

# STRATEGIES FOR EXPLOITATION AND MANAGEMENT OF MARINE FISHERIES RESOURCES IN BANGLADESH

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## Introduction

Marine Fisheries Sector in Bangladesh contributes about 17.27% of the total fish production of the country<sup>1</sup>. Out of the total marine catch the majority portion are exported to different countries that contribute about 5% in the foreign currency earning. Huge numbers of coastal people (13.5 lacs) are dependent on sea, earning their livelihood through fishing or fisheries related activities<sup>2</sup>. People around the coast go for fishing as their ancestors had been doing without having any regard to the total reserve or the scientific research or survey. Since independence the number of motorized and non-motorized boats increased exponentially as the venture is very profitable. The industrial fishing trawlers also increased from 11 in 1972 to 232 by 2014<sup>3</sup>. Many countries in the globe has experienced extinction of their reserve due to over fishing or failed in managing the reserve for a sustainable growth. State of Bangladesh also needs a review to see as to how this resource can be extracted for a sustainable period.

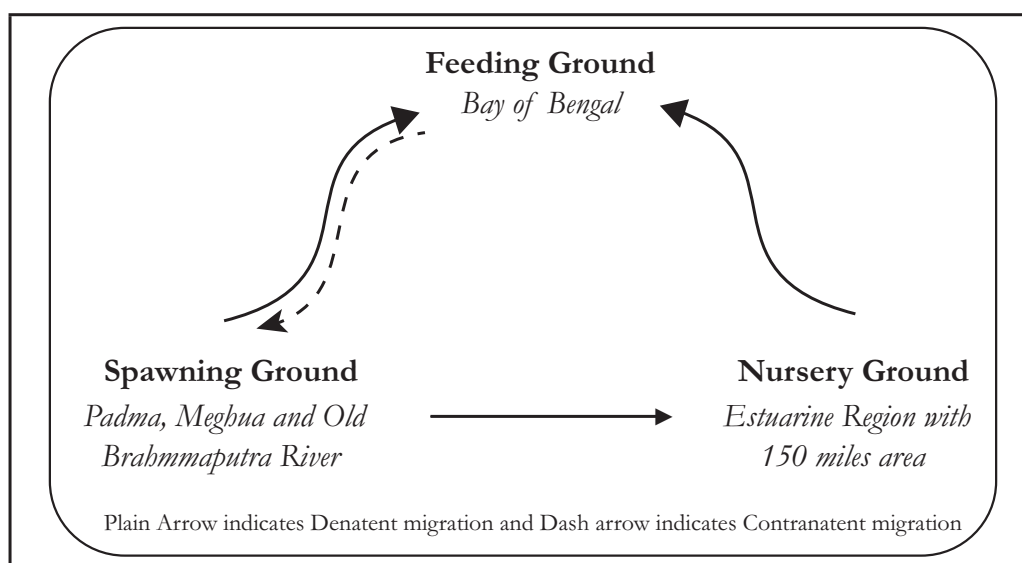
In 2002-2003 total catch from marine fisheries sector was 4.32 lacsmt and in 2011-12 the total catch was about 5.79 lacsmt<sup>4</sup>. Although the catch increased, does not give a true picture of the reserve because, at the same time number of fishing effort also increased due increased number of fishing boats and trawlers. Thus, an increased amount of fish landing may not be considered for a growth in the sector rather it may give an indication of over extraction of existing resources. 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 fishing has become non-remunerative and fisher folk are getting poorer, thus putting more and more damaging pressure on the resource. This may give the impression that marine resources exploitation has become saturated, but the story is different; in fact, the huge potential at sea is being destroyed without any effort of their survival.

1. Fisheries Statistical Year Book 2012-13, Department of Fisheries, Bangladesh Ministry of Fisheries and Livestock, Published in 2014.
2. National Marine Fisheries Policy – 2013, p 3-5.
3. Unanimous report of the Marine Fisheries Association of 2013 on the total number of Fishing Trawlers.
4. National Marine Fisheries Policy – 2013, p 3 – 5.

