COASTAL FISHERIES MANAGEMENT ISSUES AND OPPORTUNITIES

by

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ABSTRACT

Management of the industrial trawl fishery largely depends on the management of the artisanal fishing gears which restrict greatly the recruitment of the penaeid shrimps in the trawl fishery as adults. Trawlers harvest the spawners in peak spawning season, which greatly reduces in turn the chances of an enhanced stock in off-shore water. Since the exploitation of the penaeid shrimp stock is a multigear function, the cumulative affect were considered and in various ways it has been discussed that the same stock can provide a few times higher production if managed scientifically. Marine artisanal fisheries have so far been allowed to develop irrationally and as a result many of the fish and shrimp stocks have declined. One single stock of fish or shrimp is harvested by a number of fisheries at different stages of life cycle. Hence overfishing in one fishery has affected the others. Here the Push net fishery for tiger shrimp PL and the ESBN and Beach seine fisheries for juveniles have been identified as the destructive fishing methods. These fisheries restrict recruitment in the industrial fishery and hence results in over all lower catch rate and production. These fisheries need to be stopped. But since 55,000 full time fishermen are engaged in ESBN fishery, rehabilitation of them would be necessary before withdrawal. So main research and management thrust need to put on the artisanal fisheries sector. Since coastal shrimp culture industry is solely dependent on the push net fishery, rapid hatchery development is suggested. Meanwhile diversified technique for selective PL. Collection and reduction of induced mortality is proposed for research and extension. Further expansion of the coastal shrimp culture is not recommendable on the basis of natural seed supply. Trammel fishery has been proved to be bio-socio-economically most suitable fishing gear and if expansion & extension takes place vertically and horizontally it can be used as a major source of rehabilitation and also to enhance additional but sustainable production. Amendment of the rules under the Marine Fisheries Ordinance 1983 is required on the basis of present knowledge about the dynamics of the fisheries. DOF Marine Fisheries Survey & Management Unit need to be strengthened as to the manpower and facilities, to be able to independently handle the task of achieving information for management and advise the govt. of measures for rational management on a continued basis. Functions of different ministries, agencies and institutions in fisheries management and development have been reviewed and the need for strengthening of the marine sector have been identified including creation of a separate directorate for marine fisheries. To integrate and control all activities in the coastal areas, creation of Coastal Zone Management Authority has been proposed.

Bangladesh declared an Exclusive zone of 200 nautical miles in her sea waters in 1974. As a result an area of about 1,64,000 sq. km. is now under the economic jurisdiction of the country for exploration, exploitation, conservation and management of its living and non-living resources. In addition to the prevailing artisanal fishing fleet the first offshore commercial fishing operation was started with the public sector trawlers in 1974-75 catalyzed by the positive findings of PAK/22 survey. After successful operation of these trawlers joint venture commercial fishing agreement was signed with Thailand for white fish fishing in 1977-78. Meanwhile a Bangladesh-Japan joint venture shrimp survey programme was carried out during 1977-79 and as a result of its positive findings joint venture commercial shrimp operation commenced in 1978 with Japan and later with Kuwait. Thereafter local private fishing entrepreneurs became increasingly interested in this venture and in a short passage of time the size of the offshore fishing fleet radically increased, mainly because of the presence of valuable penaeid shrimp species.

The resources of the near shore waters of the Bay of Bengal region countries are in near the extinct condition due to growth overfishing and recruitment overfishing and as a result the income of fishermen has gone below the poverty line. Fishery resources are limited by biological and ecological factors. But a common belief that the resources are "**unlimited**" has repeatedly lead to production oriental development plan. So, awareness on the actual fisheries position need to be built-up at all levels.

Strategies for marine fisheries would include adequate policy supports for continued survey for finding new fishing ground and to keep the harvest at maximum sustainable yield level. In this respect, emphasis was given on technological improvements of the artisanal sector in marine fishing technology instead of highly capital intensive trawler fleet. Improvements in fish processing technologies, distribution and marketing channels, infrastructure, adequate credit facilities and security of the fishermen are other areas where policies would focus.

The main research thrust is given on semi-intensive fish and shrimp culture integrated with livestock farming and agriculture, development of effective fish and shrimp feed, intensive nursery rearing, fish disease control, new fish product development and open water fisheries management.

Fisheries sector still prevails as the major activity in the coastal zone. Other sectors have very few activities but they interact with the environmental condition as well as management of the fishery resources.

