Sources of Growth, Sturctural Change and the Role of Support Services to Fishery Sector in Bangladesh

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Abstract

The study identifies the sources of growth and analyzes the structural changes that have taken place in the fishery sector. It further investigates the factors determining the growth of aquaculture production. The estimate of growth shows that fishery sector grew at a much higher rate compared to the growth of other sub-sectors of agriculture as well as the growth of whole economy. As a result the share of fishery sector to GDP increased systematically over time. A remarkable structural change has been noticed in the fishery sector. The share of culture fishery, particularly pond fishery increased dramatically at the cost of capture fishery. Public investment shows vital role to the growth of culture fishery. Support services in the form of extension, aquaculture technology, credit contributed significantly to the yield of culture fishery. However public investment is found biased against fishery sub-sector.

1. INTORDUCTION

Fish, as resource is one of the few renewable resources available in Bangladesh. But until recently, fishery sector did not get enough attention in the country. Issues of the sector used to be looked from the sectoral perspective. The role of fishery sector was either over-looked or under-estimated in the past. However, the notion is about to change now a day. Recently considerable concern and interest have been developed at national and international level about the role and importance of fishery sector in the economy.

Fishery is one of the growing sectors in the economy. It contributes significantly to earn foreign exchange. The value added of this sector (from the national point of view) is considered to be about 100 per cent. Furthermore, the sector has

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substantial forward and backward linkages. As a result, it has been identified as one of the few potential sectors in the country.

Bangladesh is the fourth largest producers of aquatic products in the world. It produced 1.655 million m.tons of aquatic products in 1999-2000 (DOF, 2001). Both domestic demand as well as export demand have been growing. Increase in domestic demand has been attributed to increase in population and increase in per capita income.

The economy has undergone successive reforms in the form of structural adjustment and trade liberalization. The share of agricultural sector to GDP has been declining since eighties. It was 26.53 in 1989-90 and decreased to 20.29 in 1998-99 (BBS, 2000). Along with the declining role of agriculture, there exist structural change within agricultural sector. Crop sector used to make overwhelmingly contribution to agriculture. Its share to GDP gradually declined from 20.58 in 1989-90 to 15.29 in 1998-99. In contrast to the declining role of agriculture, fishery sector grew at much higher rate than the growth of agriculture as well as overall economy. Consequently, the share of fishery sector to GDP gradually increased over time.

Given the significant growth of fishery sector and its contribution to the national economy, there is yet more to achieve as the sector has great potential. With remarkable growth of fishery sector, many questions may emerge. They are: What are the main sources of growth of fishery sector? What are the factors that affect the growth of this sector? How does policy incentive, institutional environment and support services contribute to the growth of this sector? Can the growth of fishery sector help to reduce income distribution and food security as most of the traditional fishermen belong to poorest section of the community?

Thus the objectives of this study are to:

(a) Present an overview of the changes in policy incentives, institutional environment and support services in fishery sector over the last two decades.
(b) Estimate the growth of fishery sector in terms of both value added and production.
(c) Identify the sources of growth of fishery sector.
(d) Examine the structural changes in fishery sub-sector (if there is any).
(e) Investigate the factors determining the growth of aquacultural production.
(f) Evaluate the public investment policy to fishery sector.

(g) Analyze the impact of the growth of fishery sector on food security and income distribution.

2. METHODOLOCY

2.1 Theoretical Framework

The study attempts to see the role of national policy environment on fishery and aquaculture sector. Policy incentives, institutional environment and support services constitute policy environment. Appropriate policy environment can increase absolute and relative profitability. Changes in the profitability can also help to innovate new technology and to adopt existing technology. That is, appropriate policy environment can increase efficiency, productivity and thereby can contribute growth of the sector as demonstrated in Figure –1.

Policy incentives include both macro policies and sectoral policies, which have implications for fishery sector. Institutional environment includes laws, rules, regulations, organizations etc. that determine the right to use fishery resources, particularly land and water. Support services include credit, research and development (R&D), training, extension services, infrastructure etc.

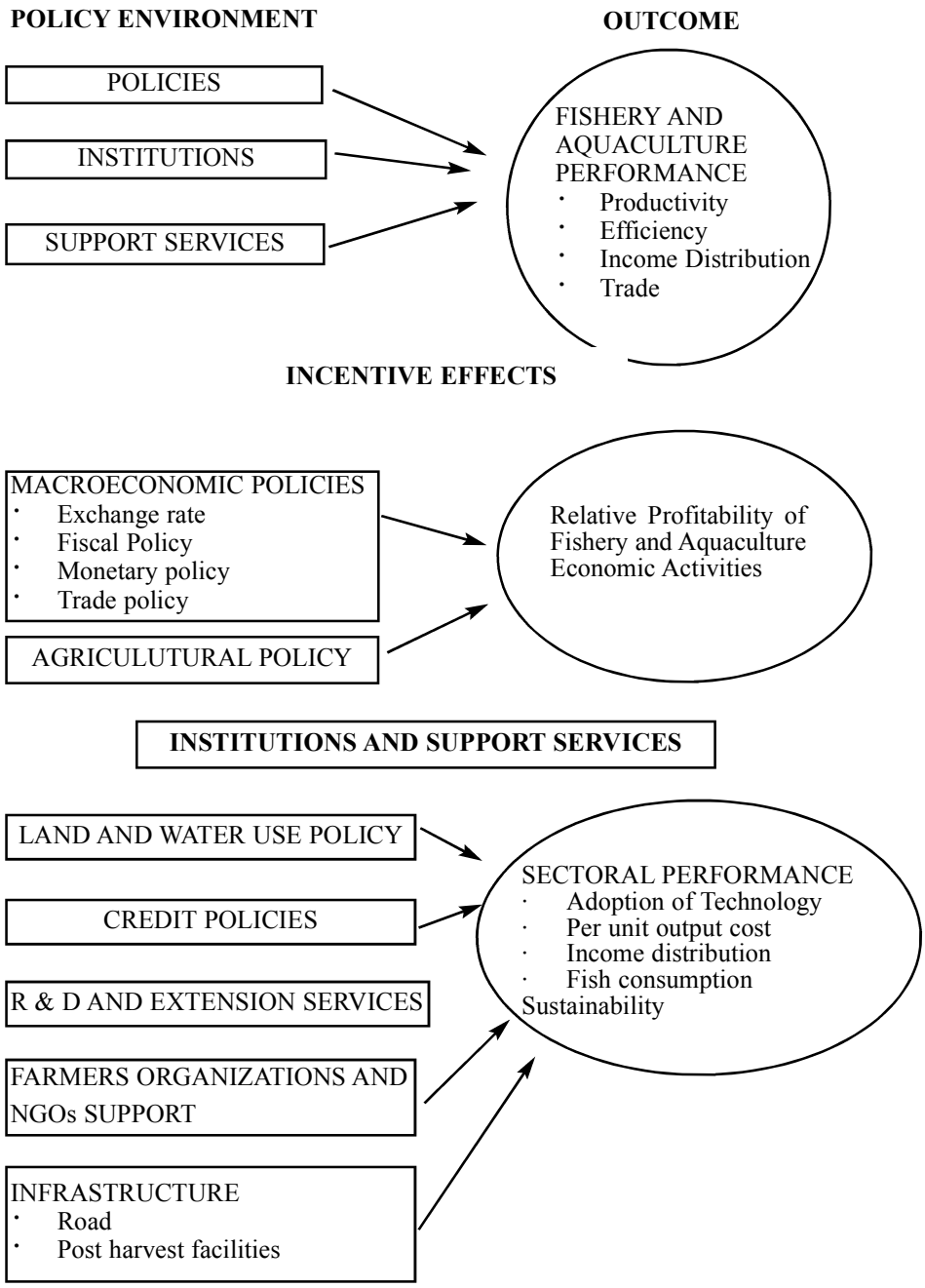
2.2 Indices and Methods Used

Average annual growth rate, share and other specific indices are estimated; and they are used in the analysis. Other indices that are used will be defined in the specific sections. Multivariate regression technique has also been used. Econometric model of multivariate regression will be discussed in the specific section.