In this paper different aspects of marine fisheries and environment would be discussed. Therefore an effort will be made to show the challenges of this sector to formulate exploitation and management strategies.

## Marine Fisheries and Environment

**Physical Environment.** The countries exclusive economic zone (EEZ) spans 1, 18,813 Sq Kmand the deep sea area covering depth between 200 -2100m is roughly about 44,383 Sq Km and the shallow area between 10 – 200m depth covers approximately about 42,007 Sq km<sup>5</sup>. Three of the main subcontinent’s rivers- the Ganga, Brahmaputra and Meghna drain vast areas of India, Bangladesh, Nepal and the Himalayas. These rivers and their tributaries converge in Bangladesh, carrying approximately 85 per cent of the total water volume which reaches the Bay of Bengal (BOB) from Bangladesh<sup>6</sup>. This freshwater runoff isa dominant feature that influences the dynamics of the coastal and marine environment. Primary production in the Bay of Bengal is known to be high during the northeast monsoon. Coral reefs are quite limited off Bangladesh due to high river discharge and turbidity. Different aspects of the physical environment are:



5. Saidur Rahman Chowdhury 2014, Map – Sea Area of Bangladesh, University of Chittagong.

6. Hussain, M G and Hoq, M E (eds). 2010, Sustainable management of Fisheries Resources of the Bay of Bengal – Compilation of National and Regional Workshop Report, p -6.

**General Hydrological Feature of the Bay of Bengal.** The sea state, current and temperature have direct effects on fish breeding. The South - West monsoon appears in April and the period April to August is clearly marked by rough seas, caused by strong winds with heavy rain. The heavy cyclonic storms recorded once during May-June and again during October - December<sup>7</sup>. The current is complicated due Bay physical position. It flows Eastward during strong Southwest winds and Westward during the Northeast wind in sea depth ~ 40 m. The lowest bay temperature is 22-24°C during December and January. It increases to 34°C in June and remains unchanged till October. In BOB, the temporal and spatial variation of temperature and its association with hydrological features is unlike other bays and oceans. Especially, BOB experiences thermal inversions during the winter months. These unique characteristics of the Bay have close alliance with the overall fish productivity.

**Chemical Oceanography.** The chemical oceanography would include Salinity, Nutrient salts and Oxygen<sup>8</sup>:

**Salinity.** Salinity in the Bay of Bengal is highly heterogeneous, with extremely fresh waters found at the surface in the Northern part of the basin, and saltier waters at subsurface as well as to the south<sup>9</sup>. Low salinity waters in the northern Bay of Bengal (north of 18 N) with salinity less than 32.5 psu (practical salinity units) during March–April lead to strong saline stratification. In south, presence of relatively high salinity waters (>34.5 psu) during spring inter-monsoon (March–May) made the upper water column, specially the upper 30 m, less stable. On the other hand, in the northern and eastern Bay of Bengal could be understood in the context of the presence of low salinity waters (<32 psu) during November–December and associated strong stratification<sup>10</sup>. This strong stratification resist bottom nutrient to go up, thus affect the primary productivity and thereby influence the production of different fish species of the area.

**Nutrient.** The Bay of Bengal is traditionally considered to have poorer biological productivity compared to its western counterpart-the Arabian Sea. Although the riverine flux may bring in nutrients, they are thought

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7. Samuel, C T, 1968. Marine Fisheries in India, Oceanographic Laboratory, University of Kerala, Cochin. P 29 – 39.
  8. Samuel CT, 1968, p 39 – 40.
  9. “The upper Bay of Bengal salinity structure in a high-resolution model” by RachidBenshila and et al., 2013.
  10. J. Narvekar and S. Prasanna Kumar, 2014 “Mixed layer variability and chlorophyll a biomass in the Bay of Bengal”

