FRAMEWORK FOR THE ESTABLISHMENT AND MANAGEMENT OF MARINE PROTECTED AREAS (MPA) IN BANGLADESH
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Executive Summary

This framework report is prepared by IUCN Bangladesh Country Office based on findings, discussions and suggestions from six regional workshops, six focus group discussions, various interviews of key informants at both regional and center level, two national level stakeholders consultation workshops (inception, where policy analysis was presented; and final national workshop where this document was validated together with other issues) and analysis of existing policies and documents on PA and MPA at home and elsewhere. This project was implemented in collaboration with the Bay of Bengal large Marine Ecosystem Programme (BOBLME), of FAO from April-December 2012. Relevant ministries (MoFL and MoEF), their agencies (DoF, BFRI and FD), other concern govt. organizations (NAVY, Coast Guard, DoE, NORI and Universities), local administration and civil societies were involved for the formation of this document. In addition of this framework report, IUCN has prepared three other documents viz. Policy gap analysis, Stakeholders analysis and Review of secondary literatures; which are also parts and parcel of the report but submitted separately.

The document is based on analysis on the Bay of Bengal (BoB) basin, coastal configurations, ecosystem, habitats, current status and management of marine fisheries and foreseen socio-economic and ecological benefits which may originate from the protection of ECA and probable MPA declarations and execution. Characteristics of coastal communities related to protection and conservation of fragile natural habitat and resources, their organizations, if any, livelihoods dependency to marine resources, conservation initiatives, partnership needed for MPA under public-private initiatives, coastal industries, land and sea based pollution sources, marine resources related knowledge gaps and probable international cooperation as part of the preliminary requirements for MPA initiatives were also discussed. Therefore, while formulating the document attempts were made to incorporate reviewed scientific findings on the BoB, information and knowledge gaps on marine ecosystem and its contents, marine resource use capabilities, abusive exploitation, pollution and socio-economic aspects of coastal inhabitants and other related matters.

Although, list of biotic entities in EEZ of Bangladesh is long but incomplete for many groups of organisms that needs further exploration. An initial attempt was taken to discuss current status of renewable marine resources those are known to be commercially harvested or accidentally caught during commercial exploitations. Such groups include fish, shrimp and other crustaceans, mollusks, marine reptiles, sea birds, cetaceans and sea weeds. Their current status, within and between groups diversity and threats of extinction due to anthropogenic interventions and activities are discussed. This is important as probable protective measures under planned MPA initiatives could be undertaken in future based on available information compiled now. Human activities and overexploitation are main threats for many commercial and some non-commercial species those are accidentally caught, destroyed and/or abused.

There are reasonably good numbers documents available on marine and estuarine fisheries, coastal zone and environment management, climate change, biodiversity and related matters. However, only very few worthwhile report or data related to MPA are found. Consequently, attempts were taken to study/review existing documents available on Bay of Bengal with special emphasis on Bangladesh and its EEZ. Related documents were collected from online sources on MPA related literature to understand how other countries are formulating or have formulated framework on MPA or outlined steps or worked out roadmap and course of actions for future MPA’s in Bangladesh in line with BOBLME initiatives. It is factual to state that a preliminary outline steps and actions are needed to prepare a framework for MPA’s. It will be the first step towards right direction and still a long way to go to demarcate, designate, declare and implement MPA in a sea area where so many stakeholders depends on its resources for their livelihoods, subsistence and to improve their quality of lives. Nonetheless, the framework mostly prepared is based on opinion of grass-root level stakeholders and some key informants who often have conflicting interest but may be considered as a loop inside which future expanded attempts may be taken under real world situations.
Under the prevailing situation mentioned above, attempts were taken to outline immediate course of actions that could be followed in different steps, based on experiences of other countries, how they have done it or trying to accomplish the establishment of MPA/s. Replicating the processes taken by others, however might not serve the real purpose. Therefore, attempts were taken to consider all the diverge elements while formulating the framework to be used under Bangladesh conditions. IUCN guideline for protected areasand FAO Guidelines for “Marine protected areas and fisheries” can be followed during implementation of the proposed framework as guiding principle the steps detailed out in Chapter 3.

The fisheries, marine fisheries and allied policies are needed to amend so that it could be “all clear-cut” or “an all-inclusive” policy documents. Since, in the existing framework there is no specific marine environmental and/or ecosystem based policy, attempt were be taken to formulate a wide range policy document with a provision of routine review and follow-ups. The modified marine policy paper were broadened to incorporate all necessary elements, reflecting sustainability based on long term perspectives and wider national marine development policy and planning framework. Declaration of MPA can be done either jointly or independently by the Ministry of Fisheries and Livestock and Ministry of Environment and Forests. There should be a national committee for MPA declaration, possibly headed by Ministry of Fisheries and Livestock. Also, there should be regional committees. The Marine Fisheries Ordinance, 1983 of Bangladesh though directly did not incorporated provisions on establishing MPA, but it has provision for protecting marine habitats and resources. Under these provisions the concept of MPA could be accommodated. However, designation and/or titling of newly created MPA will not be a problem as Bangladesh government is committed to establish of MPA in EEZ of Bangladesh part of BoB. If such provisions are missing or weak in the ordinance, the rules may be formed under the existing Marine Fisheries Ordinance 1983 or by amending it. Under the Wildlife (Preservation & Security) Acts, 2012, Chapter 4 (Protected Area) Section 13(2) Subsection 1 has the clause to declare Marine Protected Area (MPA) which can also be used for MPA in Bangladesh. The designation process on MPA may proceed alongside with the MPA management planning.

It may be mentioned that the general framework will be a broad outline, but individual MPA should have its own specific guideline or pathway. To establish an individual MPA, following steps can form the framework:

**Step 1: Identification of Area of Significance (AOS)**
**Step 2: Initial sieving of preliminary selected AOS**
**Step 3: AOS validation, assessments and suggestions**
**Step 4: Formulation of a Management Plan for a Candidate MPA Site**
**Step 5: Designation or titling of MPA**
**Step 6: Guidelines of management of MPA within a framework**
**Step 7: Declaration of MPA**
**Step 8: Code of Conducts (COC) for specialized MPA**

Based on opinion and suggestions of grass-root level stakeholders from coastal regions, key-informants from government and non-government organizations and civic society members, a number of coastal interfaces, off-shore islands and open sea areas are suggested to be incorporated as future MPAs. The suggested site/places with their inherent merits and demerits, human interference on its natural character, ecosystem, biodiversity and other relevant and related matters are also discussed for considerations as a MPA candidate. Roughly 70 odd sites are identified or suggested as probable MPA, however, most are not well demarcated, and only latitude and longitude are figured-out. All suggested places do not carry equal importance/significance; hence, initially suggested sites are differentiated into 4 categories: Area of significance (AOS), Area of Interest (AOI); Area of Curiosity (AOC), and Area of Mind (AOM). But almost all proposed sites for future MPA incidentally are either in coastal areas and or in territorial waters as those who participated in these workshops and FGDs were not very familiar with the high sea part of the EEZ.
Therefore, in final workshop it was decided that among the proposed sites a few would be taken into considerations for MPA as pilot sites for immediate future and based on outcome of pilot initiatives broader approaches will be taken afterward. Total 14 sites are identified as AOS which again could be summarized mainly in four broad sites to declare as MPA, those are: St Martin Island and its adjacent water area (approx. 100 sq. km), Nijum Dwip Island and its adjacent water area (approx. 300 sq. km), Marine Reserve area declared by DoF (approx. 5000 sq. km), and Sundarbans and its water territory. The workshop also came up with the following suggestions which should be taken care of during implementing this framework:

- Implementation of MPA will need successful partnership and assuming responsibility by concerned public and private partners
- A national approach is needed in details on how department of fisheries and department of environment will work together with other departments/agencies
- Declaration of MPA can be done either jointly or independently by the Ministry of Fisheries and Livestock and Ministry of Environment and Forests. There should be a national committee for MPA declaration, possibly headed by Ministry of Fisheries and Livestock
- Cooperative agreements and joint planning exercises between Bangladesh and her BoB neighbours are very important
- Existing fisheries, marine fisheries and allied policies are needed to amend so that those could be “all clear-cut” or “an all inclusive” policy documents in support to establish MPA
- The Marine Fisheries Ordinance, 1983 of Bangladesh though directly did not incorporate provisions on establishing MPA, but it had provision for protecting marine habitats and resources. Under these provisions the concept of MPA could be accommodated.
- Under the Wildlife (Preservation & Security) Acts, 2012, Chapter 4 (Protected Area) Section 13 (2) Subsection 1 has that clause to declare Marine Protected Area (MPA) which can also be used for MPA in Bangladesh.
- The designation process on MPA can proceed alongside with the MPA management planning
- Monitoring is vital for any programme implementation; therefore it is essential to establish an M&E system to conclude whether the objective/s of a given MPA has been successfully comprehended.

The indifferent attitude to conserve marine ecosystem and biodiversity, irrational and unsustainable resource utilization and abusive harvest attempts to some commercial species, obnoxious overuse of some of the ECA has made designation of MPA urgent, and its speedy implementations in Bangladesh with a commitment to protect marine environment and ecosystem. To maintain international obligation, especially in post Nagoya scenario, it has become highly essential to take initiatives to declare 10% of the sea area of as MPA by 2020.
Chapter 1
Background
1.1 Bay of Bengal

The Bay of Bengal is one of the world’s 64 Large Marine Ecosystems (LMEs). The bay is located at the mouth of three largest rivers in Asian continent that drains huge amount of monsoon water. There are eight countries that surrounds the Bay from north, east and west. The south is connected with the Indian Ocean. The eight countries those formed the coastal zones of the Bay of Bengal (BoB) are Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand. The BoB countries are heavily populated; relatively poor economically and significantly dependent on the Bay and its contents for gathering different types of resources for livelihoods. Due to lack of modern equipments and harvesting gears coastal dwellers of BoB countries overexploit in-shore coastal seas and probably under exploit open off-shore sea resources. However, roughly 1.6 to 1.7 billion people live in eight Bay of Bengal countries constituting roughly 25% of the world population.

Among the total population of the region, roughly 400 million lives in Bay’s catchment area, many subsisting at or below the poverty level. As mentioned earlier, the Bay is one of the large marine ecosystem and harbors coast lines of the countries which surrounds it. Therefore, management of non-renewable resources in respective EEZ of each country is not an issue; so long the extractions methods follow responsible methods and create minimum pollution. However, the management accountability of all exploitable living and renewable resources and its habitats is not only the responsibility of a single country, but it should be a collective responsibility for all the neighbouring countries to resolve the existing problems, if there is any. As mentioned earlier, eight countries including Bangladesh surrounding the BoB have already realized the importance of mutual cooperation and they are now working in closer linkages for sustainable management of the fishery resources of the BoB and its large marine ecosystem under a project.

The main problem in BoB adjacent countries is over exploitation of certain species and fishing communities facing the unsustainable harvesting of renewable resources. Besides, the coastal region and territorial waters are over exploited by artisanal fishers. They cannot go to deeper water due to the lack of engine power, inefficient fishing gears and lack of sufficient cooling system on board. Besides, open access to marine resources by anyone creates conflicts between professional fishers and others. Many of the fishery resources in members’ countries of BoB especially those of small scale fishing and harvesting in coastal areas are already heavily exploited; and these artisanal fishing needs to be brought under regulations for its own sustainability. Otherwise unregulated fishing will turn the situation worse and adverse impact on the large number of small-scale fishers dependent on these resources for their livelihoods and as a source of food security.

1.2 Coastal Area of Bangladesh

The coastal areas in Bangladesh is relatively less developed, disaster prone, inhabited by poorer people thus demographic dividend is also meager, but have relatively better access to marine and mangrove related natural resources. The rates of landless farmers in coastal areas are more compared to rest of the country. Besides, the coastal lands are relatively less productive due to salinity and in most areas a single field crop is harvested. The socio-economic condition of fisher community of Bangladesh in coastal areas is poor and unsustainable exploitation of fish by over fishing has decreased catch per unit efforts. Further, though Bangladesh do not have adequate capacity to exploit deep sea fishing but illegal intrusion of foreign fishing fleets in Bangladesh EEZ are often reported. Bangladesh has a few large scale fishing vessels and instead of fishing in deeper and blue seas they try to fish in continental shelves within 40 m depth that are supposed to be for artisanal fishing, this situation has increased antagonism and divergence between artisanal and large-
scale fishing. Further, the bottom trawling (both finfish and shrimp) by the industrial fishing vessels undertake destructive fishing as these vessels chase the sea bottom and destroy the coral beds and the benthic faunal community. Huge numbers of artisanal fishing boats continued degradation of highly productive estuarine, coastal, mangrove and near shore marine habitats, migratory routes, vital fish spawning and nursery grounds is creating imbalance landing from marine sources. Irresponsible and abusive fishing practices are expected decline marine landings further in future, if corrective measures are not undertaken.

1.3 Marine Fisheries Capability of Bangladesh

Compared to world fisheries Bangladesh fisheries is little different. World fisheries are predominantly salt water based and food habits are adapted to marine fish; while Bangladesh fisheries are mainly fresh water in origin and the nation as a whole has hardly any marine fish on the table. Fish produced in the country mainly comes from wild open fresh water sources and fresh water based aquaculture. This is one of the reasons why the authorities have not paid attention on the development of marine fisheries. This is why marine fisheries did not developed here in the same pace with fresh water fisheries.

Marine fisheries sub-sector has an estimated 22,500 non-mechanized and 21,400 mechanized fishing boats with over 100 authorized industrial trawlers. Over 200,000 fishers and support staffs are employed in the sector. The sector earns foreign exchange through export of various marine products including shrimp, frozen, dried and salted fish and shark fins. Increase exploitation with high fishing efforts is the present trend of marine fishing in Bangladesh. There had been 258% increase in fishing efforts since the start of the mechanized fishing in 1975-76. The sector provides much needed animal protein to masses, earns foreign exchange through export of various marine products including shrimp, frozen, dried and salted fish and shark fins.