2.3 Data Source

The study is based on secondary data. Different publications of Department of Fisheries (DOF) and Bangladesh Bureau of Statistics (BBS) are used to gather most of the required data.

Figure 1
NATIONAL POLICY ENVIRONMENT



3. LITERATURE REVIEW

Ahmed, M. et.al. (1999) documented major issues, priorities and needs of fisheries policy research in developing countries. Their study was based on an international consultation on fisheries policy organized by DANIDA (Danish International Development Assistance), ICLARM (International Center for Living Aquatic Resources Management), IFPRI (International Food Policy Research Institute) and IFM (Institute for Fisheries Management and Coastal Community Development) held at North Sea Centre, Hirtshats, Denmark. This study provides lot of insights, ideas and guidelines about fisheries policy in developing countries. The need for fisheries policy has been underscored in the study. Major policy issues and challenges under changed circumstances in demand, supply and international trade were identified. Finally the study demonstrated analytically the likely consequences and impacts of fisheries policy on economic growth, poverty, food security, protecting natural resources and environment. Though the study is very thought-provocating but it is general in nature for all developing countries. The study neither explained the circumstances for any specific country nor did provide any empirical results. The circumstances and situation might be different for different developing countries. Accordingly, the issues and their likely consequences might also be different for different countries.

A profile of the legal, institutional and policy mechanisms of Bangladesh in the management of fisheries and coastal resources was made by Habib, E. (1999). The overall objective of the study was to look into role of the regulatory regime, particularly the policies, laws and institutional mechanisms in the management of fishery and coastal resources. The study found that the existing laws defining the country's coastal fishery and regulating the exploitation of resources in it are flawed and prone to legal circumvention. The Marine Fishery Ordinance of 1983 and the Protection and Conservation of Fish Act of 1950 are ambiguous and to some extent conflicting. As a result their application become questionable. Conflict of jurisdiction and overlapping of functions of authority have been identified and this has led to a confusing situation regarding the appropriate departments to implement fishing regulations.

Habib's study (1999) further shows that large areas of the coastal region have been converted to shrimp farms, resulting in some social tension between rice and shrimp cultivators, destruction of mangroves and over-use of coastal resources. There exists institutional setup for sustainable use of coastal and fisher resources in Bangladesh, but the study found that the enforcement efforts by different

sectors are uncoordinated, competing and sometimes even adversarial. The study therefore, underscores the need to harmonize fishery and environmental laws in Bangladesh in order to implement its policy on sustainable exploitation and protection of its coastal resources. It examines the impact of existing regulatory regimes on the use of fishery resources with respect to biological sustainability only without looking into social sustainability. That is, the study did not show the impact of fishery policy and regulations on household, community and economy.

Toufique, K. A. (1995) in his study attempted to compare the private property rights versus common property rights to the management of open water captures fisheries in Bangladesh. He tries to answer the question that if property rights over water bodies are given to fishermen organization, can they appropriate rents and get benefits out of these? The findings of the study show that fishermen organizations incur high transaction costs compare to their private counterpart (probable because of asymmetric social power) and fail to retain the property rights (even if they are given). Thus the study concludes that the establishment of private property rights to water bodies in the form of lease seems to be better option in the management of open water bodies given present social circumstances in Bangladesh. Ullah, M. (1985), found similar findings.

World Bank (1991) undertook a fishery sector review study on Bangladesh. After evaluating the sectoral performances and its determinants, the study highlighted potentials, constraints and strategies to be required to realize sectoral potentials. This study mostly analyzed fishery sector issues and hardly touched transboundary issues. Furthermore, it did not focus much on the policies and institutions of fishery sector and their likely consequences on the economy as a whole.

Department of Fishery (1999) organized a national workshop (in collaboration with ICLARM) in order to exchange ideas and experiences about community based fishery resources management in Bangladesh, where partner NGOs (Non-Government Organizations) are involved to work with fishing communities. The success and failures of community based fishery resources management system was reviewed in the workshop. The participants of the workshop recommended appropriate strategies for the success of community based fisher resources management in Bangladesh.

4. RESOURCES AND FACILITIES AVAILABLE IN THE FISHERY SECTOR

This section presents an account of fishery resources available in Bangladesh. Table 1 shows types and quantity of different fishery resources available in the

country. Of the total inland water resources, open water accounts about 93% and closed water accounts Only about 7%. Among open water resources, flood plain predominates (65%); river and brackish water ranks second (24%). Among closed water resources, coastal shrimp farms accounts 3%; while ponds accounts 2.65% (Table 1).

Table 1 : Fisheries Resources of Bangladesh

Types of Resources	Area
1. Inland Water Resources	
(a) Open Water	
- River and Brackish Water	10,31,563 hectare (23.77%)
- Beel	1,14,161 hectare (2.63%)
- Kaptai Lake	68,800 hectare (1.58%)
- Flood Plain	28,32,792 hectare (65.28%)
Sub-total	40,47,316 hectare (93.26%)
(b) Closed Water	
- Ponds (12,88,222 in number)	1,14,890 hectare (2.65%)
- Baor (Ox-bow lake)	5,488 hectare (0.13%)
- Coastal Shrimp farm	1,40,000 hectare (3.22%)
Sub-total	2,92,378 hectare (6.74%)
Total Inland Water Resources	43,39,694 hectare (100.00%)
2. Marine Water Resources	
(a) Area	
- Coast line	480 km
- Base line	up to 10 fathom depth from coast line
- Internal water (upto base line)	25,151 sq.km
- Territorial water (upto 12 nautical miles)	9,065 sq.km
- Exclusive Economic Zone (200 nautical miles; this includes Territorial Water)	1,40,915 sq.km
- Total Marine area	1,66,066 sq.km
- Continental Shelf (up to 40 fathom depth)	85,153 sq.km
(b) Fishing Crafts (in number)	
- Authorized number of Trawler	73 (Shrimp – 51 and fish – 22)
- Number of Mechanized boats	About 5,000
- Number of Non-mechanized boats	About 14,000
(c) Units of Fishing Gear (in number)	
- Gill Net	6,389
- Set beg Net (SBN)	12,615
- Long Line	2,084
- Trammel Net	500
Others	2,222

Source: Department of Fisheries, GOB, (At a Glance), Dhaka, Sept. 1997 *Brief On Department of Fisheries and Fisheries Sector of Bangladesh*

Marine water resources include coastline of 480 k.m., internal water of 25,151 k.m, territorial water of 9,065 k.m. (Table 1). The number of marine fishing crafts and gear recorded is also presented in Table 1.