to be lost the deep because of its narrow shelf<sup>11</sup>. In previous study at the Bay (11<sup>0</sup>-20<sup>0</sup>N) the vertical distribution of **nitrate** at the upper 30-40 m was devoid, around 50m it's magnitude was 1  $\mu\text{M}$  at the South; strong gradient (2 to 24  $\mu\text{M}$ ) was between depth 55-140 m and maximum of 32  $\mu\text{M}$  at depth about 250m. In general, **Silicate** distributions was about 2  $\mu\text{M}$  near surface at the North (20<sup>0</sup>N) and same value enumerates at about 50m depth towards South (7<sup>0</sup>N); strong gradient was (2-22  $\mu\text{M}$ ) between depth 50-140m along 88<sup>0</sup>E<sup>12</sup>. As such, presence of strong physical process like up welling and meso-scale eddies can enhance productivity and fish habitation in the off shore area along Thailand, Myanmar and the Islands of Andaman Nicobar Group.

**Dissolved Oxygen.** For Bay of Bengal area there is no accurate data of dissolved oxygen content in its water. The National Institute of Oceanography (NIO) based in coastal state of Goa and Dhaka University have signed a memorandum of Understanding on Ocean Studies, which includes sampling of waters from rivers in Bangladesh that eventually flow into the Bay<sup>13</sup>. It is apprehended that the fertilizers being used in the arable land of Bangladesh are drained towards the Bay and these eventually causes the depletion of the existing oxygen level. Therefore to ascertain the fishing ground the level of oxygen needs to be measured by the concerned scientists and necessary measures should also be recommended for the preservation of the fish habitation in the Bay of Bengal.

**Biological Environment.** The entire coast of Bangladesh is dominated by soft substrate ecosystems that are biological productive, providing critical ecological habitats like mangroves, algal beds, salt marshes, sandy beach and mudflats. Mangroves serve as the transitional zone between the terrestrial and marine environment and are suitable feeding, breeding and nursery ground for various marine, estuarine and freshwater fishery resources. These areas are critical for providing nursery grounds of larval and juvenile stages of finishes, shrimps, crabs and cockles<sup>14</sup>. The net-like spread root system of the mangrove acts as a coastal stabilizer and binders of sediment and thus aids in preventing erosion in the mangrove areas. Despite their obvious ecological benefits, mangroves throughout

11. "Qasim, S.Z., 1977. Biological productivity of the Indian Ocean. *Indian Journal of Marine Sciences* 6, 122–137.
12. M. Madhupratap and et al 2001. "Biogeochemistry of the Bay of Bengal: physical, chemical and primary productivity characteristics of the central and western Bay of Bengal during summer monsoon 2001"
13. Daily Star, Bangladesh national Daily 12 July 2015.
14. Khan M G 2010. *Bangladesh Coastal and Marine Fisheries and Environment*, p 8.

the region are under increasing threat from human activities such as deforestation and shrimp culture practice.

**Maximum Sustainable Yield.** Using the results of the stock assessment studies different researchers found out the possible fisheries potential for demersal fish. The results indicated that 40,000 to 55,000 t of demersal finfish can be harvested annually from the offshore fishing grounds lying within 10 to 100 m depth zones<sup>15</sup>. This did not include the estuarine and pelagic fish reserve.

**Socio Economic Environment.** The coastal zone of Bangladesh is comprised of 19 districts that contain a mixture of very old settlements and new land developments. According to a 2001 population census, the coastal zone of Bangladesh has a population of 35.1 million. That is 28 percent of the total population<sup>16</sup>. Out of the total coastal population only about 13.5 lacs that is about 3.8% of the coastal people are engaged in fishing or fishing related activities. Within coastal zone, Chittagong-Cox's bazaar, Noakhali- Barisal and Khulna it can be seen that the people of Chittagong-Cox's bazaar zone have more financial solvency than that of the other regions<sup>17</sup>. The people working in the industrial fishing are better educated and well paid staffs. They enjoy better working conditions and their works are regulated through service rules under company act.

