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Fisheries Subsidies and Marine Resource Management: Lessons from Bangladesh



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Fisheries Subsidies and Marine Resource Management: Lessons from Bangladesh

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United Nations Environment Programme

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Preface

Fish is the primary source of protein for some 950 million people worldwide and represents an important part of the diet of many more. Fisheries are also a source of employment for about 200 millions people directly depending on ocean fishing for their livelihoods. In 2000, about 37 per cent of the world fishery production entered international trade with just over half of fishery exports supplied from developing countries, for certain of whom fishery exports represent a major source of foreign exchange earnings (FAO, 2002).[1]

In recent years, after four decades of steadily expanding catches there have been important declines in fish stocks, especially of preferred species for human consumption such as cod, haddock and plaice. While for the two decades following 1950, fisheries production increased by about 6 per cent per year, trebling from 18 to 56 million tonnes, the average rate of increase declined to 2 per cent between 1970 and 1980, and has fallen to almost zero in the 1990s (WT/CTE/W/167).[2]

Major ecological, economic and social damage is already evident. In particular, declining catches have cost more than 100,000 jobs in the last few years among the world's 15 to 21 million fishers, and the cost of fish in some local marketplaces has risen dramatically, placing fish out-of reach for many low-income consumers (Weber, 1994).[3]

Overfishing of the world's marine resources is the main cause for the decline of fisheries productivity. According to the Food and

[1] FAO (2002), *The State of World Fisheries and Aquaculture(SOFIA)*, FAO Fisheries Department, Rome.

[2] WT/CTE/W/167 (2000), *Environmental Benefits of removing Trade Restrictions and Distortions: the Fisheries Sector*, Note by the Secretariat, WTO Committee on Trade and Environment, 16 October 2000.

[3] Weber Peter, *Net Loss: Fish, Jobs and the Marine Environment, Worldwatch;* 1994.

Agriculture Organization (FAO), 50 per cent of all fishery resources are fully utilized at present, 25 per cent still hold potential to be further exploited, and the remaining 25 per cent are in severe danger of depletion and require major interventions to restore sustainable yields.

Widespread overfishing is widely recognized as a growing threat to the sustainable management of the world's fisheries. In major fishing states, investment in new capacity (vessels, equipment and labour force) has supported fishing efforts at levels significantly exceeding the reproductive capacity of fishery grounds. Excessive government support policies and especially subsidies to the fishing industry are suspected by many experts to have a direct causal relationship to recent trends in overfishing.

However, opinions still differ as to the relative importance of fisheries subsidies as a factor affecting the stability of fisheries resources. More work is required to address the linkages between fisheries subsidies and fisheries resource sustainability to guide progress towards a potential reform of fisheries policies worldwide. Policy reforms should integrate environmental, social, economic, and trade objectives to ensure long-term sustainability of entire fishery ecosystems while minimizing any negative social and economic impacts on segments of the population relying on fishing for employment or food. In particular, more empirical studies at the country-level are needed to define and categorise current forms of government support and to assess their environmental, social and economic effects.

To help meet the need for additional study, UNEP supported this study on trade liberalization and trade related policies, including subsidies, in Bangladesh. Examining the impacts of trade and subsidies on the fishery sector over the last decades, this study provides a detailed assessment of the environmental, and related socio-economic effects, while also providing policy recommendations for sustainable fisheries management. It offers valuable insights to trade and environment officials who want to increase their understanding of the intricate relationship between subsidies and the environment in the fishery sector, and to national policy-makers seeking to promote productive and sustainable fishing industries in their countries.

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Executive Summary

In Bangladesh, the shift towards a more liberal trade policy regime that began in the 1990s has contributed to the expansion of the export sector. During this time, real growth in exports was about 14 per cent, or about three times the average real GDP growth rate. Bangladesh's Export Policy provoked important structural shifts in the country's exports, with respect to both products and markets. The share of non-traditional exports that include readymade garments, frozen foods, shrimp and leather products registered a secular rise compared to traditional exports such as raw jute, jute products, bulk tea and raw leather. The ratio between traditional and non-traditional exports changed from 40:60 to 10:90, between 1991 and 2001.

The export of fishery products such as frozen shrimp, dry fish, salted fish, fish maw, shark-fin, tortoise and turtles is increasingly emerging as a prominent economic activity in Bangladesh, amounting to US$ 360 million in the fiscal year 2000-2001, or 7 per cent of total exports. The total volume of fish produced in Bangladesh is currently around 1.7 million tonnes each year.

The economic potential of the marine fisheries sector in Bangladesh is considered to be enormous in recognition of the country's 710 kilometre coastline and Exclusive Economic Zone, which spreads over an area of 164,000 square kilometres. Marine capture currently accounts for about 20 per cent of the total fish production in Bangladesh. The remaining amount is inland capture and culture fish. The production of marine fish grew at an average annual rate of roughly 3.6 per cent during the 1990s.

The marine fisheries sector is a source of employment and income for a large sector of the population, particularly in rural areas. Estimates suggest that currently 0.9 million people are employed in the sector (GOB, 2001a). The contribution of the fisheries sector to total domestic export earnings is also significant, representing more than 6 per cent.

However, the marine fishery sector is in need of financial and infrastructural assistance. According to both fishermen and fish exporters in Bangladesh, the sector does not receive any special benefit from the government. The only identifiable incentive given to the sector is a value added tax refund from fuel at the rate of 15 per cent per litre, or US$ 0.04, subsequent to the export of fish (based on 1998 diesel prices of taka 12.67 per litre) (GOB, 2001a). However, the sector does enjoy general incentives applied to the export sector as a whole, which include duty-free imports of capital machinery and raw materials, fiscal incentives for export, income tax-rebates, fast customs clearance and subsidized credit.

The link between trade-related policies and the exploitation of fishery resources has not been adequately researched. The present study seeks to address this issue and to identify a set of policy measures geared to promoting the sustainable use of Bangladesh's marine resources. Based on information from both secondary and primary sources a bio-economic model is used to estimate the sustainable economic rent and the share of the identified subsidy proportional to total marine fisheries GDP.

The study has also estimated the sustainable production level in the marine fishery sector applying the Schaefer model based on catch and effort data for the period 1984-1998. The maximum sustainable yield in this model is reached when the annual yield is 642,130 tonnes at an effort of 101,442 horsepower. The estimated catch per unit of effort, or horsepower, is about 6.33 tonnes while economic rent per unit of effort is about taka 205 million (US$ 4.27 million). The catch is estimated to be just under half of the maximum sustainable yield. This finding would imply that the present level of exploitation of the fisheries resources in Bangladesh could be doubled, even when the issue of sustainability is accounted for in estimating the potential limits of exploitation.

Given the criticality of the policy implications that emerge from this conclusion, the interpretation of the analytical results needs to be made with due caution. The analysis had to be based on limited information and suffered from a lack of comprehensive longitudinal data, which

constrains the robustness of the results. Although our findings allude to the possibility of doubling the present level of resource exploitation in marine fisheries, our analysis cannot claim to answer whether increasing subsidies in terms of attaining this enhanced level of production would either be the best or the most effective policy. The level of subsidies, as was pointed out earlier, is not significant when expressed in absolute terms and this level has also not undergone any noticeable change over recent years. Thus it is difficult to establish any causal link between subsidies and the level of production in the context of the Bangladesh fisheries sector.

The study does reveal that the general incentive package initiated under Bangladesh's trade liberalization programme has, until now, not had any detrimental effect on the country's fishing capacity and fishing practices. The findings of the study show that the potential revenue from the marine fisheries sector could be increased. This calls for the implementation of a proper management regime to ensure that the substantial potential within the sector be exploited on a sustainable basis to the benefit of a large segment of the population whose livelihoods are dependent on fisheries production. In achieving this objective, a number of specific measures need to be undertaken. Most importantly, these include:

First, the management information system for the fisheries sector should be improved in order to dynamically assess the state of the sector, and the costs and benefits resulting from adjustments in fishing capacity. The marine data collection and research cell should be strengthened to provide the government with the necessary information to manage and optimize catch from trawl as well as inshore fishing.

Second, the management of the fisheries sector should be informed by an integrated approach that takes into account the economic, environmental and social factors affecting fish supply, fish stock and fishing capacity. For example, prior to any initiative to increase productivity through modernization of the sector, it should first be understood what integrated impacts might result, such as environmental degradation and employment loss.

Third, given the sector's low level of development and lack of any effective guiding mechanism, there is a case for time-limited government support to promote the sector's sustainable management. This could be in the form of developing supportive marine sector infrastructure, such as port and docking facilities, cold storage facilities, or repair and maintenance services. Additionally, in order to avoid overfishing in the long-run Bangladesh should review regularly the state of its fish stocks. Procurement, processing and marketing support programmes for the small and marginal fishermen involved in marine fishing could also help reduce rent-seeking behaviour within the market. The country should also encourage dissemination of improved fishing practices to minimize by-catch, waste and discard. To this end, investment should also be directed to necessary trade-supportive infrastructure.

Fourth, Bangladesh needs to strengthen its monitoring, control and surveillance capacity in its territorial water with a view to stop illegal, unregulated and unreported fishing as these affect sustainability.

Fifth, the sustainable exploitation of fishery resources can only be ensured through close regional cooperation since fisheries resources, in essence, are 'regional commons' among neighbouring countries. The design of a regional strategy to exploit the common marine resources of the Bay of Bengal could be helpful in this regard.