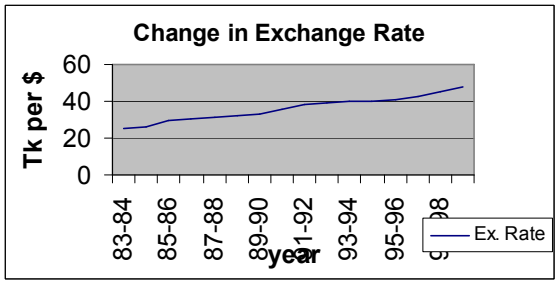
5. AN OVERVIEW OF THE CHANGES IN POLICY ENVIRONMENT

This section presents an overview of the changes in policy incentives, institutional environment, infrastructure and support services over the last two decades in fishery sector in Bangladesh.

5.1 Policy Incentive

Like many other sectors, both macro policies and sectoral policy can influence fishery sector. Bangladesh economy has experienced significant macro economic reforms since mid-eighties. Macro economic reforms characterized by successive import liberalization, devaluation of exchange rate, deregulation of foreign exchange rate. Under trade policy reform, import duties successively have been reduced remarkably and made uniform. The maximum import duty was about 400% in the early eighties and very recently it reduced to 35%. Bangladesh currency (Taka) has been devalued successively. For example, the rate of US dollar, was Tk. 24.94 in 1983-84 and it increased to Tk. 52 in 1999-2000 (see Appendix Table ..). That is over the period of one and a half decades, taka was devalued by more than 100% (against US dollar).

Figure 2



Under sectoral policy incentive, government declared fishery sector as one of the thrust sectors. To attract investment in agriculture, which include fishery sub-sector, interest subsidy has been introduced. Banks were asked

to fix lending rates within the bands of 10% to 14% for agriculture; 8% to 10% for export of agricultural products (Appendix Table 1) where commercial lending rate was between 15% to 18%.

During nineties government offers several export incentives (World Bank, 1991). These include: (i) export finance at concessional interest rate on working capital; (ii) development funds; (iii) foreign exchange for business travel abroad; (iv) an export performance benefit (XPB) equal to 100 of the difference between official exchange rate and the market exchange rate for every U.S. dollar earned through fish export; (v) reduced or no duties and excise taxes to the import of equipment and machinery for export oriented industries; (vi) other financial and non-financial incentives.

All of the above macroeconomic and sectoral policy incentives have direct and indirect implications for fishery sector. They may contribute to the growth of the sector (to be discussed later).

5.2 Institutional Arrangement to the Use of Fishery Resources

Fishery resources (except pond) in Bangladesh are mostly owned and managed by the public sector. As a result, government agencies have been heavily involved in the planning, research, promotion, development, management and regulation of the fishery sector. As many as fifteen public organization/departments (as listed in the Appendix Table 2) are involved in the management and development of fishery sector. However, private sector participation in fisheries development has rapidly increased in the recent years, especially with the introduction of aquaculture, shrimp farming, seafood export and mechanized fishing boats. Fish harvesting, marketing, processing and trade have remained mainly in the private sector.

Four sets of laws and regulations are available to protect and encourage the development of the fishery sector (Habib,1999). They are: (i) The Protection and Conservation of Fish Act, 1950 (as amended in 1982); (ii) The Tank Improvement Act (as amended in 1986); (iii) The Fish and Fish Products (Inspection and Quality Control) Ordinance, 1983 and (iv) The Marine Fisheries Ordinance, 1983 and the Marine Fisheries Rules, 1983.

Since the abolition of Zamindari system, the authority of the actual management of public water bodies was vested with the district administration on-be-half of Ministry of Land (MoL). Between 1950 and 1974, public water bodies were leased out to anybody through auction. After the independence, government decided to restrict the auctioning of

water bodies to registered fishers' cooperative societies only (Habib, 1999). As a result of this restriction, new and fake fishers' cooperative societies mushroomed. Old non-fishing ijaradars (leases) continue to control public water bodies directly or indirectly. This procedure continued up to 1980.

Toward the end of 1980, ownership of public water bodies was transferred from Ministry of Land to Ministry of Livestock and Fisheries (MoLF). Immediately after this change, MoLF started to develop new ways and procedures for replacing the revenue-oriented management of public water bodies with management of the living aquatic resources according to biological principles. But before this could be completed, the ownership of public water bodies again transferred back to MoL. However, some of the public water bodies were vested under MoLF for management purposes.

In 1986 the New Fisheries Management Policy (NFMP) was introduced by MoLF to achieve two objectives - (i) diverse of maximum benefits arising from public fisheries to the actual fishers and (ii) development of implementation measures to ensure sustainability of the fisheries resources. Under the NFMP system, the leasing system was abolished and fishing rights were directly licensed to fishers. About 257 closed water public water bodies, which were transferred to MoLF were brought under this system. The license fee was determined on the basis of size, efficiency and gear.

In September 1991, MoL further changed the leasing system. Auctioning was discontinued. In its place sealed tenders were instituted with the condition that offering of bids had to be 25% higher or more than the preceding year's lease value. Tenders were restricted to fishermen cooperative societies. But if the offer is not at least 25% higher than the previous year's lease value, the offer is not accepted. In such case, tenders had to be invited again, and this time, any individual or any organization is entitled to make offer for lease.

In 1995 government decided to abolish the procedure of leasing open water bodies such as rivers, canals in order to give fishing right to the poor fishers. But it does not restrict the access of non-fishers or occasional fisherfolk. As a result of this decision, the objectives of NFMP failed miserably.

Though the leasing of open water bodies has been abolished, the procedure of sealed tender is still being applied with the closed public water bodies. But the responsibility of the management of these water bodies lies with

different ministries depends on the size. Closed water bodies having size up to 20 acres are vested with local government and subsequently to the Ministry of Youth and Sports (MoYS). On the other hand, the management of the closed water bodies having size more than 20 acres remain vested with the MoL.