**Timing and nature of Job of the Fishermen (Coastal - Artisanal).** On an average the fishermen avail about 220 fishing days in a year. In the fishing season the fishermen work almost 7 days a week without having any rest. They rest only when the catches are poor and disappointing. In Bangladesh the fishermen go to sea in two different ways. The small boats having small engines or without engines go to sea in two batches. The first batch leaves at around 3 a.m in the morning and returns to the shore by 3 p.m in the afternoon<sup>18</sup>. The second batch leaves the shore by 3 p.m and returns by 7-8 am in the morning. Fishing seasons starts from August with day fishing. Night fishing is generally avoided during the cyclonic weather. Otherwise, both day and night fishing activities are maintained by the fishermen. The fishing community tries to bring their catch in the morning to get a higher price in the market<sup>19</sup>.

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15. Lamboeuf, M 1987.

16. Khan MG 2010. P – 11.

17. Khan MG. p – 11.

18. Personal interaction with the fishermen of subsistence sector, life style of the fishermen in Chittagong area is learnt.

19. Ali, S M 1996. Marine Fisheries Economics and Development in India, M D publications pvt ltd, New Delhi.P67-87.

**Risks and Safety Aspects Faced by Fishing Community.** There is no denying fact that the fishing at sea is an arduous job and the fishing community faces different types of challenges at every moment. They are always exposed to the danger of sea coming up from cyclone, unfavorable weather and many more. Against the risk, the wages or the income of the real fishermen are very poor. The risk factors are equally shared by both artisanal and industrial fishing community. Every year a good number of fishermen lose their life at sea during the monsoon period. Despite receiving signals, in many cases the time does not permit them to go for a safe shelter. There are also record of sinking the industrial fishing trawler at sea. Although, the fishing community contributes a lot to the national economy their life is not insured by any policy<sup>20</sup>. Therefore, when someone dies in cyclone the family becomes destitute. In case of industrial trawlers the situation is also the same. The crew members do not receive any insurance other than the merciful grant by the company he works. On the other hand the trawler or the boat owner receives the insurance money for the loss of his boats or trawlers. These factors sometimes discourage people to work in the fishing sector.

## **Marine Fisheries Resources in Bangladesh**

**Major fishing Ground.** There are four major fishing grounds in the marine water of Bangladesh. The **South Patches** and **South of South Patches** lies between 20° 50'N to 21° 40'N latitude and 91° 00'E to 91° 50'E Longitude, covering an area of about 6200 km<sup>2</sup>. The **Middling** fishing ground situated between 20° 50'N to 21° 20'N latitude and 90° 00'E to 91° 00'E longitude that covers an area of about 4600 km<sup>2</sup>. Finally, the **Swatch of no ground** lies between 21° 00'N to 21° 25'N latitude and 89° 00'E to 90° 00'E longitude, which covers an area of about 3800 Sqkm<sup>21</sup>.

**Major fishery resources.** From the available data on standing stock of marine fisheries resources it is found that only during 1958-62 a biological survey was carried out to determine the living resources available at Bay of Bengal. According to this survey total species of finfish, shrimp, seaweed, crabs, lobster, mollusks, coral, starfish, cuttle fish, squid, snakes, turtles, crocodile and mammals were recorded as 475, 36, 13, 15, 5, 301, 4, 3, 2, 2, 4, 4, 1 and 11, respectively<sup>22</sup>.

20. Mr Rashedi, 15 Jun 2015, The President of Ex Cadet Association of Marine Fisheries Academy. From personal interview it is learnt that the crew member of the fishing sector is not covered by any kind of insurance policy.

21. Hussain M G and M J Rahman. 2010. Marine Fisheries Resources of Bangladesh: Stock Status and Management Issues. P- 39.

22. Hussain M G and M J Rahman. 2010. P 39.



**Fishing Gears.** Numerous gears are used to exploit multi species marine resources in Bangladesh. Artisanal small scale fisheries uses gillnets, set bag net (behundinet), seine net, push net, hook and line, trammel net, etc. Large scale industrial fisheries (trawl fishery) uses trawl bag of different types for bottom trawling and mid-water fishing.

