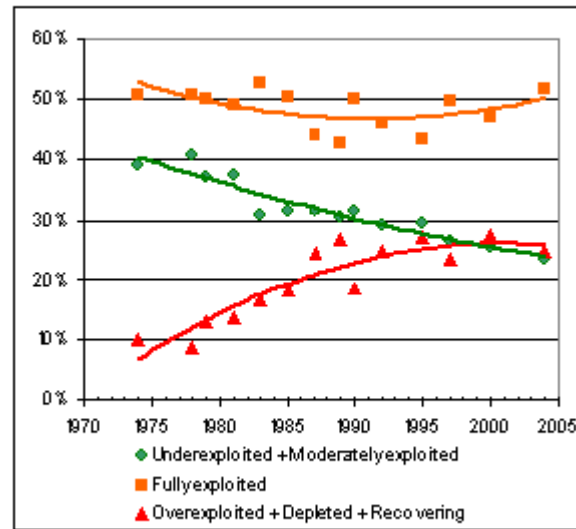


Module 6: Investment in Fisheries and Aquaculture

Rapid population growth in developing countries, increased disposable income, particularly in Asia, and changing consumer preferences have dramatically increased global demands for aquatic foods. Proliferation of more efficient capture technologies, decades of government subsidies, increased market access even for remote fishing communities, and development programs aimed at increasing production from fragile open-access resources have led to widescale depletion of fish resources. Growing concern over the sustainability of wild fish stocks is exacerbated by further concerns over the impact on aquatic ecosystems of rapidly expanding aquaculture production. Long-term investments to ensure the sustainability of capture fisheries and aquaculture are needed at many political and societal levels—in planning, ecosystems-based resource management, the postharvest sector, human resources, and applied science and extension institutions, especially in collaborative business and organizational development. This overview summarizes the principles, status, trends, and future needs for investments in fisheries and aquaculture.

Excessive exploitation (figure 6.1) has resulted in stagnating global capture fishery production, a decline in production of many high-value species, and fishing for species at increasingly lower levels on the food chain. Declining rural coastal employment opportunities and few or ineffective barriers to entry into fisheries have resulted in ever-increasing numbers of small-scale fishers. In many developing countries, the economic impact of the crisis in fisheries is compounded by spreading poverty and the destruction of habitats crucial to the health of the aquatic ecosystems.

Figure 6.1 State of exploitation of global fish stocks, 1974-2004



Source: FAO 2005

The Millennium Ecosystem Assessment identified global fisheries as one of five global systems in critical condition, and while global marine catches have remained relatively stable at around 85 million tons, less than one-quarter of global marine fish stocks are considered moderately or under-exploited. Most experts agree that marine capture fisheries production has reached or is near its limits, so that little or no growth can be expected from this area of the sector under current management regimes to meet this demand. Catches from inland or freshwater fisheries remained at around 8.7 million tons in 2000-2002 but have suffered from the impact of pollution, water abstraction, dams, and overfishing. Despite the remarkable growth in aquaculture production, it is limited by the availability of sites, seeds, feeds, disease, water, and human resources.

Several important international conventions provide a framework for the management of fisheries at national and international levels (box 6.1). These include the United Nations Convention on the Law of the Sea (UNCLOS) and the UN Fish Stocks Agreement. The Code of Conduct for Responsible Fisheries, agreed by FAO member countries, provides a comprehensive basis for effective management and development of sustainable fisheries and aquaculture.

Box 6.1 Principal international instruments relevant to fisheries

Binding instruments:

- UNCLOS (1982) provides the main international instrument. The UN Fish Stocks Agreement (2001) is an agreement made pursuant to UNCLOS and addresses highly migratory species and straddling stocks—but not high seas. Several of the principles enshrined in the agreement have a broader application in the Exclusive Economic Zones.
- The FAO Compliance Agreement (1993) provides further consensus on international fisheries obligations of States with respect to their fishing vessels.
- A range of nonfisheries agreements and conventions (for example, on biological diversity, rivers, lakes, regional seas, pollution, safety at sea, labor standards, migratory species, and whales).

Selected nonbinding instruments:

- The Code of Conduct for Responsible Fisheries (1995).
- The International Plans of Action on illicit (IUU) fishing, fleet capacity, sharks, and seabirds.
- The Technical Guidelines for the Code of Conduct.
- Numerous agreements establishing regional fisheries management organizations.
- Numerous UN General Assembly resolutions, many of which refer to sustainable fisheries, the Code, and its application.
- A range of regional agreements integrating the Code into regional fisheries policy and practice, such as NEPAD (Abuja Declaration), SADC Protocol, and the ASEAN-SEAFDEC Fish for the People Resolution.

Source: Authors

Rationale for Investment

Fish stocks, aquatic resources, and the aquatic environment are generally public goods requiring coherent public policies and their effective application. In addressing these issues, the World Bank has the comparative advantage of its convening power, its experience in economic and sector analysis and strengthening public governance, in developing cross-sector solutions, in fostering effective and transparent natural resource management, and in being able to provide substantial investment funding to support sector strategy implementation. Fisheries sector investment addresses a range of ubiquitous Bank issues: poverty, governance, knowledge, and environment.

Poverty and economic development. Primary production in the fisheries sector directly employs 38 million people worldwide (that is, fishers and fish farmers), and some estimates indicate that over 200 million people, often living in marginalized or landless communities, depend on fisheries for their livelihood. The fisheries sector is an essential

source of income for millions of women and children who catch, process, transport, or market fish. Fish is the principal animal protein consumed by about one billion people worldwide. As fishing is often the livelihood of last resort and fish often the only, or the most inexpensive, source of animal protein for the poor, the state of the world's fisheries can be critical in the fight against poverty in many parts of the developing world. Coastal fishing communities often bear a disproportionate cost of natural disasters—from typhoons and tsunamis to climate change. These communities are often marginalized from the development process, and they face unique poverty-trapping constraints by virtue of their geography, lower levels of education, and higher levels of risk inherent in their occupation, while fisher communities have been shown to have elevated levels of HIV/AIDS. These communities merit targeted rural development efforts by institutions investing in the rural sector, such as the World Bank.

The export value of world trade in fish—US\$58 billion in 2002—is more than the combined value of net exports of rice, coffee, sugar, and tea. Demand for fish products is increasing rapidly as income levels rise in Asia and population grows in Africa. Led by Asia, developing nations now produce nearly three times as much fish as the developed countries (Delgado et al. 2003).

Governance. There is broad consensus that poor sector governance is a primary cause of the crisis in world fisheries. Policies and institutional frameworks are often deficient at the regional, national, and local level. Allocation of fishing rights often takes precedence over stewardship obligations, while overfishing and economic losses generate demand for subsidies, stymie fiscal measures, constrain financing of compliance control, and undermine enforcement of regulations.

There is a jurisdictional deficit in authority to enforce international law and responsible fishing practice on the high seas, while coastal and flag state capabilities to effectively control illicit offshore activities of their citizens and corporations are similarly deficient.

Knowledge. Knowledge of the state of fish stocks and the aquatic environment is fundamental to establish a scientific basis for fisheries management and the precautionary approach and the ecosystem approach to fisheries advocated by the World Summit on Sustainable Development in 2002. Awareness of the social and economic drivers of overfishing and aquatic environmental degradation is also required to design solutions. The application of solutions similarly requires building stakeholder knowledge, awareness, and consensus on best practices and approaches.

Fish as food. Fisheries and aquaculture play a significant role in global food supplies, and demand for high-quality aquatic protein is expected to increase substantially as income levels rise in Asia and African populations expand. Global fish consumption has doubled since 1973 (increasing by 21 percent between 1992 and 2002), with China, India, and Southeast Asia accounting for almost all of the increase. China accounted for an estimated 36 percent of global fish consumption in 1997, compared with only 11 percent in 1973 (Delgado et al. 2003). However, global per capita supply of fisheries products has declined by 2.5 kilograms since the mid-1980s (from 11.8 kilograms in 1986 to 9.3

kilograms in 1999) as fish production has been unable to keep pace with population growth. In countries such as Ghana, Liberia, and Malawi, the average diet contained less fish protein in the 1990s than it did in the 1970s (FAO 2000; FAO 2004). It is widely recognized that capture fisheries will not be able to meet future global demand, and a major expansion of aquaculture production is projected to fill the gap between supply and demand. Fleets have expanded dramatically to operate in foreign waters in many corners of the globe. Developing nations now produce nearly three times as much fish as developed countries, and most of the global fish trade originates in developing countries where many of the world's poorest communities depend on fisheries for their livelihoods and protein intake.

Best practices. There are serious global concerns over the sustainability of many capture fisheries. In 1995 FAO Members adopted the Code of Conduct for Responsible Fisheries (box 6.2), which heralded a new era in fisheries management and responsible aquaculture practices. Assisting developing countries to apply the Code is a major objective of international development assistance in the sector.

Box 6.2 Objectives of the FAO Code of Conduct for Responsible Fisheries

"The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources."

The objectives of the Code are to:

- Establish principles, in accordance with the relevant rules of international law, for responsible fishing and fisheries activities, taking into account all their relevant biological, technological, economic, social, environmental, and commercial aspects.
- Establish principles and criteria for the elaboration and implementation of national policies for responsible conservation of fisheries resources and fisheries management and development.
- Serve as an instrument of reference to help States establish or improve the legal and institutional framework required for the exercise of responsible fisheries and in the formulation and implementation of appropriate measures.
- Provide guidance that may be used where appropriate in formulating and implementing international agreements and other legal instruments, both binding and voluntary.
- Facilitate and promote technical, financial, and other cooperation in the conservation of fisheries resources and fisheries management and development.
- Promote the contribution of fisheries to food security and food quality, giving priority to the nutritional needs of local communities.
- Promote protection of living aquatic resources and their environments and coastal areas.
- Promote the trade of fish and fishery products in conformity with relevant international rules, and avoid the use of measures that constitute hidden barriers to such trade.
- Promote research on fisheries as well as on associated ecosystems and relevant environmental factors.
- Provide standards of conduct for all persons involved in the fisheries sector.