1.4 Destructive Fishing

Estuarine set bag-nets operate in large numbers, in river mouths and estuaries, and catch fry and juveniles marine fauna resulting in restriction of growth of commercially important species. Decline in catch per unit effort (CPUE) for motorized boats using large meshed gill nets has also been noticed. Shrimp trawlers are also experiencing declining CPUE and are currently concentrating in shallow waters and come in conflict with artisanal boats. Management of marine fisheries is highly focused on activities of industrial trawl sector. There is no management and monitoring of artisanal sector which operates from coastal areas, where fishing pressure increasing alarmingly.
1.5 Marine Pollution

Though Bangladesh has not so many industries, but sea-based sources of pollution include oil spill outs, ship breaking debris, and offshore oil and gas exploration. Other concerns on marine fisheries include land conversion and reclamation, over-exploitation, sedimentation by river flows, sand washout towards sea during monsoon, city pollution towards sea by river flow, disparaging tourism, and shipping discards to sea. There are also the potential adverse impacts related to the future development of seabed minerals.

The cumulative effects of land based and sea based pollution are causing disruption of basic processes and functioning of the marine ecosystem. These include dilapidation and loss of fish habitat, breeding, spawning and nursery areas, may cause fish kills and possible changes of marine trophic structure. The fate and effect of pollutants has not been studied extensively elsewhere but under Bangladesh condition studies are negligible. The immediate effect of land based and sea based pollution is growing evidence which supports that most of the pollutants are indeed deposited in estuarine and coastal sediments, while a smaller portion may flush out to deeper waters. We are not yet quite sure what is the pollution assimilating capacity of the ecosystem, though some argues that the ecosystem’s assimilative capacity as a whole has not been exceeded and that pollution problems are localized in nature. This may be true to some extent on land based pollution sources, but sea based pollution may not be localized.

1.6 Knowledge Gap on the Sea and its Contents

Bangladeshis are known to be skilled sailors and people from greater Chittagong, Noakhali and Barisal, three greater coastal districts traditionally are known to have roamed seas of the world, work for many shipping companies of developed countries. Despite long history of sea travels by inhabitants of this part of the world, unfortunately, our knowledge and available information on our backyard sea is scanty, there is many unknown elements, many uncertainties, many undiscovered species, habitat, breeding, feeding, nursing and migratory grounds/routes about the Bay’s status, ecosystem and environmental and biological, hydro biological functioning, much of it could be due the lack of comprehensive and reliable data and information. Analyses of existing information of the marine resources are given in the Annex 1.

There are a number of institutions in the region supposed to accumulate data and information on sea and its contents. Bangladesh has a few of them and unfortunately they are not being able to work properly for a reason or other; none of them appear to have the authorization, capacity, organizational strength and scope to support an initiative based on Large Marine Ecosystem or Marine Protected Area based approaches. Simply we are not clear about common issues and barriers characteristic of the Bay of Bengal, its biological and other important aspects, though recently Bangladesh Navy has taken initiatives to explore the bottom characteristics of EEZ of Bangladesh. This is one step forward towards right direction.

The Bay of Bengal Program (BOBP) has done some studies to introduce the management of marine resources, but the information related to BOBP cannot resolve the aforementioned issues in isolation. What is needed is to gather previous informations, knowledge and experiences of the existing institutions and professionals to maintain the synergies of information exchange of data related to estuarine, coastal and marine habitat, ecosystem and fisheries related issues, to accomplish any important long-lasting impact. Some institutional mechanism needs to be developed and we must know who is maintaining the records, continuously updating the information and who is generating the new knowledge and information. It is important to evaluate the gaps of knowledge which become impediments to progress in work on the MPA establishments.
The ongoing Bay of Bengal based project, the BOBMLE (Bay of Bengal Marine Large Ecosystem), gives emphasis to the importance to the health, well-being and livelihoods of the millions of people living in the BOBLME region and tried to address their problems. Reportedly, the Advisory Committee of the BOBP requested the FAO to support in the initiation of a Project Proposal to be submitted to the GEF (Global Environment Facility) and other prospective donors for financial supports.

The BOBP is active in this part of the world for long and were conducting long and medium term regional fisheries program focusing Bay of Bengal and its adjacent country’s interest. Therefore, the BOBP has done significant works in collaboration with Bangladesh, India, Indonesia, Malaysia, Maldives, Sri Lanka and Thailand as active partners and Myanmar as observer partner status. Initially BOBP focused mainly to improve the socio-economic conditions of the coastal dwelling fishers of small-scale countries collaborating with it. Their focuses were mainly to develop and promote latest and pioneering techniques and technologies suitable to local fishers. In the later stage, the project was intended to address more directly the vital management problems facing the fishers’ active in Bay of Bengal under different coastal countries. During the long term works with BOBP, associated countries recognized the necessity to manage the estuarine, coastal and marine resources. Initially, the environmental threats were not considered as important as socio-economic aspect but later, environmental issues also got serious thoughts to manage marine resources in a coordinated, comprehensive and integrated manner.

Bangladesh being a predominantly deltaic country with shallow and large continental shelves covering significant part of Exclusive Economic Zone (EEZ) is unique in nature among coastal and oceanic countries. EEZ of all coastal countries is not an identical entity. An EEZ is a sea zone prescribed by the UN over which a country has special rights over the exploration and use of marine resources, including energy production from water and wind. It stretches from the seaward edge of the country’s territorial sea out to 200 nautical miles from its coast. In colloquial usage, the term may include the territorial sea and even the continental shelf beyond 200N mile limit.

Among eight countries under BOBLME (Bay of Bengal Large Marine Ecosystem), Bangladesh is different in terms of her land and coast line configurations as well as nature of her adjacent sea, especially EEZ. Being largely low floodplains, only a few meters above sea level, her territory interacts with Bay of Bengal (BoB) more closely compared to most other coastal nations and the BoB countries. Since the nature of sea adjacent to Bangladesh is different, its ecosystem, habitat, marine and estuarine wild lives are also tends to differ to a certain extent. Very few coastal seas or Bay receives so much fresh water and top soil washouts as Bangladesh part of the BoB, from combined flows of mighty Ganges, Brahmaputra, Meghna, Karnaphuli and their tributaries. Despite long history of marine voyages by the inhabitants of this part of the world as sailors, unfortunately, knowledge and available information on backyard sea of Bangladesh is scantly; there are many unknown elements, many uncertainties and undiscovered species. Quality of habitat, breeding, feeding, nursing and migratory grounds/routes of many vagrant species are also either completely non-existing or in an inadequate quality. Overall the Bay’s biophysical status, ecosystem, hydro biological functioning are not well known; much of it could be due to the lack of comprehensive and reliable data and information. BoB being one of large LME of world’s Oceans needs more and vigorous scientific studies. A LME (Large marine ecosystems) is a region of the world’s oceans encompassing coastal areas from river basins and estuaries to the seaward boundaries of continental shelves and the outer margins of the major ocean current systems. They are relatively large regions on the order of 200,000 km² or greater, characterized by distinct bathymetry, hydrography, productivity, and tropically dependent populations.

1.7 Joint initiative by BOBLME and IUCN to draft an MPA framework

A welcome initiative in this context is that eight Bay of Bengal (BoB) countries joined together under the umbrella of BOBLME (Bay of Bengal Large Marine Ecosystem) project to lay foundations for a coordinated effort for regional management of the BoB for maintaining its environment and fisheries. One of the objectives
of the BOBLME is to improve lives of the coastal populations through improved regional management. The eight countries under BOBLME are Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka and Thailand. There are several components of the BOBLME project, and it outlined diverse objectives; the objective of Subcomponent 3.2 (Marine Protected Areas in the Conservation of Regional Fish Stocks) is to gain consensus on approaches to the establishment and management of marine protected areas and fish refuge for sustainable fish management and biodiversity conservation. The 2011, BOBLME Project Work plan adopted by the PSC in March 2011 has the following activities: A MPA workshop held to review the draft MPA status report to finalize it.

IUCN Bangladesh country Office has developed a proposal for the establishment of Marine Protected Areas combining objectives of marine biodiversity conservation and ensuring sustainable marine fisheries production. In a move that clearly links protected area development with fisheries management, Bangladesh began declaring Hilssas sanctuaries in recent years - four such sanctuaries are located in two of the country’s most productive fishing grounds - the ‘Middle Ground’ and ‘South Patch’ areas. Hilsafishing is banned in these sanctuaries during certain months of the year. Besides, the Department of Environment (DoE) has declared some protected areas situated in the coastal region. However, as such, no common understanding of MPAs exists in Bangladesh as yet. A number of areas in the Bay of Bengal within EEZ are important for their sensitivity to many marine species but yet to declare as MPA. The coastal zone is important for sustaining marine biodiversity and characterized as mangroves, estuaries, mud flats, saline/brackish water, protected bays and islands. It is also vital for other marine wildlife including sea birds, winter fowl, dolphins, turtles, coral reefs and aquatic weeds. The BOBLME Project is collaborating with IUCN on several activities, ranging from critical habitat management to ICM. IUCN is the world’s largest global environmental network, consisting of governments, non-government organizations, and individual scientists. Support to Large Marine Ecosystem (LME) monitoring, assessment, management, and biodiversity conservation, through capacity building and socioeconomic studies, is one of the focal areas of IUCN’s Global Marine Programme. Through current LoA, BOBLME intends to strengthen the cooperation between IUCN and the overall LME Programme for the benefit of the BOBLME project implementation.

BOBLME participates in FAO’s MPA Workshop to launch the Guidelines to nominate 1 or 2 MPA pilot (learning, best practices) sites per country, for BOBLME support and prepare proposals for project interventions (e.g. management effectiveness monitoring, awareness raising, and compliance generation). A Working Group of MPA experts (policy level) is constituted and convened to draft/endorse a work plan on the basis of the recommendations of the status review of the nominated pilot sites. Capacity development measures on MPA management are implemented in cooperation with Indonesian (NOAA) training experts. BOBLME participates in a (FAD-led) Regional Workshop to increase awareness on MPA guidelines and promote the use of MPAs as fisheries management tools. BOBLME contributes to existing databases on MPAs (UNEP-WCMC, SACEP, World Fish Reefbase, ICRJ). A Working Group of practicing MPA managers was constituted for the meeting in 2012. For each BOBLME Project country, an allocation of around US$50 000 has been provided in 2011 to undertake MPA and ICM related activities in accordance to the BOBLME Project objectives.

The IUCN country office in Dhaka, Bangladesh, has an excellent network of researchers, research institutions, and coastal resources management practitioners, and BOBLME expects to benefit by connecting to this network. Therefore, IUCN is the logical implementation partner for BOBLME to undertake the MPA framework development activity covered by this LoA. BOBLME and IUCN have a solid track record of collaboration; including in Sri Lanka where IUCN produced a literature review and synthesis of findings on “Integrated Coastal Management (ICM) Best Practices and Lessons Learned” (Bangladesh, India, Maldives, Sri Lanka) and organized and implemented BOBLME’s “ICM Best Practices Workshop” LOA/RAP/2010/23, and more recently in Bangladesh, where IUCN co-organized the Regional ICM Workshop with BOBLME. BOBLME also has a major partnership with IUCN’s Mangroves for the Future (MFF) initiative (LOA/RAP/2010/26; LOA/RAP/2011/59 and 3 MFF-BOBLME collaborative communications workshops). BOBLME in 2010 has commissioned a review of the status of marine protected areas and fish Refuge in the Bay of Bengal Large
marine ecosystem. The 10-page Country Profile Bangladesh contained in this report will be a major input for this activity. The profile contains information on legislation and governance, aspects also covered by the BOBLME’s Draft Policy Review.

1.8 Purpose of this Framework Report

The EEZ of Bangladesh is over exploited in some areas and under exploited elsewhere. The EEZ of Bangladesh has expanded recently by the verdict of ITLOS between Bangladesh and Myanmar. Bangladesh is committed to declare 10% of her EEZ as Marine Protected Areas (MPA) by 2020. That means roughly 12,000 km2 of EEZ in Bay of Bengal needs to be protected based on internationally accepted criteria as MPA. There is no single habitat or important marine zone large enough to be a large MPA to fulfil the national commitment. Recognizing its importance and uniqueness, some land based sites has been declared as protected areas mostly by department of environment and department of forest those also includes aquatic ecosystem both in freshwater and marine habitat, but total areas of these are negligible.

One of the main objectives of establishing MPA is to create Fish Refuge in marine environment. Fish Refuge is refuge or hideaway; in some cases known as wellness area for relaxation and recovering of fishes. It is an area that has escaped ecological changes occurring elsewhere and/or suitable habitat for relict species. In other words, a shelter or sanctuary for a particular flagship species is a place which supports its environmental needs. Fisheries management in the sea and large aquatic ecosystem must balance the interests of multiple jurisdictions, dependence of coastal communities on fisheries, over-fishing, destructive fishing practices, incidental capture of endangered species, and the inherently complex nature of the tropical multi-species fisheries. However, most marine fisheries in the BoB region are characterized by strong competitions among fishers, and as such suffer from the problems of over-capitalization and over-exploitation. Illegal, unregulated and unreported fishing is also emerging as a critical fisheries management issue.

Overall, the framework preparation activity will contribute to the goal to ensure sustainable marine fisheries production and protection of other wildlife through establishing Marine Protected Areas (MPAs) as a tool of biodiversity conservation and restoration of fish resources in the Bay of Bengal. It will also feed into the Aichi targets fixed at Nagoya COP of CBD in which as a signatory of this document Bangladesh pledged to declare 10% of its marine area as protected within 2020.