**Fishing Vessels.** Broadly two different types of vessels are engaged in fishing at the Bay of Bengal. These are fishing boats (mechanized and non-mechanized) and Fishing Trawlers (Shrimp trawler and White fish trawlers). Proper record of fishing boats are not available, however, from different sources it is found that more than 57,863 mechanized and non-mechanized boats are engaged in fishing at the Bay. On the other hand about 232 industrial fishing trawlers are engaged in fishing operation. Out of these numbers 50 are shrimp trawlers and 182 are white fish trawlers<sup>23</sup>.

## **Present Catch Pattern of Marine Fisheries Resource**

**General Context.** The marine captured fisheries of Bangladesh exploit a complex, multi species resources and can be subdivided into subsistence (small-scale, noncommercial), artisanal (small-scale commercial) and industrial (large-scale commercial) fisheries sector. Among the commercial catch, more than 90% is landed by artisanal fishing vessels, while industrial fisheries contribute around 10% to the total landed catch<sup>24</sup>. However, the catch patterns of different subsectors are different.

**Subsistence Sector.** BFDC in collaboration with Food and Agriculture Organization (FAO) and the United Nations Development programme (UNDP) estimated about 9,500 sail boats and 41 mechanized vessels operated in 1967-68. During those days approximate marine catch was about 99,000 t. The gears used by those boats were mostly Set Bag Nets (SSBN). In the present day it is difficult to get correct information of total number of boats in subsistence sector. There is no correct and separate data for the subsistence sectors because of their landing is different and mostly go to the market without maintaining record or merged with the stock of artisanal sector. Boats in subsistence sector mostly operate in the near shore areas and their operation is limited within day trip.

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23. Consultation Workshop Report, 06 Sep 2014. Bangladesh marine Fisheries management: Present State and Future Development Strategy.

24. Working paper.2014. Reconstruction of Total Marine Fisheries Catches for Bangladesh: 1950 – 2010. Fisheries centre, The University of British Columbia .

**Artisanal Fishery.** Artisanal fisheries include a number of different types of fishing gears and crafts. Some of the gears are operated by mechanized/motorized boats, and some are with country boats (row boat/sail boat) while some are operated without any boat. These include: (i) five different types of gill nets (i.e. drift gill net, large mesh size gill net, fixed gill net, bottom set gill net and mullet gill net); (ii) three types of set bagnet (i.e. estuarine set bagnet, marine set bagnet and large mesh set bagnet); (iii) trammel net; (iv) bottom long line; (v) beach seine and (vi) many other gears scattered throughout the coast and estuaries. Using SBN as effort proxy an estimate of annual landing from artisanal fishery was made by Fisheries Centre, The university of British Columbia found that; in 1982 annual landing was 3,211 t against a landing of 1,286 t for one single species i.e. Bombay Duct in 1966<sup>25</sup>. It simply indicates an increase of production by 59%. This figure seems very encouraging and with this inspiration the number of mechanized boats increased exponentially; compared to only 41 before the war of liberation to about 57,863 or more today.

**Industrial fishery.** Commercial exploitation by deep sea fishing trawlers started since 1972 when BFDC introduced 11 modern fishing trawlers received from the Government of U.S.S.R. as grant. Three more trawlers were procured and commissioned by BFDC in 1974. These trawlers were mainly aimed at exploiting demersal finfish in offshore waters of Bangladesh. Shrimp catch became a focal point of interest for the industrial fisheries just after the discovery of commercial shrimp grounds in Bangladesh in 1976/77. As a result many Bangladeshi entrepreneurs and foreign firms became interested in shrimp trawl fishing. An estimate shows that in 1980/81 shrimp catch was 700 t from the trawler fleet, which sharply increased to 4,500 t in 1983/84<sup>26</sup>. The trawler fishing started gaining momentum in private sector after signing joint venture projects between Bangladesh and Thailand in 1979-80<sup>27</sup>. The joint venture project in fishing with Thailand is marked with total dissatisfaction and corrupt practice by both sides. Finally by around 1989 joint venture was terminated in the national interest. At present about 232 industrial fishing trawlers are engaged in fishing operation. Out of these numbers 50 are shrimp trawlers and 182 are white fish trawlers

