

Chapter 4: Management of Capture Fisheries

116. In 2000, Bangladesh's fisheries sector contributed some US\$1.5 billion to the country's GDP, amounting to about 4% of the total⁷³, and the seafood export sector is now the country's second largest source of foreign exchange. Bangladesh's inland and coastal/marine capture fisheries represent a safety net for the economic and nutritional needs of many of the rural poor. Four out of five rural Bangladeshis, amounting to as many as 85 million people, are dependent to some extent on aquatic resources. It is estimated that over one million people fish full time and another 11 million fish professionally on a part-time basis, with the fisheries sector providing employment for 9% of the country's labor force. In terms of nutrition, Bangladesh's aquatic resources, from both capture fisheries and aquaculture, are reported to meet more than 65% of the country's animal protein needs (twice the regional average and the seventh highest in the world), and are a critical source of essential minerals, vitamins and fatty acids.

117. The fate of Bangladesh's capture fisheries is inextricably tied to the condition of the nation's wetlands. Recent economic studies⁷⁴ indicate that wetlands have almost twice the economic output of rice crops, exceeding Tk. 35,000/ha/year, with the largest share of their direct benefits going to poor people in rural communities. In addition, wetlands provide a variety of indirect environmental services in the form of flood control, ground water recharge and pollution abatement. Any strategy that addresses poverty alleviation in rural Bangladesh must take these fisheries and aquatic resources into account.

I. The State of Capture Fisheries

118. In the past decade a wide range of changes affecting fisheries have taken place, including very large increases in fish production from all forms of pond aquaculture, declines in most capture fisheries, encroachment and degradation of natural assets, rapid urbanization, infrastructure investments that have negatively impacted fisheries, and increased pollution. A major constraint to fish production is reduced dry season surface water flows in the Ganges and other rivers, related to the operation of the Farakka Barrage, unregulated water extraction for irrigation, and the impacts of a large number of Flood Control, Drainage and Irrigation (FCDI) projects.

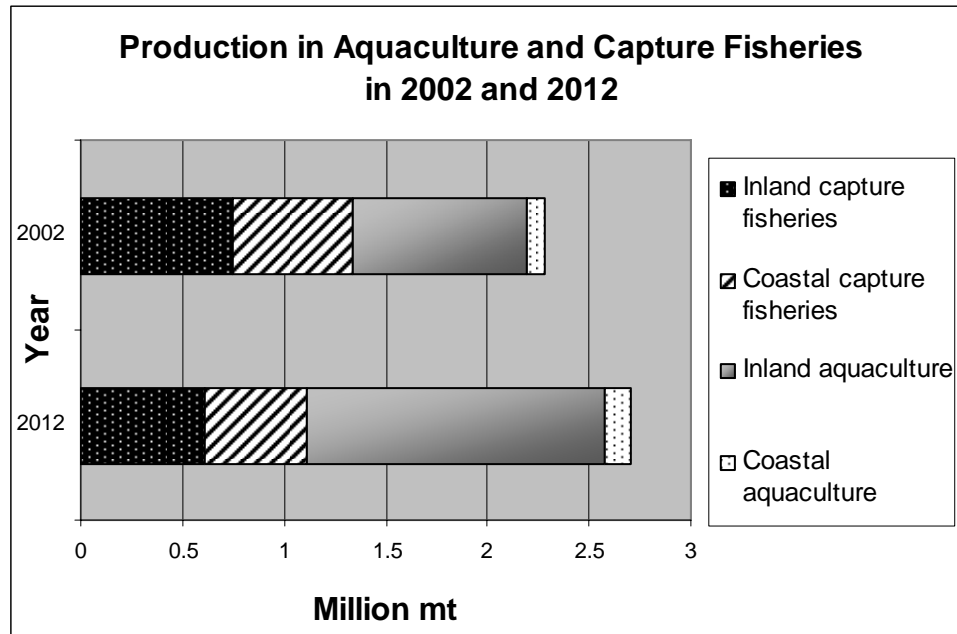
119. Figure 4.1 represents a consensus of opinion on production projections by fisheries sub-sector, based on the 2003 Fisheries Sector Review and Future Development (FSRFD) study. These data are projections from the Household Expenditure Survey (BBS) and also use aspects of Fisheries Resources Survey Service (FRSS) and other Department of Fisheries (DoF) data. It is generally agreed that both freshwater and brackish-water aquaculture will continue to grow at about 5.6% and 3.2% per year respectively, which is slower than the 20% per annum reported in the past decade. There is also a general consensus among most authorities that the capture fisheries, both inland and coastal/marine, are in decline, at rates of about 2.1% and 1.6% per year, respectively. There is not unanimous agreement with this statement, however, particularly regarding declines in the marine sector, and there is some evidence that deep water offshore stocks do offer some opportunities for the industrial

