled "Fish for All in Africa," was modeled on the WorldFish Center's highly successful "Fish for All" initiative. Introduced in 2002, "Fish for All" has been a powerful vehicle for raising awareness about the need to ensure sustainable fish production and safeguard the fish-related interests of the world's poor. "Fish for All" summits in several countries have won the support of hundreds of national and international leaders, senior policymakers, scientists, environmentalists and others from more than 40 countries. ☺

Technical assistance provided to Cambodia's Inland Fisheries Research and Development Institute (IFReDI).



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Research Priorities in Support of the Millennium Development Goals

Because fisheries and aquaculture meet a variety of essential human needs, sustainable development of this sector is a sound strategy in efforts to achieve the Millennium Development Goals. Fish production, processing and trade provide livelihoods that can help eradicate extreme poverty and hunger (MDG 1), finance primary education (MDG 2) and empower women by providing economic opportunities (MDG 3). Nutrition from fish reduces child and maternal mortality (MDG 4 & 5); it also helps people with HIV/AIDS resist secondary infections and respond to anti-retroviral drugs (MDG 6). Threats to aquatic ecosystems and to the continued productivity of global fisheries must be turned back to ensure environmental sustainability (MDG 7). Collection action to improve fisheries conditions, institutions, governance and trade policies, among other things, are part of a broader global partnership for development (MDG 8).

Direct and indirect impacts of priority research on MDGs					
Millennium Development Goals (summarized)	System Priority Areas for CGIAR Research				
	1	2	3	4	5
1. Reduce extreme poverty and hunger	+	++	++	++	++
2. Ensure universal primary education		+	+		
3. Reduce gender disparity		++	++	++	++
4. Reduce child mortality	+	+	+	+	+
5. Improve maternal health	+	+	+	+	+
6. Combat HIV/AIDS, malaria and other diseases		++			++
7. Ensure environmental sustainability	++	++	+	++	++
8. Develop a global partnership for development	++	+		++	++

++ direct impact + indirect impact

Priorities Areas of CGIAR Research				
1. Sustaining biodiversity for current and future generations	2. Producing more and better food at lower cost through genetic improvement	3. Reducing rural poverty through agricultural diversification and sustainable production of high-value commodities	4. Promoting poverty alleviation and sustainable management of water, land and forest resources	5. Improving policies and facilitating institutional innovation to support sustainable reduction of poverty and hunger
1A: Promoting conservation and characterization of staple crops	2A: Maintaining and enhancing yields and yield potential of food staples	3A: Increasing income from fruit and vegetables	4A: Promoting integrated land, water and forest management at landscape level	5A: Improving science and technology policies and institutions
1B: Promoting conservation and characterization of underutilized plant genetic resources	2B: Improving tolerance to selected abiotic stresses	3B: Increasing income from livestock	4B: Sustaining and managing aquatic ecosystems for food and livelihoods	5B: Making international and domestic markets work for the poor
1C: Promoting conservation of indigenous livestock	2C: Enhancing nutritional quality and safety	3C: Enhancing income through increased productivity of fisheries and aquaculture	4C: Improving water productivity	5C: Improving rural institutions and their governance
1D: Promoting conservation of aquatic animal genetic resources	2D: Genetically enhancing selected high-value species	3D: Promoting sustainable income generation from forests and trees	4D: Promoting sustainable agro-ecological intensification in low- and high-potential areas	5D: Improving research and development options to reduce rural poverty and vulnerability

Key – Relative research emphasis > >

Sample research projects of WorldFish

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|---|---|
| <p>1D: Habitat rehabilitation to restore fish biodiversity in Asian fisheries; development of tools and models for sustainable management of fisheries; promotion of biosafety standards and risk-assessment protocols in research for genetic improvement of fish.</p> <p>2A: Transfer of technologies that help small producers maintain and increase yields over successive generations of fish production under pond conditions.</p> <p>2B: Facilitation of aquaculture development in saline conditions.</p> <p>2D: Development of “super-tilapia” and other fish species with superior traits and higher productivity; dispersal of such strains and the technology for breeding other improved strains of native fish species to countries in Asia, Africa and Latin America.</p> <p>3C: Design of technologies that boost agricultural productivity through integrating of aquaculture into traditional farming and rice-culture systems; development and testing of new mariculture techniques for sustainable production of ornamental fish and crustaceans, coral and pearls.</p> <p>4B: Restocking and restoration of degraded coastal habitats in Asia to revive commercially valuable species such as sea cucumbers; development of tools that aid coastal and coral reef management; support for improved fisheries management and use through community-based governance approaches, institutional capacity</p> | <p>building and conflict-resolution strategies that minimize fights over access to fisheries.</p> <p>4C: Enhance productivity of seasonally occurring floodwaters for improved and sustained benefit to the poor; develop aquaculture systems to maximize water productivity.</p> <p>4D: Maximize potential of agricultural and aquacultural land and water uses on water quality, aquatic biodiversity, and inland fisheries; optimize the integration of agroecological and aquatic ecosystems for sustainable food production.</p> <p>5A: Organization of “Fish for All” Summits and policy dialogues on fish-related issues; provision of impact assessments to evaluate success of interventions for improvements to fisheries and small-scale aquaculture.</p> <p>5B: Introduction of alternative livelihood options for sustainable production of high-value aquatic species; evaluation of trade-related tradeoffs under Hazard Analysis Critical Control Point systems.</p> <p>5C: Improvement of institutions for community-based fisheries management in Asia.</p> <p>5D: Development of small-scale, low-input fish farming methods that address the needs of particularly vulnerable groups of poor people in developing countries, such as those in households affected by AIDS; provision of expertise to guide tsunami-rehabilitation efforts in Asia toward remedies that build greater long-term resilience in fishing communities.</p> |
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WorldFish is responding to CGIAR priorities through support from the following investors.