Source: FAO 1995

Aquaculture is the most dynamic and rapidly growing sector of the global agricultural economy (table 6.1). Despite adverse environmental impacts associated with irresponsible fish culture in the 1970s and 1980s, much progress has occurred in making aquaculture environmentally and socially responsible. Aquaculture remains the leading hope for bridging the widening gap between supply and demand for fish products. Despite its inherent merit and exciting future potential, aquaculture is not without challenges. Rapidly expanding aquaculture systems for carnivorous fish and shrimp can provide income, but they provide for the nutritional needs of the rural poor only indirectly. If done without adequate consideration for the wider social and environmental impacts, commercial aquaculture development may adversely impact aquatic ecosystems and social relationships in coastal communities.

Table 6.1 Key fisheries facts and figures

Total value of world trade in fisheries ^a	US\$58.2 billion
Percentage of global fish production from capture fisheries in 1970 and 2002	96% and 70%
Percentage of global fish production from aquaculture in 1970 and 2002	4% and 30%
Net receipts from fish by developing countries ^a	US\$17.4 billion
Fish exports from developing countries ^a	22 million tons, ~70% of production in 2002
Value of global fish imports ^a	US\$61 billion, 82% accounted for by developing countries
Percentage of international traded fish products that are processed	90%
Status of capture fisheries stocks ^a	24% overexploited/depleted or recovering; 52% fully exploited; 24% under- or moderately exploited
Estimated amount of fish discards ^a	7.3 million t/yr
Number of people for whom fish is the principal animal protein ^a	> 1 billion people worldwide
Number of livelihoods supported by fisheries ^b	38 million people
Largest percentage of fisheries/aquaculture employees	Asia (87%)
Number of decked vessels in the global fishing fleet ^a	1.3 million
Number of undecked vessels in the global fishing fleet ^a	2.8 million, 65% without power
Global per capita supply of fisheries products has declined	by 2.5 kg per person per year since the mid-1980s (from 11.8 kg in 1986 to 9.3 kg in 1999)

^a FAO 2004

^b Delgado et al. 2003

Sustainable capture fisheries and environmentally-friendly aquaculture require investments in improved sector governance and in knowledge management and dissemination, with a particular focus on poverty issues and equity. The entry points are diverse: from policy, legislative, and fiscal reform to community development, water basin management, and maritime security. Road, marine, and communications infrastructure all play a role, while human capacity building, technology transfer, health, safety at work, and environmental management also offer important avenues for intervention. Sustainable marine capture fisheries are likely to be attained in many countries only as a result of fleet capacity reduction, and in such cases the entry point would also

be to support economic diversification of coastal fishing communities and enable alternative livelihoods to fishing, be they aquaculture, marine tourism, or in unrelated sectors.

Past Investment Activity

The fisheries and aquaculture loan portfolio of the World Bank has evolved considerably since the 1980s (World Bank 2004).

1980s. Prior to the 1980s, about 60 percent of all World Bank fisheries loans were used for large-scale fisheries development, such as the building of large vessels and fishery service facilities. As limits on fisheries resources were recognized in the mid-1980s, the level of World Bank support for increased capture fisheries production was reduced, and investment shifted toward aquaculture, resource assessment, conservation, and fisheries research. Many fisheries sector interventions were embedded in larger cross-sector projects such as coastal zone management (World Bank 2004). The International Center for Living Aquatic Resources Management (a CGIAR research center now known as the WorldFish Center) was established, and the Support Unit for International Fisheries and Aquaculture Research was created with World Bank support.

1990s to present. The capture fisheries portfolio was substantially reduced in the 1990s as the difficulties of preparing effective fisheries management projects became apparent. As of fiscal 2003, the active fisheries and aquaculture portfolio (18 projects) was estimated at US\$412 million in direct investments. Over half of these investments were in aquaculture, including a US\$200 million Sustainable Coastal Resources Development Project in China. World Bank-funded projects involving aquaculture have been implemented in Albania, Bangladesh, Cambodia, China, Egypt, India, Indonesia, Kenya, the Philippines, Thailand, and Vietnam. Following renewed investments in Indonesia and elsewhere, the World Bank financed analyses of the fisheries sector in Eritrea, Guinea-Bissau, Indonesia, Kazakhstan, Peru, Senegal, and Vietnam. These studies formed the basis for additional inputs and investments in several of those countries (World Bank 2004).

Impacts. The impacts of past World Bank fisheries investments have been modest in terms of outcome, sustainability, and institutional development (World Bank 2004). Independent evaluations rated past projects below the average performance of other sectors. Reasons for these poor results included:

- The complexity of the fisheries sector, particularly fisheries governance. Early fisheries loan and technical assistance projects were more successful because of their simpler design, involving clear objectives to construct infrastructure such as ports and harbors. This sort of project contrasts significantly with the inherently more complex activity of policy reform, which involves changes in patterns of resource use and behavior.
- Projects focused mostly on improving technical aspects of fisheries resources management (research, monitoring, control, and surveillance), the components of the

regulatory and legal framework, strengthening of traditional institutions, and training. Some of these projects were implemented without the benefit of a broadly agreed sector strategy that integrated developmental, social, and governance requirements to achieve sector objectives and address resource constraints. In some cases, provisions for local consensus-building and donor alignment may not have been adequate.

- Some projects were overambitious in scale and the complexity of technologies employed, and they were overly dependent on public sector management for sustainability.
- Aquaculture performed better than capture fisheries activities, with most investment outcomes being sustainable. The World Bank's involvement in aquaculture development has included investments in the full range of technologies for production expansion, including support infrastructure. The investments include hatcheries, feed processing plants, seafood-processing plants, improvement and new construction of wholesale markets, disease control facilities, coastal zone management centers, water quality monitoring laboratories, and training and education facilities.

Key Issues for Investment

Increased investment by donors such as the World Bank is required to build the capacity of many coastal developing countries to address three key issues in fisheries governance: (1) limiting access to fisheries resources, (2) allocating the limited resources in an equitable manner between competing interest groups, and (3) ensuring that the exploitation of the living aquatic resources and the environment is compatible with ecosystem integrity, including conservation of biodiversity. For developed and developing countries alike, these issues raise concerns in many areas, from governance and equity through capacity building and stakeholder participation to technology transfer and community awareness. At a cross-sector level, the challenge is to promote economic diversification and alternative livelihoods for fishers and rural fishing communities in developing countries, to reduce pressures on the overexploited resource base.

Good governance and stewardship. Establishing good fisheries governance is fundamental for a healthy fisheries sector. Good governance involves control over fishing fleets and enforcing limits on catches and numbers of fishers so fish stocks can be maintained at optimal levels. Good governance requires eliminating billions of dollars of subsidies each year that contribute to overcapacity and the depletion of fish stocks. Good governance means equitable access to fish resources—protecting inshore and coastal fisheries on which the poor and small-scale fishers depend while clearly defining the important role of industrial fisheries. Good governance recognizes the vital links between aquaculture development and responsible management of water basins, wetlands, and coastal zones. Good governance involves transparent and participatory decision making that is accountable to stakeholders now and in future generations.

Fisheries governance revolves around two fundamental and politically contentious issues noted earlier: limiting access and allocating access to fish resources. Limiting access is a fundamental first step. Without such limits, the economic rents and benefits from the fishery are dissipated among increasing numbers of fishers, and the increasing fishing

effort results in increased resource depletion. Access limits can be implemented through a range of management measures and programs such as licensing, rights-based management, and international fisheries agreements. Comanagement and community management approaches are of particular interest for pro-poor interventions. Comanagement is a governance system of institutionalized collaboration between government agencies, fishers, and other sector stakeholders to design and implement management measures, with each stakeholder focused on implementing those aspects or measures best suited to the stakeholder's particular comparative advantages, and all having a say in the decision making to some degree. Investments need to include components that offset the political or social costs of implementing pro-poor fisheries access and allocation policies, or removal of excess fleet capacity.

Policy frameworks for fisheries that identify clear, realistic goals and how and when they may be reached are an important instrument for realizing sustainable fisheries management (Cunningham 2005). The institutional arrangements for effective fishery governance tend to be specific to individual countries or fisheries. They include the legal framework and effective means of applying fishery regulations, the means of achieving stakeholder consensus, provisions for conflict resolution and mediation, cooperation and participation arrangements, financing of independent scientific advice, extension and outreach institutions, and “watchdog” NGOs.

Hidden harvests. The contribution of inland or freshwater fisheries to livelihoods in developing countries tends to be substantially underestimated. Production is highly dispersed, often of only local importance, and is rarely accurately reflected in national statistics. Many lakes, impoundments, and rivers are highly productive but face increasing problems of pollution, dams that prevent fish spawning migrations, water abstraction, and poor integration of fisheries issues into water basin management. Investments in stocking water bodies and establishing user-rights schemes have been shown to be highly effective in securing sustained and productive fisheries in lakes, impoundments, and other water bodies.

Net benefits. Capture fisheries underperform as a generator of wealth and economic development, as a source of high-quality food, and in terms of sustainability. This poor performance largely occurs because of the common property and open-access nature of many fish resources. A profitable fishery without limits to access will attract other fishers until the aggregate cost of catching approaches the aggregate value of the catch. The economic “rent” (rents can be thought of as the net profits from a fishery, though use of the word “profit” is not strictly accurate in economic terms) is thus dissipated and lost in increased costs as competing fishers overcapitalize with larger vessels and more costly gear. Political pressure from a loss-making sector frequently results in subsidies and a lax fiscal regime (Milazzo 1998). Fisheries management thus has a vital economic dimension as fiscal and other economic measures must complement measures targeted on the biological state of the fishery. A profitable fishery can thus be considered as an infinite positive cash flow, a bounty of nature.

A profitable fishery that is both biologically and environmentally sustainable can be an important contributor to an economy. For example, Mauritania reportedly financed over 20 percent of central government expenditures with fisheries revenues, mainly from fishing access agreements with the EU (Cunningham 2005).

Bridging the food fish gap in Sub-Saharan Africa. In 2020, 90 percent of the fish consumed in Sub-Saharan Africa is projected to be low-value food fish, mainly small pelagics, which are the cheapest available animal protein on the continent (at times less than US\$0.20 per kilogram). Net imports of these products already approach the level projected for 2020 by IFPRI. Driven by increasing population, rising prices, and declining incomes, per capita fish consumption in Africa is projected to decline from 6.7 to 6.6 kilograms by 2020 (IFPRI). A more recent FAO scenario suggests a considerably larger supply gap of more than 2 million tons per year. There is growing concern that staple food fish will increasingly be “sucked out” of Africa, widening the region’s supply gap, with serious consequences for the diets, nutrition (box 6.3), and livelihoods of several million fish traders, most of whom are women. As in other regions, in Africa there are also indications of a growing disparity in food fish supply between rich and poor and between urban and rural consumers. This growing imbalance will need to be weighed against the benefits of trade and further attention drawn to domestic supplies.