1.9 Framework Development Process

This “Framework Development Phase” is considered the preparatory phase of a longer term initiative, to be followed by a development phase and consolidation phase (under separate funding). The main objective of the preparatory phase was to prepare a framework for establishing MPAs in (Bangladesh waters) Bay of Bengal through developing consensus among relevant stakeholders. This has been achieved through participatory consultations and dialogue among key players of this sector in Bangladesh. IUCN has created a favorable common platform for all relevant stakeholders using its inherent strength of influencing policy makers, government- and non-government agencies, civil society, scientists, private sectors, resource users and politicians to develop consensus that fed into formulation of the MPA framework. Care has been taken to ensure ownership by the government agencies through mainstreaming the framework by involving them in all steps and also advocacy. Intensive review and gap analysis exercises were another means of accumulating information and sharing those to appropriate levels to identify the hot spots that would need conservation measures. A total of eight workshops of which six at regional level and two at national level have been conducted in the presence of all relevant stakeholders. Besides, all kind of resource users were also been consulted through various FGDs along the coast. A number of key informants have also been interviewed for this purpose. Overall, government agencies like MoFL, DoF, MoEF, DoE and BFRI are given emphasis in authorizing the MPA framework which is the ultimate output of this current initiative.
Chapter 2
Concept of MPA in Bangladesh
Concept of MPA in Bangladesh: Its Status, Potential and Challenges

As a signatory Nagoya protocol, Bangladesh government is committed to declare 10% of her EEZ as MPAs by the year 2020. When the commitment was made the EEZ was roughly about 60,000 km², but suddenly it increased to 111,672 km² due to the favorable verdict by ITLOS on the conflicts of maritime boundary between Bangladesh and Myanmar. The expanded area of EEZ, much larger than the past, has become important both from ecological, biodiversity and economic viewpoints. The EEZ part of Bay of Bengal is home to 405 species of fish, 17 species of marine reptiles, 11 species of marine mammals, 20 species of birds, 28 species of crabs (including brackish water and a few fresh water), 4 species of lobster, 33 species of shrimps, 437 species of marine and brackish water mollusks and 165 species of marine algae and sea weeds, which have been identified so far. However, it is needless to mention here that a large section of species remains unidentified. The mangrove ecosystem adjacent to coastal areas of south-western Bangladesh is very important as breeding and nursing grounds of many marine lives. In addition to providing habitats to numerous species, the EEZ of Bangladesh in the BoB also directly and indirectly supports livelihoods of about eleven million people living in the coastal zones.

![Figure 1: MARINE FISHING ZONE AND EEZ](image)

The EEZ of Bangladesh, is the sea which is relatively little studied habitat for biodiversity and is virtually no administrative and management control though renewable biological resources are exploited under nominal supervision from department of fisheries and mineral resources. Currently only natural gas survey and exploitation is ongoing under the Energy and Mineral Resources Division (EMRD) of Ministry of Power, Energy and Mineral Resources. However, the artisanal fisheries are overexploited, and often abusive. On the other hand, deep sea fishing from local fishers is negligible and remains under exploited. At the moment, the EEZ covers just over 111,000 km² after the settlement with Myanmar, but it may expand further 20% more if dispute between Bangladesh and India comes in favor of Bangladesh from the International Court.
2.1 Importance and Benefits of MPA

MPA, like any other protected areas, are regions in which human activity has been placed under some restrictions in the interest of conserving the natural environment, its surrounding waters and the occupant ecosystems, and any cultural or historical resources that may require preservation or management. Marine protected areas' boundaries always include some area of ocean, even if it is only a small fraction of the total area of the territory. Traditionally, marine resources are protected by local, state, territorial, native, regional, or national authorities and may differ substantially from nation to nation. This variation includes different limitations on development, fishing practices, fishing seasons and catch limits, mooring facilities, bans on removing or disrupting marine life of any kind.

Fish exploiters all over the world are always strong proponents of conserving the marine resources upon which they depend as they believe MPA will enrich their fishing grounds, but when it appears that they also need some sacrifices, they object. In Bangladesh fisher groups raises objections whenever a protected area is proposed as it was also observed during national workshops, regional meetings and focus group discussions. This is partly due to the lack of understanding on MPA and its ultimate goal and partly due to the lack of awareness among the stakeholders. Whatever may be the cause full support of marine and estuarine fishers would be needed for successful implementation of any MPA in shallow water of EEZ.

The coastal region is most unstable, vulnerable and natural calamities prone areas in the country. There are human settlements throughout the coastal regions except southern part of three districts of greater Khulna; those areas are covered by Sundarban. The coastal areas without mangrove or cleaned areas of mangroves are now heavily populated and depends on livelihoods on field crops and resources from sea. The coastal areas covered with mangroves and declared as reserved forest, though peoples are not allowed to live within reserved forest, but thousands of people are involved in subsisting livelihoods by harvesting/collecting various resources from Sundarbans reserved Forest (SRF). The coastal areas resource or mangrove forest resource consumers, particularly the primary users are from the 19 district and 51 upazilas in coastal region under six greater districts. We need first to identify and designate the natural resource users before declaring MPAs.

We have little information of land holding by the vulnerable groups living in coastal zones as newly formed chars are usually occupied by the local powerful. A detailed study covering whole of the coastal zone is not done, some studies by local and international development agencies has showed that population living peripheral areas of Sundarbans that the average land holding size of all SRF actors is miserably low, by any standard; less than one acre (88 decimals) and half an acre (49 decimals) on account of ownership and operation respectively (IUCN, 2012)1a. The poverty situation of coastal districts shows a dismal picture compared to rest of the country. Nabiul Islam (2010) 1b studied head count ratios (HCR) for the Sundarbans adjacent districts and upazilla(SIZ), and showed a much higher extreme poverty rates (0.42) compared to non-SIZ upazilla in Bangladesh (0.26). Although agriculture is still the mainstay of the economy in the region, the SRF provides varied sources of livelihoods to SIZ people which are not commonly available in other parts of Bangladesh.

Unfortunately, Bangladesh people’s vision on public or community resources are not positive for preservation and restoration; here, people consider public property as every body’s property when it comes for exploitations, but consider public or community property as nobody’s property when comes for preservation or restoration. This apathy in a densely populated country is not a positive sign for conservation of fragile natural resources and ecosystem, unless strict monitoring and stringent measures are not taken against violators.
2.2 Economic value of the MPA

Bangladesh is a land scarce country housing roughly over 160 million people on a landmass of only 14.4 million ha. Natural resource exploitation rate in Bangladesh is one of the highest in the world. If natural resources are not utilized in a sustainable manner then gradual decline of renewable natural resources could not be arrested. By a recent estimate, it was determined that roughly 17% of the country’s land mass is seasonally or perennially comes in contact with salt or hypo-saline water and these zone of roughly 2.5 million ha could be termed as coastal land. However, coastal people are not only dependent on land for their survival they also use natural resources from sea for their livelihoods. Economics is the overriding factor in any decision making and planning. Economic information on sea and its content to the wellbeing of Bangladesh’s coastal dwellers is not an easy task to quantify. Efficient and sustainable use of natural marine resources is important. There is a common assumption in Bangladesh that Bay of Bengal is a mine of resources and an unlimited source. This is of course not true; the unlimited resource Bay of Bengal contains is perhaps, the salt. Besides salt, all other living or non-living resources are finite and thus will end one day, if judicious planning of not done on a sustainable manner.

Prospect of maximum sustainable yield (MSY), from EEZ under no-intervention plays an important role in formulating management plans for protection of ecosystem, conservation strategies for biodiversity, habitat and particular species. Besides, promoting programs for the conservation of biodiversity and ecosystem services is also important. Though EEZ of the country used to constitute one third size of the country in the past and contributes about 23% of the total fisheries landings in the country combined.

Currently or overnight the size of EEZ expanded to almost 70% of the size of Bangladesh but fish landing constitutes the same 23%. There has been no organized evaluation of the probable exploitable quantity of fish and other marine consumable products. The initiative of “Establishment and Management of Marine Protected Areas in Bangladesh” and preparation of the related document will be one step forward to get a clear idea on probable exploitable stock and its increments based on MPAs how much benefits could be available. However, based on currently available information, total fish and fisheries production (in MT) benefits from the marine waters of the country as volume in ton is shown in Table 1.

Table 1. Total landing from EEZ of Bangladesh(2010-2011); Source DoF

<table>
<thead>
<tr>
<th>Species/Group</th>
<th>Volume in ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hilsa</td>
<td>225,325</td>
</tr>
<tr>
<td>Other marine fish/shrimp</td>
<td>321,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>546,333</strong></td>
</tr>
</tbody>
</table>

This annual amount of biomass harvested represents a roughly 9.1 ton per square kilometer of EEZ by old sea area, and if current expanded sea area in EEZ is taken into consideration, unit area production will drastically decline (4.9 ton/km2). Though we know that territorial water in EEZ of Bangladesh is over-exploited and rests of the EEZ are under-exploited, therefore, expanded EEZ within a short time may be explored and deployed to harvest the unexploited /under exploited marine resources to increase overall landings. What may be the cause, the yield per square kilometer is low. Surprisingly, costs of managing the EEZ based resources are
almost negligible. Research or survey by department of fisheries or Bangladesh fisheries research institute is not adequate and cost negligible amount. The contribution of the marine landings to the total fish production in the country as mentioned earlier is only 23%. This is not surprising as Bangladesh is one of the few countries where freshwater fisheries play more important part than its marine counterpart. Therefore, expenditure for management for marine sector in department of fisheries is also unfortunately very low.

The marine products can be broadly divided into six categories: fish, shrimp, crabs, shells, sea weeds and salts. The department of fisheries in its routine publications usually do not mention about salt as it is not considered as product of fisheries. A recent publication by DoF (Fish Fortnightly-2011, dossier) indicated that roughly 11.1 million people obtain all or part of their income from marine resources of EEZ in Bay of Bengal. Several million fishermen living at coastal areas have nothing but fishing as only livelihood options. The marine fishermen are virtually landless. With the introduction of shrimp farming in coastal area, a big numbers of the landless tenant farming family members are now engaged in seasonal harvest of shrimp, prawn and mullet fingerlings to be used as seeds in shrimp polyculture.

2.3 History and Current Status of MPAs in Bangladesh

There is very little information available online about the status of protected areas in the marine environment in Bangladesh. While some of the country's terrestrial protected areas encompass parts of the coastal zone, there are no explicit ‘marine protected areas’ as defined through legislation in the Bangladesh. As such, the following sections review information about Bangladesh’s terrestrial parks that contain marine components as well as other place-based marine conservation measures, drawing primarily upon journal articles and government reports.

The Bangladesh Wildlife Preservation Act of 1974 defines national parks and wildlife sanctuaries. There are examples of both of these protected area categories in the marine environment (Mukul 2007). In total, there are currently 15 national parks and 13 wildlife sanctuaries throughout the country, 7 of which encompass parts of the marine environment (notably mangrove ecosystems) (IUCN, personal communication 2010).

Another type of protected area in Bangladesh is the ‘ecologically critical area’ (ECA), which is declared under the Environmental Conservation Act of 1995. ECAs are typically declared in areas that have suffered from intense ecological destruction. Of the four ECAs in the marine zone, the most well-known include St. Martin’s Island and the Teknaf Peninsula/Cox’s Bazaar (Mukul 2007). There are also ECAs within the Sundarbans. Bangladesh’s only coral reef communities are found in the former ECA ‘Jinjira Reefs’ (currently being considered for marine national park status), where they occupy an area less than 50km2 (Rajasuriya 2004). Of all protected areas with marine habitat in the country, only one—the Sundarbans—is recognized internationally for possessing unique ecological diversity and accordingly listed as both a World Heritage and a Ramsar Site (Mukul 2007). Status of exiting protected areas are furnished in the Annex 2.

In a move that clearly links protected area development with fisheries management, Bangladesh began declaring ‘hilsa-closed seasons’ in recent years. It began by declaring four of these areas, located in two of the country’s most productive fishing grounds – the ‘Middle Ground’ and ‘South Patch’ areas (Hussain 2009; Hossain 2004). These sanctuaries were established to “achieve the desired development of the hilsa fishery” (Momo 2007; Hussain 2009). Hilisa fishing is banned in these sanctuaries during certain months of the year (March to April in three sanctuaries, and November to January in the fourth). The country also regulates the hilsa fishery by imposing zone restrictions for artisanal and commercial and trawling operators, as well as banning hilsa catch outright during the peak spawning season in October in all major fishing grounds (Momo 2007). Bangladesh also declares closed seasons at key shrimp spawning sites (shrimp trawling is banned at certain points during the year).
Ecologically Critical Areas (ECAs) are geographically delineated areas which by themselves or in a network have distinguishing ecological characteristics, and are important for maintaining habitat heterogeneity or the viability of a species, or contribute disproportionately to an ecosystem’s health, including its productivity, biodiversity, function, structure, or resilience.

Unfortunately due to the lack of adequate information and knowledge no area of EEZ of Bangladesh has declared as ECA, though the entire length of Cox’s Bazar beach including Sonadia and Saint Martin islands falls in the category of the ECA as declared by the Department of Environment. There is a straightforward method of declaring a site as ECA based on some criteria like legal boundary and a map for each of the ECA and it should be delineated and the government should develop a management plan for the ECA. In Bangladesh some declaration on ECA at Sundarbans known as Sundarbans Reserve Forest (SRF) has been done, however, no map was prepared and there are no management plans, which are obligatory for ECA. Nonetheless, some measures like harvest of natural resources, hunting and killing of wild animals, destruction of habitats, establishment of industries those can pollute environment are prohibited in the ECA are right steps towards the goal. Environmental Conservation Act of 1995 that was amended 2010 states that legal boundary and map for each of the ECA should be made on land based.

ECA. Now, we need similar initiatives on marine habitat, ecosystem and environments to protect biodiversity and judicious exploitation of natural resources with a proven sustainability. As Bangladesh’s coastal area receives huge amount of freshwater down flow through its mighty rivers its marine environment is quite different, from other marine areas of the BOBLME countries, and starts far away from the coast, therefore, both ECA and MPA in this part of the region should get different dimension.

2.4 MPA Legislation in Bangladesh

After signing the 1982 United Nations Convention on the Law of the Sea, Bangladesh sought new ways to manage and conserve its marine resources (Chowdhury 1998). It took the first steps towards by introducing the Marine Fisheries Ordinance in 1983, which outlined rules that continue to provide the main legal framework for controlling activities, conservation and development in the marine zone (Chowdhury 1998). Among other things, the Ordinance allows for the establishment of protected areas in any part of the country’s exclusive economic zone (Chowdhury 1998). On an international level, Bangladesh is associated to the five primary conventions with bearing on marine biodiversity conservation: Convention on Biological Diversity (CBD), Convention on International Trade in Endangered Species (CITES), Convention on Migratory Species (CMS), Ramsar and Wild Life Habitat Council (WHC) (Mukul 2007).