Investors for 2005

- Asian Development Bank
- Australia
 - Australian Center for International Agricultural Research
 - Australian Institute of Marine Sciences
- Canadian International Development Agency
- Consultative Group on International Agricultural Research
 - Challenge Program on Water and Food
 - System-Wide Initiative on Water Management
- Danish Royal Ministry of Foreign Affairs
- Egyptian Ministry of Agriculture and Land Reclamation
- European Commission
- FishBase Information and Research Group, Inc
- Ford Foundation
- France, the Government of (Pacific Fund)
- Global Environment Facility
- Germany
 - Deutsche Gesellschaft für Technische Zusammenarbeit GmbH
 - Federal Ministry for Economic Development Cooperation
- Indian Council of Agricultural Research
- International Fund for Agricultural Research
- International Fund for Agricultural Development
- Israel Ministry of Agriculture and Rural Development
- Japan
 - Japan International Cooperation Agency
 - Ministry of Environment
- MacArthur Foundation
- Malaysian Agricultural Research and Development Institute
- Mekong River Commission
- New Zealand Agency for International Development
- Norwegian Royal Ministry of Foreign Affairs Oxfam
- Philippine Department of Agriculture
- New Caledonia Provinces
- Species 2000
- Swedish International Development Cooperation Agency
- The Netherlands
 - Ministry of Foreign Affairs
 - Wageningen University and Research Center (North-South Interdisciplinary Research and Education Fund)
- The Organization of Petroleum Exporting Countries Fund for International Development
- United Kingdom Department for International Development
- United Nations
 - Food and Agriculture Organization
 - United Nations Environment Program
 - United Nations Development Program (South-South Cooperation)
- United States of America
 - National Oceanic and Atmospheric Administration
 - United States of America Agency for International Development
- World Bank

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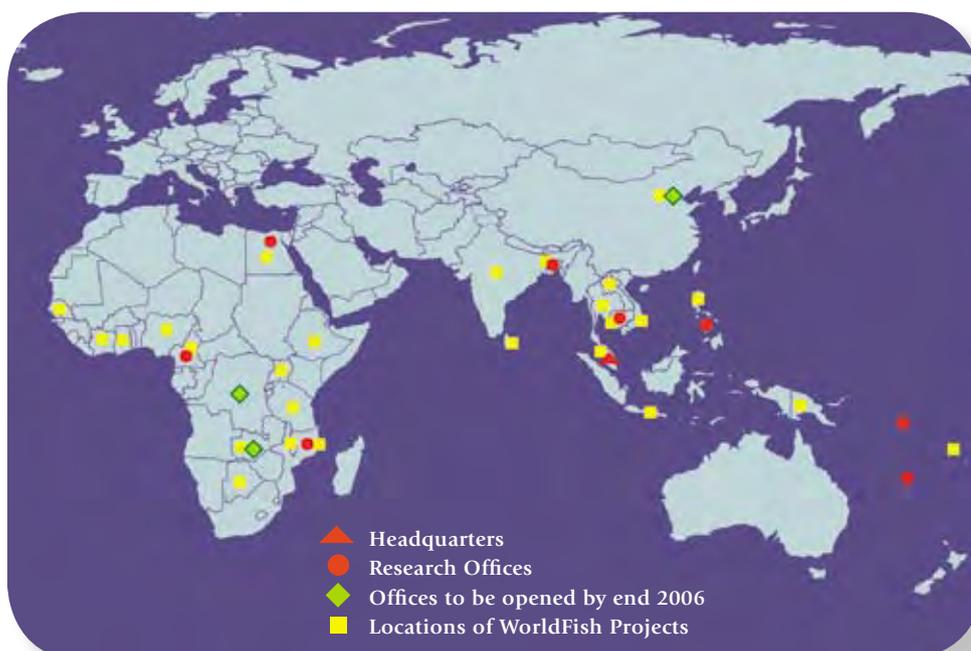
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The WorldFish Center: Location of offices and projects



WorldFish works with 405 partners from 63 countries. Partners include international, regional and national organizations; civil society and the private sector.