Fisheries sector provides about 80% of the animal protein consumed in the country. But despite continuous increase in fish production it has not been able to coped with the fast growing population. In 1975-76, country's fish production from all sources was 6.40 lac mt. In 1993-94 this production rose to 10.87 lac mt. Wherein the per capita fish consumption has gone down from 33.4 g to 21 g. This has happened because of the fact that fish production increased at arithmetical rate whereas the human population increased at geometrical proportion.

The marine fisheries sector of Bangladesh currently contributes around 28% of the total production of fish in the country and with a coastline of 480 km^2 and an exclusive economic zone of 1,64,000 km^2 has the potential to make a greater contribution to fish production and export earnings of the country. Out of the production in the marine fishery sub-sector more than 90% comes from the artisanal fisheries which constitute the main part of the coastal zone. This area is the nursery ground of the marine animals where serious overfishing is done.

Fishes, shrimps and other aquatic animals are naturally renewable resources. Their population is subject to natural mortality which is caused by various factors, such as changes of environmental parameters (e.g. temperature, salinity, dissolved oxygen, turbidity etc.) diseases, old age, perdition by other animals etc. On the other hand these population are subject to changes due to fishing mortality in the exploited fishery and due to bio-diversity/succession of species. Determination of these factors which constitutes basis for formatting management options, needs continuous study even after the details and first hand surveys complete. So the marine fisheries monitoring survey and the study of the oceanographic parameters is a continuous process.

1. Fishery Resources Potential

A number of surveys have been conducted since 1958 in the marine waters of Bangladesh. Most of these surveys are of exploratory nature and oriented to studies of fishing feasibility. Some surveys, however, have been conducted to assess the standing stock of the marine resources, particularly the demersal part of it.

The demersal fishery assessment survey results varies to a great extent. West (1973) through a desk study estimated the standing stock of demersal fish at 2,64,000 mt.-3,74,000 mt. and a shrimp standing stock of 9,000 mt. However, the recent results i.e. "R.V. Dr. Fridtjof Nansen" (FAO/NORAD) survey and "R.V. Anusandhani" (DOF/GOB & FAO/GOB) surveys before and after 1984 brings out the closer results. Therein the standing stock of demersal fish was estimated at the range of 150,000 mt. to 160,000 mt. within three surveys.

During R.V. Dr. Fridtjof Nansen survey (Saetre, 1981) through an acoustic study the pelagic stock was estimated to be from 90,000 mt. to 1,60,000 mt. but at the same time it was discussed that the estimate may be an underestimate.

Parameters of fish population dynamics for various commercial species of shrimp and finfish were estimated and results of stock assessment studies so far achieved have been treated with them to find out the fisheries potential for different resources, At this stage it has been estimated that 55,000+mt. of demersal finfish can be harvested annually from the present trawling ground. The maximum sustainable yield of shrimp has been estimated as 7,000 to 8,000 mt. Annually (Khan *et al* 1989).

The finfish species that are presently exploited consists mainly of the demersal fishes and shallow water estuarine species and also some midwater species. These include about 100 commercial species of which the most commercial or abundantly exploited species are as follows which constitute about 75% of the total production from demersal trawling.

1.	*Pampus argenteus*	-	Silver Pomfret
2.	*Pampus chinensis*	-	Chinese Pomfret
3.	*Pomadasys hasta*	-	White grunter
4.	*Lutjanus Johini*	-	Red snapper
5.	*Polynemus indicus*	-	Indian Solman
6.	*Lepturacanthus savala*	-	Ribbon fish/Hair tail
7.	*Arius spp.*	-	Cat fish
8.	*Johnius belangerii*	-	Croaker
9.	*Otolithoides argenteus*	-	Croaker
10.	*Namipterus japonicus*	-	Japanese threadfin bream
11.	*Upenus sulphurus*	-	Goat fish
12.	*Saurida tumbil*	-	Lizard fish
13.	*Ilisha filigera*	-	Big eye ilisha
14.	*Sphyraena barracuda*	-	Great barracuda
15.	*Muraenesox telabonoides*	-	Indian Pike conger

Among the surveys the Bangladesh - Thai joint survey, however, mentioned a good abundance of large pelagic i.e. tuna & tuna like fishes and sharks in Bangladesh marine waters. This survey was also aimed at demersal studies and some extra efforts were made for pelagic studies with offshore drift gill net. In the course of these studies the following species of tuna and skipjack were identified which accounted for about 40% of the experimental drift gill net catches.