As previously mentioned, many of Bangladesh’s ‘marine’ protected areas are actually terrestrial parks with marine components. These protected areas are typically declared under The Bangladesh Wildlife Preservation Act (1974). The Act uses a very narrow definition of ‘wildlife’ however, which includes only vertebrate species. As such, the Act fails to provide legal protection for a significant number of marine species, such as coral and mollusks (Mukul 2007).

Other relevant legislation and policies include:

- The National Conservation Strategy (NCS), which provides a country-level strategy for the conservation and sustainable use in eighteen different sectors. Efforts to protect the mangrove systems in St. Martin’s Island are implemented through the NCS (Mukul 2007);
- The National Environment Management Action Plan (NEMAP), which was developed collaboratively by the Ministry of Environment and Forests and local communities, NGOs, professional groups and others. It provides the policy framework for environmental development and broad sectoral guidelines to inform such development (Mukul 2007);
- The Bangladesh Environment Conservation Act (1995) and the Environment Conservation Rules (1997), which serve as the main legislative framework for environmental protection by setting requirements for environmental impact assessments among other things. The Act allows for the creation of Ecologically Critical Areas (Mukul 2007).
- The National Biodiversity Strategy and Action Plan (NBSAP), which outlines the country’s commitments and plans to meet goals under the Convention on Biological Diversity (Mukul 2007).
- The Coastal Zone Policy (2005). Described in greater detail in the following section.
- Coastal Zone Strategy (2006)
- Bangladesh Climate Change Strategic Action Plan (2008)
- National Fisheries Policy (1998). In particular, the Marine Fisheries Sub-strategy addresses marine fisheries spawning and nursery grounds.

2.5 MPA Governance in Bangladesh

The primary government agency concerned with the declaration and management of marine protected areas is the Department of Environment (DoE), which operates under the Ministry of Environment and Forest (MoEF) (Bangladesh DoE Website 2010). The DoE has the authority to declare ecologically critical areas (ECAs) if it deems an area under threat. The Forest Department is responsible for declaring national parks and sanctuaries, while the Fisheries Department is responsible for identification and declaration of MPAs in other forms (such as hilsa-closed seasons and fisheries sanctuaries).

Other agencies with a peripheral role in the management of marine protected areas (especially hilsa-closed seasons) include:
- The Ministry of Fisheries and Livestock
- The Bangladesh Fisheries Research Institute (runs the Marine Fisheries and Technology Station in Cox’s Bazaar)
- Academic Institutions such as the Institute of Marine and Fisheries Science at Chittagong University
- The Bangladesh Navy and Coast Guard, which are charged with enforcing regulations governing marine resources more generally.
- Fisheries and Marine Resource Technology School of Khulna Science and Technology University, which is involved in academic research
- Bangladesh Fishery Development Corporation (BFDC) is also important in marine fisheries improvement (Hussain 2009; Hossain 2004; IUCN 2010, personal communication).

The DoE and MoEF are currently implementing an array of projects in the marine environment, including the UNDP/ Gobal Environment Fund (GEF)-funded Coastal and Wetland Biodiversity Management Project in Cox’s Bazaar and Hakaluki Haor. The goal of the project is to design and implement an innovative system for managing Ecologically Critical Areas, and in doing so, serve as a demonstration site for other ECAs elsewhere in the country (DoE Website, 2010). In an attempt to protect Olive Ridley and Green sea turtle populations around St. Martin’s Island, the MoEF initiated a project in 1996, whose subcomponents include monitoring nesting turtles, in situ conservation, and awareness-raising activities with local coastal communities. Furthermore, per Department of Fisheries regulations and the Marine Fisheries Ordinance, all industrial trawlers in the Bay of Bengal (BoB) must use Turtle Excluding Devices (Bangladesh Marine Fisheries Ordinance).

The country also recently began bolstering its integrated coastal zone management policy, drawing funding from the World Bank and the Government of Netherlands for the endeavor (Mukul 2007). These efforts stem from recognition that “the lack of a clear-cut government policy was a bottleneck” (Iftikhar 2006). Though work is still underway, there is general consensus that the passing of the 2005 Coastal Zone Policy helped implement nationwide ICZM (Mukul 2007; Iftikhar 2008). In regards to protected areas, this new policy outlines several
goals, including:

- Attaining “meaningful” conservation in ECAs, heritage sites and marine reserve;
- Supporting institutional strengthening/capacity building programs;
- Fortifying the regulatory framework for environmental protection;
- Expanding the role of the Coast Guard such that “it can be used on behalf of all relevant institutions as a common resource for enforcement of different regulations applicable to the coastal zone”;
- Harmonizing existing environmental laws. (MoWR 2005)

2.6 Current Management of Marine Fisheries & Scope

Some areas of EEZ in Bangladesh are declared as protected areas all of which are associated with hilsa and/or black tiger shrimp fisheries. Besides, reserve forest in Sundarbans mangroves contains huge brackish water ways (roughly 180,000 ha against total area of 600,000 ha of Sundarbans) which is also some sort of protections under department of forest and environment. Surprisingly, the limited water areas in the estuary that may be called as an area under limited protection is protected not by department of fisheries but by department of forest and environment under the World Heritage Site, inscribed in 1997. The total area of the World Heritage Site is about 1,400 km², of which 490 km² is water, and reportedly carrying a very rich biodiversity of flora and fauna. Unfortunately, the management aspect of fisheries in the Sundarbans Reserve Forest only covers revenue collection, although some Acts/Regulations exist. The management of fishery resources in SRF from a technical point of view was started in 1989 with the closing of 18 canals to accelerate fish breeding (IUCN, 2012)1. Closed season and wildlife sanctuary regulations were introduced recently. However, under the forest department effectively illegal poaching has been prevented.

2.7 Threats and Challenges

With widespread poverty and one of the highest rural population densities in the world, the biodiversity and protected areas of Bangladesh face enormous pressure from anthropogenic sources (Mukul 2006). The government has responded, in part, by setting aside protected areas encompassing both marine and terrestrial environments across the country. Nonetheless, there is a noticeable lack of information online about the status of protected areas in Bangladesh. While this may be due to the relatively small number of protected areas with marine components, it could also be due to the fact that many were established in recent years. Regardless, there is a need for additional studies/better information dissemination. Having access to such information would help determine if such protected areas are meeting their objectives, as well as help identify success stories that might be replicated elsewhere (such as the hilsa closed seasons, which are reportedly responsible for increased fish catch) (Patkar 2004). Given the absence of information about marine protected area, the following section describes some of the challenges facing protected area management in Bangladesh more generally. It also
explores the literature available on Cox’s Bazaar and St. Martin’s Island, as many of the ongoing marine conservation efforts are focused in these two ECAs.

**Governance and Management Challenges**

The government agencies of Bangladesh are closely aligned with the country’s main economic sectors. This has resulted in management that disproportionately values natural resources for their economic value over nonmonetary attributes such as contribution to overall ecosystem functioning (Islam 2003). Consequently, high-level government decisions do not always draw upon the best available information produced by the local marine science community (Islam 2003). Historically, the government has tended to follow a single sector/agency approach in protected area management (Iftekhar 2006). As elsewhere in the Bay of Bengal LME, this had led to challenges in the field of protected area management. Notable consequences include the implementation of unilateral actions based on departmental priorities; overlapping, redundant activities; and a failure to coordinate efforts (Iftekhar 2006; Mukul 2007). Cognizant of these limitations, multi-agency cooperation is becoming increasingly common, however (Iftekhar 2006).

Similarly, a lack of clear legislation and definition creates challenges in protected area management. ECAs are a relatively new category in Bangladesh, and there is uncertainty as to which legislation is applicable to ECAs: “Until ECA regulations are formally acknowledged in Bangladesh law, all ECA management enforcement could become ineffective in reality, with no real benefit for biodiversity conservation” Molony et al. 2006.

Throughout the country more generally, fishery resources are threatened by the overexploitation of inshore marine resources. The indiscriminate take of post larvae and juvenile shrimp/finfish in mangrove ecosystems is of particular concern (Hossain 2004; Mahmood et al. 2004). According to one study, the collection of tiger prawn seed for aquaculture farming results in massive by catch, with 97% of (other) shrimp fry and finfish larvae discarded on dry land (Hossain 2004).

Artisanal fisheries mostly occur close to the shoreline, within 10-20 meters of depth. Non-mechanized and semi-mechanized boats are used in this area, many of which use a destructive gear (marine set bag net) known as Behundi/Jaal. According to IUCN, these artisanal fisheries exert tremendous pressure on numerous fish stocks (Personal Communication, 2010). Industrial fisheries also operate within 20-30 meters of depth, and are thought responsible for the decline of major species. Within fishery management more generally, there are concerns over the introduction of policies despite insufficient scientific information: In recent years, twenty squid operators were granted licenses to operate in waters of 40 meter depths, despite a lack of information on stock size (Chowdhury 2005).

In an effort to address these as well as other unsustainable uses, priorities for the coastal zone with relevance to protected areas include:

- Incorporating conservation policies into management plans
- Ensuring management of protected areas corresponds to their “multipurpose usefulness”
- Increasing research on local ecological processes and marine biodiversity, and identifying threats to coastal resources (Kamal 2009)

At the moment, the government does not have the manpower necessary to enforce marine regulations, and capacity/lack of training are both pronounced issues facing protected areas throughout the country (Kamal 2009). As noted earlier, however, there are plans to extend the mandate of the Coast Guard to help numerous government agencies with enforcement efforts (MoWR 2005). There is also a marine wing within the Department of Fisheries, which has a marine surveillance team (developed during the last phase of the FAO BOBP).
Other Local and Trans boundary Threats

Pollution from upstream sources threatens marine biodiversity in Bangladesh’s waters (and indeed beyond). Major sources of pollution include industrial waste, municipal waste, and agrochemical waste and oil pollution (Islam 2003; Mukul 2007). There are currently over 900 polluting industries, which directly or indirectly discharge untreated liquid and solid wastes into coastal rivers and other waterways that eventually make their way into the Bay of Bengal (Islam 2003). Nonetheless, there are few, if any, reports on the direct effects of effluents on local fish stocks and post-larvae/juvenile marine species in nursery grounds (Islam 2003). According to IUCN (personal communication, 2010), control measures to prevent land-based and in situ marine pollution in the Bay of Bengal are largely ineffective, as are efforts to curb the discharge of ballast and bilge water. While the government has moved to ban certain noxious agrochemicals, problems persist (Islam 2003; Mukul 2007).

‘Upstream’ development activities also have serious effects upon the health of local marine ecosystems. Though such activities only have indirect bearing upon MPAs, they are nevertheless worthy of mention: The use of sluice gates and barrages in construction activities affect natural siltation processes, and in the past have been responsible for silting up rivers (Islam 2003). This in turn leads to blocked migration routes, as occurred in the case of hilsa populations in the Kumar River following the Ganges-Kobadak project (Islam 2003).

Like the Maldives, Bangladesh will likely suffer disproportionately from the effects of climate change. With its relatively low topographic profile, it is expected that a third of the country may become fully inundated. Taken together with salinity intrusion, this will have profound implications on existing coastal ecosystems like mangrove forests (Mukul 2007). Other impacts will likely include increased temperatures and higher rates of precipitation/more intense cyclones (Iftikhar 2006). While these concerns are not unique to Bangladesh, local experts posit that “conventional management approaches will not suffice and integrated long-term management is more appropriate” (Shi and Singh 2003; Iftikhar 2006).

2.8 Socio-economic Considerations and Perceptions of MPAs

With much of the population dependent upon the extraction of natural resources for their livelihoods, there are profound difficulties in balancing biological conservation with socioeconomic development. Unsustainable resource extraction is an issue in/around the reefs of St. Martin’s Island for example, and there is mounting pressure on local reef systems from human activities, a growing tourism industry and increased shoreline construction (Kamal 2009; Rajasuriya 2004). There is reportedly indiscriminate harvesting of corals and associated fauna around St. Martin’s Island (Rajasuriya 2004), and the protected area is listed as “degraded” (Rajasuriya 2004). The St. Martin Pilot Program (2000–2001) sought to curb harmful activities by carrying out awareness-raising activities and better enforcement, resulting declines in the illegal collection of curios during peak tourism seasons (IUCN 2008). Problems persist, however, and the “management of wild collection and regulation of the trade at Cox’s Bazaar, together with increased awareness among visitors is essential to protect the remaining reef resources of Bangladesh” (IUCN 2008). It is also notable, that some of the products (notably coral skeletons) that appear in local markets may also come from neighboring Myanmar (Rajasuriya 2004).
Nevertheless, information about the positive and negative socioeconomic effects of protected areas on human populations is extremely limited. The literature does contain examples of attempts to increase community participation in marine management, however. Some such examples include:

- UNDP/GEF-funded “Community Mobilization for Biodiversity Conservation at Cox’s Bazar” Project (2006). Conducting in conjunction with the DoE and MoEF, this project entailed gathering feedback from community members on perceived problems, issue prioritization and consensus building in Cox’s Bazar (Bangladesh Poush 2006).

- Mainstreaming community participation and empowering coastal communities through the recently passed CZM Policy (2005). Noteworthy tenets include (1) instituting co-management procedures which “bring decision-making power to the grassroots level” (2) Addressing the vulnerabilities of coastal communities (3) adopting initiatives that maintain the cultural heritage of coastal communities (MoWR 2005).

- Activities led by the Bay of Bengal Programme to promote the involvement of fishing communities in marine management through awareness-raising programs (Chowdhury 1998).

- The FAO and Department of Fisheries-sponsored Empowerment of Coastal Fishing Community (ECFC), which sought to increase coastal fishermen capacity at Cox’s Bazar (IUCN 2010, personal communication).

- Fourth Fisheries Project, which is a GEF study on coastal and hilsa biodiversity (DoF 2004).

- Strengthening Marine Fisheries Capacity of Bangladesh, an ongoing project of the Department of Fisheries, with funding through the Organization of Islamic Countries (IUCN 2010, personal communication).

- Integrated Coastal Zone Management Programme (Phase I) of the Water Resources Planning Organization (IUCN 2010, personal communication).