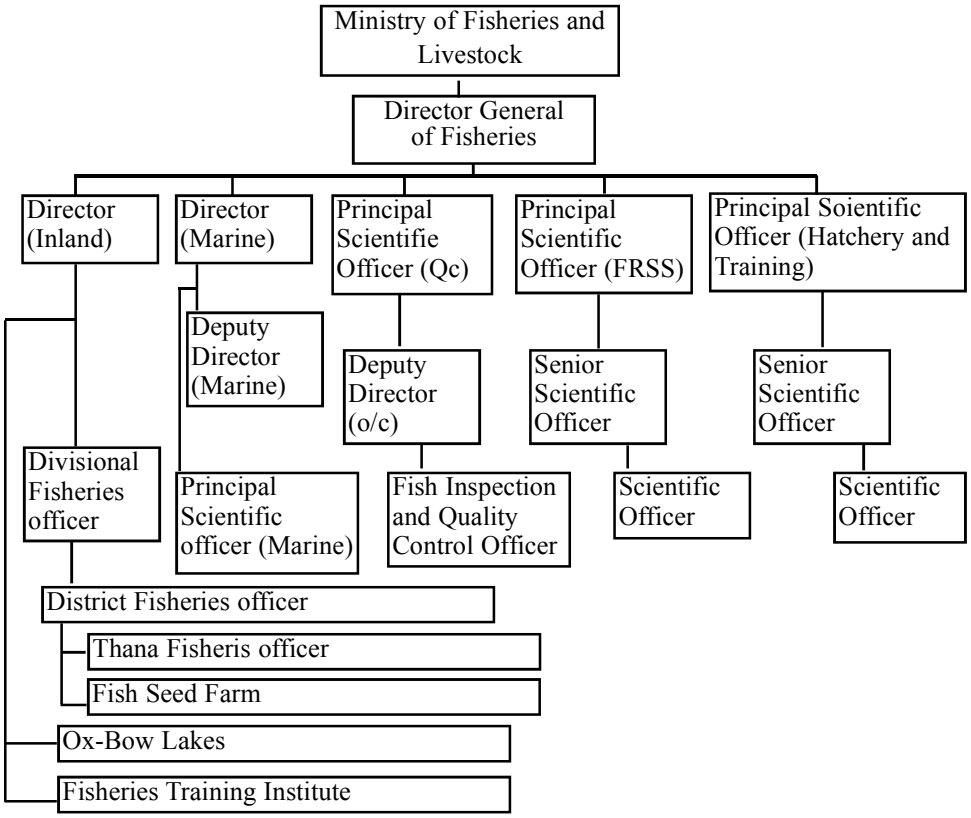
Above discussions show how institutions consisting of rules, regulations relating to the management of fishery resources changed over the last two decades. Possible consequences of these changes will be analyzed later.

5.3 Infrastructure and Support Services

Department of Fisheries (DOF) under MoFL is the government agency primarily responsible for the development of the fishery sector. It generally implements government programme and projects in the fishery sector. DOF's main responsibility is fisheries extension. An Organogram of DOF

Figure -3

Organiazational Chart of Department of Fisheries



is presented in Figure 3. As the figure reveals that DOF has its setup up to Thana level and selective demonstration farms exist below Thana. Presently there are about 4,200 staff in the DOF, among which about 3,500 are in the revenue budget and remaining in the development budget. Among the staff in the revenue budget about 2,300 are at the Thana level.

Facilities and Infrastructure available in the public and private sector are presented in Table 2. Latest record shows that public infrastructure include 7 fish training centre, 113 fish hatchery-cum-demonstration farm, 9 fish landing centre, 7 fisheries research station etc. Among private sector facilities, there are about 3,441 fish nurseries, 76 shrimp hatchery (Table 2).

6. CONTRIBUTION OF FISHERY SECTOR TO THE

Table 2 : Facilities and Infrastructure in the Fishery Sector

Types of Facilities/Infrastructure	Number
Public Sector Infrastructure	
1. Fish/Shrimp Training Centre	7
2. Fish Hachery/Demonstration Farm	113
3. Shrimp/Prawn Hatchery	6
4. Shrimp Demonstration Farm	2
5. Shrimp Service Centre	21
6. Fish Landing Centre	9
7. Fisheries Research Station	7
8. Quality Control Laboratory	3
Private Fish Hatchery and Nursery	
1. Fish Hatchery	631
2. Fish Nursery	3,441
3. Bagda Shrimp Hatchery	43
Galda Shrimp Hatchery	31
Estimated Number of Fishers	
1. Fish Farmers	3.08 million
2. Shrimp Farmers	1.15 million
3 Other Fish Farmers	1.93

Source: Department of Fisheries
BBS, Statistical Year book of Bangladesh, 1999

NATIONAL ECONOMY

This section discusses the contribution of fishery sector to the national economy. It also shows how the contribution of this sector vis-à-vis other sectors changes over time. The changes in the share of agriculture and its sub-sectors to GDP are presented in Table 3.

6.1 Changes in the Share

Among different sub-sectors in agriculture, it is only fishery sub-sector, whose share to GDP increases systematically over time. On the other hand, the share of crop sub-sector gradually declined; while it remained by and large constant for both livestocks and foresty. Agriculture as a whole shows a gradual decline in its share to GDP (Table 3).

Fishery sector contributed 4.25% to GDP in 1989-90 and its contribution increased to 5.7% in 1998-99. Figure 4 shows how the contribution of fishery sub-sector vis-à-vis other sub-sectors changes over time. Despite its relatively small size, the fishery sector is critically important to Bangladesh economy for the following reasons.

(1) The country has remarkable amount of fishery resources, which could be effectively be utilized to increase fish production.
(2) Fish is an important and probably the cheapest source of animal protein.
(3) There is a considerable scope for increased fish export.
(4) The fishery sector could significantly contribute to poverty alleviation and gainful employment generation.

6.2 Changes in the Growth Rate

Average yearly growth rate has been estimated for all sub-sectors of agriculture as well as for the country as a whole and it is presented in Table 3. Fishery sector shows significantly higher growth compared to other sub-sectors in agriculture as well as GDP growth rate of the country as shown in Table – 3. Average rate of growth of fishery sector is estimated to be 8.14% per year as against 3.47% for livestocks, 2.48 for crops, 1.56%. for forestry. During the same period the average growth of GDP grew at a rate of 4.68% against 1.14% for the agricultural sector As the Table 3 shows that fishery sector grew at a much higher rate compared to GDP growth of the country during during 1989-90 to 1998-99. A brief comparison in the growth rate among different sub-sectors of agriculture is shown in Figure 5.

6.3 Employment

Table 3 : Share and Growth of Different Sub-Sectors of Agriculture in GDP

The Share of Different Sub-Sectors in GDP						
	Country	Crops	Livestock	Forestry	Agriculture	Fishing
89-90	100	18.807	3.626	2.023	24.456	4.252
90-91	100	18.353	3.590	2.020	23.962	4.439
91-92	100	17.666	3.497	1.967	23.130	4.575
92-93	100	17.056	3.424	1.937	22.417	4.746
93-94	100	16.115	3.369	1.913	21.397	4.920
94-95	100	14.834	3.290	1.875	19.999	5.008
95-96	100	14.425	3.224	1.854	19.503	5.141
96-97	100	14.487	3.120	1.820	19.426	5.219
97-98	100	13.991	3.061	1.818	18.870	5.436
98-99	100	13.762	2.997	1.823	18.582	5.699

	Growth rate of					
Year	Country GDP	Agriculture GDP	Crops GDP	Livestock GDP	Forestry GDP	Fishing GDP
89-90	-	-	-	-	-	-
90-91	3.34	0.84	2.29	3.19	1.25	7.89
91-92	5.04	1.11	2.34	2.29	1.39	8.24
92-93	4.57	0.97	2.38	2.97	1.35	8.49
93-94	4.08	-1.66	2.42	2.80	-0.65	7.91
94-95	4.93	-3.42	2.47	2.84	-1.93	6.79
95-96	4.62	1.74	2.51	3.46	2.03	7.39
96-97	5.99	6.44	2.58	4.03	5.57	7.60
97-98	4.63	1.05	2.64	4.51	1.63	8.98
98-99	4.88	3.16	2.69	5.16	3.28	9.96
Average	4.68	1.14	2.48	3.47	1.55	8.14