Tuna and skipjack :

1.	*Euthynnus affinis*	-	Eastern little tuna/Kawakawa
2.	*Katsuwonus pelamis*	-	Skipjack tuna
3.	*Thunnus maccoyii*	-	Southern blue fin tuna
4.	*T. obesus*	-	Big eye tuna
5.	*T. tonggol*	-	Longtail tuna
6.	*Auxis rochei*	-	Bullet tuna
7.	*A. thazard*	-	Frigate tuna

Small Pelagic :

The drift gill netters of Bangladesh also catch mackerels as a by-catch of Hilsa. Four types of Mackerel (e.g. King Mackerel, Spanish Mackerel, Indian Mackerel & Short bodied Mackerel) were recorded from the Bangladesh water. These species also occur in the trawl catches accidentally.

Other than the species mentioned above a number of important species available in the marine waters of Bangladesh are either not exploited or exploited only as by-catch or as incidental catches of the existing bottom trawl, shrimp trawl or gill net fisheries. The most mentionable species are listed below;

Mackerels :

1.	*Scomberomorus guttatus*	-	King mackerel
2.	*S. commerson*	-	Spanish mackerel
3.	*Rastrelliger Kanagurta*	-	Indian mackerel
4.	*R.. brachysoma*	-	Short bodied mackerel

Non Conventional Resources :

Bottom trawlers and shrimp trawlers catch cephalopods as a by-catch. These are also available in some artisanal fishing gears at younger stages. Three species of cephalopods *(Sepia officinalis, Loligo spp., Octopus sp.)* were recorded.

Sharks & Rays are exploited by drift gill net as well as long lining. The species recorded were *Sphyrna blochii, Stegostoma fasciatum, Chiloscylium punctatum, Mustelus kanekones, Scoliodon walbeehmii, S. sorrakowa, Carcharhinus menisorrah, Negogalus balfouri, Pristis cuspidatus, P. zizsron, Rhynchobates djiddensis, Rhinobates gramulatus & Dasyatis warrak.*

Major Shrimp Species Exploited :

Bangladesh off shore commercial trawl fishery have developed on the basis of the valuable exportable penaeid shrimp resources. The commercial shrimp species are listed here.

1.	*Penaeus monodon*	-	Giant tiger
2.	*Penaeus semisulcatus*	-	Tiger
3.	*Penaeus japonicus*	-	Tiger
4.	*Penaues indicus*	-	White
5.	*Penaues merguiensis*	-	Banana/White
6.	*Metapenaeus monoceros*	-	Brown
7.	*Metapenaeus brevicornis*	-	Brown
8.	*Metapenaeus spinulatus*	-	Brown
9.	*Parapenaeopsis sculptilis*	-	Pink
10.	*Parapenaeopsis stylifera*	-	Pink

Among them *Penaeus monodon* is the most valuable and hence the targeted species. The penaeus group (tiger shrimp) accounts for <10%. The highest contribution in the total production however is made by *Metapenaeus monoceros* (brown shrimp). The Metapenaeus group (brown shrimp) accounts for >65% in the trawl fishery.

2. Degradation of Coastal Zone Environment

Brackishwater estuaries are the meeting point of the fauna from three different ecosystems. Brackishwater species eg. *Acetes indicas*, *Raconda russeliana*, etc. live, grow and spawn in the same environment, while the marine and freshwater fauna use the brackishwater low saline, nutrient rich area as nursery ground and visit for a short time.

Artisanal fisheries restricting offshore recruitment

The artisanal fishing gear operated in the open brackishwater environment, particularly the estuarine set bagnet (ESBN), the push net and the beach seine catches only the post larvae and juveniles of the marine fauna in huge numbers which restricts their recruitment in the open sea at adult stage. The degree of such restriction by size and number is immense. *P. monodon* the tiger shrimp harvested by different interactive fishing gears, were seriously over exploited.

More than 2,035 million Bagda post larvae are collected annually which is only over one percent of the total catch of the fishery. The rest of the catch is thrown on the sand to die which is equivalent to about 200 billion PL of the shrimps/fishes and zooplankton. This is considered as a serious growth overfishing imbalancing the food chain and upsetting the coastal environment.

The extensive use of set bagnets in near shore fisheries has resulted in over-exploitation. In the absence of sufficient hatcheries, collection of wild tiger shrimp post larvae in estuaries and near shore waters has led to severe destruction of larvae & juveniles of other shrimp, finfish species and zooplankton which imparts adverse affect on food chain, ecology and environment.

The situation in Bangladesh coastal shrimp fishery is as such and the penaeid shrimp stock is under pressure form all sides. ESBN, push nets and beach seine harvest the members of the same population at sizes much lower than the size at first maturity and as a result about 99% of the population do not get a chance to participate in the spawning process. It was estimated that out of the total penaeid shrimp harvested, ESBN takes 55.87% trawler fleet 29.70%, MSBN 14.30% beach seine 0.09% and the push net take only 0.04% by weight. The same production if converted in number the situation is just reverse i.e. trawler fleet takes only 1%, ESBN 3.4% and the push netters alone take 94.6% (Khan et al 1994). Thus it is evident that the enhanced production in the trawl fishery largely depends not on the trawl fishery alone but on the management of the three artisanal fisheries such as the ESBN, push net and beach seine.