1

Introduction

Among developing countries, Bangladesh has been at the forefront of trade liberalization. Except for Colombia, it has been the fastest country to reduce import tariffs. Trade reforms in Bangladesh have primarily entailed: (*a*) reducing tariff levels; (*b*) narrowing differences among tariffs; (*c*) dismantling import bans; and (*d*) eliminating import-quota restrictions on most items. Average tariff rates fell from 85 per cent in 1991/92 to about 17 per cent in 2000/01, and the number of commodities under quota restrictions shrunk from about 620 to 100. In order to stimulate exports and promote investment in export-oriented activities, the Government of Bangladesh (GOB) has, in recent years, provided a number of fiscal and financial incentives, and has established institu-

tions to implement the incentive schemes and extend trade facilitation services.

In Bangladesh, the shift towards a more liberal trade policy regime that began in the 1990s has contributed to the significant expansion of Bangladesh's export sector. Real growth in exports was roughly 14 per cent in the 1990s, or about three times the average real GDP growth rate. Bangladesh's Export Policy over the past decade has provoked important structural shifts in the country's exports, with respect to both products and markets. The share of non-traditional exports, which include ready-made garments, frozen foods, shrimp and leather products, registered a rise compared with traditional exports such as raw jute, jute products, bulk tea and raw leather. The ratio between traditional and non-traditional exports changed from 40:60 to 10:90, between 1991 and 2001.

The export of fisheries products, which include, among others, frozen shrimp, dry fish, shark-fin, fish maw, crabs, tortoise and turtles, is increasingly emerging as a prominent economic activity in Bangladesh, amounting to US$ 360 million in the fiscal year 2000-2001, or 7 per cent of total exports from the country. The total volume of fish produced in Bangladesh is currently around 1.7 million tonnes each year.

Marine capture fisheries currently account for about 20 per cent of the total fish production in Bangladesh. The remaining amount is inland capture and culture fisheries. Marine fish production grew at an average annual rate of about 3.6 per cent during the 1990s.

There is a perception prevailing among many observers in Bangladesh that the country's fisheries sector is being overexploited. Tsai and Ali (1987) noted that major carp stocks in deep depressions were severely depleted by overfishing. Based on field level surveys of fishing practices in a depression named *Halir Haor* in the northeastern district of Sylhet, Heady et. al. (1995) found that fish were near over-exploitation. An earlier UNEP study on the environmental impact of trade liberalization policies on the Bangladesh shrimp farming industry by the

authors of the present report revealed that shrimp fisheries exhibit a considerable amount of income, not withstanding negative environmental impacts inflicted upon land, livestock, human health and mangrove forests. The study also indicated that environmental costs could be internalized through sustainable management of the sector using market-based economic instruments as well as regulatory measures (UNEP, 1999). In the case of marine fisheries, however, conclusive evidence is limited to support claims of overexploitation.

The link between trade-related policies and fluctuations in fish stocks has also not been adequately researched. The heightened global debate on trade-induced environmental consequences of fishery subsidies and the WTO mandate to 'clarify' subsidy disciplines applied to fisheries has provided an added dimension to this issue. As Bangladesh seeks to promote the export of its marine fishery products in the coming years, it is pertinent for the country to assess whether its efforts comply with current obligations under WTO agreements and various multilateral environmental agreements (MEAs).

An evaluation of the implications of various trade-related policies on the marine fisheries sector is therefore of practical interest to Bangladesh. In this context the present study seeks to address the attendant issues and to identify a set of policy measures geared to promoting the sustainable use of Bangladesh's marine resources as well as sustaining the livelihoods of the poorer sections of the country, which are intimately bound to developments in the sector.

2

Design of the Study

The scope of the study is to review Bangladesh's existing trade and trade related policies in the marine fisheries sector as well as their impacts, while also assessing the state of the marine fisheries sector in Bangladesh in quantitative terms. A bio-economic model based on that developed by Schaefer (1954; 1957) is used to estimate sustainable economic rent and the share of the subsidy in total marine fisheries GDP. On the basis of these results, the study presents a series of practical policy proposals to promote the sustainable management of fisheries in Bangladesh.

The study includes a discussion on the policy evolution, the intervening factors and the consequences of trade liberalization on marine fisheries in Bangladesh. Section III presents a review of certain impor-

tant studies on the relationship between trade policies and overfishing, country experiences and concerns of developing countries. The profile of the marine fisheries sector in Bangladesh and the trade policy framework within which it is situated are discussed in Section IV. Section V provides an analytical insight into the state of the marine fishery in Bangladesh relative to the sustainable yield and the effort level that is required. Finally, Section VI proposes a set of policy recommendations to ensure the sustainable management of marine fisheries resources in Bangladesh.

The study followed a participatory approach whereby in the course of research, information and data were collected from a broad cross-section of stakeholders. A detailed discussion of the stakeholder process including the list of stakeholders is given in Annexure A.1.

Four sites were visited along the Chittagong coast: Fishery Ghat, Majheer Ghat, Sadar Ghat and Patenga beach. In addition, researchers from the Centre for Policy Dialogue (CPD) visited Apex foods (one of the leading exporters of frozen foods in Bangladesh), the Director of the Department of Fisheries, and the Chittagong Chamber of Commerce and Industries (CCCI). Furthermore, consultations took place with policy-makers and officials from the Ministry of Fisheries, the Department of Fisheries, leaders of trade bodies, the Bangladesh Marine Fisheries Association, and the Bangladesh Frozen Food Exporters Association. Secondary data were collected from published government documents of the relevant ministries and departments, in addition to other sources. The dearth of adequate information from the secondary sources led the study to rely, to a large measure, on primary sources.

3

An Overview of the Issues and Concerns of Developing Countries

3.1 Overview of the Issues

Subsidies to activities that lead to the exploitation of natural resources play a significant role in resource allocation. They distort the market by reducing the private costs of production, while increasing the associated social and environmental costs. This results in excessive consumption and exploitation of natural resources and leads to environmental degradation.

Various studies have confirmed that global fishing stocks tend to suffer from depletion or near-depletion due to market distortions and lack of proper management systems. Concerns about the unsustainability of fishing have led experts and policymakers to investigate the causal factors that stimulate and promote such outcomes. It is recognised that excessive fishing capacity is one of the major problems responsible for overexploitation of fishery resources (FAO, 1999). It is furthermore felt that over-capacity and over-fishing in the fisheries sector is a result of subsidies. The belief is that in an open-access fishery, subsidies targeted to increase revenue or reduce costs increase the marginal profit at each level of fishing effort, and thus lead to an increase in overall fishing effort.

Studies on the impact of trade liberalization and trade related policies on the fisheries sector covering a number of countries reveal that there is a positive link between subsidies and over-fishing. Box 3.1 presents results of some country studies that bear out this conclusion.

This issue of fishery subsidies received heightened attention in international forums, including the Fourth WTO Ministerial meeting held in November 2001 in Doha. The topic forms a part of the negotiations mandated under paragraph 28 of the Doha Ministerial Declaration regarding the Agreement on Implementation of Article VI of the GATT 1994 and the Agreement on Subsidies and Countervailing Measures. Member countries are urged "to clarify and improve the existing WTO disciplines on fisheries subsidies, taking into account the importance of this sector to developing countries." The issue of fisheries subsidies has also been cross-referenced in the work programme relating to "Trade and Environment" (WTO Doha Ministerial Declaration, 2001).

The definition of the term "subsidy" remains under debate. To address this particular concern, the need for defining a list of "Sustainability Criteria" applicable to fishery subsidies has been repeatedly underscored. An FAO expert consultation on economic incentives and responsible fisheries concluded that subsidies do not always contribute to resource depletion, and the effects of subsidies will depend on the extent to which fishing effort is controlled (FAO, 2000). Thus, the effects

Box 3.1

Summary of Findings from Country Studies

Country	*Study*	*Types of Subsidies examined*	*Findings/Impact*
Canada	UNEP(1998) OECD (1995) Schrank (1997)	• Subsidies for vessel construction and modernization through grants and low-market loans or loan guarantees during 1954 and 1968. • Subsidies for vessel construction and improvement through grants and low-market loans or loan guarantees in the late 1970s -through 1980s.	• Increase of offshore fleet capacity; over capitalization of fleet in 1970 • Catching power increased by five times; collapse of cod stocks.
EC and member states	Holden (1994)	Grants for modernization of fleets between 1970 and 1987 provided.	Drastic decline in population of major commercial fish species in European water.
USA	Milazzo (1998) UNEP (1998)	Low-interest loans and loan guarantees in the 1980s to help the United States' fishing industry finance the construction of a large fleet of factory trawlers for the Alaska Pollak fishery of the Eastern Bering Sea, Aleutian Islands and the Gulf of Alaska.	Fleet capacity increased by four times more than the sustainable capacity. Only the closure of the fishery in those areas for most of the year prevented the collapse of the fishery.
Japan	OECD (2000)	Decommissioning programme for vessel withdrawal in 1990-91.	Reduced the number of vessels in fleet by 22 per cent, but replaced with new and more powerful ones.
Taiwan	Chuang and Zhang (1999)	License back programme after 1990.	Number and tonnage of vessels decreased; total engine power continued to increase.
Norway	OECD (2000)	Support for the fishing industry in the late 1970s and early 1980s in forms of loans and grants were followed by subsidies for withdrawal of capacity.	Decline in fish catches; increase in the number of vessels, fisheries and fleet engine power.

Country	*Study*	*Types of Subsidies examined*	*Findings/Impact*
Argentina	UNEP(2001)	Fuel tax subsidies, environmental subsidies, export promotion, etc.	Increase in production, export, employment, income etc., but also led to decline in fisheries biomass, increase in operation cost, corruption, overcapitalization, etc.
Senegal	UNEP(2001)	• During 1970s: Govt. policy to promote industrial fishing through subsidies such as aid for boat construction • During 1980s: Export subsidies, fisheries agreement with EU, devaluation programme, etc. • At present: Fuel subsidies, export subsidies, tax reduction on equipment, support of trade, fishing agreements, assistance to small-scale processing, etc.	• Extension of vessel capacity, migration of small-scale fishermen, etc. • Consequences in terms of fisheries sustainability are ambiguous. • Maximum growth in small-scale fishing. • Unprecedented growth in landings, technological effects, imbalance between domestic and export market, etc.

of any particular subsidy on the level of exploitation of fisheries resources depend on a number of criteria, including management systems and the level of exploitation in fishing waters.