Source: BBS, Statistical Yearbook of Bangladesh, 1999

Figure 4

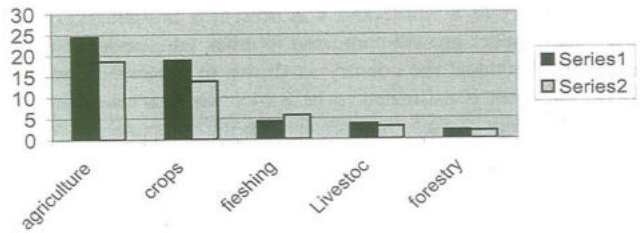
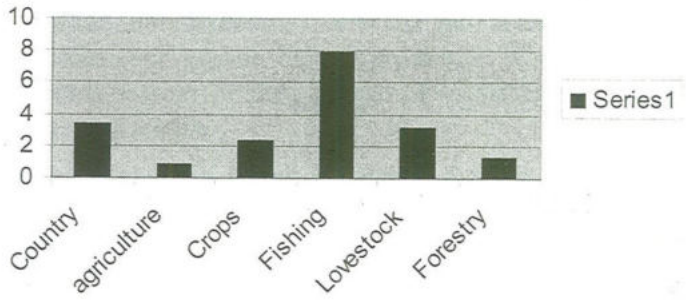


Figure 5



6.3 Employment

Estimates of employment in the fishery sector is incomplete and vary widely between sources. Total number of fishermen has been estimated to be 2.3 million in 1999-2000 (Table 10). Considering average family size of 6, it is estimated that about 13.8 million people live on fishery sector directly for their livelihood, which account 10% of the total population. Estimates show that about 75% of the households in the rural areas involve in subsistence fishing in flood lands (Planning commission). Many people are involved in primary, secondary and tertiary fishery related activities. These activities include aquaculture, fish trade, fish processing, the manufacturing of fishing gear and crafts etc.

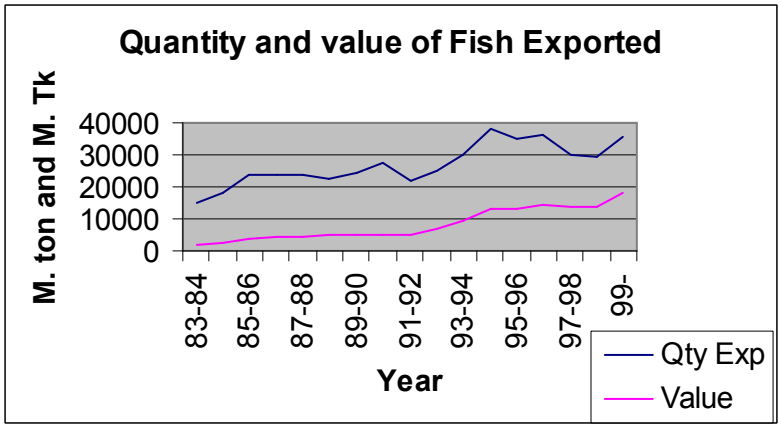
6.4 Other Role

Fish is an important source of human nutrition and it is expected to remain an integral part of diet in Bangladesh. 1995-96 per capita consumption per day estimated to be 43.8 grams, which accounts 65% of the average per capita intake of protein and 80% of animal protein intake (BBS, HES, 1995-96).

Fisheries sector has been emerging rapidly as a major source of foreign exchange earning for Bangladesh. The value of fish export increased more than nine times over the period of 1983-84 to 1999-2000 (Figure 6; Appendix Table 2). But the share of fish export to total value of export earning declined gradually. It decreased from 9.89% in 1983-84 to 6.28 in 1999-2000 (Appendix Table 2). The percentage declined in the value of fish export is attributable primarily to a rapid increase in ready-made garments. In 1998-99 ready-made garments contributed

The value added of ready-made garments is considered to be only 25%; whereas the domestic value added of fish export is about 100%. As a result, net earnings of ready-made garments is only 2.6 times (instead of 10.6 times) more than that of fish export earnings.

Figure 6



7. STUCTURAL CHANGES AND SOURCES OF GROWTH OF FISHERIES SECTOR

This section first investigates the sources of growth of fishery sector and then it analyzes the structural changes in the sector (if there is any). Fishery sector can be divided into inland fishery and marine fishery. Growth of production of inlan and marine fisheries has been estimated and it is presented in Table 4. Between 1989-90 to 1999-2000, total production of fish increased 7.69 times but production of inland fish increased by more than 9 times. Whereas the production of marine fish increase by only 3 times during the same period. As the table shows that the average growth of total fish production increased at a rate of 5.4% during 1985-86 to 1999-2000. Inland fisheries show an average growth of 6% as against about 3.5% for marine fisheries during the same period. These statistics clearly imply that production of inland fisheries increased at a remarkable rate compared to marine fisheries. From this one can conclude that inland fisheries conctributed mostly to the growth of fihery sector, particularly to the growth of fish production.

Inland fisheries divided into capture and culture. Growth of culture fisheries

shows 11.6% per year on the average (during 1985-86 to 1999-2000) as against only 3% for capture fisheries (Table 5). Inland capture fisheries even grew much slower rate compared to marine fisheries, which also belongs capture fisheries. A comparative situation of growth of fish production by sources is depicted in Figure 6. Probable reasons of slow growth of inland capture fisheries will be discussed in the next section.

The changes in the share of inland vs. marine fisheries as well as capture vs. culture fisheries (in the inland fisheries) are also demonstrated in Table 5. The estimate shows that the share of inland fisheries increased from 74% in 1985-86 to about 80% in 1999-2000. Accordingly the share of marine fisheries declined over the same perion from 26% to 20% (Table 4). But a significant structural change has been observed within inland fisheries sector.

Within inland fisheries the share of capture and culture fisheries has been estimated. The estimate shows that the share of capture (in the inland) declined systematically and significantly over time. Capture fisheries accounted more than 75% in 1985-86 and decreased to nearly 50% in 1999-2000 (Table 5). On the contrary, the share of culture fisheries gradually increased during the same period. It increased from 25% in 1985-86 to 49% in 1999-2000. Among the culture fisheries, pond culture played predominant role in total production of inland fisheries. It accounted about 21% in 1985-86 but in 1999-2000 its share increased to nearly 42%. The changes in the share of different inland fisheries have bee presented in Figure 7. It is to be mentioned that pond is only 2.65% of the total inland water resources.

From the above discussion, one can conclude that culture fisheries remained responsible mostly to the growth of fisheries sector in the country. Among culture fisheries pond, particularly pond culture not only played overwhelming contribution but also its share increased remarkably over time. Because the share of non-pond culture fisheries remained remained relatively low compared to its share of total inland water resources. Thus, it can be concluded that fishery sector in Bangladesh has undergone significant structural changes. Factors responsible for the growth of pond culture fisheries will be investigated in the later section.