Industrial fishery reducing recruitment and killing spawners

The trawler fleet although not permitted by rules and the ordinance to fish at depth shallower than 40m but they normally fish up to 30 m and even up to 20 m depth. Since the gear is non-selective they also harvest sizes of fishes and shrimps

which fall under the post juvenile and preadult categories which restricts adult recruitment of a part of the population. The number & production of trawlers is given in the table.

The penaeid shrimps spawn throughout the year with two peck season (January-Feb. and July-August) when more than 90% of the population in the spawning ground show the signs of full ripeness. To ensure the larval population for the next generation the brooders need to be saved from fishing mortality during that time. But the trawler fleet also randomly harvests the brood shrimps during the peak spawning season. Thus the larval population is getting reduced year after year.

3. Other national agencies and institutions responsible for degradation of Coastal Zone & their linkage to fishery

Many water resources project have recently been developed to protect the inhabitants from devastating floods and to increase food grain production. As a result of these projects free movement of fauna from freshwater to brackishwater is being hampered. Changes have been caused in the aquatic ecosystems and fish production has been affected. The migration of hilsa and other anadromous and catadromous species has, for instance, been obstructed.

The sunderban forest in the south-eastern part of the country is the largest single compact mangrove resources in the world, but in 1985 survey showed that standing volume of the main species had declined alarmingly since an inventory 20 years earlier. Destruction of mangrove and other forests impact on fisheries resources and environment.

Besides overcutting and overestimation of regeneration times, diversion of river waters have impaired the growth of mangroves. The mangrove forests are being removed for aquaculture. There is an increasing conflict between mangroves forests, shrimp farms and rice cultivation.

Industrial pollution in the country however, has grown 150 percent over the last few years, but since there is no treatment of waste products before their discharges local environmental degradation has occurred. This, together with lack of sewage treatment plants, has resulted in fish mortality as well as occurrences of toxic substances in fish and shrimp.

Since the introduction of HYV's by farmers, the annual transport of pesticides into the Bay of Bengal has been estimated at 1800t. There are few studies on the impact of agrochemical residues on fisheries, but toxic residues have been recorded in both shell and finfish.

Situation has increased exponentially over the last century at the month of Ganga-Brahmaputra-Meghna river systems and has actively reshaped the coastal and nearshore habitats, with consequent impact on fisheries, changes in bottom topography, increased turbidity and entrapment of pollutants are some of the

detrimental effects. Sometimes waste products such as oil is discharged in the Bay of Bengal impacts on marine fisheries resources.

The ministry of Environment is directly concerned about the follow-up of the UNCED. But of fisheries purpose fisheries ministry is directly concerned and need coordinated interministerial effort from the other related ministries e.g. Agriculture, Forestry, Science & Technology, Shipping, Industry etc.

4. Impediments to Fisheries Development & Management

There are various impediments to fisheries development some of which are particular to the sources of fisheries. In case of capture fishery inadequate knowledge and know how, overfishing and indiscriminate killing of juveniles and destruction of spawning grounds, obstruction of migration routes due to unplanned construction of dams and embankments, degradation of water quality, lack of proper management policy and credit facilities, defective fish conservation laws and inadequacy of proper processing, marketing and other facilities are some of the major factors affecting proper development.

The major constraints to the development of closed water culture fishery in Bangladesh relate to problems of property rights, competing water uses and related conflicts, lack of trained manpower and quality fish seed and lack of finance. The problems are diversified in nature and vary not only with the type of water bodies but also from place to place.

In case of marine fishery at present the marine fisheries wing is managed by only a very limited people which is too inadequate for maintaining the ongoing work of resources survey, monitoring and law enforcement. Moreover out of the present manpower all are not adequately trained in marine fisheries aspects. Licensing system of the mechanized fishing boats is to impose the rules of the Marine Fisheries Ordinance is yet to implement adequately due to lack of adequate manpower. Fund constraint for applied research and survey.

Pollution of water and the aquatic environment caused by (i) the discharges of toxic industrial wastes(ii) the discharges of raw organic and domestic wastes, and (iii) release of agrochemical through run-off are making the aquatic environment uninhabitable for fish, prawn and other aquatic life.

Use of land for brackishwater shrimp and finfish culture in the South-west region has given rise to social tensions and conflicts with other land uses. In the South-east region, some mangrove forests have been converted into brackishwater shrimp culture ponds, upsetting the mangrove ecology.