Under access agreements, foreign industrial fleets operating in West African waters harvest a substantial proportion of the staple small pelagic fish. While undoubtedly there are impacts on local artisanal fisheries, the companies involved also provide an efficient trade service in moving as much as 1 million tons of low-value frozen fish from Mauritania and Morocco to Gulf of Guinea countries, Egypt, and elsewhere.

Box 6.3 Fish and human health

Though fish are a good source of a group of important nutrients known as omega-3 fatty acids, the average diet does not include enough seafood. Recent studies suggest these fatty acids are even more important than previously recognized. In particular, the amount of omega-3 in a pregnant woman's diet affects her child's intelligence, fine motor skills, and propensity to antisocial behavior. For example, children of women who consumed the smallest amounts of omega-3 fatty acids during their pregnancies had verbal IQs six points lower than average. Widespread deficiencies within a country or region thus could have serious effects on human resource potential. This finding is particularly pertinent because some countries have advised pregnant women to limit consumption of seafood—one of the richest sources of omega-3s—to avoid exposing fetuses to trace amounts of brain-damaging methyl mercury. Other studies indicate that changes in diet over the past 50 years—particularly changes in omega-3 and omega-6 consumption—are an important factor behind the rise in mental ill-health in Britain.

Source: The *Economist* (2006)

Fish trade. Thirty-eight percent of global fish production is exported, and developing countries account for eighty-two percent of the global fish trade. In 2002, the value of net fish exports from developing countries was higher than the combined value of coffee, cocoa, bananas, rubber, rice, and tea. Low-income food-deficit countries (LIFDCs) accounted for more than 20 percent (US\$8.2 billion) of the value of fish exports. As

noted, the expanding global fish trade creates opportunities for developing countries but can foster overfishing and place fish beyond the purchasing power of the poor. Subsidies, estimated at US\$14-20 billion per year (Milazzo 1998), tariff barriers, and increasingly stringent sanitary requirements also pose challenges. Despite increases in fuel costs, real prices of many major fish commodities remain flat (Tveteras 2005) as more cost-effective aquaculture production and distribution encroach on the markets for capture fishery products. There are growing opportunities for development of ecolabels and product traceability systems to certify to buyers that fish originate from sustainable fisheries, while developing coastal states often need support in establishing equitable fisheries access agreements (box 6.4).

Box 6.4 Access agreements: a two-edged sword

Revenues accruing to developing countries from fisheries access agreements can be of great importance for national treasuries and the fisheries sector (in Guinea Bissau, for example, the various payments amount to almost half of government revenues). In the World Trade Organization (WTO) negotiations, many coastal and island states do not wish to consider government support for fisheries access agreements as subsidies.

Yet there is ample evidence that many foreign access agreements have significant negative impacts on small-scale fisheries in developing countries, whether by competing for the same fish or the same markets, and fisher associations have frequently pointed out that the agreements do not meet legitimate concerns of small-scale fishing communities (CONPAS et al. 2005).

The more transparent fisheries access agreements between developed and developing countries are merely the highly visible tip of an inequitable trade and investment iceberg. Perhaps of more concern are the less transparent joint venture, charter, and agency business arrangements of irresponsible industrial fleets and the links between these arrangements and illegal fishing, trade in illicit fish, transfer pricing, flags of convenience, tax evasion, maintenance of an offshore economy, corruption, and undermining of the rule of law. The spectrum of fisheries arrangements between developed and developing countries ranges from access agreements, which may be highly advantageous to developing countries, to direct foreign investments designed to mine fish resources and yield few benefits to the developing country.

A fundamental target for any developing country strategy is to capture the benefits of its fisheries resources for the state—whether these benefits are lost through foreign access agreements, overcapacity in the domestic fleets, inequitable trade, or illegal fishing. Defining equitable fisheries arrangements, whether in the form of access agreements, direct foreign investment in fishing and processing, barter trade, or in the context of WTO issues (for example, rules of origin, subsidies, sanitary norms, traceability, or tariff barriers) presents a considerable challenge.

Source: Authors

Alternative livelihoods. Creating economic alternatives to fishing for small-scale fishers and fishing communities faced with resource degradation, overcapacity, and the need for effort reduction is essential to reducing human pressure on overexploited resources (World Bank 2004). Consequently, participatory, multisectoral, and multidisciplinary efforts are an essential part of the fisheries management process, particularly in small-scale fisheries. Alternative livelihood development is often based on community-driven

programs and ideally offers a wide range of options to redundant fishers. Successful experiences with alternative livelihoods exist in World Bank projects in China, where most alternative employment was found in aquaculture, and in Indonesia, where most success was achieved outside the sector (World Bank 2004). Fisheries are just one part of livelihood strategies for many millions in developing countries. Because fishing regulations often limit year-round activity, fishing is a part-time occupation for 60 percent of global fishers (FAO 2004). Owing to the seasonality of fish resources, many fishers already include other economic activities in their livelihood strategies.

Tides of change. Climate change, changing markets, changing product requirements, and economies of scale in fisheries tend to favor large-scale producers at the expense of small fishers and remote communities dependent on fishing. An example from the Maldives (box 6.5) illustrates typical changes and issues. A range of other issues and investment opportunities are considered in the AINs on “Capture Fisheries” and “Aquaculture.”

Box 6.5 The Maldives: a roadmap to sustainable fisheries

The fisheries sector in the Maldives experienced strong growth in recent years, contributing approximately 9.3 percent of GDP in 2004. One-third of the annual catch is consumed domestically, and fish exports (valued at US\$75.6 million in 2003) currently account for almost half of the country’s exports. The sector employs 11 percent of the labor force. About 20 percent of the total population, particularly in outlying atolls, depends on fisheries as the major income-earning activity. Dispersed production over the 1,000-kilometer chain of atolls, lack of economies of scale, and the isolation of the archipelago make the Maldives a high-cost producer in a highly competitive global tuna market. For these reasons, the Maldives fishery must be highly efficient in terms of its fleet, fish collection logistics, and value-added processing.

The World Bank legacy. Since 1979, the International Development Association (IDA) has supported three lending operations in the Maldives fisheries sector. The first project (1979-83) successfully mechanized the Maldives’ tuna pole-and-line fishing fleet. The second project (1983-91) further expanded the country’s fish production and developed export markets for frozen tuna by strengthening fisheries infrastructure and a fuel distribution system. The third project (1992-97) also focused on modernizing the artisanal fishing fleet and improving fish collection, processing, and storage. These investments, which mainly focused on fisheries infrastructure development, were highly successful in achieving the projects’ goals, fostered rapid development in the sector, and contributed to the national economy.

Changing times. Recently, concerns have been raised over possible fleet overcapacity and overcapitalization and possible declines in some fish stocks. The dismantling of the state monopoly on tuna collection and processing has led to a doubling of processing capacity, but a lack of interest by the Maldivian labor force in tuna processing has forced recruitment of foreign labor. Fiscal returns are negligible, while the profile of the skipjack fleet is changing rapidly from traditional wooden vessels of approximately 45 feet to fewer and larger GRP (fiberglass) vessels of 90 feet or more, fitted with more powerful engines.

Issues. The larger vessels are more profitable when the tuna are in season but may not put to sea when tuna are scarce, resulting in erratic supplies to processors. The more numerous traditional vessels fish all year, and their incomes are more widely distributed. Should the government aim to influence and control further development of larger vessels? In a post-tsunami climate, can

fiscal measures be introduced? What is the optimal level of processing capacity in comparison to the catching capacity of the fleet? To answer these questions, the Maldives government and the World Bank are collaborating on a roadmap for developing a sustainable and profitable fishery sector.

Source: Authors

Future Directions

As noted previously, World Bank investment in capture fisheries now focuses on building capacity in developing countries to sustainably govern and manage their fisheries and aquaculture rather than expanding catching power and capture fisheries production. Several initiatives and partnerships are evolving to meet this challenge and are discussed in more detail in the AINs on “Capture Fisheries” and “Aquaculture.” Approaches include:

- The GEF-funded Large Marine Ecosystem Projects.
- The World Bank’s Global Program on Fisheries (PROFISH).
- The Strategic Partnership for a Sustainable Fisheries Investment Fund in Sub-Saharan Africa.
- Actions to combat illegal fishing.
- Market mechanisms.

Scaling Up

World Bank and IFC experience, particularly in Asia, provides lessons and guidance in aquaculture investment. Though it is premature to assess the impacts of Bank-funded interventions in building sustainable fisheries, the AINs that follow this overview reflect current thinking and recent experiences.

Selected Readings

Asterisk (*) at the end of a reference indicates that it is available on the Web. See Appendix 1 for a full list of Websites.

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<p>This Overview was prepared by Kieran Kelleher and Ronald Zweig with inputs from Eriko Hoshino and Barry A. Costa-Pierce. Peer-review comments were provided by Cornelis de Haan and John Virdin.</p>

Implementing the Code of Conduct for Responsible Fisheries

There is a global consensus that capture fisheries face an environmental and socioeconomic crisis in many parts of the world. Similarly, broad consensus is shared about the root cause of the crisis: poor sector governance. The common property nature of the resources, ecosystem change, the mobility of fishers and fish, the high levels of poverty among some fishing communities, and the diverse objectives of competing stakeholder groups complicate effective governance. Ineffective sector policies and institutional frameworks at the regional, national, and local level are often unable to accommodate the highly charged political process of fisheries management. Ill-defined rights to open-access resources and direct and indirect subsidies have often caused overcapitalization. Rapid technological advances and strong global demand for fish have also contributed to the excessive global fish catching capacity.

Benefits

The benefits of healthy capture fisheries are reflected in the World Summit for Sustainable Development (WSSD) Plan of Implementation, which sets out targets for restoring and sustaining capture fisheries (box 6.6). More specific benefits of investments in the management of capture fisheries are evident from several World Bank projects; see the IAPs for Bangladesh (poverty alleviation and food supply) and Indonesia (sustainable livelihoods and natural resource management).