2.9 Effectiveness of MPAs

There are reports on the success of the hilsa-closed seasons. According to one study, the production of hilsa increased following the institutions of such closed seasons/the ban on catching hilsa fry (Patkar 2004). It is worth pointing out that these closed seasons occur in both marine and freshwater zones. In other words, it is possible that the observed increases in biomass are due to a multi-pronged effort to conserve the species in its many habitats.

The St. Martin’s Island/Cox’s Bazaar ECA initially had relatively poor management as a direct result of a lack of resources (Rajasuriya 2004). This has started to change in recent years, however, in part thanks to the introduction of the UNDP/GEF funded program in the area. This program is putting a regulatory framework in place, and conducting ECA mapping/boundary definition activities. It is also conducting community mobilization efforts in conjunction with local NGOs, and performing ecological/economic baseline information (DOE website 2010).

Other programs in Cox’s Bazaar include the MOFL/FAO “Empowerment of Coastal Fishing Communities”, the MOEF “Conservation of Biodiversity, Marine Park Establishment and Eco-tourism Development Project at St. Martin’s Island” and the “Integrated Coastal Zone Management” program of the World Bank/Government of the Netherlands.Very little information is available on the effectiveness of protected areas with marine components elsewhere in the country.
Bay of Bengal, a northern extended arm of the Indian ocean, is located between latitudes 5°N and 22°N and longitudes 80°E and 100°E. It is bounded in the west by the east coasts of Sri Lanka and India, on the north by the deltaic region of the Ganges-Brahmaputra-Meghna river system, and on the east by the Myanmar peninsula extending up to the Andaman-Nicobar ridges. The southern boundary of the Bay is approximately along the line drawn from Donana Head in the south of Sri Lanka to the north tip of Sumatra. The Bay occupies an area of about 2.2 million sq km and the average depth is 2,600 m with a maximum depth of 5,258 m. Bangladesh is situated at the head of the Bay of Bengal.

Bangladesh is one of the marginal coastal countries of the Bay of Bengal Large Marine Ecosystem with a land area of 144,054 km², located on the northern tip of the Bay of Bengal and bounded by India on the west, north and north-east and by Myanmar on the east and south-east. Coastline of Bangladesh is about 710 km long stretching from south-west corner of the Sundarbans Mangrove Forest of Satkhira up to Sera deep of the St. Martin’s Island in the south-east. Total continental shelf area covers roughly 36,400 km² and the exclusive economic zone (EEZ) spans 166,000 km² towards open sea and its jurisdiction is up to 200 nautical miles from the beach baseline. The continental slope is about 100,000 km². The coastal area is generally shallow where 10 m depth zone spans over 24,000 km², 0-40 m depth zone spans around 37,000 km² from the beach baseline and 40-100 m depth zone spans around 20,700 km². The shelf area of 150 m depth appears to be smooth, few obstacles for bottom trawling, and the continental edge occurs at 160-180 m depths. The slope of continental edge is very steep and seems trawling is not possible in waters deeper than 180 m (Khan et al. 1997).

2.10 Studies Necessary to Implement MPA

Throughout the world, many areas of the seas are declared as MPAs those hardly have any importance in context of conservation of biodiversity, habitat and/or ecosystem. Hence, before declaring a site as PA or MPA it is rational to outline why the site is important to be declared as PA or MPA and what benefit it will provide to the nation and to the society after the protection. Productive roles of biodiversity and ecosystem functions of any selected site should be considered in a participatory manner whether these are linked with livelihoods of local people that ultimately influence, enhanced production in the long run once PA or MPA is declared. However, the functions of the complex ecosystem are less understood without detailed studies. Although vast but the EEZ of Bangladesh has not been studied adequately.

It is known that the coastal ecosystem incorporating mangroves, intertidal zones are rich in biodiversity. But this region is also facing unusual rates of exploitation due to human pressure and high rate of unemployment in coastal region. The shallow coastal region, especially the Sundarban wetland may be considered as ecologically critical zones (ECAs). Besides the coastal zone, rest of the EEZ of BoB is almost virgin of investigations. Recognizing the importance and ensuring conservation of the existing biodiversity of the EEZ exploring habitant and ecological profile of the area, a comprehensive program need to be developed that will address challenges of the EEZ to draft a framework. The IUCN supports for the preparation of the framework based on essential studies that would enable the concerned authorities to develop a framework for a strategic biodiversity management action plan that integrates all elements necessary for declaring of a MPA. Investigations of all parameters and criteria for defining the zonation for improvement of knowledge including critical habitat, migratory routes and spawning areas are needed for making decision for identifying of an MPA.

2.11 Necessity for Effective Partnership

Even PA on terrestrial environment is not widely accepted in Bangladesh and awareness to protect PA is still inadequate. MPA is new concept in Bangladesh that needs support of national government agencies and local bodies and potential non-government organizations and most importantly coastal communities. Cooperation among all stakeholders should be encouraged in all steps of the framework. The concept of cooperation and partnership is vital to the MPA Program and its implementation and ultimately its success. To have a successful
MPA various interest groups needs to work together. Important program areas or sites are dependent on effective partnership, collection of information and knowledge on environment, ecosystem, biodiversity and all other related issues. Hence conducting studies, planning and implementation of interventions and enforcements of regulations and codes of conduct will be required.

The number and classification of stakeholder’s especially based on coastal areas, who rely upon living aquatic/ marine resources will vary with geographic locations, demographic distributions, regional needs, attitudes of coastal dwellers, awareness on importance of MPA and biodiversity for future food security. The level of participation and responsibility of stakeholders depends on the purpose of the MPA, its proximity to commercial fishing grounds and its oceanographical location. However, in Bangladesh unlike various countries with many oceanic islands where specific pockets or habitats of seas and Bays creates fragile ecosystem for specific marine lives suitable for selection for MPAs. It was experienced during regional workshops that many participants without any real thought outright suggested apparent suitable sites for MPA outside the known fishing grounds and when enquired why s/he thinks its suitability, they just claim that it will protect livelihood of fishermen and women. Also, a group of people think that since government is committed to declare 10% of EEZ as MPA, so a declaration by government the offshore EEZ as MPA would serve the purpose of international commitment. This is important to note that a mere declaration without its inherent quality to become a MPA will be a waste of time and energy. MPA should be judiciously selected. The government declaration of MPA is no doubt very important, however, implementation of MPA will need successful partnership and assuming responsibility by concerned public and private parties. When large areas are needed to be declared as MPA that often involve many interest groups and stakeholders and they must be dealt with caution.

2.12 Coastal Communities and Livelihoods

Roughly, 17% of the territory of the country is considered as coastal region in Bangladesh, based on existence of salinity to a certain ppt (parts per thousand) in aquatic ecosystem at least seasonally. That comprises roughly 2.5 million ha in 16 coastal districts accommodating almost 25 million people. The coastal region is relatively more fraught with danger of natural calamities; cyclone, tidal bore, tsunami, river erosion, and occasional floods. The people living in coastal region are prone to unstable livelihoods and their economic dividend is also low compared to rest of the country that was revealed during FGD and regional workshops. In Chandpur it was learned that almost half of Haimchar Upazilais eroded to Meghna estuary making thousands of people landless during the last few years, thus, farmers are now opting for a subsistence living. The whole of Bangladesh coastal regions is similar; huge number of floating population virtually lives on coastal fisheries and coast based mangrove resources.

Though the MPA program provides opportunities for communities and resources users in long run, they consider that declaration of MPA will deprive them from harvesting resources from their backyard. The same words were repeatedly asked during specially focus groups discussion where mostly primary stakeholders dependent on sea and its contents participated. The assumption came also from dialogue among key stakeholders through regional meetings. Since, conservation in sea is also needed where biodiversity is rich and those rich grounds are usually associated with fishing grounds. From project sides, repeatedly narrated that a well-managed MPA indeed will support more livelihoods by protecting biodiversity of renewable resources in a particular area in sea and will allow seepage to enrich areas outside the MPA for exploitation.
In coastal based MPA planning and management, local government (LG) leader, local elected body members, local/regional organizations and coastal communities should have the opportunity to play lead and prominent role. Co-management of declared sites should be determined by consultation among all stakeholders and initiatives should be taken to create public awareness on designated programs. The organizations/agencies entrusted to nominate an MPA could become a partner.party for the management of the site. The parties of co-management would long-term partnering arrangement among themselves for managing and protecting the MPA.

2.13 Conservation Organizations

Unlike developed countries, Bangladesh lacks strong environmental organizations like “Greens” active in Western Europe. Though many consider some conservation organizations acts like extremists, but their role is praiseworthy in most of the case for PA or MPA. The local, regional and national conservation groups, if they are truly any, should be involved in conservation activities in the marine environment and demarcating Marine Protected Areas (MPA). However, there should be dialogue among conservation organizations, other stakeholders, NGOs and public agencies regarding MPA issues.

2.14 Fishing and Aquaculture Interests

Fishing and aquaculture industries often have a conflicting interests and important investment in MPAs. Therefore, it is essential to involve all associated parties prior to declaration of MPA. Also, clear-cut code of conduct regarding MPA, fishing rights and rights of all vested groups including commercial and artisanal fish harvesters, recreational fishers, businesses, processing companies, and the fishing-dependent communities, should be introduced/established to play an active role in the MPA process management. Fish exploiters in many countries are always strong proponents of conserving the marine resources upon which they depend as they believe MPA will enrich their fishing grounds ultimately. Unfortunately, in Bangladesh fisher groups always raise objections whenever a protected area is discussed as was observed during national workshops, regional meetings and focus group discussions.

The fisheries and aquaculture group possesses information and knowledge to add to the scientific facts that shapes the approaches of management of MPA. Reports and experience gained elsewhere suggests that for MPA implementation strong support from all types of fishing interests, particularly, if the MPAs will remove territory from fishing areas or restrict fishing is vital. Support for MPAs grows when harvesters see the results of a successful MPA, or when they become involved in the many stages of the MPA establishment process. The development of the Canadian Code of Conduct for Responsible Fishing Operations in Atlantic Canada complements the MPA process and encourages cooperative approaches to management of the fisheries resources process. IUCN contribution on road mapping of MPA guidelines lead by Kelleher & Kenchington, 19925c) is also a pioneering work in the area.

Aquaculture is a fast-growing industry in Bangladesh with annual growth rates of 4-5% and yearly landing over million ton, however, most of the aquaculture production comes from fresh and/or brackish water farming. Though, interest of aquaculture seldom make conflicts with marine resources except harvest of prawn and shrimp seeds from wild and resulting destruction of marine larval biodiversity. However, in long run, like the fishing industry, aquaculture will be closely involved in the consideration of individual MPA sites with particular reference to generating alternative livelihoods for the partly or fully displaced fishers.
2.15 Coastal Communities and Organizations

Many coastal communities like artisanal fishers, landless farmers harvesting shrimp and prawn seeds, day labors working on fishing boats, labors working at landing centers and fishing input sellers and traders’ communities and related organizations should have a strong interest in conserving marine resources for their livelihood, but while conducting FGDs in coastal regions resistant or halfhearted supports were received from these group of people. While declaring some protected areas in estuaries and river mouth to protect migratory hilsa resources, affected hilsa fishing communities were provided with VGF (vulnerable group feeding) cards so that poor fisher families could get some staple food supports during harvest-banned period. This is a good step towards right direction. If the fishing communities are convinced then it will create an opportunity to participate in the establishment and management of MPAs. A realistic MPA policy can be framed by working closely with fisher communities as it will result in sharing of scientific knowledge and skill along with traditional knowledge.

While planning and establishing MPAs special consideration to traditional fisherman’s activity in the marine area is requires as law enforcement on marine fishing will be difficult task for the Bangladesh Navy and Coast Guard without the support of the fishing community. Partnering arrangements will be encouraged to integrate fishers’ interests into the MPA Program. Effective organization among coastal or marine fishing community is non-existent, some societies exists but those are led by non-fishing people who prevent holding a fruitful and viable discussion.

2.16 Sea and Ocean Industries

In many countries, there is ocean acts and implementing such act as MPAs for ecosystem or biodiversity protections may restrict human activities in some designated areas. The traditional uses of marine resources mainly concentrates on fisheries, however, seas are now not restricted for uses for fisheries or navigations, but also uses for many ocean industries, including oil and gas companies, marine mining interests, tourism, shoreline developers, shipping agencies, and other users, will have a direct interest in the development of an MPA program.

If, MPAs are declared for ecosystem and biodiversity protections, people using sea for other purpose may have to be displaced in order to establish MPAs. As a result, The MPA selection procedures needs to be discussed with other current or future potential uses, otherwise their interests may be threatened and essence of MPA declaration may not be fulfilled. Unless interest of the vested groups are considered during MPA planning and establishment, effective preservation of MPA status will be hampered. Many of these industries and users may wish to assume a long-term collaborative role in managing an MPA, assisting in activities such as enforcement and monitoring.

2.17 Coastal Districts and Municipal Government Agencies

In Bangladesh, yet district elected government does not exists, the so called ZillaParishad are not elected body hence have limited administrative powers, instead, district level administration under direct supervision of central government wield more power, therefore, while conducting regional meetings district level general and police administrations were invited and ensured their participations together with others. It was surprising in some places, where district level public officials were reluctant to participate to informal meeting where no conventional inaugural sessions accompanied by chief guest positions existed. Nonetheless, during formulation of MPA guidelines table based paper works may serve the purpose, but district and local level public official’s active participation will be vital during declaration and implementation of MPA. Coastal municipal authorities have unknown jurisdiction over the seabed in inshore waters under Bangladesh conditions.
The district and municipal authorities though are not in control of sea and ocean or even coastal water but their participations are vital as they are accountable for running most of the land-based actions that have an effect on the coastal and marine environment and potential MPAs like affluent discharge, city discharge, city based pollutions, water and sewerage systems, tourism, and shoreline development.

2.18 Government Ministries and Field Agencies

Bangladesh does not have a sea or ocean act, though there is a marine fisheries act that needs update. Bangladesh government through its field departments and agencies has direct commitments for the identification, designation and management of protected areas in the marine environment. There should be a document/s on future MPA Program/Policy for the country where all associated departments/agencies should work together for Marine Protected Areas (MPA). A national approach is needed in details on how department of fisheries and department of environment will work together with other departments/agencies. Other agencies like department of maritime transport, department of shipping and department of energy, Navy, Coast guard and Police need to be consulted for assistance in addressing specific issues and in considering particular sites. In line with the stated approaches, the present initiative has initiated a dialogue with different stakeholders at national and regional levels on future MPA in EEZ of Bangladesh.