Introduction and expansion of improved aquacultural practices are progressing at a comparatively slower rate due, in part, to the inadequacy of fisheries extension services. Adequate manpower with practical knowledge, skill and experiences in advanced aquacultural techniques and practices is lacking. Lack of

proper management organization for establishment of a management unit and unit and its strengthening to sufficient degree of specialization on the subject matter. Conflict exists between the industrial and artisanal fishing fleet.

No restriction exists on harvesting the oyster, blood clam, green mussel, sea weeds, coral reef etc, as a result these resources may extinct in near future.

In the planning, designing and implementation of projects on Flood Control and Drainage (FCD), Flood control, Drainage and Irrigation (FCDI), construction of Cross Dams, River Closure etc. the needs of fish, prawn and other aquatic living populations for water as habitat are not considered and accommodated. This results in the reduction of aquatic bodies for fish causing reduction in species diversity and quantity of fish and prawn in the open waters of the country and obstructing the route of spawning, feeding & over-wintering migration of the anadromous and catadromous fishes.

5. Legal and Institutional Frame Work

Marine Fisheries Ordinance 1983 and its present situation

In 1983 the Government of the Peoples Republic of Bangladesh enacted the Marine Fisheries Rules, 1983 in accordance with the provisions of the Marine Fisheries Ordinance, 1983. Under the provisions of the ordinance the Marine Fisheries Wing of the DOF is authorized to deal with the matters relating to marine fisheries exploitation including licensing and monitoring of operation of fishing vessels. The marine fisheries rules amended in 1993 provide for licensing and monitoring of artisanal mechanized fishing boats. Under the ordinance the officers of the Marine Wing of DOF have been empowered to check, seize or take appropriate actions required for surveillance and enforcement of the rules of the ordinance. These activities are performed from the Marine Fisheries check post established under DOF Marine Wing at Patenga bay front, Chittagong.

The Ministry of Industry is currently authorized to accord permission for acquisition of fishing trawlers in consultation within MOFL. The mechanized fishing vessels are registered with Mercantile Marine Department (MMD). For patrolling of the EEZ the DOF procured two modern gun boats and placed under the operational control of Bangladesh Navy. Besides MOFL other ministries directly involved are the Ministry of Land, Ministry of Industries, LGRD, MOEF.

6. The agencies and institutions involved in development and management of the marine fisheries resources

Fisheries administration and management primarily remain under the control of the MOFL. The Department of Fisheries (DOF) is the line agency responsible for development and management of fisheries. Bangladesh Fisheries Development Corporation (BFDC) was established in 1964 with a view to promoting fishing industry, landing, preservation and processing facilities particularly in the marine

sector. A part of the survey and exploratory work was once included in the mandate of BFDC which is now carried out by the Marine Fishery Survey Project DOF.

Fisheries Research Institute (FRI) was established in 1984, an autonomous body under the administrative control of the MOFL. Research stations and ancillary facilities of the DOF were subsequently transferred to FRI by an administrative order of the govt. The mandate of FRI is to plan and undertake adaptive research programmes to develop suitable technology for the fish farmers and fishery managers (Rahman 1993). But the survey work producing information on resource monitoring and management remains with the DOF for practical reason. Now this work is done under a permanent setup of the DOF called Marine Fishery Resource Survey & Management Unit based at Chittagong having in possession of two marine and brackishwater research vessels and other equipments for this purpose, but manpower & facilities are inadequate. Creation of a separate directorate for marine fisheries would gradually remove these bottlenecks.

Several NGO's and fishermen cooperatives are involved in the marine fisheries development activities in the country. Bangladesh Jatiyo Matshyajibi Samabay Smity (BJMSS) for example had direct involvement in the marine fisheries development, now not that effective. Among the NGO's the CODEC, CARITAS, Proshika-MUK are mentionable who are directly involved in the development of the coastal fisherfolk community.

7. Infrastructure and Service Facilities

Infrastructure and service facilities are too inadequate. In absence of proper landing centers artisanal fishermen land their catches at scattered places without processing marketing and fast transportation facilities. Only the industrial trawler fleet (public and private) lands at defined places, mechanized boats for hilsa to some extent land at the few landing centers of BFDC. The other private landing places also not have adequate ice. Freshwater, berthing and bunkering facilities. BFDC operated four landing centers in Cox's Bazar, Khulna, Barisal and Patuakhali. It has modern landing preservation, Ice, water, berthing and bunkering facilities at Chittagong used for its own fleet as well as extended services to the private operators. Such landing centers need be developed in every coastal districts and other important landing areas.