⁷³ FSRFD, 2003

⁷⁴ MACH Project, Hail *Haor* Resource Valuation; DANIDA, MAEP and GNAEP Wetlands Study; BCAS-ICLARM Livelihoods Study; Munir, A, 2004

trawler fleet. Nevertheless, data from the Household Expenditure Survey and surveys by the Fourth Fisheries Project (FFP), as well as opinions of fishers themselves, indicate overall declines in coastal and some marine stocks.

Figure 4.1: Fisheries Production by Major Sub-Sector ⁷⁵



120. As with all biological systems, recovery is possible if political will combines with good management. By late 2004 a remarkable recovery of Hilsa was seen, most likely as a result of Government management activities (see Box 4.1). There is still a fear, however, that some of the fisheries, namely the inland major carps, Indian Salmon and other coastal inshore fisheries, may be in danger of collapse.⁷⁶ The consequences of a collapse of the sort seen in the North Atlantic cod fishery would impact every citizen of the country, particularly the poor.

The Inland Capture Fishery: a Resource under Threat

121. Almost all authorities agree that production in the inland capture fishery has declined, given the continuing losses of floodplain habitat due to agriculture and urbanization, lost connections along critical fish migration pathways, significant reductions in dry season riverine flows, over-fishing, and rapidly increasing industrial, human and agricultural pollution. The IUCN Red Book for Bangladesh suggests that almost 30% of all inland fish species for which data is available are in some danger of extinction. The Red Book⁷⁷ reports that 54 inland and estuarine fish species out of a total of 266 present in Bangladesh are endangered.

⁷⁵ MoFL, 2003
⁷⁶ Fourth Fisheries Project. 2004
⁷⁷ IUCN. 2000

Box 4.1: Saving the Hilsa – Showing it Can be Done

Hilsa remains the most important fish in the capture fisheries, and is the national fish of Bangladesh. In the years 1999-2002 the hilsa fishery showed precipitous declines of as much as 60%. These were likely, in the long term, to have resulted in the collapse of this fishery. In 2004, however, a series of management steps based on recommendations of the DoF/FFP-GEF have contributed to a very notable recovery. This may be one of the first times in Bangladesh that a nationwide effort has led, at least temporarily, to a reversal in the decline of a natural resource.

From the point of view of the hilsa fishery this was a remarkable effort by Government, and a clear success of the DoF, the project and the individuals involved. This effort should be seen as an important first step in what should become a long-term national effort. This combined national effort was an *ad hoc* endeavor responding to an important national issue, combining a number of key elements:

- *Awareness* - national concern and wide agreement that an important resource was declining;
- *Sound science* - a concerned Department and Ministry with an understanding of the problem and an action plan based on sound science;
- *Political will* – political representatives willing and able to provide the political support necessary;
- *Inter-ministerial cooperation* - brought about by that political will; and,
- *Implementation of the management plan* - developed by the relevant government Department.

Source: Based on information collected by the DoF/World Bank funded GEF component of the Fourth Fisheries Project

122. Production from the eight million hectares of seasonal flood-lands is by far the most important component of the inland fishery, which includes floodplains, *beels* and rivers. As monsoon water annually spreads across the floodplain, nutrients are released and primary production explodes over a very wide area. So long as adequate recruitment is present, there follows tremendous fisheries production. Studies in Bangladesh and throughout Asia suggest that this production could be as high as 300-400kg/ha in high quality floodplains. Production is dependent on a number of factors including the extent, duration and seasonality of flooding, as well as the hydrology of individual water bodies.