8. IMPACT OF SUPPORT SERVICES ON THE GROWTH OF POND CULTURE

Fish production is determined by fish area and fish yield for a particular type of fishery. There is limited scope for expanding the total area of inland fishery. This area is expected to continue decline because of flood control, drainage, irrigation

Table 4 : Growth of Fish Porduction by Sources and Changes in the Share by Sources, 1985-86 to 1999-2000

Year	Inland Production (M. ton)	Marine Production (M. ton)	Total Production (M. ton)	Growth of Inland	Growth of Marine	Growth of Total
85-86	586522	207401	793923			
86-87	597106	217579	814685	1.805	4.907	2.615
87-88	599523	227582	827105	0.405	4.597	1.525
88-89	607645	233281	840926	1.355	2.504	1.671
89-90	616464	239063	855527	1.451	2.479	1.736
91-92	706605	245474	952079	7.978	1.630	6.267
92-93	770162	250492	1020654	8.995	2.044	7.203
93-94	837566	253044	1090610	8.752	1.019	6.854
94-95	908218	264650	1172868	8.435	4.587	7.542
95-96	988238	269702	1257940	8.811	1.909	7.253
96-97	1085764	274704	1360468	9.869	1.855	8.150
97-98	1190761	272818	1463579	9.670	-0.687	7.579
98-99	1242620	309797	1552417	4.355	13.554	6.070
99-2000	1321235	333799	1655034	6.327	7.748	6.610
Av. Growth				6.026	3.513	5.414

Changes in the Share of Fish Production by Inland and Marie

Year	Inland Production (M. ton)	Marine Production (M. ton)	Total Production (M. ton)	Share of Inland	Share of Marine	Total Total
85-86	586522	207401	793923	73.88	26.12	100
86-87	597106	217579	814685	73.29	26.71	100
87-88	599523	227582	827105	72.48	27.52	100
88-89	607645	233281	840926	72.26	27.74	100
89-90	616464	239063	855527	72.06	27.94	100
90-91	654397	241538	895935	73.04	26.96	100
91-92	706605	245474	952079	74.22	25.78	100
92-93	770162	250492	1020654	75.46	24.54	100
93-94	837566	253044	1090610	76.80	23.20	100
94-95	908218	264650	1172868	77.44	22.56	100
95-96	988238	269702	1257940	78.56	21.44	100
96-97	1085764	274704	1360468	79.81	20.19	100
97-98	1190761	272818	1463579	81.36	18.64	100
98-99	1242620	309797	1552417	80.04	19.96	100
99-2000	1321235	333799	1655034	79.83	20.17	100

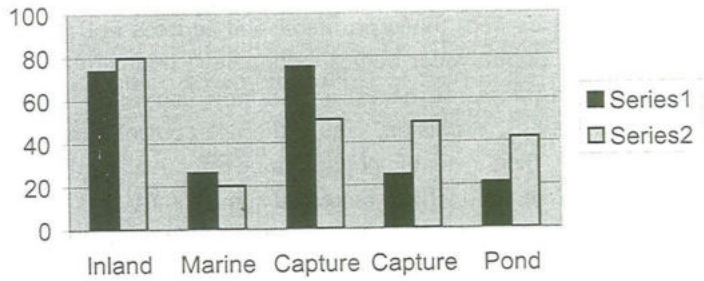
Source: Fisheries Statistical Yearbook of Bangladesh, 1985-86, 1987-88, 1995-96, 1999-2000, 2001

Table 5 : Growth and Share of Different Sources of Inland Fisheries Porductio,1985-86 to 1999-2000

Year	Growth of Capture	Growth of Pond	Growth of Other cult	Growth of Total Cult	Growth of Inland	Share of Capture	Share of Pond	Share of Other Cult	Share of Total Cult
85-86						75.33	21.11	3.57	24.67
86-87	-2.443	15.405	11.019	14.77	1.80	72.18	23.93	3.89	27.82
87-88	-1.719	4.582	14.115	5.92	0.40	70.66	4.92	4.42	29.34
88-89	0.128	3.740	7.513	4.31	1.35	69.80	25.51	4.69	30.20
89-90	-0.063	5.624	1.295	4.95	1.45	68.76	26.56	4.68	31.24
90-91	4.608	10.559	3.856	9.55	6.15	67.76	27.66	4.58	32.24
91-92	8.195	7.743	6.185	7.52	7.98	67.89	27.60	4.50	32.11
92-93	10.980	3.657	11.772	4.80	8.99	69.13	26.25	4.62	30.87
93-94	7.693	10.078	17.068	11.12	8.75	68.46	26.57	4.97	31.54
94-95	3.099	20.104	19.552	20.02	8.44	65.09	29.43	5.48	34.91
95-96	3.046	15.224	42.823	19.56	8.81	61.64	31.16	7.20	38.36
96-97	-1.519	31.125	15.357	28.17	9.87	55.25	37.19	7.56	44.75
97-98	2.675	19.708	11.412	18.31	9.67	51.73	40.60	7.68	48.27
98-99	5.434	3.346	2.425	3.20	4.36	52.26	40.20	7.53	47.74
99-2000	3.241	11.031	2.626	9.70	6.33	50.75	41.98	7.27	49.25
Av. Growth	3.10	11.57	11.93	11.56	6.03				

Source: Fisheries Statistical Yearbook of Bangladesh, 1985-86, 1987-88, 1995-96, 1999-2000, 2001

Figure 7



development and construction of rural roads etc. Flood control, drainage and irrigation projects adversely affect aquatic habitat by limiting breeding ground and migratory paths. Following factors may contribute to slow growth of capture fisheries.

(1) Lack of implementation of fishery sector policy.
(2) Lack of enforcement of regulations related to fishery sector, which result (i) indiscriminate use of fishing gear (some of which are illegal), (ii) increasing industrial pollution in river waters, (iii) over use of public water bodies.
(3) Inadequate control and inefficient use of public water bodites because of ownership conflicts, auction rights and management problem.
(4) A resource conflict between fisheries and crop production because of (i) increased use of irrigation in dry season, (ii) use of pesticides, fertilizers and other chemicals for crop production.

All of the factors may cause to reduce both fish area and fish yield in case of inland capture fisheries. It has been shown (in the previous section) that fishery sector has undergone structural change. Analysis shows that the growth of total fish production as well as the growth of inland fish production is attributed by the growth of culture fisheries, particularly the pond culture fisheries. In this regard, it is of interest to know what factors are responsible to the growth of pond fisheries. This section investigates the factors that contribute the growth of pond fisheries. Understanding of these factors can be very useful for policy formulation.

Over the last two decades many types of aquaculture technologies have been invented and innovated in different countries of the world. Some of the aquaculture technologies were found profitable and adopted in Bangladesh (Dey, 2000). Unlike closed public water bodies, ponds have relatively less ownership and management problem. If necessary support services, which include availability of fingerlings, extension, credit, disease control and other relevant information are given, then available ponds can be effectively utilized for culture fisheries. As a result fish yield will be increased significantly. It is to be noted that nearly 40% of the ponds area are being utilized for fish culture. That is considerable potential remains to increase fish yiel by increasing pond area under fish culture.

In this section an effort has been made to see how different suppport services

influence fish yield. Total area and total catch of pond fisheries are available by district. From these data yield per hectre for pond fisheries can be estimated by district. Available data also help us to estimate the proportion of pond area under fish culture for all districts. Available aquaculture technologies are expected to encourage people to adopt them as these technologies are considered to be profitable. Adoption of more aquaculture technologies will increase fish yield.