3.2 Concerns of Developing Countries

A number of developing countries have experienced substantial overcapacity in their national fleets for many years (UNEP, 1998). It has been argued that if these countries are exempted from subsidy disciplines, the fisheries sector may become unsustainable in the medium to long-term in a number of developing countries.

The abovementioned study argues that a clear distinction should be made between over-exploited and under-exploited fisheries and subsi-

dies. A continuation of subsidies could take place in the latter case, but be complemented with effective management measures. However, even then, the dynamics of fishing means that there is always a great risk of over-shooting the sustainable target.

4

The Marine Fisheries Sector in Bangladesh and the Trade Policy Framework

4.1 Profile of the Marine Fisheries Sector

Marine harvest fishing still accounts for only a small share of total fish production in Bangladesh. Freshwater fishing contributes more than 80 per cent of production, measured on a value basis, placing Bangladesh third among the world's inland fish producing countries after China and India.

Table 4.1

The Fisheries Sector in Bangladesh: Contribution to GDP (at constant price, 1984-85 =100)

Year	*Marine (million taka)*	*Marine (million US $)*	*Inland (million taka)*	*Inland (million US $)*	*Total (million taka)*
1990	2308	70.11	11591	352.10	13899
1991	2361	66.17	12438	348.60	14799
1992	2435	63.83	13344	349.78	15780
1993	2508	64.08	14637	373.97	17145
1994	2684	67.10	16119	402.98	18803
1995	2696	67.06	17218	428.31	19914
1996	2928	71.69	18698	457.84	21626
1997	3180	74.47	20305	475.53	23485
1998	3446	75.80	22006	484.07	25452

Source: GOB, 2001b.

The economic potential for the marine fisheries sector in Bangladesh is considered enormous in view of the country's 710 kilometre long coastline and Exclusive Economic Zone (EEZ), which spreads over an area of 164,000 square kilometres. Some 475 species of fish and 25 species of shrimp can be found in this area.

Fishing in the marine sector in Bangladesh is generally carried out using mechanized and non-mechanized small boats, the capacity of which ranges between 1 and 40 horsepower. The Ministry of Fisheries and Livestock (MOFL) has quoted a constant number of mechanized (3,317) and non-mechanized (14,014) boats operating between 1987 and 1998. A current calculation by the MOFL (GOB, 2001a) suggests that there are in fact a total of about 21,830 mechanized and 28,707 non-mechanized boats engaged in fishing in the country. In addition, 67 officially approved trawlers are conducting industrial fishing, of which

Table 4.2

Marine Fish Production in Bangladesh

Year	*Total Fish Production (000 tonnes)*	*Growth Amount (000 tonnes)*	*Growth Rate of Total fish Production (%)*	*Marine Fish Production (000 tonnes)*			*Share of Marine Fish in Total Fish Production (%)*
				Industrial	*Artisanal*	*Total*	
1990	896	56.00	6.25	9.00	233	242	27.0
1991	952	69.00	7.25	10.00	236	246	25.8
1992	1,021	69.00	6.76	11.00	239	250	24.5
1993	1,090	82.00	7.52	14.00	245	259	23.9
1994	1,172	85.00	7.25	11.00	253	264	22.6
1995	1,257	103.00	8.19	12.00	257	269	21.4
1996	1,360	104.00	7.65	14.00	261	275	20.2
1997	1,464	88.00	6.01	15.00	258	273	19.2
1998	1,552	103.00	6.64	16.00	294	310	20.0
1999	1,655	103.00	6.64	16.00	317	333	20.1

Source: Unpublished data from the Department of Fisheries, GOB.

48 are engaged in shrimp fishing and the remaining 19 in other forms of fishing (GOB, 2001a).

According to the MOFL, the marine fisheries sector is a source of employment and income for a large number of people, particularly in rural areas. Employment in this sector has increased from 123,562 in 1984 to 916,539 in 1999, implying that the annual growth of employment was 14.3 per cent during 1984-1999 (GOB, 2001a). This growth rate is faster than that of marine fisheries production, which was 3.9 per cent annually between 1984-1999, and indicates that an increasing number of people have found their livelihoods in the sector. The fast employment growth in the sector potentially results from limited employment opportunities in other sectors.

Table 4.3

Total Export of Fish and Percentage Share in Total Export Earning

Year	*Total Export of Fish and Fish-products*				*Percentage of Total Export Earning*
	Quantity (tonnes)	*Growth Rate %*	*Value (taka million)*	*Valu (US $ million)*	
1990	26109	10.61	5266.2	147.59	8.64
1991	22080	-18.25	5243.4	137.44	6.91
1992	26607	17.01	7002.9	178.91	7.57
1993	31835	16.42	9209.6	230.24	9.12
1994	41686	23.63	13069.4	325.10	9.38
1995	38929	-7.08	13409.4	328.34	8.44
1996	41549	6.31	14574.1	341.31	7.75
1997	30158	-37.77	13878.1	305.28	5.93
1998	28477	-5.90	13793.3	287.00	5.41
1999	35134	23.14	17813.2	354.0	6.28

Source: GOB, 2001b.

Presently, the contribution of the fisheries sector in total export earnings of the country is also significant, representing more than 6 per cent (see Table 4.3). Unfortunately, no direct estimate of the country's export of marine fish is readily available. Fish from Bangladesh is exported to a large number of countries and is dominated by shrimp, which accounts for almost 90 per cent of these exports. Japan is the largest importer of marine shrimp, while Thailand is a major importer of marine 'white fish'. Only two to three species of white fish are exported to Europe and the USA. Hong Kong is the biggest market for dried fish from Bangladesh. There are only two fishing joint ventures in Bangladesh with companies from Japan and Thailand.

4.2 Legal and Regulatory Framework in the Fisheries Sector

International and regional agreements require Bangladesh to comply with specific provisions as detailed in the agreement. Furthermore, Bangladesh is obligated to adhere to various disciplines and provisions in accordance with WTO membership. Due to its status as a least developed country (LDC), however, Bangladesh enjoys "special and differential treatment", in the form of fewer commitments and a protracted period of compliance. Additionally, national legislation pertinent to the marine fisheries sector enables Bangladesh to define its maritime boundaries and exploitation of the reserves within those boundaries. Some of these are described below:

International Agreements: The Third Meeting of the United Nations Convention on the Law of the Sea (UNCLOS III), held in 1982, adopted a "Declaration of Principles" to which Bangladesh is a signatory in addition to the Convention itself. The Convention (1982) places special emphasis on regional and international cooperation in study, research programmes and information exchange. However, no studies on Bangladesh have been conducted in connection with the Convention.

WTO Provisions: The Agreement on Subsidies and Countervailing Measures in the Uruguay Round has a number of provisions relating to "special and differential treatment" for developing countries (Article 27). According to these provisions, as an LDC, Bangladesh is not required to phase-out export subsidies. If Bangladesh advances from its current status as an LDC in the near future, it may still continue to enjoy such special and differential treatment as long as annual GNP per capita remains below US$ 1,000.

Furthermore, subsidies granted by developing countries, including Bangladesh, cannot be challenged on the allegation of "serious prejudice". This can only be done on the basis of positive evidence that such subsidies "nullify or impair benefits" as referenced under the 1994 Uruguay Round Agreement, or that they cause "serious injury" to a domestic industry in the market of an importing member country.

Regional Arrangements: Maritime cooperation is envisaged under the South Asian Association for Regional Cooperation (SAARC) and under the Economic Cooperation (BIMST-EC) between Bangladesh, India, Myanmar, Sri Lanka, and Thailand, although no specific guidelines have yet been formulated. *The Marine Fisheries Ordinance* is the basic legislation, which provides management guidelines for the fisheries sector in Bangladesh. Recently, Bangladesh has sought active engagement in the recently launched Indian Ocean Rim Countries (IORC) initiative. Amongst these regional arrangements, the SAARC is, at present, most advanced. A preferential trading arrangement (SAARC Preferential Trading Arrangement - SAPTA) was established in 1993, under which the seven SAARC countries (Bangladesh, India, Pakistan, Sri Lanka, Myanmar, Bhutan and Maldives) are provided with preferential access to imports when traded among partner countries. Presently, three rounds of SAPTA negotiations have taken place on the basis of offer and request lists, with those goods enjoying preferential access numbering around 3000. The preferential margin of the reduction in the import tariffs under the SAPTA ranges between 10 per cent and 100 per cent. However, it should be noted that a large number of goods which are actually traded within the region have continued to remain outside the preferential list, while a large number of goods offered preferential treatment under the three SAPTA nations are not actually traded between the various countries of the region. The SAARC countries are currently discussing the transition from SAPTA to SAFTA (South Asian Free Trade Agreement). In this context it may be envisaged that once SAFTA is established the SAARC countries will offer zero-tariff access to fisheries products exported by regional countries. This may induce cooperation amongst the regional countries in the area of exploration of fisheries resources in the region. There is also an initiative to establish a Free Trade Agreement in the BIMST-EC region with similar implications.

National Legislation: Even though the Bay of Bengal is reported to be rich in marine resources, the marine fishery sector lacks a proper management policy. The existing legislative framework relating to the maritime laws and fishing practices is presented in Box 4.1.