123. The dry season represents the most critical season for all species of fish and the greatest impacts occur at this time, when populations are at their lowest levels, fishery habitats are limited, predation is at a peak, and growth is slowed. Competition for food is keen and pressure by fishermen remains high. Reductions, for whatever reason, in dry season aquatic habitat have the potential to reduce parent stocks to below replaceable levels. Basic minimum stream flow requirements are necessary to maintain healthy fish populations and to ensure that sufficient parent stock are available for re-population of the floodplain fishery during the next wet season. Perennial wetlands and minimal riverine flows along with sufficient parent stock are the key to fish production in Bangladesh.

The Shifting Species Composition of the Inland Capture Fishery

124. The major species group (66%) caught in the *beels* and floodplains are now a wide variety of mostly small fish, mainly comprising grazers and detritus feeders, small predators, and small “pelagic” plankton feeders. Carp, including major carps, large catfish and large fish in general, have greatly declined in abundance, but together may still comprise around 11% of the catch. Smaller Koi (climbing perch), snakeheads, other catfish and other *beel* resident species with the ability to tolerate low oxygen levels, comprise a significant proportion of the catch, together around 18%.

125. Overall 40-70 species are typically caught in most *beel*/floodplain systems. However, 5-7 species will typically contribute 60-80% of the catch. Dominant species (commonly more than 10% of the catch) in the floodplain catch are small prawns (mainly *Macrobrachium* spp), *Puntius sophore* and other *Puntius* species, small *Channa*, *Colisa fasciatus*, *Aorichthys seenghala* and *Heteropneustes fossilis*, and a few other fast breeding small species. Prices for all non-aquaculture species including the smallest fish have risen substantially in recent years.

126. There appears to have been a significant shift from larger fish and fish species to smaller fish and prawns. This is probably related to:

- Restriction of breeding migrations for all migratory species;
- Loss of dry season habitats most suitable to the species and the loss of connections for estuarine and riverine species that utilize the seasonal floodplains as breeding and nursery areas;
- Greater susceptibility of larger species to over-fishing (of spawn and adult); and,
- Greater resilience of smaller rapidly reproducing species to over-fishing and to losses of dry season habitat.

In some of the smaller *beels* and enclosed floodplain areas stocking takes place, and in these systems the proportion of major carps, silver carp, common carp and grass carp is significant. Most of the *baors* (oxbow lakes) in the Jessore area are stocked, and the catch composition reflects this, with 40-60% exotic carps, 8-13% major carps, and 29-42% other.

127. The river catch was in the past dominated in terms of both value and production by the migratory hilsa (*Tenualosa ilisha*). The Farraka Barrage in India coupled with heavy fishing of juvenile stocks has resulted in the disappearance of riverine hilsa. Until the 1970's almost all the hilsa consumed came from the rivers, but now most of the catch comes from the Bay of Bengal. However, the *jatka* or juvenile hilsa catch still occurs in the lower reaches of the Meghna and other rivers which serve as nursery areas for 5-7 months. Prawns, mostly small, are probably the second most important group, contributing 10-15% of the catch. Other important species are *Macrobrachium* spp., *Clupisoma garua*, *Pangasius pangasius*, *Puntius sophore*, *Glossogobius giurus*, *Aorichthys seenghala*, *Labeo rohita*, *Catla catla*, *Wallagu attu* and *Mystus cavasius*. In practice a wide variety of other species are caught, with around 35 species each contributing more than 1% to the catch.

Open Water Stocking: Ambiguous Impacts

128. Open water stocking in Bangladesh is the result of the success of the World Bank supported Second Fisheries Project, also known as the *Baor* Program in the mid-1980's. This program showed that yields as high as 1,000 kg/ha could be obtained with intensive stocking of native and exotic carps in the semi-closed *baor* areas. In the early 1990's the Third Fisheries Project (also supported by the World Bank) and the Second Aquaculture Project (supported by the Asian Development Bank) incorporated open water stocking into their strategies. More recently the DoF is supporting private sector initiatives that block off large seasonally flooded areas. Open water stocking continues to be supported by the DoF, a number of development partners, and many national and international NGOs. All have

shown the overall technical feasibility and increased yields of high value carps that result from open water stocking.