Box 6.6 Fisheries and the World Summit on Sustainable Development

- Encourage the application by 2010 of the ecosystem approach for the sustainable development of the oceans.
- On an urgent basis and where possible by 2015, maintain or restore depleted fish stocks to levels that can produce the maximum sustainable yield.
- Put into effect the Food and Agriculture Organization (FAO) international plans of action by the agreed dates:
 - for the management of fishing capacity by 2005; and
 - to prevent, deter, and eliminate illegal, unreported, and unregulated fishing by 2004.
- Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, and the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks, by 2012.
- Establish by 2004 a regular process under the United Nations for global reporting and assessment of the state of the marine environment.
- Eliminate subsidies that contribute to illegal, unreported, and unregulated fishing and to overcapacity.

Source: WSSD Plan of Implementation

Policy and Implementation Issues

Implementing the global consensus. The vast majority of World Bank client countries have endorsed the Code of Conduct for Responsible Fisheries, which is a voluntary instrument. A major target of the World Bank's new partnership, the Global Program on Fisheries (PROFISH), is to assist client countries in implementing the provisions of the Code. The implementation of the Code presents numerous challenges. Although many of the technical challenges have been addressed in the Technical Guidelines (box 6.7), the development and application of effective policies requires political commitment and technical guidance. The convening power of the World Bank and its ability to develop and finance solutions gives the Bank a strategic advantage in addressing contentious issues of resource allocation.

Box 6.7 Technical guidelines for responsible fisheries

[Fishing operations.](#) - *No.1*

[Fishing operations. 1. Vessel monitoring systems](#) - *No.1,Suppl.1*

[Precautionary approach to capture fisheries and species introductions](#) - *No.2*

[Integration of Fisheries into coastal area management.](#) - *No.3*

[Fisheries management.](#) - *No.4*

[Fisheries management. 1. Conservation and management of sharks](#) - *No.4,Suppl.1*

[Fisheries management. 2. The ecosystem approach to fisheries](#) - *No.4,Suppl.2*

[Aquaculture development.](#) - *No.5*

[Aquaculture development. 1. Good aquaculture feed manufacturing practice.](#) - *No.5,Suppl.1*

[Inland fisheries.](#) - *No.6*

[Responsible fish utilization](#) - *No.7*

[Indicators for sustainable development of marine capture fisheries.](#) - *No.8*

[Implementation of the International Plan of Action to deter, prevent and eliminate, illegal, unreported and unregulated fishing.](#) - *No.9*

Source: FAO 2005

Under the Code of Conduct a number of International Plans of Action have also been agreed by FAO Member Countries. These Plans, which are among the targets of the WSSD Plan of Implementation (box 6.6), address the control of fishing (fleet) capacity; illegal, unreported, and unregulated (IUU) fishing; and measures to mitigate the impact of fishing on threatened species such as sharks and seabirds. Poor uptake and implementation of the Code and Plans have generated several partnerships to address key issues.

Generating political willingness for reform: the PROFISH partnership. The World Bank established PROFISH to improve sustainable livelihoods in the fisheries sector and make concrete progress towards the WSSD goals in fisheries. PROFISH is a programming and funding partnership between the World Bank and key fishery sector donors, developing countries, stakeholder organizations, and international agencies. PROFISH is not an investment fund but provides for (1) country-level fisheries analyses and (2) under Development Grant Facility (DGF) funding, provides for global fisheries goods in the areas of knowledge management, development of toolkits, and guidelines and advocacy. The country-level analyses are expected to lead to an increased investment in fisheries policy reform, good governance, and pro-poor fisheries strategies by mainstreaming

sustainable fisheries initiatives into the national economic planning frameworks. The World Conservation Union (IUCN), FAO, and WorldFish Center are the international partners collaborating in PROFISH; they help develop and promote solutions to core fisheries problems, including control of fishing capacity, management of small-scale fisheries, and illegal fishing. An example of one of the “regional products” of this partnership is the NEPAD *Fish for All* Summit Declaration and Action Plan (Anon. 2005).

Funding: Strategic Partnership for a Sustainable Fisheries Investment Fund in the Large Marine Ecosystems of Sub-Saharan Africa. The Strategic Partnership for a Sustainable Fisheries Investment Fund in the Large Marine Ecosystems of Sub-Saharan Africa is a GEF-funded initiative involving a US\$60 million grant mechanism for country-level fisheries projects. The grant funding is intended to be leveraged at 3:1 ratio to deliver a total investment of US\$240 million for sustainable fisheries over the next 10 years. There is a close link between PROFISH and the Partnership. It is intended that PROFISH will work at the country level to prepare some of the analyses required as a basis for Strategic Partnership projects and will also assist in aligning donors to attract the additional funding required. The Strategic Partnership is designed to help apply knowledge, capacity, and science generated through the four GEF Large Marine Ecosystem (LME) initiatives in Africa to build sustainable fisheries and effective governance of marine and coastal resources. These projects (Canary Current, Guinea Current, Benguela Current, and Agulhas and Somali Current) are building a scientific basis for fisheries management and establishing institutional capacity in Sub-Saharan Africa. It is anticipated that the GEF-financed Southwest Indian Ocean Fisheries Project will further strengthen the fisheries dimension of the Agulhas and Somali Current LME program in Mozambique, Kenya, Tanzania, South Africa, Madagascar, Seychelles, Comoros, and Mauritius. Other LME projects are in various stages of preparation or implementation in other areas, including the Bay of Bengal and South America (Humboldt Current), and GEF is also helping to create a scientific basis for coral reef management (box 6.8).

Box 6.8. The [Coral Reef Targeted Research and Capacity Building](#)

This Management Partnership (US\$2.5 million) has established a global network of eminent coral reef scientists working across disciplines to provide the knowledge and capacity building required to base coral reef management policies on sound scientific practices. The Bank also participates in the International Coral Reef Initiative (ICRI). These coral reef activities are a direct response to the need for ecosystem-based management, providing managers and policy makers with a sound scientific basis for sustainable use and conservation of one of the ocean’s most diverse and fragile ecosystems and the hundreds of thousands of coastal communities dependent on these ecosystems.

Source: World Bank 2004

Market mechanisms. Building on rapid expansion in the international fish trade, several ecolabelling and certification programs (see box 6.9 for an example) promote sustainable fishing and aquaculture by creating market mechanisms to encourage fisheries to comply with a suite of criteria, such as healthy fish stocks and ecosystems. Others target conservation of endangered species. In 2005 COFI approved criteria for fisheries ecolabelling schemes.

Box 6.9 Certifying sustainability

The Marine Stewardship Council (MSC) is one example of a fisheries certification program. The MSC accredits third party certification bodies, which assess whether fisheries meet the MSC's environmental standard for well-managed and sustainable fisheries. Products certified to meet the standard can display the MSC's logo.



The MSC Label

Source: Authors

Actions to combat illicit fisheries

activities. Preliminary estimates indicate that the value of IUU catches is on the order of US\$9 billion per year. A recent study indicates close correlation between the level of illegal fishing and World Bank governance indicators (MRAG 2005). Illicit fishing activities are often characterized by repeated changes of vessel flags, noncompliance with vessel safety standards, unacceptable labor conditions on vessels (including child and indentured labor), illegal immigration, smuggling, and offshore economies that straddle jurisdictions and yield minimal benefits to the economies of either flag, or coastal states. The illicit activities are not isolated incidents, but generally form part of an institutionalized value chain, as the illicit products must be traded and the vessels must be serviced. Recent international efforts to combat IUU activity include strategic actions by a fast-track inter-ministerial group, the High Seas Task Force, calling for a review of the effectiveness of Regional Fisheries Management organizations and preparation of National Plans of Action to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated Fishing. Developing countries need substantial assistance to design and implement these plans, blending an efficient regulatory framework with cost-effective deterrence.

Lessons Learned

Investments in the sector tend to be highly country and fishery specific, and a wide range of entry points can be considered, including rural development, natural resource reform, science and technology, water basin and coastal zone management, trade, food safety, maritime security, and infrastructure development.

Country and regional policy statements may not be backed by the political willingness to address the contentious issues of access limitation and equitable distribution. Investment in advocacy and support for civil society activities and development of a common vision of the issues may be a necessary precursor to effective policy implementation.

Recommendations

1. The Code of Conduct for Responsible Fisheries is an internationally agreed framework for sustainable fisheries and aquaculture and can be used as a basis for building sustainable fisheries.
2. Particularly in countries where fisheries are of high importance, due consideration should be given to including a fisheries dimension in CASs, CES, and key country instruments such as PRSPs and national plans.
3. The resources for sustainable fisheries are often spread among different stakeholders. At the national and international level, partnerships are key to harnessing these resources and directing them towards the common aim of responsible and sustainable fisheries.

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Asterisk (*) at the end of a reference indicates that it is available on the Web. See Appendix 1 for a full list of Websites.

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Managing Capture Fisheries

Fundamental differences between agriculture and fisheries shape investment priorities and opportunities (table 6.2). Wild fish are generally a common property resource subject to free and open access, making governance and equitable resource allocation difficult without a measure of public intervention. The mobility of fish and fishers, the difficulty of assessing the state of diverse fish stocks, and the impact of fishing and environmental change pose substantial challenges for policies and plans, for politicians and planners. Similarly, aquaculture uses public goods, including freshwater resources, marine spaces, common property wetlands, and inter-tidal areas. It can affect critical habitats as well as biodiversity and genetic heritage. Enforcement of fishery regulations is often weak or ineffective, even in developed countries. Risk in fisheries is high—changes in weather and in market prices present daily risks, whereas fishing claims a higher rate of human mortality than any other occupation. Public investments are required to ensure the sustainability of capture fisheries and aquaculture and equitable use of the public goods involved.