Box 4.1

National Legislation for Marine Zones and Fishing

(1) *Territorial Waters and Maritime Zones* Act 1974 (Act no XXVI of 1974). This Act provides for declaration of various maritime zones:

i. *Territorial waters:* Territorial waters extend to 12 nautical miles beyond the coast of Bangladesh, and also include all internal waters.

ii. *Contiguous zone:* The zone of the high seas contiguous to the territorial waters and extending seawards to a line of 6 nautical miles measured from the outer limits of the territorial waters was declared to be the contiguous zone of Bangladesh.

iii. *Economic zone:* The zone of the high seas extending to 200 nautical miles measured from the baseline is the Exclusive Economic Zone of Bangladesh.

iv. *Conservation zone:* Through official notification, the Government may establish conservation zones in areas adjacent to the territorial waters.

v. *Continental Shelf:* The continental shelf of Bangladesh is comprised of (a) the seabed and subsoil of the sub-marine areas adjacent to the coast of Bangladesh, and (b) the seabed and subsoil of the analogous sub-marine areas adjacent to the coast of any island, rock or any composite group constituting part of the territory of Bangladesh.

(2) *The Marine Fisheries Ordinance, 1983 (Ordinance No. XXXV of 1983)*

(i) *The Marine Fisheries Ordinance*, *1983* (Ordinance No. XXXV of 1983, July 19, 1983).

(ii) *The Marine Fisheries Rules, 1983* (No. S.R.O. 349 - L/83, September 8, 1983 of Ministry of Agriculture, Fisheries and Livestock Division).

(iii) *The Marine Fisheries Rules (Amendment), 1992* (No. S.R.O. 275 - Rule/92, December 1992 of the Ministry of Fisheries and Livestock).

This *Marine Fisheries Ordinance*, *1983* made provisions for the management, conservation and development of marine fisheries for water bodies with a depth in excess of 50 metres. Any body of water under 50 metres depth is reserved for small-scale fisheries. All trawlers are required to obtain a fishing license for a year, which then allows them to fish within the 200 nautical mile maritime boundary of Bangladesh. Each trawler must be granted sailing permission from the Directorate of Fisheries for every voyage. Mechanized boats have been brought under a licensing system in accordance with *Amendment 92* of the *Marine Fisheries Ordinance, 1983*. Since January 2001, all non-mechanized boats have also been included under the licensing system.

Source: GOB, 1974.

4.3 Trade Related Policies for the Fisheries Sector

The marine fishery in Bangladesh does not receive any special benefit package from the government. The only identifiable incentive given to the sector is a value added tax (VAT) refund on fuel at the rate of 15 per cent per litre, or US$ 0.04, subsequent to the export of fish (based on 1998 diesel prices of taka 12.67 per litre) (GOB, 2001a). The sector does additionally enjoy incentives given to the export sector in general, which include duty-free imports of capital machinery and raw materials, fiscal incentives for export, income-tax rebates, duty drawback facilities, fast customs clearance and subsidized credit. Such incentives are part of the policies aimed at boosting export performance in the country (see Box 4.2).

However, exporters in Bangladesh stress that fishing is different from other export-oriented industries, and that treatment accorded to these sectors, which is similar to other sectors, will not generate equal benefits. For example, in the case of an exporting factory that produces ready-made garments, the producer and exporter may be the same entity that benefits from a lower bank rate. In the case of marine fisheries, the exporter and fisherman are two different entities. Consequently, the beneficiary of incentives is the exporter, not the fisherman who is the primary producer. Furthermore, it is often the fisherman who needs the support more than the exporter, namely to support the catch and preservation of exportable fish. Small fishermen do not have access to credit facilities provided by the government. They must instead rely on informal sources, such as relatives or other money lenders for financial support with a very high interest rate and on condition that they will sell their fish at a lower price to those who provide the needed loans.

Due to the absence of fish-procurement centres, fishermen are forced to sell their fish to middlemen immediately following the catch at relatively low prices. The procurement system is segmented as well. Due to poor dock security and the risk of robbery, most exporters do not buy fish on site from fishermen. Moreover, the existence of a class of middlemen delays the procurement process by six to eight hours, during which time the freshness of the fish deteriorates sometimes even to the

Box 4.2

General Export Incentives Provided in Bangladesh

1. *Assistance to gross value added or returns to primary factors:*
   a) duty free import of capital machineries for *industries exporting at least 75 per cent of their output*
   b) simplified tax payment
   c) 50 per cent tax exemption on export earnings
   d) soft loan for export oriented industries
   e) provision for export credit in local currency at a concessional rate of interest within a band (the per cent band is 8-10 per cent)
   f) provision for export credit in foreign currency under the Export Development Fund (EDF) at a concessional rate of interest (the rate of interest applicable to the London Interbank Offer Rate (LIBOR)+1 per cent)
   g) export oriented industries are exempted from paying local tax and VAT
   h) 100 per cent export-oriented industries are now allowed to sell 20 per cent of their products in the local market subsequent to payment of duties and taxes
   i) industries in the EPZ get the advantage of-
      - tax holiday for 10 years
      - exemption of interest on borrowed capital
      - relief from double taxation
      - duty free export of goods

2. *Assistance to inputs or intermediaries:*
   a) provision for back-to-back letter of credit for importation of raw materials for export production, on deferred payment basis
   b) bonded warehouse facility for all 100 per cent export oriented industries
   c) provision for duty drawback on imported inputs for export, if the bonded warehouse facility is not available
   d) provision for duty-free import of samples in exporting industries
   e) incentives for backward linkage activities related to export-oriented industries, for example, textiles, dyeing and finishing for the export oriented apparels sector

f) industries in the EPZ get the advantage of-
   - duty free import of machinery, equipment and raw materials
   - duty free import of materials for constructing factory buildings
   - expeditious import of raw materials on Document Acceptance basis
   - import of goods from the Domestic Tariff Area (DTA)

3. *Assistance to output:*

   a) assistance under cash compensation scheme to some "thrust sectors" *(does not include fisheries)*
   b) retention in foreign currency up to 40 per cent export receipts
   c) export diversification support through Matching Grant Facility (MGF)
   d) simplified export credit guarantee scheme
   e) special rebate on the premiums on fire and marine insurance
   f) lower rate of interest on loans from commercial banks for export processing
   g) enhancement of time limit for export credit from 180 days to 270 days
   h) industries in the EPZ get the advantage of selling 10 per cent of output to the DTA under certain conditions
   i) market development assistance (10 per cent) for export of certain products (does not include fisheries).

4. *General incentives*

   a) recognition of industries exporting at least 80 per cent of their products as 100 per cent export oriented industries
   b) enhancing the final limit of dispatch for export samples abroad
   c) provisions for product and market development support under the EDF
   d) national Trophy for export
   e) reduced air freight for export of all crash program items including fruits and vegetables *(not for fish)*
   f) withdrawal of payment of royalty which was needed to pay for the use of cargo services of foreign airlines for export purposes

Source: Compiled from various EXIM policies.

point of decay. Bangladesh is thus unable to sell into the lucrative Japanese market for fresh fish. Similarly, Bangladesh has failed to break into the markets of Eastern Asia, where there is high demand for live fish, due to the lack of appropriate technology to keep the fish alive for extended periods. There is no cold storage near the sea and the price of ice is exorbitantly high, sometimes two to three times more than the actual cost. Fishing trawlers are also inadequately equipped with cooling facilities. Most of the trawlers are old and are purchased second-hand.

The exporters maintain that due to lack of proper infrastructural facilities, a large amount of relatively cheap fish is being wasted. It is a very common practice in Bangladesh that when fishermen catch high-value fish, they throw away low-value fish, as there is not an adequate supply of cold storage facilities near the beaches to preserve both. According to the Bangladesh Frozen Food Exporters Association, the amount of low-value fish wasted in this manner ranges from 35,000 to 40,000 tonnes a year.

The government can take initiatives to reduce this waste in two ways: firstly, by establishing the required number of cold storage facilities and, secondly, by increasing the presence of well-equipped vessels. At present, there are an insufficient number of such vessels, as the ownership and licensing procedure of mechanized boats are restricted mainly in order to control the smuggling of commodities. It has furthermore been reported by certain people interviewed that some businessmen are avoiding customs duties by transporting commodities in fishing trawlers. The boats involved in fishing are mostly country boats which are not equipped with facilities required to meet occupational safety standards, much less the quality and food safety standards of importers. Many of these lack even a radio to listen to weather reports.

4.4 Effects of Trade Policy

The supportive policy framework for exports introduced in the 1990s created an environment conducive to export-oriented activities in Bangladesh. In the marine fisheries sector, however, limited govern-

ment assistance in the form of a VAT refund on fuel is unlikely to have resulted in any major social, environmental or economic impact on the sector. Moreover, the nature of the industry is such that the trickle-down effects of general trade-support policies are also insignificant.

The VAT refund applied to fuel forms an insubstantial part of the total value added. As Box A1 in Annexure A.2 shows, fuel subsidies represent only 2.4 per cent of the value of marine fisheries production when estimated in terms of trawl fishing and 0.9 per cent when estimated in terms of small mechanized boats. This estimation has been done separately for the two main segments of fleets because they have different fishing capacity and expenses. No matter how small the share of the subsidy is, it may have impacts on the technological development by encouraging greater fuel use as well as more powerful engines among boat owners, which in turn facilitates longer and farther fishing trips out to sea. While this is likely to affect catch and effort, it is difficult to assess the actual impact of such initiatives. Official sources claim that such assistance does not have any real impact either on fishing efforts or on harvest as shown in the yield and effort data in Table A1 in Annexure A.5.