In order to dissiminate aquaculture technologies DOF (Department of Fisheries) established fish farm and training centre at the grass root level i.e. at village level in different districts. The purpose of these farm is to demonstrate aquaculture technologies to people at the grass root level. That is, these farm not only dissiminate aquaculture technologies but also provide extension services. Location of DOF operated fish farm and training centre has been collected from DOF. About 87 such farm are located in 42 districts. The prsesence of DOF operated fish farm can be considered as an index of extension services for technology diffusion. Institutional credit is also considered an important factor, which may induce people to culture fish in their ponds. Thus among other things, yield of the pond fishereis is expected to be influenced by following factors.

$$Y = f(X, D, C) \text{ where}$$

Y = Yield per hectre of pond fisheries
X = Proportion of pond area (in %) under aquculture
D = Dummy variable
D = 1 if district has DOF operated fish demonstration farm and 0 otherwise
C = amount of institutional rural credit disbursed in the district

Amount of institutional credit disbursed in the fisheries sector by district is not available. So, total amount of institutional rural credit disbursed has been used as a proxy of institutional credit in fisheries sector. Above regression model has been fitted to identify factors determining yield of the pond fisheries. District level cross-section data for 1997-98 are used to estimate the model. That is, district is considered as unit of observation in the regression analysis. Out of 64 districts, data are missing for three hilly districts. So, the number of observations turns out to be 61. The model is estimated by OLS method. The results of the regression are presented in Table 6.

The data seem to fit the model relatively well as demonstrated by F-statistics (27.77 with 57 d.f.). Adjusted R-Square is found to be 0.57, which implies that 57% of the variation in the dependent variable (fish yield per hectre of pond

Table 6 : Estimated Results of the Regression Model

Variable	Parameter Estimate	St. Error	T-value	Prob> T
Intercept	0.88684	0.20127	2.428	0.0184
X	0.022198	0.00326	6.808	0.0001
D	0.345571	0.130987	2.638	0.0107
C	0.000261	0.00008515	3.067	0.0033
F-Value = 27.77	27			
Adjusted R-Square = 0.57				
Sample size = 61				
D.W. Statistics = 1.67				

fisheries) is explained by the independent variables under study. The parameter estimates show that all three explanatory variables are found highly significant at less than 1%.

Among the explanatory variables, the coefficient of D (the dummy varibles used to proxy support services) shows very high (0.34) compared to other variables. This implies that the presence of aquaculture demonstration and training farm in the district can greatly influence people in the district to adopt aquaculture technologies, which ultimately contributes to increase yield in the pond fisheries. The proportion of pond area under aquaculture is positively related to the fish yield (Table 6). The results also show that rural institutional credit influence fish yield of the pond fisheries. Availability of institutional credit helps to reduce financial constriant in the rural areas.

Thus, the regression results clearly demonstrate that support services in the form of extension, availability of aquaculture technologies, credit can play a mojor role to increase fish yield in the pond fisheries. However government's other policy incentives like interest subsidy, devaluation of currency, export incentives may also encourage producers to adopt aquaculture technologies, which contribute fish yield in the pond fisheries.

9. PUBLIC INVESTMENT/EXPENDITURE POLICIES

Previous section demonstrates that public investmet/expenditure have great role and can contribute significatly to the growth of fisheries sector. This section will examine to what extent public investment is encouraging to fisheries sector. Government investment (expenditure) bisas (IB) is estimated. The method of estimating investment bias (IB) for a particular sector, k is given below.

$$IB_k = \frac{Sik}{Sgk} \quad \text{where}$$

Sik = share of total government investment in k sector

Sgk = share of total GDP in k sector

If IB = 1 (or 100%), the investment policy is considered neutral.

If IB>1 (or more than 100%), the investment policy is encouraging or pro-sector bias.

If IB<1 (or less than 100%), the investment policy is anti-sectoral bias in the public investimet or expenditure policy.

The share of total public investment in agriculture and fisheries sectors and the estimation of investment bias (IB) index have been presented in Table 7 and 8 respectively. The estimate of IB index shows that it was consistently well below 1 both for agriculture as well as for fisheries for all the years under study (Table 8). For agricultural sector, it varied from 0.24 to 0.18. The index was 0.24 in 1992-93 and decreased to 0.19 in1998-99.

The share of fisheries sector to total public investment steadily decreased over the

Table 7 : Actual Public Investment (Development Expenditure) in Fisheries and Agriculture Sector

Year	Public Exp. On Agriculture Sector	Public Exp. On Fisheries Sector	Total Public Exp.	Share of Public Exp In Agriculture	Share of Public Exp. In Fisheries sector
1992-93	4415	525.0	65500	6.740	0.800
1993-94	4361	668.2	89830	4.850	0.740
1994-95	5858	712.0	103030	5.686	0.690
1995-96	5654	589.5	100157	5.645	0.588
1996-97	6048	496.5	110410	5.480	0.450
1997-98	6296	346.0	110370	5.700	0.313
1998-99	6080	431.4	125090	4.860	0.345

Table 8 : Sectoral Share of Agriculture and Fisheries to GDP and Investment Bias Index (IBI), 1992-93 to 1998-99

Year	Sectoral Share of GDP at constant price in		Investment Bias Index (IBI) in	
	Agriculture	Fisheries	Agriculture sector	Fisheries sector
1992-93	28.21	4.93	0.239	0.160
1993-94	27.30	5.10	0.178	0.145
1994-95	26.02	5.21	0.218	0.132
1995-96	25.68	5.36	0.220	0.110
1996-97	25.87	5.48	0.210	0.080
1997-98	25.34	5.67	0.225	0.055
1998-99	25.28	5.93	0.192	0.058

Source: Directorate of Fisheries (DOF)
BBS, Statistical Year book of Bangladesh 1999

years. Conversely, the share of fisheries sector to GDP increased gradually over time. As a result the estimate of investment bias (IB) index for fisheries sector declined dramatically over time. It was 0.16 in 1992-93 and became 0.058 in 1998-99. This index clearly shows how much public investment/expenditure policy is biased against agricultural sector in general. But within agricultural sector, it is more biased against fisheries sub-sector. From these findings, one can conclude that agricultural sector in general and fisheries sector in particular fail to get their due shares in public investment.

10. CONCLUSION

The fishery is one of the growing and potential sectors in Bangladesh. The study attempts to identify the sources of the growth of fishery sector and analyzes the structural changes that have undergone in the sector. It further investigates the factors determining the growth of aquaculture production to see whether public investment in the form of support services can play any role to its growth. The study also evaluates public investment policy to see whether public investment is biased against fishery sector.

Changes in policy environment, which include policy incentive, institutional environment and support services can influence profitability and efficiency; and thereby it can play significant role to the growth of fishery sector. The study provides an overview of the changes in policy environment over the last two decades in the fishery sector. The anlysis shows that as many as ten

departments/ministries are involved in the management of public water bodies. There are many laws, rules and regulations designed to manage public water bodies. These rules are complex and changed frequently withour any rational reasons. Most of the laws and rules are not enforced properly. As a result, the productivity of the public water bodies is affected adversely. However, policy incentives seem to encourage the growth of private sector fishery, particularly the aquaculture growth.