Table 6.2 Fundamental differences between agriculture and fisheries

Characteristic	Agriculture	Capture fisheries
Tenure	Fixed	Common property, ill-defined rights
Resource/crop	Fixed, measurable	Mobile, hidden
Capital	Fixed (farm, equipment)	Mobile (vessels) highly technical
Weather impact	Seasonal	Both daily and seasonal
Harvest/market	Seasonal, single crop	Daily, multispecies, highly variable
Products	Durable crops	Highly perishable
Large scale/small scale	Physically separate	Interact/compete directly
Governance	Modest requirement	Vital, costly, often ineffective
Infrastructure	Roads, irrigation	Ports, ice, boatyards, navigation aids
Health	Rural	Most hazardous occupation; also relatively high HIV/AIDS rates in fishing populations (box 6.10)

Source: Authors

Production from marine capture fisheries has reached a plateau. Few fisheries can expand production, so attention has turned to fostering sustainable use of fish resources and increasing the value and net returns from fisheries. Owing to degraded marine and coastal habitats and depleted fish stocks, limited harvests are divided among ever-expanding fleets and growing numbers of fishers in most developing countries. Trapped in a downward spiral of poverty, many fishers have few alternatives but to fish more and fish harder and destroy the very foundation of their livelihoods. With the advent of synthetic nets and outboard motors, traditional controls have weakened. Scarcity undermines incentives to conserve resources, as each fisher believes that a fish left uncaught today will be caught by a rival fisher tomorrow. The freshwater fisheries often have an added burden of high pollution, dams, and water abstraction.

Box 6.10 High levels of HIV/AIDS in many fishing populations and communities

- In Thailand, 13-20 percent of marine fishing boat crews tested HIV-positive in the late 1990s, while the general prevalence rate was 1.5 percent.
- In Honduras, 8 percent of adults in coastal fishing communities in Honduras are HIV-positive, 4 times the national average.
- In the city of New Bedford, USA during 1990-1995, 12 percent of AIDS patients were fishers. Seroprevalence rates were less than 0.01 percent in the general population, of which fishers made up less than 1 percent.
- In the Lake Victoria region of Africa, fishers are 5 time more likely to die of AIDS-related illness than farmers.
- On Lake Albert in Uganda, 24 percent of fishers were HIV-positive in 1992, compared to 17 percent of truck drivers in Mombasa, Kenya.

Source: FAO/Sustainable Fisheries Livelihoods Project

Benefits

Sustainable capture fisheries offer opportunities for creating wealth, alleviating poverty, and improving human health and wellbeing, but they will require public policy adjustments and the implementation of improved sector governance. Fisheries are an essential source of income for the millions of people (including women and children), often from marginalized or landless communities, who catch, process, transport, or market fish. The sector contributes over 50 percent of treasury receipts in several coastal states and can be a vital source of foreign exchange. As fishing is often the livelihood of last resort and fish often the only source of animal protein for the poor, the state of the world's capture fisheries can be critical in the fight against poverty in many parts of the developing world.

Policy and Implementation Issues

Rights-based fisheries. Rights-based fisheries create private or community property rights to “close” access to formerly open-access fisheries resources. The most commonly known rights are fishing licenses, community fishing rights, traditional fishing rights and individual quotas. Japan offers an example of community fishing rights with allocations carried out by fishing cooperatives. The traditional fishing rights of indigenous peoples are often given legislative guarantees (for example, in the South Pacific and North America). Individual Transferable Quotas (ITQs) have been successfully introduced in Iceland, Australia, and New Zealand, and variations on the ITQ model are common in fisheries in Europe and North America. Tradable fishing licenses are similar to ITQs, but rights pertain to the vessel or the right to fish rather than to a quota of fish, and transfer may involve sale of the fishing vessel.

Rights-based systems give fishers a stake in fisheries resources. They improve regulatory compliance and resource use. Successful, documented examples exist from Namibia, the Shetland Islands, India, and Senegal (Cunningham and Bostock 2005). These and other examples from Ghana, Japan, Iceland, New Zealand, Norway, the Pacific Islands, and the Philippines demonstrate:

- Strong legal and enforcement frameworks are important.

- Improved management processes define clearly and at the outset the participants, their resources, their access rights, and obligations.
- An effective system of decentralization and other stakeholder involvement (collaborative management or comanagement) is important.
- A balance must be established between short- and long-term objectives, trust must be built between the small-scale and industrial sectors, and the maximization of income from license fees must be balanced with equity and with concerns over the long-term sustainability of the fisheries. Adherence to the precautionary approach for fisheries is essential (World Bank 2004).

While there is general agreement that open-access systems almost invariably lead to overfishing and overcapacity, the introduction of rights-based regimes is likely to result in winners and losers. Several case studies indicate an unwanted concentration of wealth and benefits. To meet equity objectives, the design of the regime implies that the winners compensate the losers and that the fiscal regime and mitigating measures accompanying the introduction of fishing rights receive due consideration. Buybacks (box 6.11) effectively reinforce fishing rights for fishers remaining in the fishery.

Box 6.11 Reducing fleet overcapacity

“Buybacks,” also known as “decommissioning schemes,” are a means of removing excess fishing fleet capacity to reduce fishing effort and overfishing or to reallocate harvesting rights (for example, from industrial to small-scale fisheries). Fishers can be compensated either for the removal of the actual fishing vessel, withdrawal of the fishing license, or fishing rights acquired either historically or through law. Because fishers may be compensated for loss of what is seen as a public good, public financing of these schemes may prove difficult, and the financial design of buybacks may require the remaining fishers to repay the buyback from future profits. Countries that have undertaken buyback schemes include Australia, China, Denmark, Korea, Malaysia, the UK, and the USA. Reviews of buyback schemes indicate that they have had mixed success and generally must be accompanied by complementary regulatory measures.

Source: Nautilus Consultants 1997; Newby et al. 2004

Fiscal reform. Fiscal reform generally aims at achieving fisheries production in the most economically efficient manner. It is a contentious process, particularly when a fishery is overfished and society can benefit most from the reform. Raising taxes is on the one hand an indirect means of reducing fishing effort by raising the cost of access; on the other hand, it offers a possibility of reallocating economic rents to establish alternative livelihoods. Convincing different stakeholder groups of the social value of fiscal reform and defining the mechanism and steps in reform constitute challenges to the process. Reforms will create winners and losers, and the equity implications require study and consultation. The gains in economic efficiency may be insufficient to compensate the losers, although the alternative may be increasing economic inefficiency, leading to further overfishing. Fiscal reform is closely allied with the creation of property rights, which may require protracted stakeholder consultation.

Comanagement and decentralized decision making. “Comanagement” refers to an arrangement through which government and resource users share the responsibility for managing fisheries, while decentralization involves delegating such responsibilities to the local level. These complementary approaches have been among the most successful approaches to fisheries management. Their advantage is that the fishers can influence the decisions made, while governments can ensure that long-term management objectives are met. Participation in decision making gains the support of the fishers, confers legitimacy on the regulations, and fosters compliance, which may also reduce the costs of monitoring and surveillance. However, comanagement systems require significant applied research, extension, education, and awareness-building for all fisheries stakeholders as a means of building trust and empowering stakeholders to participate in the shared governance of fisheries. Building comanagement institutions with a “democratic” mandate and transparent processes for allocation of access rights is also challenging. Successful examples of comanagement now exist from Australia, India, Indonesia, New Zealand, Samoa, Senegal, and the Shetland Islands (UK).

Cost-effective monitoring, control, and surveillance. Cost-effective monitoring, control, and surveillance (MCS) is fundamental to enforcing fishery regulations. High-cost MCS activities using patrol vessels, aircraft, or fishery inspectors are only one facet of a suite of activities that aim to balance persuasion with dissuasion. Dialogue and consultation with fishers to achieve understanding, acceptance, and voluntary compliance with regulations has proven a most cost-effective approach. Fishers often consider penalties for illegal fishing as simply a “cost of doing business,” while corrupt practices reduce the risk of successful prosecution for violations. New technologies such as vessel monitoring systems (VMS) and vessel detection systems (VDS) now have the potential to track and detect fishing vessels worldwide. Facilitating cooperation between developing countries and with Regional Fisheries Management Organizations can be an effective means of fisheries control and sharing of the costs of MCS activities.

Marine Protected Areas (MPAs). The term “MPA” covers a spectrum of spatial management arrangements, from complete prohibitions against removal of any living creature to other regulations, such as seasonal closures or restrictions on the removal of specific species. MPAs allow target species to mature and reproduce and help repopulate the adjacent fishing grounds. The long-term benefits to fishers can outweigh short-term losses that they may experience in the early years when MPAs are established and fishing grounds are closed. Interventions are needed to mitigate short-term economic hardships by supporting alternative livelihoods for affected fishing communities and equitable systems for benefit sharing. MPAs have the added benefit of applying the “ecosystem approach” to fisheries, ensuring the sustainability not only of fishing activities, but also of the entire marine ecosystem. Successful MPAs require the active involvement of civil society, science-based approaches to the design of MPA networks, and a realistic financing plan, which may include payments for ecosystem services. World Bank projects in the Caribbean, Indonesia, and the Philippines have successfully introduced MPAs (World Bank 2004), often focusing on coral reef areas.

Lessons Learned

The difficulties in managing fisheries should not be underestimated and involve a long-term commitment by all stakeholders. Solutions are likely to be country and fishery specific, but they can build on the tools and successes described above. Good governance leans heavily on sound technical solutions, whether they involved building economic buffers to modulate the effects of climate change on fisheries or managing the social change required to reduce an artisanal fleet. Advocacy and policy must be complemented with clarity on the solutions and their effective implementation. There are a number of successful examples of fisheries management illustrating a broad range of approaches (Cunningham and Bostock 2005; World Bank 2004). These experiences have demonstrated that threatened aquatic ecosystems can recover, that effective fisheries management can reverse declines in fisheries incomes, and that the knowledge gained can be built upon and adapted to other fisheries using a range of good practices and entry points.

Recommendations

1. Focus on improved sector governance and development of stakeholder consensus.
2. Encourage strategic policy reforms in the areas of access limitation, creation of rights-based management regimes, fiscal measures, and equitable allocation.
3. Establish effective management of small-scale fisheries employing some of the approaches described earlier, such as comanagement and establishment of MPAs.
4. Ensure that management objectives consider both economic and biological objectives, as the sustainable yield in physical terms tends to be higher than the sustainable yield in economic (value) terms.
5. Consider pro-poor transfers of fish wealth (for example, from industrial to small-scale fisheries), but these must be accompanied by commitments to responsible stewardship at the community level.
6. Promote development of a scientific basis for management measures and development of human capacity to undertake change management.
7. Consider pilot projects to test and refine management approaches and create the knowledge base for further reform.