8. Issues and Opportunities for Management of Coastal Zone

Fisheries Sector Issues and Opportunities

Increased production and exports and creation of employment opportunities have been the main focus of development activities in the sub-sector over the years. In order to achieve the objective of fisheries development, the following strategies and policies is emphasized.

- development of skilled manpower, appropriate research and technologist loges, expanded institutional/organizational capabilities to plan and implement development activities;

- community based integrated development approach for artisanal fisheries with improvement in technology, processing, marketing and distribution facilities;

- continuation of the marine fishery resources survey for its development and management to achieve yield at MSY (Maximum Sustainable Yield) and identification for new fishing grounds and preparation of extension materials on resource position, more effective fishing and resource conservation;

- gradual intensification of aquaculture practices to obtain increased production per unit area;

- policy support for improving quality of fish and fish products;

- adequate infrastructure to support planned expansion of shrimp culture in the private sector;

- adequate polices and measures to harness the export potentials of fisheries.

Strategies for marine fisheries would include adequate policy supports for continued survey for finding new fishing ground and to be the harvest at maximum sustainable yield level. In this respect, emphasis will be given on technological improvements of the artisanal sector in marine fishing technology instead of highly capital intensive trawler fleet. Improvements in fish processing technologies, distribution and marketing channels, infrastructure, adequate credit facilities land security of the fishermen are other where policies would focus.

The main research thrust is given on semi-intensive fish land shrimp culture integrated with livestock farming and agriculture, development of effective fish and shrimp feed, intensive nursery rearing, fish disease control, new fish product development and open water fisheries management. Among the above mentioned research programme, the problem oriented basic and adoptive research and basic fishery biological research is under the jurisdiction of the Fisheries Research Institute. Applied and management oriented research/ survey would particularly on stock assessment, biology and the fishery data base statistical source & resource monitoring work is the responsibilities of the Directorate of Fisheries since it is directly involved for implementation of the management plan and policy including law enforcement according to the ordinance.

The number of offshore trawlers operating at this moment are believed to be quite enough to harvest the demersal shrimp and finfish resource because irrespective of the landing data the supplementary data cross-checking records available with the DOF Marine Fisheries Survey Management and Development Project through sampling from research vessel indicates that the present annual catches of fish and

shrimp are at about the same level of maximum potential yield, as expressed in the relevant section. So the government at this stage have no plan to further increase the number of trawlers in the demersal fishing and shrimp sector.

The government has plan to conduct stock assessment and feasibility survey in the inshore and offshore pelagic resources area in order to harness the under-exploited/unexploded resources like tuna, mackerel, cephalopods, lobsters etc. In this connection some project synopsis are under consideration for inclusion in the fourth five year plan.

The government has also plan to establish a permanent center based at Chittagong for monitoring and management of the marine fishery resources on a continued basis. The Marine Fisheries Survey, Management and Development Project after completing of the development phase in June/1991 was supposed to from the base for the proposed establishment in the name "Marine Fishery Resources Monitoring and Management Center".

9. Cross Sectoral Issues and Opportunities

The Ministry of Industry is currently authorized to accord permission for acquisition of fishing trawlers in consultation with MOFL. The mechanized fishing vessels are registered with Mercantile Marine Department (MMD). For patrolling of the EEZ the DOF procured two modern gun boats and placed under the operational control of Bangladesh Navy. Besides MOFL other ministers directly involved are the Ministry of Land, Ministry of Industries, LGRD, MOEF.

Several NGO's and fishermen cooperatives are involved in the marine fisheries development activities in the country. Bangladesh Jatiyo Matshyajibi Samabay Samity (BJMSS) for example had direct involvement in the marine fisheries development, now ineffective. Among the NGO's the CODEC, CARITAS, Proshika-MUK are mentionable who are directly involved in the development of the coastal fisherfolk community.

As part of the global initiative taken by the coastal zone management subgroup (CZMS) of the inter-governmental panel on climate change (IPCC),. Bangladesh center for Advance Studies (BCAS), in collaboration with Resource Analyst (The Netherlands) and Approach Consultants (Bangladesh), undertook a pilot study on the assessment of the vulnerability of coastal to climate change and sea level rise. The results of the study were presented on behalf of the Ministry of Environment & Forest, Government of Bangladesh, at the World Coast conference.

The objective of the study was to analyze the vulnerability of Bangladesh to sea level rise and global climatic changes and to prepare a vulnerability profile of Bangladesh. Other objectives included identification of the institutional strengths and weakness for implementing integrated coastal zone management (ICZM).