**Total Marine Fisheries catches for Bangladesh.** The Fisheries Resource Survey System (FRSS) was initiated with the financial and technical assistance

25. University of British Columbia Working Paper# 2014 -15.P 1.

26. University of British Columbia Working Paper# 2014 -15. P- 4.

27. John G Butcher 2004. The Closing of the Frontier: A History of the Marine Fisheries of South East Asia ISEAS Publications, Institute of Southeast Asian Studies, 30 HengMuiKengTerrace, PasirPanjang, Singapore, p 248-249



of FAO/UNDP in order to achieve some management objectives. Finally in 1984 a system was developed for collection of catch statistics as well as a manual for survey methodology<sup>28</sup>. Presently marine catch contribute around 17.27% to the total fish catch of Bangladesh, and of this approximately 90% is landed by artisanal fisheries<sup>29</sup>. The total catch of Bangladesh is shown below:

|                                   |   |                        |
|-----------------------------------|---|------------------------|
| • Total fish production (2012-13) | : | 34.10 m mt             |
| • Net Value (BDT)                 | : | 50,000 Crore           |
| • Contribution to GDP             | : | 4.37%                  |
| • Contribution to Export Earning  | : | 2.01%                  |
| • Per capita Fish Consumption     | : | 18.98 Kg/Yr (52 g/c/d) |
| • Growth rate during last 5 years | : | 5.88%                  |

From the growth rate of last five years it may seem very encouraging, but if the issue is viewed critically it can be seen that within the stated 05 years period the number of fishing boats and trawlers have also increased by many fold meaning the catch effort has increased. Therefore, against the catch effort the harvest is low.

### **Challenges in exploitation and management of marine fisheries resources**

**Challenges in Exploitation.** Managing multispecies fisheries are a challenging task; therefore, continuous effort is needed to develop appropriate models to manage complex fisheries system. Exploitation and management of marine fisheries has two very distinct and different dimensions. One is the exploitation and the other is the management of this resources. Salient aspect of the challenges relating to exploitation is described below:

- **Controls over the Fishing Ground.** For the exploitation issues pertinent aspects are; kind of gears being used by different fishing vessels. There are some fishing gears used by the vessels of all three subsectors are detrimental to the fishing ground. Bottom trawling is also hazardous for the fingerlings and other juveniles in the fishing ground. Because of poor monitoring arrangement and weak statutory regulations the control over the fishing ground remains weaker.

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28 Reconstruction of Total Marine Fisheries Catches of Bangladesh: 1950 – 2010 by HadayetUllah.

29 Fisheries Statistical Year Book 2012-13, Department of Fisheries, Bangladesh. Ministry of Fisheries and Livestock.

- **Catch data and the Type of Vessels and Gears being used.** To examine biological and economic over fishing of fish stocks, detailed scientific data on stock levels, regeneration, and catch are prerequisite. In case of Bangladesh a good number of fishing vessels in artisanal sector and subsistence sector has no registrations. Their landings are also wide spread. In case of industrial fishing the catch data is maintained by the individual company through the fishing vessel log and the landing data. In the industrial fishing there is a tendency of showing less catch, as such it is also difficult to reach in a correct figure. Thus, the entire system of recording catch data, gears and vessels remains a challenge to this sector.

**Challenges for the Management of Marine Fisheries Resources.** In a simple definition management of Marine fisheries resources can be termed as the organization and coordination of the activities of fishing in order to achieve defined objectives<sup>30</sup>. The management issues in respect to marine fisheries in broad sense can be identified as follows:

- **The current policy, legal and administrative systems can only serve as a partial foundation for reform towards more progressive fisheries management.** In the three broad fields of economic, social, and environmental performance, marine fisheries in Bangladesh are not fully meeting government expectation that is to increase production. The fishing rights needs to be defined more clearly. That means which type of vessel should fish in which area is a requirement by the fishing community and this issue needs to be addressed holistically for a better production and discipline in fishing activities.
- **The biological and economic sustainability of marine fish stocks in Bangladesh faces challenges.** Presently there is no data which shows about the species which are already extinct or about to be extinct in near future. Although, there are few research on shrimp and some other species which only give a record of over exploitation without any record of stock position.
- **Small scale fisheries are losing their livelihoods and opportunities for development, and there are presently few options for alternatives.** In Bangladesh the small scale fisheries contribute about 90% of the marine catch<sup>31</sup> but they live below poverty line because of the advance sell of their catch or the system of 'Dadon'. The poor fishermen generally do not own

30. Web page <http://www.businessdictionary.com/definition/management.html#ixzz3cD12FRr8>

31. Khan MG 2010. Bangladesh Coastal and Marine Fisheries, and Environment. P – 11.

the boats rather they only sell their labor. The middlemen are exploiting them in many ways. Their safety aspects are also overlooked. In the fishing ground generally within 40m depth often the industrial fisheries are also found in operation. In such situation it is difficult for them to sustain.

- **Fisheries management needs to be strengthened, especially for inshore waters.** In Bangladesh water within 40m depth from the coast is generally allocated for the small scale fisheries to operate. Because of different reasons this regulation is not complied with. Thus a regulatory decision is required taking suggestions from the fishing community. The kind of fishing gears in use by all the subsectors of marine fisheries is also not well defined.
- **Market channels, particularly for small-scale fishers, are inefficient and hinder delivery of high quality products at optimal prices.** Small-scale fisheries are often unable to gain access to more efficient marketing systems and supporting infrastructure (ice, cold storage, etc.) that would lead to better quality and prices. Thus ensuring fair price and good infrastructural support remains as a challenge.

## **Formulation of Strategy for Exploitation and Management of Marine Fisheries in Bangladesh**

**Considerations for Formulating Strategies for the Exploitation of Marine Fisheries Resources.** From the overall analysis of this paper it is revealed that, Bangladesh's marine fisheries can generally be characterized as a free and open access system, underpinned by fairly conventional policy goals of maximizing production, based on increased fish landings through technology inputs and expanded fishing effort. This approach generally yields low level of success in generating sustained economic benefits. In some cases it may lead to stock collapse from over capacity and overfishing. It has been revealed that the artisanal and subsistence fishing sector are not bounded by any rules or regulations. On the other hand the industrial fisheries are also reluctant to follow the rules and regulations in respect to the mesh size and depth as stipulated in the Marine Fisheries Ordinance.

**Formulating Strategy for the Exploitation of Marine Fisheries Resources.** To formulate the strategy for the exploitation of marine fisheries resources following have been recommended.

- The objectives of exploiting marine fisheries resources should be to increase productivity without impairing the reserve or the MSY.
- To attain the objectives of the strategy a number of means would be required. First of all the fishing boats and trawlers should be registered and brought under absolute control of the Department of Fisheries. A proper research should be carried out to determine the fisheries stock and then the professionals should determine the number of fishing vessels required to harvest the resources without damaging the stock. Skilled manpower power should be developed to work on the field.
- Fish landing sites should be designated with proper monitoring arrangement. The marketing channel with proper storage capacity should be developed. Protection of the fishing ground against illegal fishing should be ensured in coordination with Bangladesh Navy and Coast Guard.
- Depending on the survey report breeding season should be determined and accordingly fishing operations should be suspended during the breeding period. The small scale fishing community should be provided with alternative income source to sustain their livelihood during off season. Fishing gears which are detrimental to the fish habitation should be prohibited.
- The fishing ground should be divided into different fishing zones/region depending on their proximity to the shoreline. This will ensure safety of the small scale fisheries and bring discipline in the ground. Bottom trawling in the near shore areas should be prohibited for the protection of juvenile and protection of the fishing ground.
- The survey should also be conducted in the extended water of EEZ to determine the demersal fishing stock and encourage industrial fisheries to explore in the distant water.