Selected Readings

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Aquaculture Production Systems

Aquaculture is the farming and husbandry of aquatic organisms such as fish, crustaceans, mollusks, seaweed, and the production of freshwater and marine pearls. Aquaculture has grown at an annual average rate of 10 percent since the mid-1980s, reaching almost 55 million tons (or about 37 percent of global fish supply) in 2003. During the same period, capture fisheries averaged an annual growth rate of less than 2 percent, and its contribution to direct human nutrition actually declined by about 10 percent because of an increase in the proportion of lower-value species, typically used to produce fishmeal for feed and fertilizer. As almost one-third of capture fish production is reduced to fish meal, in the near future aquaculture is likely to provide half the fish used for direct human consumption. Based on this trend, it is likely that production from aquaculture as of 2005 equals that from capture fisheries in terms of products directly consumed by people.

With a growing fish supply gap and declining yields of capture fisheries, the potential for aquaculture production in developing countries continues to rise. Worldwide production from aquaculture is growing rapidly (table 6.3), far outstripping the growth rate in capture fisheries.

Table 6.3 Animal and plant aquaculture

Trophic level	Million t	%
Carnivorous finfish	3.98	7.3
Omnivorous/scavenging crustaceans	2.79	5.1
Omnivorous/herbivorous finfish	16.02	29.3
Filter-feeding fish	7.04	12.9
Filter-feeding mollusks	12.3	22.5
<i>Total animal aquaculture:</i>	<i>42.13</i>	<i>77.1</i>
Photosynthetic aquatic plants	12.48	22.9
Total animal and plant aquaculture	54.61	100.0

Source: FAO Fishstat

Benefits

Aquaculture can be integrated with other farming systems. Inland fish culture is often carried out in farm ponds with direct links to animal husbandry and agriculture, where by-products of each subcomponent are recycled as resources for the others (for example, fish waste that enters irrigation canals becomes a supplementary fertilizer for crops). Pond culture on farms of this kind often includes the culture of many fish species that feed on grasses, legumes, benthic invertebrates, detritus, zooplankton, and phytoplankton. Fish culture has been gaining application in rice fields where a second benefit is control of insect pests and reduced the need to apply pesticides.

Areas that are not suitable for agriculture and are not critical habitats for wildlife can often be effectively used for aquaculture pond development. Publicly owned lands and waters suitable for conversion to aquaculture can be developed or leased to poor

households that otherwise lack productive assets. Furthermore, aquaculture can often offer direct management roles for women.

The development of reliable production technologies that often require only simple management skills has facilitated the recent rapid expansion of the industry. Options for aquaculture development can involve production at household, community, or industrial scale, employing ponds, net pens, net cages, flow-through raceways, and water recirculation systems. Fish monoculture systems have also been developed for a wide range of species that are most often grown on processed feed diets in ponds, raceways, and irrigation canals.

Policy and Implementation Issues

Aquaculture is a net protein provider to humanity. However, aquaculture faces a number of problems, including a shortage of suitable sites, access to appropriate technologies, lack of comprehensive, inter-sectoral planning, a lack of financial resources for the poor, the lack of an information base on its positive and negative social-environmental impacts, and a lack of research on diseases. Expansion of intensive aquaculture production systems (that is, high density using feeds) will require aquaculture to be developed in a more environmentally friendly manner with due consideration for social impacts. Sustainable, environmentally friendly aquaculture systems require that a strong, multidisciplinary applied science establishment be fostered and supported.

Aquaculture projects may encounter several implementation difficulties. The legislative and institutional framework may be deficient, while newly introduced aquaculture needs to reach a critical mass rapidly at the country level to support the services required, such as disease control, feed industry, breeding programs and the science and technology required.

Lessons

Africa, most of Latin America, and Oceania have not experienced Asia's expansion in aquaculture production. This offers opportunities to apply the lessons learned in Asia regarding business models and the transfer of science and technology. Perhaps more important, the lessons learned in Asia and countries such as Norway can be applied to ensure that aquaculture is environmentally friendly and sustainable. In particular these lessons include: building awareness of the need for effective public policies, planning, and governance; a favorable investment climate; involvement of stakeholders; enforcement of environmental controls; transfer of technologies and skills; and measures to mitigate negative externalities and unwanted social impacts.

A major challenge for aquaculture is how to provide small-scale farmers with the economies of scale enjoyed by large-scale producers. Useful approaches to this problem include support for cooperatives, community development, and industry associations, as well as contract farming and public assistance in extension and marketing. Successful

experiences with alternative livelihoods in aquaculture exist in World Bank projects in China (box 6.12) and Bangladesh.

Box 6.12 China's experience with coastal and inland aquaculture

Coastal aquaculture. The Sustainable Coastal Resources Development Project established integrated coastal zone management plans that featured the creation of mariculture (marine aquaculture) zones. The mariculture activities included the production of fish in cages and ponds, and the culture of oysters, hard clams, several species of seaweed, and shrimp in four coastal provinces. In addition to improved shrimp culture methods, the project provided training in seafood processing techniques and upgraded processing plants. The Southwest Poverty Reduction Project included an aquaculture component to provide employment for people from impoverished inland areas in Guangxi through enterprises producing products such as fish, shellfish, and pearls.

Inland aquaculture. The Freshwater Fisheries Project developed integrated fish farming complexes around eight major Chinese cities, providing a source of fish close to markets. The Guangxi Agricultural Development Project achieved its objectives of providing employment for about 2,200 households and production of about 8,500 tons of fish a year from the development of 1,500 hectares of integrated fish ponds on saline, alkaline, or waterlogged soils. It introduced yeast as a protein-rich feed supplement to replace fish meal, reducing the cost of feed and the dependency on foreign exchange to import fish meal. Tourism emerged as an unexpected benefit, because tourists are attracted to view migrating birds drawn to some of the project's fish ponds.

Source: Zweig 1998

“Traditional” producers such as China and India also face new challenges, including disease control, environmental monitoring, and loss of genetic vigor. The rapid expansion of aquaculture can lead to trade disputes (box 6.13) and heighten the need to create new and alternative markets. The increasing use of seaweeds and mollusk aquaculture for environmental services, such as treating sewage or reducing eutrophication, offers further investment possibilities.

Box 6.13 Catfish trade dispute between the USA and Vietnam

By 2002 the USA had become the biggest importer of Vietnamese catfish, importing 18,300 tons, worth US\$55.1 million, between January and November 2002. Vietnam had captured 20 percent of the US\$590 million catfish market, formerly the purview of U.S. catfish farmers. U.S. rulings that Vietnamese catfish fillets were “dumped” (sold in the U.S. market at unfairly low prices) resulted in retroactive import duties of 37-64 percent (catfish import duties were 5 percent before the rulings). The U.S. Congress ruled that only the native family Ictaluridae could be called catfish, effectively preventing the Vietnamese product from being called catfish.

Some half-million Vietnamese live off the catfish trade in the Mekong Delta. The catfish dispute threatened the livelihoods of thousands of farmers until Vietnam developed alternative markets, mainly in the EU and Japan.

Source: Authors

A wide range of investments supported by World Bank projects have had successful outcomes, including:

- Integrating aquaculture into water development, reuse, and recycling projects.
- Supporting integrated, cooperative, multidisciplinary research, education, and outreach units in governments and universities that can demonstrate economically viable, pro-poor aquaculture ecosystems.
- Developing alternative, low-cost hatcheries and feed mills (especially for feeds for omnivorous fish based on agricultural products—that is, not fish meal) in communities where aquaculture production systems are being developed. For example, commercially available yeast-based proteins are being used in China, and soybean meals with high omega-3 content are under development.
- Establishing programs that develop protocols to prevent introductions of disease; develop contingency, control, and eradication programs; and adhere to the OIE Aquatic Animal Health Code.
- Enhancing the quality and safety of aquaculture products, for example, through application of the hazard analysis critical control point (HACCP) methodology as well as traceability and ecolabelling protocols. The viability of aquaculture increasingly is driven by consumer requirements for compliance with food health and safety standards.
- Supporting restocking and stock enhancement programs or culture-based fisheries. Releasing hatchery-reared juvenile fish and shellfish into enclosed bays, irrigation schemes, lakes, and reservoirs has proven effective in projects in Bangladesh, China, Sri Lanka, Indonesia, India, and elsewhere, though issues concerning potential impacts on the gene pool of the stocked species need further study.

Recommendations for Practitioners

1. Refer to codes of practice on sustainable and environmentally-friendly aquaculture, including the Code of Conduct for Responsible Fisheries and Technical Guidelines on Aquaculture (boxes 6.1 and 6.7), Principles for Responsible Shrimp Farming (box 6.14), and principles for mangrove forest management (see Selected Readings). Reference may also be made to World Bank and IFC Safeguard Policies.

Box 6.14 The Consortium on Shrimp Farming and the Environment

The Consortium was formed in 1999 as a partnership of the World Bank, the Network of Aquaculture Centers in Asia (NACA), the World Wildlife Fund, the Food and Agriculture Organization (FAO), and the United Nations Environment Program (UNEP). The objective was to identify issues and better management practices in shrimp aquaculture.

The Consortium produced the International Principles for Responsible Shrimp Farming to address technical, environmental, social, and economic issues associated with shrimp aquaculture. The Principles provide the basis for developing and implementing “better management practices” (BMPs) and government policies that can guide the sustainability of shrimp farming at the national, regional, and global levels.

Source: NACA

2. An effective institutional framework for aquaculture is highly important to address not only environmental, planning, and equity issues and externalities but also make provisions to facilitate smallholders' engagement. Public and private sector roles need to be clearly defined. Although the private sector will be the main driver of aquaculture development, the public sector has a vital role in creating an attractive investment climate, controlling diseases, monitoring transfers of live fish across boundaries, facilitating water management and environmental protection, ensuring the quality of feeds and seeds, and certifying the health and safety of aquaculture food products.

3. While stand-alone aquaculture projects are of great value, a range of other entry points may also be considered (box 6.15) and should develop mechanisms for the poor, men and women, to participate. Aquaculture development can take place at multiple levels, from small-scale household operations through to community projects and industrial plants. Land and water tenure rights policies are central to making it possible for the poor to engage in aquaculture production. Leasing public land and water bodies to poor households with proper development guidelines and infrastructure and appropriate training can be an important tool for poverty reduction.