129. Controversies have arisen, however, regarding the sustainability and cost recovery of stocking programs, as well as social and biodiversity concerns. Surveys undertaken by the Fourth Fisheries Project⁷⁸ alarmingly show that the Fourth Fisheries Stocking Programs have negative or at best no impact on the livelihoods of the poor. Studies by WorldFish of fishers and other community groups who have undertaken stocking have shown that those directly involved in stocking do benefit, but the impacts on the wider community, including other subsistence users of the resource, are ambiguous.⁷⁹

130. Intuitively, cutting off a water body from the floodplain, other wetlands and rivers, is likely to limit biodiversity in that water body, as well as in surrounding open water areas. Short-term studies undertaken by the DANIDA funded *Baor* Program as well as the GEF component of the Fourth Fisheries Project examined impacts of stocking on fisheries biodiversity. These showed that high stocking rates did negatively impact natural fish stocks and overall biodiversity, while stocking at lower levels did not appear to have an impact. Another system, pioneered in Daudkundi and being promoted by the DoF, calls for shares to be sold to landowners whose lands seasonally flood. Once again, while profitable, issues of access rights of the poor, and impacts on biodiversity, are unknown. What is known is that this system is spreading quickly in a number of areas.

The Need for Management Controls in the Coastal Capture Fishery

131. The marine and coastal capture fishery is a primary source of income and nutrition for over 484,000 households in the coastal region.⁸⁰ Yearly production is in the order of 0.45 – 0.6 million MT. Full-time equivalent employment is thought to be almost 0.2 million. In addition about 0.4 million poor men, women and children are involved in seasonal shrimp larvae collection. As in the case of the inland fishery, much of this work is seasonal with most of the labor provided by the poorest segments of the communities.

132. Unlike the inland fishery there is more of a commercial focus to the coastal and marine fishery. Access to most coastal and marine waters entails the use of a boat and, except for river mouths and estuaries, motorized boats are a requirement. The industrial trawl fishery can exploit deeper water fishery resources up to a depth of 50-200 m, and the prospects for exploiting the deepest waters have not been fully explored.

133. Worldwide, marine fishery resources are in decline, and those in Bangladesh are no different. The majority of opinion from fishers, DoF fisheries professionals and fisheries scientists, is that most inshore stocks are in decline or at best have reached their maximum sustainable yields, and that the peak of coastal and marine production was reached in the late 1990's. This is almost entirely the result of unregulated access and a lack of management controls. While pollution and illegal fishing by foreign trawlers operating in Bangladeshi waters are certainly concerns, over-fishing remains the main issue. Of particular concern has been the hilsa fishery, which accounts for much of the marine catch.

⁷⁸ World Bank, 2003

⁷⁹ P. Thompson, World Fish, Personal Communication

⁸⁰ ICZMP, 2003, Personal Communications

Protecting Coastal Breeding and Nursery Areas

134. Bangladesh's coastal waters hold a wide diversity of fishery resources. The marine environment contains 475 species of finfish and a number of crustacean (shellfish) resources including 36 species of shrimps, and several other traditional and non-traditional fishery items such as cuttlefish, octopus, oysters and mussels. Natural mangrove forests cover almost 600,000 ha primarily associated with the Sundarbans Reserve Forest with another 100,000 ha of planted mangroves, the result of various Government and development partner supported programs.⁸¹ It has been estimated that every hectare of mangrove generates upwards of 450 kg of marine catch. There is a need to identify and protect breeding and nursery areas of commercially important fish and prawns, as has taken place on an ad-hoc basis for the hilsa. Outside of the Sunderbans (see Box 4.2) few effective protected areas exist.

Box 4.2: Fisheries Management in the Sundarbans

The Sunderbans comprise the most important nursery area for the Bay of Bengal fisheries. It has been estimated that every hectare of mangrove generates upwards of 450 kg/ha of marine catch. The continued existence and functionality of the Sunderbans mangrove forest is of critical importance to the entire marine fishery of the Bay of Bengal. Through the Sunderbans Biodiversity Project (SBCP - an MoEF project supported by the ADB) a management regime has been developed and is reported to have been adopted. This represents the first attempt at managing a coastal fishery in Bangladesh.