5

The Exploitation Status of the Marine Fisheries Sector

5.1 Sustainability in the Marine Fisheries Sector: Theoretical Approach

In a sustainably managed fishery, the relationship between effort and yield is such that the total yield will rise with an increase in effort up to the point at which harvesting can be sustained without impairing the capacity of the resource to renew itself. This point is called the maximum sustainable yield (MSY) of the fishery, and is illustrated in Figure 5.1 in Annexure A.3. However, the maximum equilibrium yield (MEY) occurs at a lower level of effort than the MSY (see figure 5.2 in Annexure A.3) where the difference between total cost and total revenue (i.e.

economic rent) is the highest. If a sole proprietor owns the fishery, it would be rational for him not to exert additional fishing effort beyond MEY. However, when access to a fishery is unrestricted, fishermen will continue to exploit it until they fail to earn any surplus over their variable costs. This point is usually called the open-access equilibrium yield (OAEY). At this point, total cost equals total revenue, implying that zero rents are being earned in the fishery and economically rational firms will not expand any effort beyond this point. The theoretical framework which provides the basis for computing costs, total effort, returns per unit of effort, catch per unit of effort and economic rent over time in the fisheries sector is further discussed in Annexure A.3. Schaefer's fishery production model was used as a tool for the economic analyses under discussion here.

It should, however, be pointed out that the Schaefer model has been criticised as not accurately accounting for biological processes. For a stock size greater than zero and less than the environmental carrying capacity, growth of the stock is positive and there may be in practice a minimum viable population. Schaefer's model implies that a sufficiently high level of effort can reduce the steady stock and may lead to a situation of near extinction (Henderson and Thugwell, 1979; Townsend, 1986; Cunningham, Dunn and Whitmarsh, 1985). Moreover, the MSY derived from this model does not provide any information on the sustainability of the ecosystem in which the fishery forms a part.

Though the Schaefer model is applicable only to single species stocks, this study has applied it to explain the dynamics of the marine fisheries sector as a whole. The assumption behind doing this is that the effort and yield level are the same for all types of species. In order to estimate the effort and yield at the MSY for each species, it requires data on the current amount of effort exerted. In the absence of such information, values can be assigned to the level of effort in terms of horsepower for each type of species according to the share of catch, assuming that the effort level per unit of each type of fish stock is the same for all types of species. In such a situation the exercise would have to be performed separately for all types of species making the estimation complicated. In

order to avoid such complications the study chose to apply the Schaefer model for the whole marine fisheries sector keeping in mind that the results are only indicative.

Despite these limitations, the model addresses the rent dissipation issue and provides a relatively uncomplicated framework for an econometric study of catch and effort data. The reason for using the model in this study is additionally that it can be conducted with a limited set of data, as is the case in the fishery sector. The model has been applied in the next section by a linear regression of the yield function (see Annexure A.3) using time-series data for the period 1984 to 1998.

5.2 Sustainable Production Level

Fishing Effort

The variety of fishing technologies used in the Bangladeshi EEZ gives rise to the problem of how to accurately aggregate inputs. This particular difficulty can be overcome by converting the inputs into units of time, for example hours, days and months of fishing, since different types of fishing efforts are complementary to each other. In other words, there is a correlation, albeit imperfect, between a larger number of fishermen and the number of nets and boats in use. Thus any of these inputs expressed in units of time can serve as a proxy for fishing effort. Additionally, the number of fishing boats serves as another estimate of effort. For the purpose of this study, effort is measured in terms of fishing crafts, including trawlers, mechanized boats (MB) and non-mechanized boats (NMB), where their various efficiency levels have been converted into one unit. The engine capacity of the trawlers varies between 250 to 1250 horsepower (HP), with the majority having a capacity of around 400 HP. The engine capacity of MBs varies from 2 to 40 HP. It may be mentioned here that available data show that, except for the period 1984-1986, the official number of MBs and NMBs remained the same until 1998. Though a recent estimate shows that the number of MBs and NMBs increased in 2001, as mentioned in Section 4.1, there is no infor-

mation for the period 1999 and 2000. The study has therefore made estimates for the period 1984-1998.

On the basis of field visits, and interviews with concerned stakeholders, it was estimated that the average HP of fishing trawlers in Bangladesh is around 400 HP, and of mechanized boats is roughly 10 HP. Though NMBs are manually operated and do not have any engine, the study assumes a capacity of 1 HP for these types of boats on the basis of the efficiency of NMBs relative to the MBs. Total fishing effort in terms of horsepower is presented in Table A1 in Annexure A.5. For convenience, other means of fishing in Bangladesh such as trammel net and certain fishing gear have been grouped together with NMBs since they are also non-mechanized and the amount of catch resulting from their use is not significant to make any considerable difference in the estimation.

Yield, Total Costs and Total Revenue

Using catch and effort data for the period 1984-1998, the yield per unit of effort is estimated from Equation (5.1) in Annexure A.4. Regression results are shown in Table A3 in Annexure A.5. The values of a = 3.165 and b = 0.0000078, estimated from the regression, are used to derive the yield per unit of effort, sustainable yield function, maximum sustainable yield and the required effort as follows:

$Y/f = 3.165 - 0.0000078f$

Y_{msy} = 642,130 tonnes

f_{msy} = 101,442 horsepower

This means that with the maximum effort of 101,442 HP a maximum sustainable yield of 642,130 tonnes of fish can be landed.

The corresponding cost and revenue can also be estimated using the cost and price data of the marine fisheries sector. The cost of fishing effort has been computed on the basis of field visits and is presented in Table A4 in Annexure A.5. This value can be estimated based on the cost per unit of horsepower that might apply to any type of fishing craft.

This study, however, applies an average cost to each of the three types of fishing boats, such that their differences are reflected. The annual average cost of a trawler is estimated to be taka 15.7 million, which means that the average cost per HP is taka 39.3 thousand. Costs of boats were provided in terms of the cost per trip. Mechanized boats generally tend to go for 10-day trips while the non-mechanized boats perform single day trips. For a mechanized boat, each trip costs about taka 42.5 thousand and for a non-mechanized boat it costs on average taka 1000. Assuming that the fishermen fish for 300 days a year the mechanized boats make 30 trips and the non-mechanized boats make 300 trips annually. Therefore, the yearly cost of a mechanized boat amounts to taka 1.275 million and for a non-mechanized one, taka 300 thousand. Dividing by the average engine capacity of each type of fishing boat the cost per horsepower is estimated to be taka 128 thousand and taka 300 thousand for mechanized and non-mechanized boats respectively. Adding the cost of all types of fishing effort, the cost in terms of horsepower is estimated to be taka 470 thousand. Thus the annual average cost per horsepower is taka 160 thousand. Accordingly, total cost (TC) expressed as a function of the effort measured in terms of horsepower amounts to taka 16.23 billion (US$ 337.7 million).

The revenue (Price × Yield) function in terms of efforts will be:

$$TR = P(3.1651f - 0.0000078f^2)$$

It is somewhat problematic to arrive at average prices for different types of fish. First, it requires differentiating between export and local prices, the latter being substantially lower. Secondly, information on the volume of various types of marine fish exported is not available. Interviews with key stakeholders show that about 80 per cent of all shrimp and approximately 20 per cent of other fish caught in the marine fishery are exported. The price of marine fish used here is the weighted average of the export price of shrimp, exportable fish and the local price of marine fish (Table A5, Annexure A.5). With a calculated price for fish of taka 129.47 per kg, total revenue (TR) and Economic Rent (TR minus

TC) are estimated to be about taka. 31.18 billion (US$ 648.8 million) and taka 14.95 billion (US$ 311 million) respectively.

5.3 Analysis of the Results

With an annual yield of 642,130 tonnes and effort of 101,442 HP at the point of the MSY in this model, the estimated catch per unit of effort (HP) will be about 6.33 tonnes while economic rent per unit of effort will be about taka 205 million (US$ 4.27 million). The estimated results are compared with the actual data in Table 5.1. The actual catch (310,000 tonnes) is estimated to be just under half of the MSY. Results of the exercise suggest that yields in the marine fisheries sector have not

Table 5.1

Estimated and Actual Results

MSY: 642,130 tonnes	Actual Yield, 1998: 310,000 tonnes (48.27 per cent of MSY yield)
Effort at MSY: 101,442 horsepower	Actual Effort, 1998: 71,184 horsepower (70 per cent of MSY effort)
Total Cost at MSY: US$ 337.7 mln	Almost half of total MSY revenue (US$ 648.8 mln)
Total Revenue at MSY: US$ 648.8 mln	2 times higher than the total export of fish and fish products (US$ 287 mln, in 1998)
Economic Rent at MSY: US$ 311 mln	4 times higher than marine fisheries GDP (US$ 75.80), 1998
MSY Yield per unit of Effort: 6.32 tonnes	Actual Yield per unit of Effort: 4.35 tonnes
MSY Rent per unit of Effort: US$ 4.27 mln	Actual Rent per unit of Effort: US$ 3.9 mln

reached the point of MSY and the actual yield is below the estimated MSY. The actual effort that is being applied at present (71,184 HP) is also lower than the estimated level of effort at MSY (101,442 HP). This is an interesting finding, as it would imply that even when the issue of sustainability is accounted for in estimating the potential limits of exploitation, the present level of exploitation of marine fishery resources in Bangladesh could theoretically be doubled.

Thus, our estimates would indicate that the marine fisheries sector of Bangladesh has not yet reached the open access equilibrium level. A corollary of this would be that there is still scope for further exploitation and for development of the marine fisheries sector. The results of the study also coincide with the views held by the MOFL that pelagic and deep-sea fishery resources in Bangladesh are still abundant (GOB, 2001c).