2.19 International Cooperation on MPA

Protected area concept in Bangladesh is not widespread and MPA concept is almost non-existent except declaring some breeding/nursing grounds and migratory routes of some important aquatic species on seasonal/weekly basis as protected areas in sea/estuary/river mouth. In MPA and related common conservation objectives in sea and ocean international cooperation/facilitation is needed. Cooperative agreements and joint planning exercises between Bangladesh and her BoBneighbors are very important and one such initiative is currently underway involving eight BoB countries.

There are many highly migratory marine fish, cetaceans, birds, turtles and cephalopods those does not confine their habitat in channel or a pocket of marine habitat, their migratory route may extend several hundred kilometer from Bangladesh EEZ to elsewhere. It may require a network of protected areas based on the spawning and recruitment areas, along their migratory routes with international cooperation. Some potential marine protected area sites in EEZ of Bangladesh may fall in close proximity to India and Myanmar, and cooperation between these countries should be vital. Bangladesh has cooperative agreements with India on protection of Bengal tiger. Similar agreements on marine protected areas will be helpful after careful studies.

In this context, IUCN initiatives through BOBLME and others is projects could be mentioned, where regional cooperation and coordination is praiseworthy and exemplary. Interagency cooperation among neighboring countries in this part of the world for common resource management is few except programs like BOBP; consequently, IUCN is taking leading role in the areas in recent years.

2.20 Information Gap on Knowledge base

Information is very important for selection and management of any MPAs; therefore, it is required to ensure that all available information on EEZ of Bangladesh is gathered. Sound management of MPAs will depend on how much information and knowledge has been gathered. The resident as well as migratory animals’ population
dynamics is to be understood and its response to the dynamics of the anthropogenic activities need to be recorded. As part of its discipline based mandate, department of fisheries and department of environment together with other related agencies (if, there are any) should continue to collect data for understanding the EEZ of Bangladesh, Bay of Bengal it’s living, renewable and non-living resources, including fisheries, biological, mineral, hydrographic, sea bottom structure, sea currents, oceanography, and other marine data.

When different agencies are mandated to develop different resources, therefore, a number of coastal databases needs to be established but coordination among the performing agencies are must and that will be useful for decision-making for the management of MPAs. Based on effective coordination an effective coastal zone information management system could be established. Coastal communities who gathers natural resource for their livelihood and conservation groups may possesses vital information that may be very helpful in an MPA program and may become important tool in decision-making.

Most important limitation/constraints in proposing and planning for MPAs in Bangladesh EEZ are the limited information, knowledge and understanding of the dynamism of BoB in general and EEZ of Bangladesh in particular, it’s marine habitat, bottom topography, currents, ecosystems, diverse aquatic plants and animals thriving there. Since our information, knowledge and understanding on BoB and Bangladesh EEZ is limited; then planning and management decisions should be taken based on studies, analyzing secondary data and grey records and information gathering and on a precautionary basis.

The MPA planning, implementable program and management should focus on followings and try to make a judicious decision:

- Focusing mainly on integrated coastal zone management taking into consideration on man, resource and nature
- Pursuing sustainable development of sea and its resources with upmost the precautionary measure
- Judicious selection of MPA sites with thoughtful considerations
- Initial selection of MPAs should be considered as a learning chance by certain and adaptive management principle
- Ensuring fruitful monitoring component as part of some MPA management
- MPAs should be considered as living concepts not as an unchangeable document
- MPAs should be considered as natural laboratories and should facilitate continuous environment, habitat, resources, species and ecosystem based research.

Monitoring programs is vital for any program implementation; therefore it is essential to establish a Monitoring and Evaluation (M&E) system to conclude whether the objective/s of a given MPA has been successfully comprehended. Environmental and ecological parameters need to be scrutinizing to find-out normal and man-made changes in habitat and ecosystems systems. This information is necessary for signifying management achievements. If accomplishment is established or proved to be worthy, observance with regulations and government support for more MPAs establishment would get momentum.
Chapter 3
Framework to Establish Marine Protected Areas in Bangladesh
Marine Protected Area declaration should follow an established or well thought of guideline; and since, there is no guideline available for Bangladesh to follow, and following step-wise framework is drafted based on sketches those are already outlined and under execution elsewhere. The initiative through this assignment is entrusted to design a framework to establish MPAs in the EEZ of Bangladesh.

With the smaller number of marine protected areas (MPAs) compared with terrestrial protected areas, there is less experience and understanding of applying the categories to MPAs. Application of the categories to MPAs has often been inaccurate and inconsistent. This framework has been drafted so that it can be implemented following the IUCN’s guidelines and thus aimed at ensuring that the IUCN categories can be effectively applied to all types of MPAs as well as to any marine components of adjoining terrestrial protected areas, provided a site meets the IUCN definition of a protected area.30, 31

Since fisheries has been considered as the major renewable resources for Bangladesh from its EEZ, emphasis was given on the FAO Technical Guidelines for Responsible Fisheries No. 4, Suppl. 4 (FISHERIES MANAGEMENT.4. Marine protected areas and fisheries).32 Hence a synchronized approach has been followed during formulating the framework.

It needs to be understood that establishing MPAs may not follow a set formula by which all MPAs can be selected. Each MPA actually is an independent entity based on its special characteristics. At first a marine area may be selected as a candidate area of interest or area of significance (AOS) for a proposed/designated MPA. Since, Bangladesh does not have a Sea or Ocean act, it may be incorporated in the marine fisheries act for the time being until a Sea or Ocean act is proclaimed. Through this initiative, relatively good numbers of coastal and off-shore sites were suggested by stakeholders to be designated as MPA. However, through discussion in the stakeholder consultations, it was decided to categorize all listed /suggested sites in four different categories based on priority. Later, the initially selected sites and their category were vetted at National seminar and some corrections were also made. The prioritized groups in descending order are Area of significance (AOS), Area of Interest (AII); Area of Curiosity (AOC), and Area of Mind (AOM). Since, at the first phase only a few sites would be brought under pilot program, understandably, AOS will get highest preference.

3.1 Framework to establish and manage individual MPA & MPAs and its steps

It may be mentioned that the general framework will be a broad outline, but individual MPA should have its own specific guideline or pathway. Selection and implementation pathway can be summarized as indicated in the following flow chart:
To establish an individual MPA, following steps can form the framework:

**Step 1:** Identification of Areas of Significance (AOSs)

**Step 2:** Initial sieving of preliminarily selected AOSs

**Step 3:** AOSs validation, assessments and suggestions

**Step 4:** Formulation of a Management Plan for a Candidate MPA Site

**Step 5:** Designation or titling of MPA

**Step 6:** Guidelines of management of MPAs within a framework

**Step 7:** Declaration of MPA

**Step 8:** Code of Conducts (COC) for specialized MPA

This is a draft proposal, therefore if any new information/data comes to surface it should be incorporated for that particular MPA and subsequent appropriate mediatory management measures should be undertaken. Concurrent decisions may be taken by management authority based on new information or happenings. MPA declaration by different countries is authorized to different authorities, in some countries, Minister of Fisheries is responsible for recommendation on MPA and concerned competent authority of the respective region/district/province or authorize council declare it. In case of Bangladesh, it is yet not decided who should declare the MPAs. It may be jointly vested to Ministry of Fisheries and Livestock and Ministry of Environment and Forests.

However, regional fishery officers, consulting with other departments, concerned non-government organizations, and civic groups may recommend a MPA to the appropriate/competent authority, who can take the responsibility of declaring a MPA after discussion with the all relevant agencies. There should be a national committee for MPA declaration, possibly headed by Minister of Fisheries and Livestock. Also, there should be regional committees. The MPAs in different parts should be guided with flexibility. To reflect the necessary flexibility, Department of fisheries in consultation with department of environment, if the designated sites is coastal land based, may develop specific guides for local marine conservation and protection needs. Regional guidelines to select a MPA must follow the National Framework and guidelines to be prepared in consultation of the respective sectoral policies and strategies of the government. It will also preserve all data and information on the steps and phases that were considered for the selection and declaration of an individual MPA.

### 3.1.1 Step 1: Identification of Areas of Significance (AOSs)

The first stage in establishing a MPA is to identify potential sites depending on primary and secondary information, importance for species, habitat, ecosystem and or other environment factors that is vital for the protection of at least a an element mentioned above.

#### 3.1.1.1 Identification

To identify a prospective site the participation/opinions of all relevant stakeholders is the key ingredient of success. In line with this approaches IUCN arranged 6 regional meetings in Noakhali, Chandpur, Patuakhali, Khulna Chittagong and Cox’s Bazar. After each regional meeting, a focus group discussion was followed with active participation of directly involved fishing industry people. Other related initiatives for identification of AOSs may include:
A. Ecosystem studies and overviews
B. Marine fisheries regulation and management planning
C. Past initiatives (Public and Private)
D. Integrated coastal zone management proposal and processes
E. Individual stakeholder suggestion
F. Other appropriate approaches, if commensurate with the initiative

To designate a certain marine ecosystem or specific area as MPA, local/regional committee in collaboration with local stakeholders will propose nominations, citing reasons of its importance and how it is going to contribute protecting the species, habitat or ecosystem. This should initiate a logical chain of events and an opportunity for interested groups to work together within the country and elsewhere in identifying possible sites.

Once a few MPAs are already designated then it is also essential to follow a systematic approach to identify new locations to form a network of MPAs that will facilitate the management and scientific purposes identified in the marine fisheries ordinances and sub-strategy under the National Fisheries Strategy 2006.

3.1.1.2 Description of an AOS

The identification of an area is important but identification should also incorporate the detailed description of the area and the cause of its importance as candidate to be considered as AOS. The area of significance (AOS) may incorporate the following:

A. The proposing authority, organization, agency, or individual and its contact information.

B. A statement of significance which should incorporate the followings:
   Why the proposed site and or area has merits as MPA sites and status
   - How the planned or projected area/site/spot meets the aims and objectives defined as MPAs under the Bangladesh Marine Fisheries Ordinance 1983 (amended and MPA clause incorporated, if it is possible).
   - Is the projected or proposed area meets the principles of other marine protected area legislation of the country, if there is any or , if it is applicable.

C. Recommended site/spot/ location, boundaries and current status of the area
   - Analysis of national, international, and stakeholders jurisdictions

D. Habitat, Biodiversity, Environment and ecology related data and information such as:
   - Presence of biologically important, endangered and or rare species, their conditions, habitat integrity and requirements;
   - Promote ecological services;
   - Significant and vital ecosystem and habitat characteristics, including environmental status and known
   - Special marine/ oceanographic characteristics, appearance or features observed (e.g., upwelling, rivers and estuaries, land-based runoff, and nutrient areas);
   - Imperative abiotic processes (e.g., physical, chemical, climatic, and geological processes).
E. Geophysical, social and economic characteristics within and near the area, such as:
- Present and historic resources utilization;
- All types of human activities with actual or potential impacts on the area such as oil and gas activities, shipping, aquaculture, tourism, recreation, and food gathering;
- All livelihood options and subsistence population’s past and present commercial, recreational, and coastal dwellers fishing activities and opportunities;
- Presence of coastal dwellers or ethnic groups land claims those who do not preserve documents (frequently observed in Chittagong Hill Districts);
- Potential socio-economic impacts from this designation.

F. Alternatives to MPA protection, such as:
- Protection mechanisms already in place within AOS;
- Other types of designation, e.g., park, conservation area, ecological reserve, wildlife management area;
- Other types of regulation or conservation measure, e.g., fisheries closure.

G. A list of groups and individuals interested in the development of the MPA, including proposed partnering arrangements

H. Proposed Management Strategies and Regulations Inside the MPA and Associated Rationale for each, such as:
- The strategy should incorporate suggestion/s on management objectives and priorities, zoning system and pattern, and other controls on AOS
- Proposition or arrangements for research and monitoring, surveillance and enforcement
- Suggestions for marking, signage and public awareness

3.1.2 Step 2: Initial sieving of preliminary selected AOSs

3.1.2.1 Objectives

The initial screening or sieving phase associated with an evaluation of an AOS to conclude, if it needs to be evaluated in more detail. Recommended AOSs will be validated to ensure that the aims and objectives narrated for the proposed areas of significance indeed fit for MPAs under the Marine Fisheries act/ordinance; if such provisions are missing or weak in the ordinance, the rules may be formed under the existing Marine Fisheries Ordinance 1983 or by amending it.

Data required for screening the Proposed Site/s

At this phase, detailed data may not be necessary. However, types of data on the proposed site/s may be needed to comprise are as follows:

- The site and location of the preliminarily selected and proposed AOS;
- A concise biological and physical explanation and socio-economic outline of the AOS and neighbouring/adjacent areas;
- The probable category of management actions, policy and rules to apply to the area to make it effective MPA;
- The focal person, group or agency leading or facilitating the MPA process;
• A brief outline of the reason and underlying principle for establishing an MPA in this site/location describe a rationale of the selection in terms of its contingent to the Marine Fisheries Sub-strategy of the National Fisheries Strategy 2006; relating to the principles of the Marine Fisheries Ordinance will follow;
• The active involvements of partners/ stakeholders or sponsors in the future management of the proposed MPA;
• Supplemental information, data sources, if it deems necessary.