Management of the Sunderbans reserve forest lies with the Forestry Department, under the auspices of the MoEF. Management practices within the Sunderbans are subject to specific protection orders, which prohibit access to specific areas at specific times of year. Access to the Sunderbans is restricted by a permit system, allocated to specific vessels with a history of having fished in the zone. There are no quota or effort limits set in the policies of the Forest Department. Of recent concern is the precipitous closing of the SBCP, but it is not known how this will impact the management schemes put in place.

II. Impacts of Capture Fisheries Decline

135. Traditionally the inland capture fishery has been Bangladesh's main source of fish for food. This is no longer the case, with change occurring rapidly over the past 25 years. In spite of declines, the inland fisheries continue to play a significant role as a source of nutrition and income for a large proportion of the rural and urban population. Consumption information from the 2000 Household Expenditure Survey of the BBS shows that average fish consumption in the country declined by 12% since 1995, while fish consumption of the poorest 22% of the population has declined by 38%, evidence that lower per capita fish supplies are pushing fish prices beyond the reach of the poorest consumer.

Loss of Wetlands: a Key Resource for the Poor

136. The *beels, boars, haors* and rivers that make up the wetlands in Bangladesh have been undervalued by decision makers and developers, too few of whom are aware of their

⁸¹ For example, the ADB Greenbelt Program

true economic value and the environmental services they provide. It is reported that Bangladesh has lost 50% of its permanent wetland area.⁸²

137. Recent studies from a variety of GOB programs⁸³ show that wetlands and fisheries are of critical importance to Bangladesh's rural poor. The first economic valuation of a Bangladesh wetland took place in Hail Haor, Molvi Bazaar, and indicated that this wetland has an annual output of approximately Tk 30,000⁸⁴ per ha. The study mainly considered physical outputs. It did not include water recharge, pollution abatement, existence or a number of other values as data were not immediately available. This conservative estimate found that almost 50% of the value directly benefited the poor.

138. Apart from fish, the seasonal and permanent wetlands in Bangladesh provide a range of products. These include various food items (plants and animals), medicinal plants, fodder, fuel and building materials, mainly used by the poor. As detailed in FSRFD and DANIDA studies, four out of five rural Bangladeshis, particularly the poor, depend to some extent on aquatic resources. They are increasingly vulnerable to threats to the resource and conflicts over access to resources. With land holdings declining, incomes from rice stagnating, and limited opportunities for other rural income generating activities, increasing pressure is being placed on the remaining wetlands and open fisheries.

139. Surveys conducted by several DoF projects⁸⁵ conclusively show that the poor depend on, and are major beneficiaries of public wetlands for food, income and other purposes.⁸⁶ Data from the MACH wetlands valuation show that as much as 60% of the benefits from a large *haor* in Syhlet flow to the poor. An environmental impact assessment of wetlands in Greater Noakhali⁸⁷ conducted for DANIDA showed that 80-93% of the community utilized those wetlands and that the poorest members of that community derived 15% of their income from harvesting its products. Surveys of highly degraded wetlands in Sherpur District conducted by the SUFER Project⁸⁸ show similar trends with over 80% of wetlands users being among the poorest members of their respective communities.

Quantifying Losses from Capture Fisheries

140. The lack of quality time-series data makes the economic losses in Bangladesh's fisheries difficult to quantify. Overall it is known that during the period 1999-2002 the Hilsa catch declined by as much as 50% from previous levels. It is further known that major declines have occurred in the major and minor carp fisheries since the 1970's. Estimates by a variety of authors suggest that historical declines in the inland fisheries amount to 30%, while the peak of marine capture fishery is known to have occurred in the 1990's. As Table 4.1 indicates, the annual losses for the species shown could be in the order of US\$ 42 million per year. Applying an average economic value for the decline in all capture fishery species of

⁸² While alarming, this compares with the continental US, which has seen the destruction of more than 50% of its wetlands, while California has lost 90% or more, as studied by the University of California at Berkeley, and quoted by Williams, T. 1996

⁸³ The MACH Project, the DANIDA funded AEPs, the World Fish Center CBFM program, the Fourth Fisheries Project and its GEF component

⁸⁴ Colavito, L. et al. 2000

⁸⁵ MACH, DANIDA, SUFER

⁸⁶ Colavito, L, Collis W. J. et al, 2001; IUCN: Wetlands Workshop; DANIDA, 2003.