However, given the criticality of the policy implications which would emerge from such a conclusion, the interpretation of the analytical results needs to be made with due caution. As was pointed out earlier, the analysis had to be based on limited information and suffered from a lack of comprehensive longitudinal data. This has constrained the robustness of the results. In parallel, the exclusive use of the MSY model (in absence of any other appropriate model) applied to the whole marine fisheries sector, has also considerably constrained the rigor of the analysis.

Although our findings allude to the possibility of doubling the present level of exploitation of marine fishery resources, our analysis cannot claim to answer whether increasing subsidies in terms of attaining this enhanced level of production would either be the best or the most effective policy. The level of subsidies, as was pointed out earlier, is not significant when expressed in absolute terms and this level has also not undergone any noticeable change over recent years. Thus it is difficult to establish any causal link between subsidies and the level of production in the context of the Bangladesh fisheries sector.

The study indicates that subsidies have not played a significant role in enhancing marine fishing effort in recent years. One could argue that the fish effort could have been lower in the absence of subsidies, though this is difficult to prove. On the other hand, trade policies have had important implications on employment, income and overall economic activities. As was pointed out earlier, trade policies pursued by Bangladesh in the 1990s removed the anti-export bias of previous economic policies and stimulated export-oriented activities in the country. In the fisheries sector, the rise of shrimp exports, and to a lesser extent other frozen fish, are direct outcomes of these trade related policies and incentives. It should, however, be noted here that the rise of commercial fishing, a direct result of trade policy incentives, has had negative implications on the lives and livelihoods of artisanal communities. In many coastal areas commercial fishery farms have displaced traditional rice farmers, and led to deforestation, increased salinity, health hazards, reduction in land fertility and biodiversity loss. These negative effects, particularly related to export-oriented shrimp culture have been well documented in several studies (UNEP, 1999).

Thus, while our analysis would tend to indicate that in the given context of Bangladesh, there is further scope for sustainable exploitation of marine fisheries, the extent to which the relevant policy conclusions should be derived from this needs to be carefully evaluated.

6

Policies to Promote Sustainable Management of the Marine Fisheries in Bangladesh

6.1 Fisheries in Bangladesh

The fisheries sector in Bangladesh does not receive much support. The only targeted support that is identified relates to a VAT refund on fuel. The sector does not receive any "cost reducing" or "revenue enhancing" subsidies other than the general export promotion incentives

that have been introduced largely to reduce the anti-export bias otherwise prevailing under the effective rate of protection structure in the Bangladesh economy. In spite of the trade-related reforms pursued by the country, the level of actual yield has tended to remain at less than half the level of the maximum sustainable yield. Thus, the study reveals that the general incentive package initiated under the trade liberalization programme, until now, has not had any detrimental effect on the country's fishing capacity and fishing practice. Rather, the findings show that the potential revenue from the marine fisheries sector could approach US$ 650 million.

However, it remains critical that a proper management regime be implemented to ensure that the substantial potential within the sector can be exploited on a sustainable basis to the benefit of a large segment of the population whose livelihoods depend on fish production. In this context, some of the specific measures that should be considered include:

i. *Assessment of the Sector*: Bangladesh needs to improve the management information system for fisheries in order to dynamically assess the state of the sector, and the costs and benefits resulting from adjustments in fishing capacity. The marine data collection and research cell should be strengthened to provide the government with the necessary information to manage and optimise catch from trawlers as well as inshore fishing.

ii. *Integrated Approach*: The management of the fisheries sector of Bangladesh should be informed by an integrated approach that takes into account all economic, social and environmental factors that affect fish supply, fish stock and fishing capacity. For example, prior to any initiative that increases productivity through modernization of the sector, it should first be understood what integrated impacts might result, such as environmental degradation and employment loss.

iii. *Emphasis on Small-Scale Fishing*: The gradual expansion of the sector in terms of increased fish production and fishing effort has given an opportunity to a large number of poor people in the coastal districts to earn a livelihood. However, the sector is still underdeveloped and thus the social needs of the coastal communities still remain unfulfilled. This particular group of fishermen should be given further attention in an effort to reorient these disparate communities towards sustainable exploitation of the marine resources through targeted training, advocacy and financial support programmes.

iv. *Support for Infrastructure Development*: Under the current system of macroeconomic management, the marine fisheries sector is expected to adhere to market principles. However, given the sector's low level of development and lack of any effective guiding mechanism, there is a case for government support to promote the sector's sustainable management. This could be in the form of development of the marine sector's supportive infrastructure such as port and docking facilities, cold storage facilities, and repair and maintenance services. Initiatives to lend funds to fishermen, specially small and marginal ones are also essential to bringing these informal players within the scope of the formal sector. Additionally, in order to avoid overfishing induced by segmentation and rent-seeking behaviour, Bangladesh needs to undertake procurement, processing and marketing support programmes for fishermen involved in small and marginal-scale marine fishing. Such programmes should encourage dissemination of improved fishing practices to minimize by-catch, waste and discard. To this end, investment should also be directed towards necessary trade-supportive infrastructure, including construction of cold storages and transport with cooling facility.

v. *Monitoring, Control and Surveillance*: Bangladesh needs to strengthen its monitoring, control and surveillance capacity with a view to stopping illegal and often unreported fishing.

The Marine Fisheries Ordinance, 1983 of Bangladesh made provisions for the management, conservation and development of marine fisheries only for water bodies in excess of 50 meters. The sea area that is up to 50 meters depth is reserved for small-scale fisheries. However, this distinction is hardly observed by industrial fishing vessels. Moreover, due to inadequate enforcement capacity on the part of national agencies, fishing trawlers from India, Myanmar and Thailand regularly intrude into the territorial waters of Bangladesh.

vi. *Smooth Operation of the Licensing System*: In an effort to curb illegal fishing, Bangladesh needs to improve its system of maintaining records of all vessels, owners and operators authorized to undertake fishing activities. Additionally, the current licensing procedure should be relaxed, as it heavily excludes small-scale fishermen. Though mechanized boats have been brought under the licensing system with *Amendment 92* of the *Marine Fisheries Ordinance 1983*, the process is complicated and slow. Since January 2001, all types of non-mechanized boats have also been included under the licensing system. However, due to cumbersome registration procedures, the issuance of licenses is regularly delayed. Smooth operation of the licensing system is required to keep a record of the pressure on the marine resources through fishing efforts so that measures can be taken to reduce pressure if and when it is necessary.

vii. *Regional Cooperation*: Fisheries resources, in essence, are 'regional commons' among neighbouring countries. Thus, sustainable exploitation of these resources can only be ensured through close regional cooperation. Bangladesh should accord heightened attention and importance to the issue of regional cooperation. This aspect of regional cooperation should receive due importance in such platforms as the SAARC, BIMSTEC and IORC. The design of a regional strategy to exploit

the common marine resources of the Bay of Bengal could be helpful in this regard.

viii. *Capacity building*: Trade related environmental issues are receiving increasing attention in the on-going negotiations in the WTO. There is a strong tendency to discourage subsidies that promote environmentally harmful practices. Bangladesh needs to build the capacity to argue her specific case and articulate that global support to the country's under-developed marine fisheries sector could help ensure the sustainable management of marine fisheries resources, under the conditions outlined in this study. International support may be sought in order to strengthen and enhance its institutional capacity, which could ensure the sustainable management of marine fishing activities in Bangladesh. Capacity building assistance regarding stock assessment and support for measures to replenish depleted stocks should be sought from developed countries.

In contrast to the more common trend, the case of Bangladesh illustrates that in the absence of market distorting subsidies or preferential fishing agreements, a country can improve its foreign revenue from fish exports and still maintain a sustainable fish stock. However, given the limitations in terms of adequate data and appropriate methodology the robustness of the results is constrained implying that the results are only indicative. Therefore, the results should be interpreted carefully and the policies have to be formulated accordingly.

As far as the exploitation of the country's marine fisheries sector is concerned, it should be ensured that the incremental benefits from further exploitation are not offset by the attendant negative implications and externalities. Thus, the extent to which the marine fisheries are to be exploited further must be very carefully judged by taking cognisance of sustainability factors. If there were to be an overshooting of the limits of exploitation originating from the notion of under exploitation, the country may end up with a negative balance sheet. Accordingly, the bounds of any incremental interventions towards further exploitation, through direct and indirect policy support, will need to be determined

after careful and thorough cost-benefit analysis that takes into account all relevant variables. Such an approach should factor in the possible implications of these interventions for the fragile ecosystem of the southern coastal region. This is all the more important in view of the continuing degradation of this ecosystem as a result of crop practices, deforestation, intrusion of human beings and livelihood necessities of a poverty-stricken populace. It is also important to bear in mind that marine resources belong to regional commons and further exploitation by Bangladesh will have to take into account the cross-boundary implications and considerations within the context of the common character of this resource. Regional cooperation towards sustainable exploitation of marine resources could play an important role in encouraging the countries of the region to look at the relevant issues from the point of long-term sustainability.

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Annexures

1. Stakeholder Process

A.1 Inputs from the Stakeholders

The stakeholder process involved identifying and contacting relevant stakeholders with the aim of discussing the issues and problems related to the marine fisheries sector. We therefore contacted fishermen, boat and trawler owners, exporters and members of the fish exporters' association. In the course of this process government officials of the Department of Fisheries were also interviewed. Certain officials interviewed declined to comment on issues in which there was a strong lobby interest. Those who took part in the process were interviewed individually by the members of CPD's research team. Four fishing sites along the Chittagong coast were also visited in order to gain first hand experience on the state of the marine fisheries sector.