Box 6.15 Entry points for aquaculture

- International Finance Corporation (IFC) private sector projects.
- Water basin management.
- Rural and community-driven development.
- Reform of natural resource management.
- Disposal of animal/organic wastes.
- Coastal zone management.
- Irrigation and irrigated rice schemes.
- Small and medium enterprise (SME) and credit schemes.
- Rehabilitation of sodic lands.

Source: Authors

4. In countries where aquaculture is weak, tried and tested technologies should be advocated. Investment in research may focus on adapting these technologies to local conditions and determining how aquaculture can be integrated effectively into existing farming systems or can make use of land and water that are unsuitable for other purposes. In more advanced producer countries, investment in applied research may focus on new technological opportunities, such as economically viable recirculating aquaculture systems, polycultures, or integrated systems that take advantage of the fact that one species can "feed" off the wastes or production of another, as in the case of seaweeds, mollusks, and finfish.

5. Development of environmentally friendly aquaculture systems is important both for the client country and the Bank's reputation. In this regard, several actions and issues may be considered:

- Undertake the required environmental and social impact assessments.
- Discourage the collection of wild seed stock. Processed feeds should be used instead of feeds derived wholly from wild fish and mollusks. Alternatives include lysine-rich yeast, a single-cell source of protein that is used widely in China and other countries.

- Carefully evaluate the transfer of species used for aquaculture between river basins, countries, and regions with regard to impacts on other indigenous aquatic species, habitats, and genetics, as well as to the inadvertent transmission of disease.
- Implement provisions for monitoring and testing water quality and, if necessary, prepare the relevant water and product standards and develop human capacity in this field.
- Use ecolabels and certification systems, particularly to develop export markets.

6. The experience of “genetic dilution/degradation” through inbreeding and hybridization in China and most other major aquaculture countries demonstrates that public support for breeding programs may be advisable in any country with major aquaculture investments. Support may include conventional genetic improvement techniques, such as selective breeding, or support for advanced biotechnologies such as transgenics. The World Bank provides support to WorldFish Center, a CGIAR member, whose program on Genetically Improved Farmed Tilapia (GIFT) and development of international protocols for GIFT product dissemination is an example of the types of biotechnology investments that merit future support.

Selected Readings

Asterisk (*) at the end of a reference indicates that it is available on the Web. See Appendix 1 for a full list of Websites.

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This investment note was prepared by the Sourcebook team, based on a World Bank Agriculture Technology Note, "Sustainable Aquaculture," with inputs from Ronald Zweig and the Sustainable Agriculture (SASKI) Thematic Team of the World Bank.

Bangladesh: Listening to the Voice of the Poor

Bangladesh depends on fisheries for 67 percent of animal protein intake, 13 percent of protein supplies, and 5 percent of export earnings. The nation fits well into the World Bank's development strategy of increased fish production with particular emphasis on poverty alleviation and on export potential for the fisheries sector.

What's innovative? Embracing participatory governance, enhancing voice of the poor, and improving nonmaterial dimensions of well being, including security, power, and social inclusion.

Project Objectives and Description

The objective of the Fourth Fisheries Project was to support sustainable growth in (and equitable distribution of the benefits generated from) increased fish and shrimp production for domestic consumption and exports. The project components called for:

- Community-based management of inland open-water fisheries.
- Development and management of coastal shrimp aquaculture.
- Freshwater aquaculture extension and training, including the supply of transport.
- Support for managing and mainstreaming biodiversity aspects of the project, as well as for assessing sustainability of aquatic ecosystems and exotic species.
- Institutional support, including technical assistance to prepare a national fisheries strategy, training, civil works, and/or equipment as needed.

Bangladesh has vast inland open-water fisheries resources. Changes in land use and a growing population have increased the pressure on fisheries resources. The abundance of some species (particularly of the valuable migratory carps) has been seriously affected, and the availability of more resilient floodplain fish species may even be at risk. The Government of Bangladesh (GOB) addressed these issues through a strategy that includes conserving aquatic resources, shifting priorities in management from revenue generation to biological conservation and sustainability, increasing production by involving beneficiaries in management and stock enhancement, and rehabilitating degraded habitats.

Unplanned shrimp farming development has led to a degradation of agricultural land and negatively affected the livelihoods of local people. The expansion of shrimp farming has raised conflicts between rice farmers and those involved in shrimp farming. The project identified that conflict resolution was essential for the industry to grow sustainably.

Benefits and Impacts

Although the impacts of the project have not been assessed fully, benefits include:

- 60 percent of targeted inland water-bodies (31) have fully functioning Fisheries Management Committees, effectively representing the interests of fishers. Fish production from these bodies of water has increased by 17-73 percent.

- Coastal shrimp aquaculture production is likely to increase by about 20 percent.
- Aquaculture production has increased by about 50 percent among target beneficiaries of 200,000 persons.
- A National Fisheries Strategy has been approved by the government for implementation.

A review has indicated that the poverty impact of the project remains unclear and that the aquaculture component encountered difficulty in targeting the poor, although the project target figure of 200,000 beneficiaries was reached.

Lessons Learned and Issues for Wider Applicability

Although the project achieved its purpose in terms of production increases, it is doubtful whether it will contribute to sustained poverty alleviation. Flaws in project design and operation meant that the project engaged wealthier members of the population and focused on aquaculture, for which access to appropriate water and other resources was a problem for the poor. The key lesson is that where poverty alleviation is the primary focus, aquaculture and fisheries management (including access control) may not always be the most appropriate entry points. Other lessons and suggestions include:

- In participatory management, it takes time to get the implementing partnerships right.
- Sufficient resources and time must be allocated to train partners.
- The project has five related but very different components. It is questionable whether they should have been implemented as a single project.
- Flexibility to move away from the original project design towards a more innovative approach is vital to success in participatory management.
- It is essential for the project to include sustainable monitoring and evaluation as a priority.

Country	Bangladesh
Project Name	Fourth Fisheries Project
Project ID	P009468
Project Cost	US\$60.8 million (original)
Dates	FY2000- FY2006
Contact Point	S. A. M. Rafiquzzaman The World Bank Office Dhaka, E 32, Agargaon Road, Sher-e-Bangla Nagar, Dhaka 1207 Srafiquzzaman@worldbank.org

China: Integrated Coastal Zone Management for Sustaining Marine Resources

China has a continental coastline of 18,000 kilometers, and its territorial waters cover 4.87 million square kilometers. This vast area is one of the world's largest and most productive sources of aquatic products. In recent years, the output from China's coastal resources has shown dramatic growth. Outputs from marine and freshwater aquaculture and offshore capture fishing have spurred the growth of processing industries and led to substantial foreign exchange earnings. Rapid growth in production has led to new challenges that require urgent attention, including disease outbreaks, declining stocks of some valued species, water pollution, loss of critical habitat and biodiversity, and overexploitation of marine resources.

What's innovative? To address the enormous pressure to exploit China's coastal resources, this project has used advanced technology and methods for environmental monitoring in coastal waters and introduced international seafood handling and processing standards.

Project Objectives and Description

The Sustainable Coastal Resource Development Project (SCRDP) aims to support the government in sustainably developing China's coastal resources, reduce pressure on coastal fisheries resources, and help improve aquatic product quality (which also directly supports the national "Law on Marine Resource Use of the People's Republic of China," passed by the National People's Congress in January 2002). The project has four components:

1. Support the design and implementation of integrated coastal zone management (ICZM) plans in four provinces.
2. Support environmentally sustainable marine aquaculture in shallow waters and tidal flats. This activity involves the production of fish in cages and ponds, oysters, scallops, clams, several species of seaweed, and shrimp in four coastal provinces.
3. Support trials of new methods of shrimp culture.
4. Finance a number of seafood handling operations, including processing and wholesale markets, to improve product quality and safety. This project component should enable companies to meet higher food quality and safety standards demanded by China's main customers in North America and Europe.

During the identification phase, the objective of the project was shifted from a single focus on production (mainly from aquaculture) and primary seafood processing to one centered on sustainability and product quality. The project originally proposed to devote about 50 percent of the investment to constructing and rehabilitating shrimp ponds, 30 percent to expanding eel production, and the remainder to new processing facilities for aquatic products. During the project preparation stage, the team concluded that shrimp pond rehabilitation on a large scale would be too risky, given the uncertainty of new techniques. Similarly, eel farming still depends entirely on the catch of natural fry

(elvers) in the East China Sea, and the declining supply of elvers suggests that this production system is not sustainable. Investment in new aquatic product processing plants was found to have lower priority than upgrading hygienic standards and quality at existing plants. With the full support of local leaders, proposals to build new fish ponds in areas of valuable wildlife habitat were dropped.

Benefits and Impacts

Although the project is still under implementation and its benefits and impacts are not fully assessed, the involvement of the Bank has already stimulated considerable discussion at the local level and between the provinces and participating communities regarding the formulation and implementation of CZM plans. This discussion has not only raised awareness of the importance of CZM but has already yielded substantial commitment to action, including coastal zone planning, integrated marine aquaculture schemes, the implementation of state-of-the-art marine environmental monitoring and disease control systems, initiation of a fishing boat monitoring and surveillance system, establishment of a marine protected area, protection of endangered species, and mangrove restoration.

Lessons Learned and Issues for Wider Applicability

The key lesson learned is that coastal development needs to be placed in the context of integrated coastal zone management where a wide range of interests and economic demands are placed on coastal resources. The experience from China is special mainly because of the extremely intensive use of coastal resources for aquaculture of a wide range of species in addition to other demands for industrial and urban development, tourism, and transport. The project has fostered conservation measures such as control of fishing activities using exclusion zones and closed fishing seasons that have been established and enforced. The project has addressed these issues through promoting and financing a complex network of actions that involve planning, monitoring, and management of marine resource use, while at the same focusing on marine aquaculture development and production needs, including the development of hatcheries, production systems, and processing and marketing facilities. The benefits of this effort have already begun to be realized with regard to aquaculture planning. The full project impact and outcome will be assessed once all of the systems are in full operation.