**Considerations for the Management of marine Fisheries Resources in Bangladesh.** As referred before, management of Marine fisheries resources is all about the organization and coordination of the activities of fishing in order to achieve defined objectives or productivity. While Bangladesh's marine fishing sub-sector has many positive features to build on, a new approach is needed with an increased focus on maximizing economic, social and environmental benefits, improving productivity, and providing better equity. This needs to be supported by appropriate policy, legal, and institutional frameworks, and a more effective fisheries management system for both inshore and offshore stocks.

**Management Strategy for the Marine Fisheries Resources.** It is apparent that for proper exploitation of the resources proper management is needed. This will lead to a sustainable benefit of a large segment of the population whose livelihoods are dependent on fisheries production. In achieving this objective, a number of specific measures need to be undertaken. Some of the important ones are included below:

- The management information system for the fisheries sector should be improved in order to dynamically assess the state of the sector, and the costs and benefits resulting from adjustments in fishing capacity. The marine data collection and research cell should be strengthened to provide the government with the necessary information to manage and optimize catch from trawl as well as artisanal/subsistence sector.
- The management of the fisheries sector should be an integrated approach that takes into account the economic, environmental and social factors affecting fish supply, fish stock and fishing capacity. For example, prior to any initiative to increase productivity through modernization of the sector, it should first be understood what integrated impacts might result, such as dividing the fishing ground into different region or introducing new fishing technology.
- Since artisanal/ subsistence sector contributes more on the total catch they should be brought under a total control by reducing the formalities of obtaining registration and fishing license. Licensing and catch permission may be vested on one single authority to make it more user-friendly.
- Incentives for the fishing community should be planned and their safety aspects should be taken care off. Insurance policy for the fishing folk should be implemented on priority basis.
- Regional cooperation in respect to research may be instrumental for development. This will help issuing of license depending on the stock position in the Bay, also overfishing could be avoided. The country should also encourage dissemination of improved fishing practices to minimize by-catch, waste and discard.
- Bangladesh needs to strengthen its monitoring, control and surveillance capacity in its territorial water with a view to stopping illegal, unregulated and under-reported fishing as these affect sustainability. The industrial fishing

fleet may be asked to install Automatic Identification System (AIS) so that the monitoring can be eased by DOF.

- For sustainable exploitation of fishery resources the lead ministry should hold coordination with all stake holders and law enforcing agencies to maximize production.

## **Conclusion**

Commercial exploitation of marine Fisheries Resources in Bangladesh mainly started after the independence in 1971. At the beginning it was only a venture by the subsistence and artisanal fishing sector. The industrial fishing was started with a handful of trawlers gifted from the then Soviet Union. As the venture was profitable more number of industrial fishing trawlers started coming in and the fish landing started increasing. From the record it is found that in 1978 the fish landing was 113,240 t which increased to 379,497 t by 2001. Presently the total catch is about 590,000 t. From the statistics it is evident that gradually the catch went up. But in the same area the number of fishing vessels has also increased by many folds. As such it cannot be said that the productivity has increased, rather it gives an indication of over exploitation of resources because of huge increase in unit effort.

Resources at sea had been considered to be a common property where everyone has access. Therefore, uncontrolled exploitation is taking place and these uncontrolled and unmanaged resources may lead to the chronic economic overexploitation and over fishing. In recognition to this phenomenon many countries in the world have attempted to manage their marine fisheries through policy guide line, restrictions, strategies and management measures. Bangladesh also needs to develop certain strategy to exploit and manage this resources.

In Bangladesh about 13.5 Lacs coastal people are directly involved into the artisanal fishing. Overall 13.5 million people are directly and indirectly involved into the marine fisheries sector. Out of this sector many other business and enterprises are earning their livelihood. It also significantly contributes in providing protein need of the people in the country, livelihood of coastal people and earns foreign currencies. Thus this sector must survive for the nation with its economic importance. To survive this sector a well regulated and well defined strategy is must. To conserve and manage fishery resources for the benefit of the present and future generations, the resources need to be managed and exploited on a



sustainable basis. Thus, the concerned ministry and department have to come forward with right strategy for the conservation, exploitation and management of the marine fisheries resources for today and in the days to come.

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