⁸⁷ Winrock. 2003

⁸⁸ Ahmed, M. 2003 (draft)

US\$2,232 per tonne⁸⁹ to the annual losses shown in Figure 4.1 suggests that the lost production amounts to some \$56 million per year, which probably understates the broader economic losses to fishers and the nation as a whole.

Table 4.1: Estimated Physical and Financial Loss due to Declining Production

Species	Maximum Annual Production 1999-2002 (mt)	Average Annual Production 1999-2002 (mt)	Production 2002 (mt)	Physical Production Loss (mt)		Annual Production Loss (\$)
				Based on Maximum Production (mt)	Based on Average Production (mt)	Based on Average Production (US\$)
Major Carps	9,639	2,780	1,443	8,196	1,337	1,586,271
Other Carps	3,594	1,345	382	3,212	968	984,203
Inland Hilsha	112,408	79,616	62,944	49,464	16,672	39,560,441
Indian Salmon	2,428	1,129	930	1,498	199	675,330
All Species						\$42,806,245

Source: FRSS data

III. Policies and Institutions for Capture Fisheries Management

141. The role of MoFL and DoF as promoters of aquaculture, commercial fishing and other forms of production is clear. They are also the responsible agencies for the regulation of fishing effort and fish quality issues. It is not clear, however, which government agency or group holds primary responsibility for the protection of aquatic habitats (wetlands and coastal habitats), that are the basis for fish production. A number of Ministries including Environment, Water, and Land, and Local Government, hold a variety of mandates in this regard.

MoEF Responsibilities for Aquatic Habitat and Biodiversity Conservation

142. The Ministry of Environment and Forests (MoEF) is responsible for coordination of the Government's Environment Policy of 1992, giving it overall responsibility for national environmental issues. These include environmental pollution control, conservation of wildlife including waterfowl, responsibility for management of the country's various national parks and protected areas, and implementation of the various international environmental treaties to which Bangladesh is a party. Part of the Environment Policy of 1992 calls for protection of freshwater and coastal/marine resources. As a result of these responsibilities, the MoEF, through both the Departments of Forestry and the Environment, is becoming more involved in wetlands and, therefore, fisheries conservation.

⁸⁹ The price of US\$2,232 per tonne is calculated as the weighted average price of the losses shown in Table 4-1. Consistent with the economic analysis conducted for the World Bank-supported Fourth Fisheries Project, the economic value of fish consumed domestically is assumed to be equal to the financial value, as no significant distortions due to taxes or subsidies are involved.

143. The Forest Department (FD) controls the two most important wetlands of the country, the Sunderbans and Tanguar Haor. The MoEF has implemented the only fisheries management scheme in the coastal sector, as a result of the Sunderbans Biodiversity Project's Fisheries Management Program. In Tanguar Haor, the most important freshwater wetland in the country and Bangladesh's second Ramsar site, the MoEF has responsibility for overall management. In addition, through the UNDP-funded Sustainable Environment Management Project (SEMP) the MoEF is overseeing a number of further wetland management schemes.

144. The Department of Environment (DoE) under the MoEF is responsible for protecting overall biodiversity and under the Environmental Conservation Act is able to designate Environmentally Critical Areas (ECA) as areas for environmental protection. The DoE has designated coastal areas, urban lakes and large wetlands as ECAs. This includes Hakaluki Haor, the second most important wetland area in the country and a potential Ramsar site. While having a general responsibility for conservation and the environment, the MoEF does not have a specific mandate in the area of aquatic resource protection. In general, these organizations lack the capacity and the in-house expertise to manage fisheries. However, the DoF, while having expertise in the areas of fisheries management and to a certain extent community management, lacks a background in protected area management.