Period of the Interview Between December 2001 - January 2002
List of Offices Visited i. Department of Fisheries, Ministry of Fisheries ii. Bangladesh Marine Fisheries Association iii. Bangladesh Frozen Foods Exporters Association iv. Apex Foods, Dhaka and Chittagong Office v. Department of Marine Fisheries, Chittagong vi. Chittagong Chamber of Commerce and Industries
Fishing Areas Visited in Chittagong 1. Fishery Ghat 2. Majheer Ghat 3. Sadar Ghat 4. Patenga Ghat

Persons Interviewed 1. Fishermen 2. Boat and Trawler Owners 3. Processors 4. Exporters 5. Government Officials
Method of Soliciting Information 1. Check List 2. Open Discussion

Check List for Exporters

1. Number of People Employed in the Marine Fisheries Sector (Directly and Indirectly)
2. Number of Fishing Crafts
   - Trawler
   - Mechanized Boats (MBs)
   - Non-mechanized Boats (NMBs)
3. Horsepower (HP) of the Fishing Crafts - Trawler, MB, NMB
4. Average HP of the fishing trawlers
5. Area under Marine Fisheries
6. Yield of Marine Fish
7. Types of Incentives given to the exporters of Marine Fish
8. Problems of the marine fisheries sector
   - procurement
   - processing
   - storage

- marketing
- environmental
- social
- others

9. Is there any bilateral agreement with a country?
10. Is there any joint venture with a country?
11. Is there any maritime law in Bangladesh?
12. Which are the GOB institutions that deal with the Marine Fisheries Sector?
13. Do you interact with GOB institutions? What is your experience?
14. Is there intrusion by fishermen from other countries within our maritime boundaries?
15. Is there overfishing or underfishing within the maritime boundaries of Bangladesh?
16. What are your suggestions to stimulate production and export of marine fisheries from Bangladesh?

Check List for the Government Officials

1. Types of Incentives given to the exporters of Marine Fish
2. Do you interact with the exporting firms?
3. What are the demands put forward by the exporters of marine fish?
4. Problems of the marine fisheries sector
   - procurement
   - processing
   - storage
   - marketing

- environmental
- social
- others

5. Is there any maritime law in Bangladesh?
6. Is there any bilateral maritime agreement with any country in the region?
7. Does Bangladesh take part in international conventions/conferences related to marine fisheries sector?
8. Is there overfishing or underfishing within the maritime boundaries of Bangladesh?
9. Is there any government plan to promote an environmentally sustainable exploitation of marine fishery resources in Bangladesh?
10. Is there any joint venture with any country in production and export of marine fish?
11. Is there intrusion by fishermen from other countries within the maritime boundaries of Bangladesh? How do you address such problems?
12. What are your suggestions to stimulate production and export of marine fisheries by Bangladesh?

2. Views Expressed by the Stakeholders

2A. Issues and Problems

The stakeholders expressed their concerns on a number of issues affecting the proper utilization of the marine fish resources. They felt that the sector is relatively un-exploited and could be developed and maintained on a sustainable basis through the implementation of an appropri-

ate management programme. The discussions with the boat and trawler owners, exporters, middlemen and fishermen are summarized below.

i. *Procurement:* Due to the absence of fish procurement centres, the fishermen are forced to sell their fish to middlemen immediately following the catch at relatively low prices.

ii. *Processing:* Though there is a big shrimp processing industry the unavailability of raw materials such as ice makes the full utilization of the plants difficult. For dried fish more fish processing factories are required and quality of the fish should be maintained.

iii. *Cold Storage:* There is no cold storage near the sea and the price of ice is exorbitantly high, sometimes two to three times more than the actual cost. Therefore, the fishermen have to sell the fish immediately after catch at a very low price to the middlemen. The ice making factories are operated only a few months of the year during the Hilsha fish season (July to September). The water quality used for making ice is sometimes poor, coming from ponds and canals, which deteriorates the quality of the fish. The frequent interruption of electricity supply makes investment in ice-making factories an unprofitable business. The long distance required to transport ice to fishing sites also increases its price.

iv. *Marketing:* Japan is the largest importer of marine shrimp, while Thailand is a major importer of marine 'white fish'. Only 2-3 species of white fish are exported to Europe and USA, where the major consumers are Bangladeshi communities living abroad.

v. *Lack of Infrastructural Support:* The exporters maintain that due to the lack of proper infrastructural facilities, a large amount of relatively cheap fish is being wasted. It is a common practice in Bangladesh that when fishermen catch high-value fish they throw away the low-value fish, as there is not an adequate supply of cold storage facilities near the beaches

to preserve both. According to the Bangladesh Frozen Food Exporters Association, the amount of low-value fish wasted in this manner ranges from 35,000 to 40,000 tonnes a year.

vi. *Inadequate Incentives:* The marine fishery in Bangladesh does not receive any special benefit package from the government. The only identifiable incentive given to the sector is a value added tax (VAT) refund from fuel at the rate of 15 per cent per litre (that is taka 1.9 per litre on the price of diesel in 1998 which was taka 12.67) subsequent to export of fish. However, the fishermen do not get any support from the government, as they are not the direct exporters.

vii. *Lack of Resources:* The mechanized boat owners lack sufficient capital to bear the expenditure of a fishing trip. As they do not have access to formal loans from the banks and financial institutions they take loans from individuals at higher interest rates than banks and on condition that the lender receive a lower price than the market level. If the loan is interest free the fish price must be even lower. The repayment on the loan is required at the end of the vessel's fishing outing, which is usually 10 days.

viii. *Restricted Ownership of Engine Boats:* At present, there are an insufficient number of mechanized vessels, which are restricted mainly in order to control illegal commodity smuggling where fishing trawlers are used as the transport vehicle. Because of such restrictions, marine fisheries production has suffered.

ix. *Old and Primitive Boats:* The boats involved in fishing are mostly country boats, which are not equipped with facilities required to meet occupational safety standards, much less the quality and food-safety standard of importers. Many of these boats lack even radios to listen to weather reports. Mechanized boats and trawlers are also often in second hand condition.

x. *Lack of Security:* Due to the risk of robbery and poor dock security, most exporters do not buy fish on site from fishermen.

xi. *Sea Piracy and Intrusion:* Fishermen are sometimes robbed at sea by pirates, losing everything, including their fish catch. Additionally, there are frequent allegations that fishermen from India, Thailand and Burma fish illegally in Bangladeshi waters.

xii. *Environmental and Social Problems:* The engine boats pollute through the burning of diesel. Sometimes fishermen have to pay unrecorded/illegal fees to the local hoodlums who have links with local power group.

xiii. *Bilateral Agreement and Joint Venture:* There is no bilateral agreement on marine fisheries and joint venture initiative is also very limited. There are only two joint ventures in Bangladesh in the fishing sector - one with a Japanese company and the other with a Thai company.

xiv. *Overfishing or Underfishing:* The main pressure is on inland fisheries, not the marine fisheries sector. A deep-sea bed named 'Swatch of No Ground' has reportedly large fish stocks that remain unexploited.

2B. Recommendations made by the Stakeholders

Stakeholders increasingly feel the urgent need for financial and infrastructural support from the government for the overall development of the marine fisheries sector. Specific recommendations made in this regard are as follows.

i. Procurement centres with modern facilities should be set up.

ii. Arrangements should be made for interest free bank loans or bank loans at a low rate of interest for the small-scale fishermen.

iii. Award licenses to new trawlers. The procedures of issuing licenses to fishing boats should be made less complicated.

iv. Arrange bank loans for the exporters to buy trawlers.

v. Improve security along the shore as well as at sea.

vi. Increase the amount of fuel refund.

vii. Fishermen should be given training on the procurement and processing of fish.

viii. Establish ice-making factories and provide incentives to the investors in terms of financial support to establish ice-making factories with proper quality control measures. Bringing them under a licensing system is one way of monitoring these factories.

ix. Establish fish processing factories. The quality of these factories should be ensured and they should be brought under the licensing system.

x. Small fishermen should be provided with insulated vans to transport fish so that they receive fair prices for fresh fish.

xi. Shelter for the mechanized and non-mechanized boats during natural disasters is required.

2C. Opinion of the Government Officials

The government recognizes the importance of the marine fisheries sector in terms of its export potential and domestic consumption. In order to properly manage the marine fisheries sector the government has set up the Department of Marine Fisheries (DMF) under the Department of Fisheries, Ministry of Fisheries and Livestock with the responsibility to preserve and manage marine fisheries, implement the existing fishing laws of the country, preserve the environment of the sea, control fishing trawlers and improve the socio-economic condition of fishermen. *The Marine Fisheries Ordinance, 1983* and the establishment of the *Surveillance Check Post* by the government at the confluence of Karnaphuli River in Chittagong district are also important initiatives towards proper management of the sector. Government officials from the Department of Fisheries expressed that, due to the difficulties they face to manage

such a huge sector, the DMF should be expanded and strengthened with a sufficient number of adequately trained personnel and modern technologies in order to facilitate activity operation. Interactions with marine fisheries exporters do occur occasionally. When special problems arise exporters bring it to the government's attention. Officials emphasised that in recognition of the exhaustive nature of fish resources, the government is cautious in granting access to fish trawlers and boats. The government is aware of the intrusion of fishermen from other countries and has strengthened the monitoring and surveillance process. Government officials believe that there is enough scope to take advantage of the liberal trade policies to increase marine fish exports.