The study focused on assessing the Primary Physical effects (PPE) in terms of changes in inundation, salinity intrusion, droughts as well as cyclones and flesh flood. The study reveals that there is clearly a need for integrated coastal zone management both at the national as well as the local level.

Environmental Survey and Research Unit (ESRU) of the Department of Geography, Dhaka University, is a research and study organization committed to the pursuit of gathering information useful for implementing project of national importance. ESRU also assists development agencies at their request in dealing with development oriented problems, in forms and means best suited to their needs. They have directed and participated in different projects financed by UNDP. HABITAT, UNFPA, World Bank, USAID, ADB, FAO , JICA. Ford Foundation and other organizations.

10. Other Related Matter which Interfere with Resource Management and Surveillance Work and Probable Solutions

Other management and legislative measures which are not under the direct-control of the DOF/MOFL need interministerial and inter departmental decision and arrangements. Some of these measures which deserve specification are discussed here.

10.1 There are water bodies under the control and ownership of the ministries other than fisheries. Some of these water bodies/areas are directly "managed" by other ministries such as Ministry of Land. Department of Forest, MOFL. These are the revenue oriented management by collecting tools and by leasing of the water areas. But since fisheries resources are the living renewable resource, biological management based on the research findings and scientific information would be invariable necessary, irrespective of which ever agency/organization own the land, water or the fish. Department of Fisheries must be entrusted with the responsibility for such management for such management it has the capability to shoulder that duty.

As discussed in text, various water development activities have altered much of the ecological habitat concerning Fisheries so any development or management activity (non-biology) in such water bodies, for the purposes other than fisheries should be done only in close consultation with the MOFL/DOF to ensure a healthy environment for the growth of the fish population. A high power steering committee for Integrated Coastal Zone Management with respective position for MOFL/DOF need to be established.

10.2 To minimize the degradation of coastal environment by industrial, agro-chemical, oil and other population integrated research to qualify and quantify the toxic effect on fish need be undertaken immediately and should identify the pesticides which are not water soluble or not having a toxic effect on aquatic life, limit the other brands of fertilizer and pesticides. Waste treatment facilities need by established in the coastal districts and rules need be reformulated to take care or aquatic life and

legislation must be improved. A co-ordination is necessary with the MOFL and MOEF.

10.3 Mangrove aforestration programme may be undertaken jointly by the DOF and DOF (Forest) to save the environment from further degradation.

10.4 In the Marine Fisheries Ordinance subsequent rules have been made for licensing of the artisanal fishing boats with DOF. The Mercantile Marine Department (MMD) deals with the registration of those boats. But it is evident that all boats are not registered and enforcement hardly exists for the registration of the rest. MMD look after the safety of life at sea and issue vessel health certificates by checking the safety equipment. Fishermen are reportedly not interested to observe formalities with two similar departments for registration and for license. DOF has the capability to check the craft health and safety equipments. The two function need to be put under DOF for easy monitoring and enforcement system.

10.5 There are gear and area conflicts between artisanal and industrial fishermen, and also there are reports of sea piracy. Resource use conflicts are also there. Coast guard strengthening is required to solve these problems.

10.6 Overnight withdrawal of ESBN fishing gear would not be possible forcing 55,000 fisherfolk, who live below the poverty line, to starvation. So, alternate employment for their livelihood need be identified inside or outside the fisheries sector. So, new fisheries development and expansion of presently sustainable fisheries with direct participation of ESBN fisherfolk would be necessary.

10.7 Some fisheries are found biologically sustainable but their distribution and effort is limited. Expansion of these fisheries may give enhanced sustainable production as well as create room for rehabilitation of the ESBN fisherfolk. The trammel net fishery has proved to be the biologically most sustainable fishery. At present this fishery is in operation at Teknaf coast only. Feasibility and technical demonstration of this gear in the western part of the coast may help expand this fishery in the other areas to produce more fish and would enhance economic as well as socio-economic benefits.

11. Concluding

Competition has increased over the years for investment in the demersal and artisanal fisheries sector which are already over burdened. While the pelagic resources e.g. Tuna and tuna like fishes have remained untapped. Now, ilisha is the only pelagic species categorized in the fish catch statistics of Bangladesh. Eight species of tuna and skipjack and a number of potential species of mackerels, sharks, rays, sardines, anchovies, shads and several species of cephalopods. Soles and flat fishes, lobster etc. are available in our water area (Rahman et al 1995). Development of these resources will open new era for Bangladesh fisheries sector to boost up production sustainable. But detail survey and assessment of stock and MSY would

be necessary along with feasibility and technological demonstration for transfer to the private sector.