Leasing of Water Bodies by the Ministry of Land

145. Apart from those areas controlled by the MoEF, the Ministry of Land (MoL) controls 3,773 open water areas (about 1,126,000 ha) and 8,549 closed or semi-closed water bodies (about 14,000 ha). Total revenue from leasing these assets in 1998 was Tk. 127 million.⁹⁰ The major purpose of the lease system remains revenue generation. MoL lease policies have been and remain an area of contention within Government and the NGO community. Leasing rates and methods of awarding leases continue to stir controversy and it has long been recognized that the current lease system is part of the reason for the continued decline of Bangladesh fisheries and wetlands.

146. Determining which Ministry or Department controls the lease process is a highly political issue, and remains subject to discussion, but there is no doubt of the need to add conservation elements to leasing agreements, and to eliminate illegal fishing methods (for example drying, poisoning, and use of illegal gear) for individual leases. In addition, lease agreements could include requirements for small sanctuaries and specific management practices established in conjunction with local government and their communities.

Areas of Institutional Reform: Cross-Sectoral Coordination and Community Participation

147. Complex institutional and governance issues, engaging a mix of formal and informal institutions, public and private, and involving a range of cross-sectoral linkages and areas of responsibility, characterize the fishery sector. Both the recent FSRFD study (2003) and the Bangladesh Biodiversity Strategy and Action Plan (BBSAP, 2004) emphasize the need for improved mechanisms to coordinate management and planning of the broader natural resources and rural development sectors. Both follow the reasoning of the National Strategy for Accelerated Poverty Reduction and the MDGs, which support more cross-sectoral coordination and community participation. Both the FSRFD and the BBSAP recommend

⁹⁰ Islam, M.N., 1999

that high level committees be formed to coordinate inter-institutional relationships and management of natural resources. They suggest that future investment in the sectors be channeled through these committees.

IV. Capture Fisheries: Recommendations and Areas for World Bank Support

148. The recent success of the DoF hilsa management program, and the achievements of a number of other DoF programs such as MACH, CBFM-II and others, point the way forward for management of the inland and coastal/marine capture fisheries. At the national level, development partners should align their priorities with the Government's strategic planning for fisheries, including the draft Inland Capture Fisheries Strategy. Within this strategy, the actions that are needed to reverse the decline of Bangladesh's capture fisheries are reasonably clear, as summarized below.

Protect Dry Season Water Flows

149. The World Bank's Country Water Resources Assistance Strategy for Bangladesh concludes that the availability of dry season water is the most critical issue facing the nation's inland capture fisheries.⁹¹ It is estimated that 50% or more of the perennial wetlands of Bangladesh have been drained, encroached, filled or otherwise lost in the past 30-40 years. This has negatively impacted the poor, fish production, plant and animal biodiversity, as well as a variety of environmental services that wetlands provide. Given the direct connection between the poor and the wetlands of Bangladesh, and in line with the recommendations of the PRSP, there is a need to preserve dry season water. This will entail the conservation of dry season flows in the major rivers, conservation and rehabilitation of perennial wetlands, potentially including some re-excavation, and management of these areas. As part of this effort, capture fishery requirements for dry season flows should be estimated, and the information provided to the Ministry of Water Resources for use in planning and international negotiations. Water quality, as well as quantity, is also important, and pollution from industrial, urban and agricultural sources must be controlled to protect aquatic habitats.

Establish National Sanctuary Systems

150. Designation of protected areas large and small, fresh and salt water, is the first step in ensuring the continued sustainable use of Bangladesh's aquatic resources. In addition to protecting the major breeding and nursery areas through nationally designated sanctuaries, significant benefits would be derived from establishing small sanctuaries as an element of the lease for all water bodies. This would require revision of MoL lease procedures to require conservation elements that include (at a minimum) establishment of small local sanctuaries. Where communities agree, such small sanctuaries should be made permanent through Government recognition.