The estimate of growth shows that fishery sector grew at a much higher rate (8.14%) compared to the growth of other sub-sectors of agriculture (1.55% to 3.47%) as well as the growth of economy as a whole (4.68%) during 1989-90 to 1998-99. As a result, the share of fishery sector to GDP increased systematically over time whereas the share of agrcultural sector, as a whole declinced gradually. The fishery sector also contributes significanlty to employment generation, supply of nutrition, foreign exchange earning.

A remarkable structural change has been observed in the fishery sector. The share of inland inland fishery increased and the share of marine fishery declined. Within inland fishery, the share of capture fishery declined systematically and the share of culture fishery, particularly pond culture increased substantially over time. That is, culture fishery grew at much higher rate (11.56%) compared to inland capture fisheries (3.1%) and marine fisheries (3.36%). Thus, culture fishery, particularly the pond culture contributed mostly to the growth of fishery sector but pond accounts only 2.65% of the total inland fishery resources.

The muliple regression model has been fitted to identify the factors responsible for the yield of the pond fisheries. The results show that support services in the form of extension, availability of aquaculture technologies, credit play a mojor role to increase the yield of the pond fisheries. However, government other policy incentives like interest subsidy, devaluation of local currency, export incentives may also encourage producers to adopt aquaculture technologies, which contribute yield of pond fisheries.

The estimate of public investment bias shows that it is biased against fishery sector as well as agricultural sector. But the degree of bias is found to be more for fishery sector compared to agricultural sector. Furthermore, public investment bias steadily decreased over time against fishery sector. This concludes that agricultual sector in general and fishery sector in particular fail to get their due share in public investment.

The impact of fishery sector growth on food security and income distribution has

been analyzed. Analysis shows that growth of fishery sector benefited mostly to the richer section of the community. The per capita consumption of fish has increased remarkably for the richest section of the community; on the other hand the same decreased significantly for the poorest section of the community. The economic condition of the traditional fishermen seems to deteriorate gradually as catch per fisherman declined over time. Above statistics reveal that rich people in Bangladesh consumed more and more fish, on the average but poor people in the society has decreased their consumption overtime. Thus, the benefit of the fishery sector's growth did not reach to the poorest section of society; the economic condition of the poorest section deteriorated.

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Appendix

Appendix Table 1 : Lending rate for different sectors (Figures are in Nominal Term)

	Agriculture		Small Industry		Export	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Dec. 89	16	16	10	10	8	11
Jun. 90	16	16	10	10	8	11
Dec.90	16	16	10	10	8.5	11.5
Jun. 90	16	16	10	10	8.5	11.5
Dec. 91	11	15	8	13	7.5	11
Jun. 92	11	15	8	13	7	10.5
Dec. 92	11	15	8	13	7.5	10.5
Jan. 93	11	15	8	13	7.5	10.5
Dec. 95	11.5	12.5	9	10	8.5	9
Dec. 96	13.5	13.75	11	11	10	10
Dec. 99	12.5	13	11	11.5	10	10

Source:1 Ghafur, Abdul, "Financial Sector Reform: An Overview" in A Review of Bangladesh's Development 1995, Centre for Policy Dialogue, Dhaka 1995, PP. 87-100
2 Statistical Yearbook of Bangladesh, 1995, 1996, 1999

Appendix Table 2 : Quantity and Value of Fish Exported from Bangladesh, 1983-84 to 1999-2000

Year	Frozen Shrimp		Frozenfish & Frog leg		Dry and Salted Fish		Tortles/Crab Share of		Total		Shark fish in total Ex. value
	Qty	Value	Qty	Value	Qty	Value	Qty	Value	Qty	Value	
83-84	8818	155.5	5312	33.42	357	4.07	483	3.82	14844	196.81	9.89
84-85	12682	199.45	4662	25.04	429	4.21	533	4.55	18202	233.25	9.66
85-86	13631	269.31	7480	66.57	1208	15.01	729	5.36	23527	356.25	14.65
86-87	16275	341.75	6214	65.97	697	8.74	575	7.59	23883	424.05	12.99
87-88	15023	361.17	6899	70.77	847	11.5	654	10.68	23616	454.12	11.93
88-89	15386	382.05	5112	66.41	860	18.01	361	5.42	22218	471.89	11.51
89-90	17505	414.31	4214	35.87	1439	24.84	181	3.75	24597	478.77	9.62
90-91	17985	451.22	6020	48.76	1621	19.7	483	6.94	27247	526.62	8.64
91-92	16730	455.73	3375	41.19	972	15.5	1003	11.93	22049	524.35	6.91
92-93	19224	604.03	2704	38.31	1641	22.1	3038	35.85	25210	700.29	7.57
93-94	22054	787.73	3125	51.18	2523	42.89	4133	39.16	30225	920.96	9.12
94-95	26277	1045.37	9267	180.26	1170	21.74	4972	57.27	37884	1304.64	9.38
95-96	25225	1106.39	8827	176.62	618	14.52	4259	43.41	35288	1340.94	9.38
96-97	25742	1188.91	8754	176.74	988	21.73	6065	70.03	36472	1457.41	7.75
97-98	18630	1181.48	8836	151.66	1339	29.54	1353	25.13	30144	1387.81	5.83
98-99	20086	1162.21	6382	153.92	1369	39.41	640	23.79	29206	1379.33	5.41
99-2000	28514	1612.15	5227	106.95	1024	29.61	369	32.61	35789	1781.32	6.28
Increase	3.23	10.37	0.98	3.20	2.87	7.28	0.76	8.54	2.41	9.05	

Note: Quantity in M. ton and Value in Crore Taka
Source: Fisheries Statistical Yearbook, 1995-96, 1999-2000

Appendix Table 3 : Government Department/Ministries Involved in the Management of Fisheries Resources

Departmeent/Ministries	Role in the Management
Department of Fisheries	National Fisheries managemet, development, extension, training, conservation, quality control, law enforcement, policy advice and information collection.
Bangladesh Fisheries Development corporation (BFDC)	Autonomous national development of marine fisheries, management of Kapti Lake, marketing and processing of fish.
Fisheries Research Institute (FRI)	National Fisheries research on riverine fisheries, marine fisheries and aquaculture.
Ministry of Land	Administration and leasing of public water bodies (more than 20 acres) for fisheries. These bodies of water will be gradually transferred to MFL under the new Fisheries Management Policy (NFMP).
Upazilla Parishad	Administration of small water bodies (up to 20 acres) for fisheries and fisheries extension.
Ministry of Irrigation, Flood Control and Water Developmemt	Assessment of impact on fisheries from project related to flood control, water development and irrigation
Ministry of Local Government, Rural Development and Cooperatives	Inclusion of the fisheries component in rural development projects, development cooperatives and collection of revenue from small water bodies (up to 20 acres)
Ministry of Industry	Licensing of fish processing plants and trawlers for marine fisheries.
Ministry of Commerce Ministry of Shipping Ministry of Education Ministry of Finace	Export of frozen fish Regulation of fishing boats Control of fisheries related education and research Budget and administration of externally funded fisheries projects.
Forestry Department Nationalized Banks Planning Commission	Management of fisheries in reserved forests. Provision of credit for fisheries Planning of fisheries sector, as part of overall national planning