The freshwater area is getting reduced and overall ecology of fish habitat and route of migration have altered due to various water resources development activities. So it is far to fulfill the minimum protein requirement of the teeming millions from the freshwater sub-sector alone. But the highest priority has always been accorded to the freshwater fisheries as reflected in the large number of fisheries development project implemented since liberation inspire of the fact that marine fisheries sector holds the lion share in foreign exchange earning and contribute to the development budget at the proportion. If similar level of management and development attention was paid to the marine sector in would possibly be able to give a substantially increased production, manpower and facilities.

The development potential of this sector has not been properly exploited. Rather because of unplanned and irrational increase in fishing effort many of the marine fish and shrimp stocks have already declined. As a result coastal artisanal fishing has become non-remunerative and fisherfolk are getting poorer, thus putting more and more damaging pressure on the resource, a fruitless endeavor for survival. This gives a false impression that the prospect of marine resources exploitation has become saturated. But the story is different, in fact we are killing the goose which lays eggs. Artisanal coastal fisheries management need to be given top priority.

The most valuable penaeid shrimp stocks in particular have been under pressure form three different sides leading to a complete risk of annihilation. Superseding the long-term development objectives by various quick money strategies is a common practice in the tropical developing countries, which has led many fisheries throughout Asia and the Pacific to a total annihilation. This must be taken as a lesson and we must choose the long term but not the short term strategies for management, before we reach at a point of no return. Since the fishery resources are renewable, a diversified judicial exploitation plan may give a production manifold higher than the present from the same stock.

Coastal zone management is a multisectoral activity. Many sectors are usually involved in the use of coastal areas, but not equally paying attention to the interest of conservation of the environment. But coastal fisheries is not a multisectoral business as it appears in Bangladesh (as discussed in the paper). So fishery management should be solely with the DOF/MOFL. Environment in the coastal zone should be well preserved. Research and study in this area need be strengthened. Petroleum extraction in the coastal zone is only in the process of development. So an Integrated Coastal Zone Management Authority (ICZMA) should be established with key role for DOF/MOFL since fisheries sector still play major role in the coastal zone.

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Appendix I

Marine & Artisanal Fishery production by gear/craft type:

Type of Fishing	Major species/groups exploited	Annual prod(MT)		Number of Unit		Area/Depth(M)
		Craft	Gear	Shrimp	Fish	of operation
A. INDUSTREIAL						
1, Trawl Fishing	*Metapenaeus monoceros,*					
a. Shrimp Trawler	*Penaeus monodon, P. Semisulcatus, P. merguiensis* etc.	4661	2314	35	-	40-100
b. Fish Trawler	Jewfish, catfish, Indian, Salmon, Shark & Rays, Pomfret.	212	3146	17	-	40-100
SUB-TOTAL		4893	5460	52	-	
B. ARTISANAL						
1, Gill net			136469		6389	
a. Drift gill net	*Hilsa ilisha*	-	-	-	-	upto 30.00
b. Fixed gill net	*Hilsa ilisha*	-	-	-	-	8-10.0
c. Large mesh drift gill n	Sharks	-	-	-	-	30.00
d. Bottom set gill net	*Polynemus indicus* (Indian Salmon	-	-	-	-	South patches
e. Mullet gill net	Grey mullet	-	-	-	-	5-10.0
2. Set bagnet		Shrimp & Fish				
a. Estuarine Set Bagnet	Brown and pink shrimp, Bombay duck, jew fish, Anchovies, clupids, Hairtail etc.(mostly juveniles)	72285.0				5-20.0
b. Marine set Bagnet	Brown and pink shrimp, Hairtail, Bombay duck, Anchovies, clupeids, etc.	26111.00				10-30.0
c. Large mesh set bagnet	*Lates calcarifer* (Sea perch)	-				10-30.0
3. Trammel net	White, Tiger, Brown shrimp-Jewfish, catfish.	1753.50				8-20.0
4. Bottom long line	Jew fish (like *johnius sp. pennahia sp., protonebia sp. Otolithoides sp.* etc.)	2853.00				10-30.0
5. Beach seine	Small brown and pink shrimp, clupeids, Anchovies, Jewfish, Hairtail, etc.	7319.00				8-10.0
6. Char pata jal	Brown, white & Tiger shrimp etc.	-				upto 10.0
7. Cast net	Brown, white & Tiger shrimp etc.	-				upto 10.0
SUB-TOTAL		247390				
8. Push net	Larvae of *P. monodon* as a target species which constitute less than 1% of the catch	1294 million				upto 10.0
9. Fixed Bagnet	-do-	741 million				upto 5.0
10. Dragnet	-do-	14				upto 2.0
GRAND TOTAL		257743.50				