Develop and Implement Fisheries Management Regulations

151. An important step towards sustainable fisheries management would be the development and implementation of regulations covering gear use, mesh sizes, and closed seasons appropriate for the individual inland and marine areas, based on sound science and

⁹¹ World Bank, 2005

community participation. Such initiatives should aim to limit entry to the fisheries, but protect the access rights of true subsistence fishers. Where appropriate, communities should be encouraged to self-regulate entry. Leasing can be a means to limit access and manage the capture fisheries resource in a biologically sustainable way, but this will require reform of the existing system's emphasis on short-term revenue generation, and a renewed focus on community-based fisheries management. In the marine setting, this process will require boat registration and limits on the entry of new boats into the fishery. To build community support and offset any possible negative social or economic consequences, suitable mitigation must be provided to impacted fisher communities. A separate regulatory concern is the need to ensure that impacts on fisheries are more consistently addressed in the environmental assessment of infrastructure that may restrict fish migration, particularly investments in roads, embankments and drainage structures.

Integrated Coastal Resource Management

152. Based on the assessment of continuing decline in marine inshore resources, high poverty incidence in coastal regions, particularly among landless people dependent on the capture fisheries, and the critical need to manage and regulate the artisanal marine capture fisheries, the adoption of an Integrated Coastal Resource Management framework addressing poverty and the long-term viability of the coastal/marine ecosystem is recommended. Strategically, the support should be multi-sectoral and lead to livelihood diversification, reduced pressure on marine inshore resources, devolved and strengthened monitoring and law enforcement capacities, and effective participation of local communities in coastal resource management. This strategy could take place within the framework being developed by the Integrated Coastal Zone Management (ICZM) project.⁹²

Enhance Monitoring of Fisheries

153. Fisheries statistics are at present unreliable. There is significant disagreement over the actual state of the country's fish production and fish biodiversity. Investments and specific management decisions are almost impossible to make without current reliable information. Improving the fisheries database involves spreading the ownership of the data and involving universities, FRI, NGOs, the private sector and others in civil society in the collection and assessment of fisheries information. Catch monitoring must also be improved through a revision of the FRSS, which would entail establishing a separate group within FRSS to monitor the open water catch.

Reducing Barriers to the Import of Fish

154. Maintaining stable prices for the country's most important source of animal protein will also help relieve pressure on capture fisheries. The key to stable prices is increased supplies. There is little or no scope for the further expansion of capture fisheries given the current levels of exploitation. The only internal source where sustainable fish supply increases are possible is aquaculture, mainly from inland ponds, and it is extremely unlikely

⁹² The GOB, Dutch and DFID-funded project works within the Water Resource Planning Organization (WARPO) of the Ministry of Water Resources. At present it does not cover fisheries but aims at laying the foundation for an integrated coastal development process. In consultation with the Government its objectives include the development of the following: (i) Coastal Zone Policy, (ii) Coastal Zone Development Strategy, (iii) Priority Investment Program (PIP) within 2005

that internal production will meet demand. The reduction of import duties and other barriers, particularly on cheaper fish, should be a part of the effort to increase supplies and reduce the intensity of the exploitation of capture fisheries.

Maintaining Assistance for Capture Fisheries

155. Government and development partner assistance have been instrumental in shaping the sector, particularly in the areas of inland aquaculture and to a lesser extent the inland capture fishery. There has been continuous assistance provided over the past three decades by development partners to the Government supporting the expansion of aquaculture and small scale management of inland open water capture fisheries. In this period more than US\$ 350 million has been invested by international organizations.

156. International financial assistance has been allocated in decreasing order of importance to (i) aquaculture (50%), (ii) inland open water fisheries (40%), and (iii) coastal/marine capture fisheries (5%). At present, inland aquaculture continues to be strongly supported by DoF and a variety of development partners. Brackish water (shrimp) aquaculture is rightfully led by the private sector with some support from Government agencies and donors. Earlier support to the inland capture fishery mainly focused on open water stocking but the sub-sector is now receiving more broad-based support from Government and development partners. The coastal and marine capture fisheries have not enjoyed the long-term support that has been provided to aquaculture and the inland capture fisheries. Following the focus of the MDGs and National Strategy for Accelerated Poverty Reduction on pro-poor policies and growth, the key priorities for continued World Bank support to the fisheries sector in the mid- to long-term should be in the areas indicated above.