Country	China
Project Name	Sustainable Coastal Resource Development Project
Project ID	P003539
Project Cost	US\$200 million
Dates	FY1998 –
Contact Point	Nathan M. Belete The World Bank, 9th Floor, Building A, Fuhua Mansion, No. 8, Chaoyangmen Beidajie, Dongcheng District, Beijing 100027, China Telephone 5788+7685; email nbelete@worldbank.org

India: Income Generation through Aquaculture

The fisheries subsector contributes only about 2.4 percent of India's agricultural GDP and less than one percent of total GDP. However, fisheries are instrumental in providing employment to an estimated nine million people, predominantly from poorer coastal communities. Furthermore, fisheries contribute to improved nutritional standards and foreign exchange earnings. The development of fresh and brackish water aquaculture has been necessary for India to continue to meet its growing domestic needs and maintain its position in export markets.

What's innovative? Using technical assistance to build fishing cooperatives and reform regulatory and institutional practices to improve the efficiency and poverty impact of inland fisheries managed by cooperatives of small-scale farmers.

Project Objectives and Description

The overall objective of the Shrimp and Fish Culture Project was to reduce poverty by generating employment from increased shrimp and inland fish production that would tap underutilized inter-tidal areas and inland water bodies. Interventions included:

- A brackish water shrimp component (three states and about 80 percent of project costs).
- An inland fisheries component (four states and about 8 percent of project costs).
- Project management, including environmental management and training (about 12 percent of project costs).

In the past, almost all shrimp culture was based on a traditional, extensive shrimp culture system, with ponds frequently used for paddy cultivation in the rainy season and converted to shrimp and fish culture the rest of the year. As a result, shrimp yields were low (average below 300 kilograms per hectare), reflecting poor infrastructure, low density of stocking, inadequate water exchange, lack of feed, and the low level of technology. The project's shrimp component supported the first attempt to introduce technologically advanced, semi-intensive shrimp culture.

For shrimp aquaculture, the project brought together entrepreneurs to work with beneficiaries from the weakest socioeconomic sections of the community (with a ratio of three entrepreneurs to seven beneficiaries). Pond site and infrastructure development accounted for 73 percent of total project costs and involved development costs of about US\$11,000 per hectare. Close coordination between shrimp production, hatcheries, and feed suppliers was important. Other activities financed include credit for private entrepreneurs to establish support infrastructure and services (hatcheries, nurseries, feed mills, ice plants, and individual quick freezing machinery) and initial working capital for poor farmers to stock ponds and purchase feed. The participating state governments constructed basic infrastructure and common facilities on state-owned land and recovered costs through lease charges.

For the fishery component, although individual ponds are owned by individual

beneficiaries, the inter-linkages in the system required coordinated management through an association of pond owners. Technical assistance and training to promote development of fish cooperatives was an important aspect of the project. Some of the ponds were leased to private firms to provide opportunities for improved technology access and transfer to community farmers. High investment needs, the ongoing need for intense management and coordinated decision making, and high risk aversion of poor farmers made the system complex and required the project to focus on developing solutions for these problems. The impact of project interventions (stocking, feeding, improved practices for pond management, and phased catching) on pond-owners' incomes was huge.

Overall, the project focused on: reform and capacity building of cooperatives; reform of regulations and lease and management practices; strengthening of the cooperative position with respect to large-scale contractors and downstream water user associations; increasing cooperative members' knowledge of the ecosystem and the natural cycle of species and catch management; and capacity building for increased market orientation.

Benefits and Impacts

For the inland fish project component, specific impacts included:

- The fish catch increased by up to 250 percent.
- In Bihar, Andhra Pradesh, and Orissa, approximately 15,000 members of the 118 project-assisted cooperatives are engaged in rearing fingerlings and marketing fish.
- Cooperative membership expanded to include women.
- Per capita income of fishermen rose by Rs6,000-13,250.

Experience with the shrimp component of the project was somewhat different. Following the mid-term review, the number of shrimp farm sites was reduced to 6 from 13, largely because detailed technical surveys revealed that some proposed sites were impractical and because private sector developments overtook project developments. Subsequently support services to infrastructure (shrimp hatcheries, ice plants, and feed mills) were reduced. The reduction reflected low demand resulting from a lower number of project-assisted shrimp production farms, and private sector investment in infrastructure and service provision, which reduced the need for project investment.

Lessons Learned and Issues for Wider Applicability

The project highlighted the potential for community-based, semi-intensive shrimp culture. However, the technology- and investment-intensive nature of the farms, the complexities of management at the group level by risk-averse farmers, resource linkages between farms and consequent environmental impacts, and the need for effective supply chains for an efficient industry, pointed to the need for follow-on work at an industry and watershed level to develop the sector. Project impact is enhanced by:

- Maximizing participation of the poor through clear selection processes and detailed information.
- Providing in-service training to fisheries extension officers, especially in the areas of

- physical planning, optimizing fish production, marketing, and business management.
- Initiating accurate monitoring of fish/shrimp yields, and feeding this information back into planning to ensure fair rental charges by state governments.

Aquaculture systems need to be guided by appropriate policies embedded in a functioning regulatory framework. Aquaculture development must be accompanied by support from institutions capable of addressing collateral problems, such as displacement of fishers and health and sanitation problems. A similar approach could be replicated in other freshwater and inter-tidal areas, though additional work would be required to refine the program model for use in other situations.

Country	India
Project Name	Shrimp and Fish Culture Project
Project ID	P009921
Project Cost	US\$41.3 million
Dates	FY1992 – FY2001
Contact Point	Harideep Singh The World Bank, 1818 H Street NW, Washington, D.C. 20433 Telephone (202) 458-1380; email hsingh4@worldbank.org

Indonesia: Community-based Coral Reef Management

Indonesia has more than 17,000 islands, an 81,000 kilometer coastline, and approximately 51,000 square kilometers of coral reefs—17 percent of the world's total. Healthy coral reef ecosystems can annually produce marine products worth an average of US\$15,000 per square kilometer and are an important source of food and livelihoods for roughly 9,969 coastal villages across the country, many of them poor. Despite their importance, Indonesia's coral reefs are under serious threat from poison and blast fishing, overfishing, sedimentation, and pollution.

What's innovative? Empowering communities to make decisions and improve their ability to manage and monitor coral reefs.

Project Objectives and Description

Indonesian coastal communities that depend on fishing for their livelihoods often use destructive methods like cyanide and explosives to catch fish. These practices ultimately destroy the reefs that are essential habitats for marine life. As a consequence, prospects for future income from fishing are diminishing.

The Coral Reef Rehabilitation and Management Program I (COREMAP I) aimed to foster more environmentally friendly fishing practices to preserve the reefs and sustain fish populations. The program placed communities at the center of coral reef management, providing them with legal rights to manage the use of the reefs with local governments. The overall objective of COREMAP I was to establish viable, operational, and institutionalized coral reef management systems in priority coral reef sites in Indonesia. Interventions included:

- Developing a national policy and strategy for coral reef management, including a stronger legal framework.
- Conducting a public awareness campaign.
- Strengthening monitoring, control, and surveillance (MCS).
- Piloting community-based management (CBM) in two sites.

Key to success was the Indonesian government's decision to have the reefs managed jointly by local government authorities and communities, a management process that is now becoming law. The program supported the government's decision to designate the newly created Ministry for Marine Affairs and Fisheries (MMAF) as the agency responsible for management of coral reef resources. The program supported the MMAF in establishing a Directorate General for Coasts and Small Islands which was directly responsible for coral reef ecosystems, and it trained many of the staff that would work in this new Directorate. COREMAP I also created and improved the institutional framework needed to implement the program, including the national Project Management Office, the district Pokjas, and the village community groups.

The program also financed about one-third of the cost to the MCS. Pilot community-based management plans in two sites have been designed and tested, establishing the

framework for COREMAP II to develop potentially sustainable, cooperative, or “comanagement” partnerships between communities and local governments.

The program is now in the second of a three-level adoptable program loan. COREMAP II is cofinanced by a US\$33.2 million loan, a US\$23 million interest-free credit, and a US\$7.5 million grant from the GEF.

Benefits and Impacts

Compliance rates (numbers of patrol days without violation/total patrol days) increased by 10 percent in pilot sites following introduction of the MCS system. According to the Independent Evaluation, “a very high level of community involvement in coral reef resource management was achieved in a few pilot areas, resulting in a significant reduction in illegal and destructive fishing and coral mining in most of the pilot sites by more than 50 percent.”

Awareness campaigns also seemed to have had a positive impact on fishers’ behavior; 39 percent of fishers with low to medium exposure to COREMAP reported using reef-friendly fishing gear, compared to 46 percent with a high exposure to the COREMAP.

Lessons Learned and Issues for Wider Applicability

COREMAP I represents the first time any developing country has initiated a program of such scale to target the sustainable management of coral reefs and associated ecosystems. For this reason, it was designed to *test* approaches in several pilot sites, to generate lessons that could inform the design of interventions in an expanded number of priority coral reef sites in COREMAP II and III. In particular, the independent evaluation of COREMAP I suggested that coral reef ecosystem management activities supported by the COREMAP program should take a greater development focus, placing community needs (rather than approaches entirely devoted to conservation) at the center of coral reef ecosystem management.

In addition to these lessons, significant institutional developments have taken place in Indonesia over the course of COMEMAP I. Decentralization has created an opportunity to adapt the approach for coral reef ecosystem management in COREMAP II, placing greater emphasis on local government implementation and community responsibility than was originally envisaged at the outset of the Adaptable Program Loan (APL). As a result, the national strategic framework for coral reef management in Indonesia is one of collaborative management or comanagement, in which communities are legally empowered to collaborate with local governments to sustainably manage coral reefs and associated ecosystems upon which they depend for their livelihood. It was also noted that the investments in MCS were too costly, and in particular the operational costs were almost impossible to sustain after program termination. For this reason, COREMAP II is based on a much more scaled-down and cost-effective community-based MCS.

Key lessons learned include:

- Communities should be placed at the center of coral reef ecosystem management.
- Coral reef ecosystem management is most likely to be sustainable when local governments form partnerships with coastal communities (example: collaborative management).
- Collaborative coral reef ecosystem management is a process and must be implemented as such, rather than in a compartmentalized or fragmented approach focused on individual components.
- As a result of the 1999 laws supporting decentralization, district governments should be charged with program implementation, with coordination and support from the national government.

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