A.2 VAT Refund on Fuel Received by the Marine Fisheries Sector

Box A1

TRAWLER

Annual expenditure on fuel per trawler (Table A4) = Taka 5,500,000

Average horsepower (HP) of fishing trawler = 400 HP

Fuel cost per HP = 5,500,000 ÷ 400 = Taka 13,750

In terms of the cost of diesel (taka 12.67 per litre) the amount of fuel available with the cost per HP = taka 13,750 ÷ 12.67 = 1085 litre

Total fuel available with taka 5,500,000 = 5,500,000 ÷ 12.67 = 434,096.29 litre

Refund = Taka 1.9 per litre

Refund per trawler = 1.9 × 434,094 = Taka 824,782

Percentage of refund per litre = 15%

Total number of trawlers in 1998 = 60

Refund on total trawler = 824,782 × 60 = Taka 49,486,920

Total trawl catch = 16,000 tonnes

Price per tonne = Taka 129,470 (price of fish per kg. is estimated at Taka 129.47; Table A5)

Total trawl fish price = 16,000 × 129, 470 = Taka 2,071,520,000

Refund/fish price = 49,486,920 ÷ 2,071,520,000 = 0.0238

Refund as % of total trawler fish price = 2.4 %

Marine Fisheries GDP = Taka 3446 million, 1998

Share of VAT refund in Marine Fisheries GDP = 49,486,920 ÷ 3,446,000,000 × 100 = 1.4%

MECHANIZED BOAT

Annual expenditure on fuel per boat = Taka 525,000 (30 trips annually; Taka 17500 per trip; Table A4)

Total boats in 1998 = 3,317

Total expenditure on all boats = 525,000 × 3317 = 1,741,425,000

Refund 15% = .15 × 1,741,425,000 = Taka 261,213,750

Total catch by mechanized boats = 221,016 tonnes

Total price of fish caught = 221,016 × 129470 = 28,614,941,000

Refund/price = 261,213,750 ÷ 28,614,941,000 = 0.0091

Refund as percentage of total mechanized boats fish price = 0.9%

Share of VAT refund in Marine Fisheries GDP = 261,213,750 ÷ 3,446,000,000 × 100 = 7.6%

Source: Own Calculation

A.3 Theoretical Discussion on the Sustainability of Marine Fisheries

Fishery harvesting can be analyzed according to three possible allocations of effort and exploitation levels. Figures 5.1 and 5.2 show various levels of yield and effort and the cost and revenue of such fish harvesting levels.

Fig: 5.1 Sustainable Yield Curve

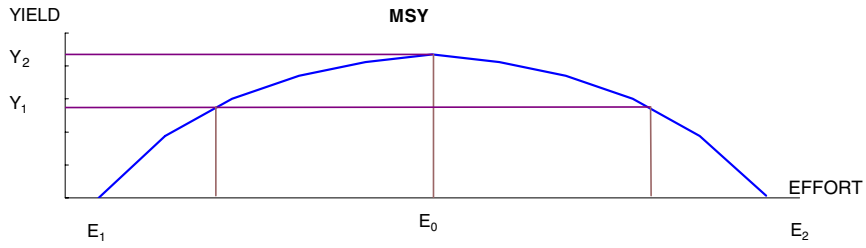
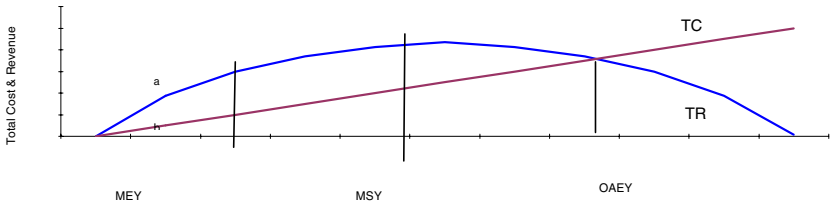


Fig: 5.2 Revenue and Cost in an Open Access Fishery



In Figure 5.1, two different levels of fishing effort can produce the same yield Y1. Fishing at effort level E1 is below MSY, and at level E2 is beyond MSY. The best possible allocation of resources is achieved when the value of fish that a marginal unit of effort produces is equal to the value that a marginal unit of effort would produce in its best alternative use. The total revenue curve is the same shape as the yield curve in Figure 5.2. If it is assumed that the total cost for the fishery increases in proportion to the effort, then the total cost curve for the fishery will be a straight line as shown in Figure 5.2. There is a linear relationship between fishing effort and income earned, and as effort increases, total revenue also increases up to MSY. Beyond MSY, the average yield per unit of effort will fall as there are now more fishermen exploiting a smaller fish stock. If a sole proprietor owns the fishery it would be rational for him not to exert additional fishing effort beyond the MEY.

However, when access to a fishery is unrestricted, fishermen will continue to exploit it until they fail to earn any surplus over their variable costs. At this point, which is an open-access equilibrium yield (OAEY), total cost equals total revenue implying that no rent is being earned in the fishery and economically rational firms will not expand any effort beyond this point.

The Model

In the Schaefer model catch per unit of effort is a linear function of effort. If *Y* is the sustainable yield, *f* is the effort and *a* and *b* are constants, the yield function can be expressed as:

$$Y/f = a - bf \qquad (5.1)$$

Alternatively,

$$Y = af - bf^2 \qquad (5.2)$$

Differentiating Equation (5.1) with respect to *f* and setting dY/df = 0 the level of effort (f_{msy}) giving maximum sustainable yield can be derived:

$$dY/df = a - 2bf = 0$$

$$a = 2bf$$

$$f_{msy} = a/2b \qquad (5.3)$$

The maximum sustainable yield (Y_{msy}) can be obtained from Equations (5.2) and (5.3).

$$Y_{msy} = a(a/2b) - b(a^2/4b^2)$$

$$= a^2/2b - a^2/4b$$

$$= a^2/2b(1 - 1/2)$$

$$= a^2/4b \qquad (5.4)$$

A.4 Estimation Results

Box A2

$Y/f = 3.165 - 0.0000078f$

$Y = 3.165f - 0.0000078f^2$

$Y_{msy} = (3.165)^2 / (4 \times 0.0000078)$

$= 642{,}130$ tonnes

$f_{msy} = 3.165 / (2 \times 0.0000078)$

$= 101{,}442$ HP

$TC = 160f$

$=$ Taka 160 thousand $\times$ 101,442 HP

$=$ Taka 16.23. billion

$TR =$ Taka. 129470

$(3.165 \times 101{,}442 - 0.0000078 \times 101{,}442 \times 101{,}442)$

$=$ Taka. 31.18 billion

Economic Rent = TR - TC = Taka. 14.95 billion (US$ 311 million)

A.5 Tables

Table A1

Fishing Effort in Marine Fisheries (in horse power)

Year	*Fishing Crafts Used in Marine Fisheries*			*Horsepower of Fishing Boats*			
	Trawler	*Mechanized Boats*	*Non-Mechanized Boats*	*THP = Number of Trawlers x 400*	*MBHP = Number of MB x 10*	*NMBHP = Number of NMB x 1*	*Total Horsepower*
1984	67	3300	6200	26800	33000	6359	66159
1985	45	3137	6559	18000	33170	6559	55929
1986	49	3132	6461	19600	33170	6461	57381
1987	52	3317	14014	20800	33170	14014	67984
1988	50	3317	14014	20000	33170	14014	67184
1989	52	3317	14014	20800	33170	14014	67984
1990	54	3317	14014	21600	33170	14014	68784
1991	60	3317	14014	24000	33170	14014	71184
1992	49	3317	14014	09600	33170	14014	66784
1993	51	3317	14014	20400	33170	14014	67584
1994	53	3317	14014	21200	33170	14014	68384
1995	53	3317	14014	21200	33170	14014	68364
1996	55	3317	14014	22000	33170	14014	69184
1997	61	3317	14014	24400	33170	14014	71584
1998	60	3317	14014	24400	33170	14014	71184

Source: GOB, 1999 and own calculation.

THP Trawler horsepower

MBHP Mechanized boat horsepower

NMBHP Non-mechanized boat horsepower

Table A2

Actual and Estimated Yield of Marine Fish

Year	*Y (000)*	*F(000)*	*Y/f*	*Est Y/f*	*Est Y (000)*
1984	188	66	2.84	2.65	175.25
1985	207	56	3.70	2.73	152.62
1986	218	57	3.80	2.73	152.62
1987	227	68	3.34	2.64	179.12
1988	233	67	3.47	2.64	177.43
1989	239	68	3.52	2.64	179.12
1990	242	69	3.57	2.64	178.70
1991	242	71	3.40	2.61	185.77
1992	250	67	3.74	2.64	176.58
1993	260	68	3.85	2.64	178.28
1994	270	68	3.95	2.63	179.96
1995	279	68	4.08	2.63	179.96
1996	275	69	3.97	2.63	181.63
1997	273	72	3.81	2.61	186.59
1998	310	71	4.35	2.61	185.77

Table A3

Regression Results

R square = 0.0095
Standard Error = 0.376
Number of Observation = 15
Intercept = 3.165
X Variable = 0.0000078

Table A4

Expenditure of Fishing Boats

Expenditure	*Cost*
Annual expenditure of a fishing trawler (Taka million)	**15.7**
Fuel	5.5
Salary and Wages	2.0
Repair and Maintenance	1.5
Selling Expenses (container, freight, packing, inspection fee)	2.0
Interest on Bank Loan	0.6
Inter-company Interest	0.9
Insurance Premium	0.4
Depreciation	1.0
Administrative Expenses (Shore Office Expenses)	1.6
Miscellaneous	0.2
Expenditure for a 10 day trip per mechanized boat (Taka)	**42500**
Fuel	17500
Stationary	5000
Ice	5000
Food	3500
Boat Rent	5000
Maintenance	1500
Miscellaneous	5000

Source: Field visit.

Table A5

Price of Marine Fish, 1998

	Q (tonnes)	*P (Taka/Kg)*	*PxQ (Taka million)*	*Weighted price (Taka/Kg)*
Exported fish	25394	578	14.68	
Other exportable fish	55611	123	6.84	
Other fish	228792	60	18.59	
Total	309797	638	60.55	129.47

Source: GOB, 2001

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