Issues to be considered before selecting of significant areas are:

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<tr>
<th>Primary conservation goal</th>
<th>Level of Protection</th>
<th>Permanence of Protection</th>
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<tbody>
<tr>
<td>•Natural Heritage</td>
<td>•No Access</td>
<td>•Permanent</td>
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<td>•Cultural Heritage</td>
<td>•No Impact</td>
<td>•Conditional</td>
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<td>•Sustainable Production</td>
<td>•No Take (Catch)</td>
<td>•Temporary</td>
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<td>•Zoned With No-Take Areas</td>
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<td>•Zoned Multiple Use</td>
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<td></td>
<td>•Uniform Multiple Use</td>
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<th>Constancy of Protection</th>
<th>Scale of Protection</th>
<th>Allowed Extractive Activities</th>
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<td>•Year-Round</td>
<td>•Ecosystem</td>
<td>•Commercial Fishing</td>
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<td>•Seasonal</td>
<td>•Focal Resource</td>
<td>•Recreational Fishing</td>
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### 3.1.2.2 AOSs list

Proposed areas of interest that may be considered significant and may qualify for MPA status based on: Reasons for Establishing MPAs under the existing Marine Fisheries Law of the country will be placed on a prospective AOS List. The AOS List will be made available to the main stakeholders, concerned public departments as well as to the general public and mass media for validation, reactions and suggestions.
The listed AOS will be scrutinized if their numbers are large and will be monitored to ensure that the ecological integrity of the proposed area remains undamaged/unchanged while in anticipation of a final suggestion relating to MPA status/declaration of MPAs. It may happen that the ecological, biological, habitat and biodiversity related integrity of an AOS is being endangered by human activities, in those cases interim protection measures may be needed to put into practice, on an ad-hoc basis if MPA declaration need extra time due to administrative, procedural and/or logistic delays.

3.1.2.3 Interim Protection and its Purpose

The identification and preliminary selection of a prospective site as an AOS or even as MPA does not necessarily provide immediate protection to an area; law needs to be enacted first and then protective measure could be undertaken. If a significant site appears to be threatened / endangered at any step throughout the assessment of an AOS, the Government or concerned agencies may impose provisional actions to preserve and look after potentially affected resources, ecosystem and habitats. In Bangladesh this is more important as once a site is declared for protection as public actions are not always encouraging/ rewarding.

3.1.2.4 Probable interim protection measures

Governments can enact a variety of actions/measures to protect marine ecosystem, resources, biodiversity and habitats on a temporary, short, medium or longer-term basis before a final decision is made as a law. As mentioned earlier, temporary measures are needed practice, under socio-economic conditions of the country. Interim protective measures will be necessary, once a site is tentatively selected.

Type of some protective measures may be like followings:

- Wide circulated notification to all stakeholders to discourage uses of the preliminary sites in the EEZ of Bangladesh which conflict with the purpose of the AOS;
- Compliance of Bangladesh Marine Fisheries Act regulations and fisheries closures;
- Implementing Bangladesh Shipping Act (if, any) regulations such as anchoring, navigation, and pollution restrictions;
- Wishes to other public agencies to defer establishment of tenures such as leases, licenses, or other rights to an area of significance/interest occupy the site;
- Arrangements with fishing industry and other marine/sea related stakeholders to look after the preliminary selected area/s;
- Overall imposition of controls by public agencies on the preliminarily selected area/s or AOS.

3.1.3 Step 3.AOSs validation, assessment and suggestions

3.1.3.1 Rationale

To classify and evaluate the environmental, ecological, biological and habitat quality, technical, and logistics support base, socio-economic merits of an AOS, to encourage public participation in the process to assess/evaluate the AOS, and to put forward whether the AOS should be established as an MPA in the EEZ of Bangladesh in BoB.
3.1.3.2 Evaluation related actions

Evaluation related action may comprise two or three actions:

a. Evaluation of the AOS  
b. Recommendation/suggestion  
c. Urgently required measures

3.1.3.3 Proposal on probable MPAs

In order to judge an AOS for a probable MPA status, a comprehensive and detailed proposal will be required, incorporating all necessary criteria. The proposal should be based on existing situations of the prospective and preliminary selected site/s, a detail planning procedure that brings together associated agencies and interests. All available information on the prospective site/s should be evaluated for screening. The regional fisheries office should coordinate activities related to evaluation of prospective MPA sites/ AOS. Those stakeholders are interested should contact regional fisheries offices for further information on procedures for proposals and evaluation on proposed MPA sites.

3.1.3.4 Evaluation of AOSs and its Purpose

The first step of evaluation is needed to determine the applicability of MPA. Therefore, it is essential to assess the merits of preliminarily selected AOS on technical and logistical aspects. Any AOS preliminarily selected should go through validation/evaluation process so that its relevancy is not questioned later.

3.1.3.5 The evaluation

In general evaluation is performed to determine the suitability of the proposed sites that are examined for a specific purpose. In this context, utilization of all available information, scientific, traditional, local knowledge and words of mouth should be taken into consideration. Also, all information should be evaluated based on the merits of an AOS. A basic discussion paper containing a guideline on how to develop a Marine protected area, and what types of queries are necessary should be considered in the assessments. All associated and interested parties should have an opportunity to participate in the evaluation process.

A simple evaluation process is not enough; it should be followed by a brief summing up of information and knowledge relevant to the assessment, including a underlying principle for accommodating or refusing a candidate site (AOS) as an MPA. All prescribed designed format and content of evaluation documents should be formulated through pilot MPA reviews.

3.1.3.6 Assessment activities

The AOS appraisal will involve the following judgment:

i. Environmental and Ecological Judgment  
ii. Scientific and technological Judgment  
iii. Geophysical and Socio-economic Judgment

These Judgments may be done at the same time or in succession. Once all of these appear positive in favor of an AOS, undoubtedly it should be the principal candidate for selection for a future MPA.
3.1.3.7 Environmental and Ecological Judgment

The environmental and ecological judgments should be based on some specific criteria practiced elsewhere and appeared fruitful and replicable. However, answers of the following queries are helpful to determine to take a correct decision:

- Whether the preliminarily selected and draft proposed site for MPA complies with the true essence for MPAs stated in the conservation and protection of fragile ecosystem, habitat and biodiversity?
- Does it comply terms and conditions of Bangladesh Marine Fisheries Policy/Ordinance? Or not contrary to establish rules and regulations.
- Does the draft proposal have ecological merits sufficient enough to be considered it as a MPA under existing geophysical-socio-economic condition of the country?
- Is the draft proposal is made with adequate homework at grass root level?
- Is the ecological, biodiversity and habitat based merits are significant enough for MPA?
- Does the draft proposal is simply fulfillment international commitment of the government?
- Ecological considerations contained in the UN Code of Conduct for Responsible Fisheries are not ignored.

Besides available information and knowledge, the judgment should be based on visible activities of the people that may appear harmful to ecosystem, habitat, biodiversity and those may need to be controlled to protect the ecosystem and associated links.

If, any destruction has already been made that needs restoration, then the extent of damage should be quantified, if it is measurable and if the destruction is qualitative then assessments should be done how to mitigate those.

If environmental and ecological judgment is not deemed appropriate for a initially selected AOS site, the process should not go through any further evaluation or judgment. MPA is very important but it should not go against the existing law or the social norms of the country that may create a social conflict. It is also necessary to make sure that the MPA declaration and establishment is done in a pro-poor context.

3.1.3.8 Scientific and technological Judgment

It is essential to determine the scientific and technical Judgment on some queries that are practical, applicable, and implementable and fulfill the criteria based on which draft proposals are made. However, answers to the following queries are needed for the decision making of the process.

- Whether the draft proposal is feasible from the scientific and technical point of view?
- Does the proposed site for MPA will be practical from management perspective?
- Is the draft proposal has rooms for adjustments to the practical need?
- Can the proposal will be able to improve viability and expediency?
- Is the boundaries of the proposed AOS is definite or quantifiable?
- Whether local public or stakeholders in the area supports the proposed AOS? If not, are their judgments/logics are valid from an ecological restoration point of view?
- Whether livelihood of local people, poor living on subsistence will be affected? If so what could be the alternative for their livelihoods?
The Scientific and technological Judgment determines the followings:

- It reveals the previous acknowledgment of the preservation value of the proposed site, as for example recognition by national, regional or civic body and/or professionals societies as of site’s importance/significance;
- Whether there was any prior international recognition on the proposed site;
- What would be the contributions of the proposed site for the existing or probable integrated coastal zone management principles;
- The probable nomenclature of the site based on area of recognition so that it could be recognized as by a suitable name of designation;
- The suitability of planned site borders in terms of management and regulations;
- Whether the proposed site fulfills the proposed management objectives in line with the National Fisheries Strategy and action plans;
- The capacity of the local authority of the proposed site for adequate planning and management;
- The local /regional resource users of the propose site, general public and associated stakeholder support on the draft proposal;
- Whether there are any cooperative partnering or co-management arrangements, if there are any, type and nature of cooperation agreements that may be helpful for running of the MPA;
- Probable disagreement or conflict with the resources users of proposed site, and mitigation measures to lessen the said disagreement or conflict so that effective running of the MPA could be materialized;
- How the conservation purposes will be served and whether there is any demonstration value of the site for conservation.

The technical judgment is also necessary to refine the draft proposal so that necessary modifications could be made to improve the document so that it becomes judicious and acceptable. The technical judgment also minimizes scientific and technical dilemma related to the design of the proposed MPA. It is also helpful to develop mutual partnerships, joint-management, or joint-designation with other agencies to meet site objectives. As a final point, the assessor must also examine whether other actions or convention/rules may be more suitable for preserving and defending the available resources (e.g., fisheries closures or harvest regulations).

3.1.3.9 Geophysical and Socio-economic Judgment

A geophysical and Socio-economic Judgment responds the following queries:

- Whether proposed MPA, if implemented, in any way going to affect human activities, and if so, to what extent? How the influence on human activities could be minimized? So that general public antagonism against the proposed MPA will be lessen.
- One thing should be understood that MPA is for the protection of ecosystem and biodiversity that ultimately helps the community to enhance and sustain the resource base on which they depends and so creating awareness is essential among the public.
- How can socio-economic benefits of the MPA be enhanced or the costs reduced?

The geophysical and socio-economic appraisals also decide how the founding mechanism of an MPA may influence the followings:

- Fishing rights, fishing on specific species, fishing harming non-target species like marine turtles, cetaceans, cephalopods, shell fish beds, corals and/or sea weed beds;
• Community beneficial activities or uses (collecting firewood, wax, honey, building materials, wild fruits from mangrove; wild fish, shrimps, crabs, shells and cephalopods, from rivers, creeks and inter-tidal zones inside mangroves, local recreation, anchoring, food gathering);
• Coastal dweller's interests (claims on coastal natural resources, mangrove and mangrove related resources, fishing industry, hatcheries, cultural or traditional activities);
• Economic and financial activities (transportation, shipping, oil and gas, minerals, sand and gravel, aquaculture, sea beaches, sea resort uses, ports, harbors, docks, Navy, coast guards, defense and maritime security interests, coastal based air ports and aircraft facilities);
• Recreational, cultural and tourism values and uses (mangrove based tourism, Sea beach based tourism, wildlife viewing, ship breaking yards, ship building yards, wrecks, educational opportunities, recreational seashores or water areas).

A geophysical socio-economic assessment may be conducted concurrently with the technical assessment or may be done step by step. Whatever may be the methods, both are essential to be done for successful designation of a MPA.

3.1.3.10 Priorities to designate AOS as first step for establishment of MPA

It needs to be understood that there is always possibilities of error while making a decision on a new site with a lot of unknown qualities and factors. Precaution must be taken but precaution does not necessarily guarantee faultless initiatives. We should understand that it is always difficult to take decisions about sensitive marine resources, biodiversity and habitats. This suggests that an Area of interest's (AOI) ecological values may be more important than technical and socio-economic considerations. In such areas, the overriding concern may be to provide special protection for these values.

3.1.3.11 Recommendations

At the end of judgments/assessments/evaluations, DoF of Bangladesh and other concerned public agencies will analyze the available data and information and formulate a recommendation on either the site to be chosen as an MPA candidate (choosing a site and MPA candidate will require formulation of a management plan) or it be lesser important than MPA but may be chosen for other form of preservation/protection.

The DoF has its strategy (if not the regulatory measures/ regulatory guidelines for establishment or management of MPAs) for fisheries conservation and protection. Under such scenario it is recommended that a new institutional framework is developed to work with DoF to review the DoF’s regulatory regime and to make amendments/adjustments to translate them into MPA management perspective.

Stakeholders and Public Participation on MPA Initiatives

All concerned people and those who pay attention to these initiatives will be given equal chances to contribute in the appraisal of an AOS. They will be notified of proposal concerning the AOS and their active participation will be encouraged. Public debate before enacting any declaration is always healthy; top down decision may not bring desired fruit. Based on the assessment procedure and all stakeholders and public input, proposal/suggestion may be made to accommodate the followings:
• Removal of the AOS from further contemplation is better, if it is already decided what to do, so next step may be taken;
• Initiatives be taken to gear up other than MPA status for defending or safeguard the area’s sensitive resources and habitats for which it is selected as candidate MPA;
• Submit the AOS to another agency expressing an interest in considering the site under their legislation;
• Adjourn further consideration of the AOS until more data is collected and access to additional info;
• Last but not least this stage will be right time to step forward to develop a MPA management plan that is executable.

3.1.3.12 Provisional Preservation/ Protection

Whenever an AOS is designated as an MPA contender list, provisional protection deems necessary, unfortunately in Bangladesh when any area is declared as protected or sanctuary, no preservation or protection measures are usually taken except made an declaration, as if simple declaration will be abide by law obeying people. In a resources scarce heavily populated country, simple declaration is not enough. It is vital to undertake some preliminary measures for newly designated MPA's protection. The preliminary measures may be put into effect, as discussed earlier, to protect and conserve the site’s resources and habitats until an effective and manageable MPA is established with a good planning.

3.1.4 Step 4: Formulation of a Management Plan for a Candidate MPA Site

3.1.4.1 Objective of Management Plans

It should be self-explanatory why a management plan is necessary for MPA. The goals and objectives of MPA and how these goals and objectives will be achieved needs to be described. The result indicators by which success of the MPA will be measured will need to be described and explained as well. Usually separate management plan for each MPA is necessary as each MPA should be unique in its position and content. A management plan should be prepared based on draft proposals and appraisal reports, suggestions of all concerned stakeholders, the local people, and local concerned government agencies. The planning process should focus on all related issues and all apprehension of interested and associated stakeholders in line with stated objectives and goals of the designated MPA.

3.1.4.2 Formulation Management Plan for the MPA

Preliminary formulation processes of MPA management plan starts when AOS judgment and appraisal is completed. The implementation of a management plan is time consuming, therefore, while planning capacity of implementer need to be assessed. It needs to be understood that effective planning will depend on practical and implementable timetable, focusing on a specific site or habitat with few species at a time. Most important agenda should be to ensure cooperation of interested people/stakeholder associated with the program. Management planning should not be done only by apex body seated in Dhaka. Local governments, district level as well as Upozilla level agencies should also be involved, local people and organizations, NGOs and general public should be involved as well.

It is essential and also helpful to define aims and objectives of MPA prior to formulation of the effective management plan. Management planning approach may be prepared based on habitat, biodiversity and overall ecosystem overviews of the selected AOS; it should also include, information and data gathered from primary and secondary sources on the biological, ecological, technical, and socio-economic studies; and inputs from available stakeholders and general public aware of or living adjacent to the designated MPA.
3.1.4.3 Code of Conducts (COC) of the Planning

The Marine Protected Area as a whole is a new concept for Bangladesh; therefore, the management plan should contain elaborate discussion on MPA in general terms and will also provide details on how the MPA was selected and how it will be managed and what benefit out of the program may be expected. It will make available a number of parameters for effective management such as the location and tentative boundaries of the designated MPA, zoning mechanism, prohibited activities with the designated MPA, and other relevant regulations and specific code of conducts (COC). The MPA management plan may also provide additional policies, strategies, or other management tools for achieving the purposes stated for the MPA.

The general conception is that declaration of a MPA is more important than the management; it is assume that declaration itself is enough to protect it for further deterioration of the ecosystem. However, this seems to be a wrong conception, declaration maybe done through paper based declaration, but management needs to be done in a real world situations. So, establishing an MPA may require implementing a variety of initiatives to manage the designated area, including studies on resource (inventories, research and monitoring), general awareness on MPA its benefits and necessity, education, surveillance, enforcement and resource use management. All of these elements should be included in the MPA management plan for its successful implementation.

The following checklist5 will provide guidelines on some of the elements that an MPA management plan should consider to address. These fundamentals may vary based on overall purposes of establishing the MPA, its location, partnering arrangements, and other factors.

- purpose and scope of the plan
- background and history of the site
- location and boundaries of area and surroundings
- descriptive information, such as
  1. physical, biological, social, and cultural resources
  2. existing activities and uses in or near the MPA
  3. existing and potential threats to the MPA and how these might affect the MPA and its management
  4. existing legal and management framework

- management goals and objectives
- interpretation of regulations (e.g., details on zoning and activity prohibitions)
- core and special use zones management
- buffer areas and management of surrounding areas
- resource studies plans (inventory, research, monitoring)
- awareness, interpretation, and education
- markers, signs, buoys, and charting
- surveillance and enforcement
- resource enhancement or restoration proposals
- resource harvesting and use management
- visitor management
- continuing traditional Aboriginal or community uses
- participation, including advisory committees
- partnering agreements
- administration (staffing, training, facilities and equipment, budget)
- evaluation cycles and procedures for assessing MPA effectiveness and benefits
- planning cycles and update procedures
3.1.4.4 Partnering Arrangement

In general MPA may be effectively managed unilaterally by a single agency or co-managed with one or more organizations. The management plan with the specific scope of work for each participating partner/s should be mentioned clearly. This will minimize overlapping and ensure effective management procedures. The involvement of the resource users and other stakeholders in the management entity may also be taken into consideration.

3.1.4.5 Source of Finance

The proposed management plan should name and classify the sources of finance with line items of expenditure in detail. Besides, the predictable/projected management budget also should describe in detail how budgetary provision will support program interventions and activities under a time frame.

3.1.4.6 Surroundings and Background Information and Resource Analyses

The management plan/s for a specific MPA/s should incorporate a brief description of natural resources available in and around the site to the plan. The AOS proposal and assessment reports should also incorporate a great deal of other necessary data and information. Additional data and information may be obtained for detailed area planning from diverse sources; however, data/information sources should be validated to ensure its authenticity.

3.1.4.7 Designated Diverse Marine Zones

In EEZ of Bangladesh in BoBit has some zoning based on depth of sea bottom not ecosystem, habitat or biodiversity. The marine fisheries ordinance has no bar for zoning, simply that was not incorporated in the document. However, zones defining levels of protection will be necessary to be established within MPAs. The MPA management plan will include all zoning provisions that specifies; which activities will be permitted or prohibited within each zone based on reality; demarcate a tentative boundaries for specific activities and permitted uses; and prescribe rules of use and restrictions on various activities.

The zoning system is not a fixed entity, it may be variable depending on circumstances. The number, type and category of zoning/ grouping will vary depending on the purpose of an individual MPA.

Under strict system there may be provision of ‘no take’ or ‘no activity’ areas, to protect and preserve the habitat, ecosystem and biodiversity where access to the MPA is severely restricted. On the other hand, there are areas where controlled use of habitat and ecosystem, limited resource exploitation, limited fishing activities, or other human intervention/ activities are allowed under specified rules and regulations. The temporary zoning categories are usually designed based on diverse ecological conditions. The temporary zoning may include variable provisions depending on seasons or climatic condition; other biological time periods, such as spawning, migration, breeding, nursing and feeding period of diverse groups of marine lives.

MPA and Adjacent Buffer Zones
It is essential to protect and preserve the MPA, however, protection and preservation of MPA alone would be difficult if there remains no buffer zone surrounding the MPA. Buffer zones are areas defined around the MPA to protect it from unnecessary encroachment of human activities that may damage important species or habitats of the MPA’s ecosystem. Buffer zone may be considered as first line of defence to MPA to protect and preserve its resources. Uses within buffer zones are managed in a manner that conserves and protects the marine resources and habitats within the MPA.
3.1.4.8 Banned or Prohibited Activities in MPA

The Marine Fisheries Ordinance empowers the government of Bangladesh to enact rules and regulations to preserve the protected areas, habitat, species and to establish marine protected areas and at the same time prohibiting interventions and activities within an MPA deems destructive to MPA. This power permits the government/agencies take comprehensive actions to exclude activities that would conflict with the purposes, aims and objectives of the AOS and MPA establishment.

3.1.4.9 MPA Protection and Preservation Standards

It is predictable and desired that each MPA management plan will be exclusive based on the needs of its aims and objectives for its establishment. The kinds of actions, intervention those are banned or permissible, within an MPA are precise to each MPA based on the causes for its establishment. When the activities allowed or not allowed are specified, no additional protection and preservation standards are necessary.

3.1.4.10 Activities within the Designated MPA

When a new area is designated as MPA there may be some existing activities which might conflict with the conservation, protection aims and objectives of newly designated MPAs. Therefore careful scrutinizing will be necessary to collaborate existing and new rules and regulations. All on a sudden existing all activities could not be phase-out, therefore, the management plan should accommodate to provide opportunities for step by step for a phasing out of on-going activities.

However, it may happen that existing users have legal rights or fixed tenures permitting them to exploit marine resources of the area or they may have multinational involvements so MPA declaration should not create diplomatic bottlenecks. For example, a hydrocarbon exploration in sea bed by foreign companies, an aquaculture farm, a fishing company or a resort operator may have a mutual agreement for digging, lease to operate a business within the proposed MPA. In such scenario, agreements will be sought with the company, operator or other governments and responsible authority for protection of the area’s resources, not altering physical configuration or destruction of habitat and exploitation of endangering and threatened species.

Open water and resource management agencies, including department of fisheries, other related departments and agencies, and coastal area based local governments may have powers for regulating the use of resources, leasing some areas. Therefore, the selective MPA management plans can make available freedom for the appropriate paraphernalia according to existing geophysical and socio-economic conditions, in collaboration with resource consumer or those who have stake.

3.1.4.11 Formulation of Set of Laws for Description of the MPA

The MPA management plan should incorporate different process that may provide important data, statistics, and information for decisive documentation on what should be included or omitted in the regulations designating an MPA. The description/designation regulations confirm requirements that will be restricted in the final MPA management plan, side by side with stated objectives, tentative geographical boundaries, zoning, and other regulatory requirements deemed necessary for an MPA.

It is quite natural that the general management plans of MPA will incorporate operational details under a time frame and fixed geographical boundaries as well as awareness programs, which will not be included in initial designation regulations. One thing must be taken in consideration that like all policy documents, MPA management plans should be treated as living documents with a provision of update options periodically so that any correction, modification, alternation, change may be incorporated. This may not always necessarily require introducing new regulations, or amending existing ones.
3.1.4.12 Expected Outcome of MPA management planning

Once the MPA management plan has been developed, reviewed, validated and updated by concerned authorities, the corrected version should be forwarded to the highest approving authority with a strong recommendation so that MPA could be designated through regulation under the Bangladesh Marine Fisheries Ordinance or Bangladesh Fisheries Policy or any other rules and regulation, if there are any. Once a MPA becomes part of the country's law, other MPA establishment will be relatively easier following the procedures followed in the first cases.

3.1.4.13 MPA Regulatory Bodies

This will describe the name and jurisdiction of the ‘authority’ for regulating an MPA. Please bear in mind that it may be impractical to think of a separate regulatory body; rather it has to go with the newly created/ amended rules under certain ordinance. The most direct and relevant agency under its existing ordinance (ordinance can’t be created under a shadowed organization/ institution) e.g. the additional rules and regulations may be created under MoFL/DoF and/or the MoEF DoE or FD.

3.1.5 Step 5: Designation or Titling of an MPA

3.1.5.1 Objectives

The Marine Fisheries Ordinance, 1983 of Bangladesh though directly did not incorporated provisions on establishing MPA, but it has provision for protecting marine habitats and resources. Under these provisions the concept of MPA could be accommodated. However, designation and/or titling of newly created MPA will not be a problem as Bangladesh government is committed to establish of MPA in EEZ of Bangladesh part of BoB. What will be needed is to pass rules and regulations on this regards. The designation process on MPA may proceed alongside with the MPA management planning.

3.1.5.2 The Designation Process of MPA

An area of significance (AOS) is a marine area proposed for MPA designation under the “Marine Fisheries Ordinance of Bangladesh”. Once an AOS has been suggested for establishment, it will be referred to as a probable MPA designated site. To designate a MPA a series of different legal steps and procedures are necessary to complete the loop of laws of a particular country. In Bangladesh, the MPA management strategy, in line with the National Fisheries Strategy as well as the FAO UN Code of conduct for Responsibility (FAO UN CCRF) need to be outlined and shared with DoF and other related agencies and then passed through the MoFL. To facilitate this approval process by the Government, a working paper may be required on behalf of DoF and MoFL for discussion and endorsement by the Cabinet Division. Guideline for Protected Area (IUCN, 1994) could be the guiding principle in this respect. Under Bangladesh conditions the following steps are necessary to follow:

- The appropriate/ competent authority with recommendation of Department of Fisheries (DoF) and the Ministry of Fisheries and Livestock (MoFL) will draft rules and regulations for designation
- Then, designating marine protected areas will be shared with the DoF and other sector agencies once it is passed by the designated professional forum/body
- The prescribing measures that may include but not to be limited to
  - Zoning of marine protected areas
  - Provision of programmed activities within marine protected areas
  - Any other matters consistence with the purpose of designation
3.1.5.3 Implementation of MPA and its Provisions

Implementation of designation or titling regulations and MPA management plans may require completion of partnership arrangements between department of fisheries and partnering organizations, if there are any. The agreement may be considered as public private partnerships as well when governments, private organizations and/or NGO are involved through allocation of financial, material, staffs and other promise. Community based implementation of a MPA is a possibility, when stakeholder gets direct benefit coming out of it. Best examples of such initiatives is Halda river protected area for indigenous carps species from genetic corruptions resulting from inbreeding through crossing among identical or similar genetic lines. Protection of genetic resources by nearby communities directly benefits the community of the area.

The Marine Fisheries Ordinance-1983 of Bangladesh has provisions for enforcement of violators of law and regulations though these are not effectively enforced. However, declines of some renewable resources from marine habitat have encouraged Bangladesh government to enforce law and regulations so that enforcing agencies with magisterial powers could fines for violations of regulations. The law enforcement authorities providing services to seasonal protection of hilsa breeding grounds and preventions of Jatka (juvenile hilsa) harvest. Similar enforcement of law and regulations may be done for concerning MPA and AOS. So the message is very much clear here that necessary amendments and/ or creation of rules would be fairly easy to do since the line agency has an ordinance in place and addition/amendment of rules under this ordinance are being done as deemed necessary.

3.1.6 Step 6: Guidelines of Management of MPAs within a Framework

3.1.6.1 MPA based Area Management

Selection, validation and designation of probable new MPA are usually table/workshop based paper works with a lot of debates, arguments and counter-arguments, but these are far from real world situations. MPA management is neither table nor paper works. MPAs will be managed using existing data, statistics, information, previous research findings, on-going research, and traditional ecological information from a variety of stakeholders and general public. Interventions and activities necessary for achieving the aims and objectives of the MPA may include site planning, on the spot inspections, research, sampling, if it is necessary, monitoring and evaluation, surveillance, enforcement, visitor management, and apprenticeship initiatives.

3.1.6.2 Responsibility of MPA Management and Execution of the Plan

Each MPA should be looked after by a management team comprising representatives from all stakeholders and regional bodies and all of the team members should abide by the management plan, until it is amended by the competent authority. Initial management plan may appear inadequate as it proceeds for effective implementation. But it should be noted that even a faulty plan is always better than no plan. MPAs should be managed on a spot by spot as starting point, since aims and purposes of each MPA are unique by its nature.

This is clear that individually all MPAs should have their own management plan. Each individual management plan will reflect the special quality of the site and the rationales for which it was recognized and designated. All MPAs should be operated and managed by mutual collaboration of other organizations associated/involved with the initiatives and interested voluntary and involved parties to run in an effective way.
Management plan for each MPA should be self-explanatory and guidance for management and operation will be provided by the rules and regulations designating the MPA when it was established. As mentioned earlier, the MPA management plan, and other conservation policies and regulations should be drafted prior to designations/tilting of the MPAs and the MPA management strategy should be passed through the appropriate authority, in order to develop strong foundation for future support of relevant agencies/ institutions/ bodies

3.1.6.3 Research, monitoring and Management Plan of MPA

Terrestrial environment, ecosystem, biodiversity and habitat are known to people for generations; but many environmental processes and structures within marine ecosystems are unknown quality and often poorly studied and understood. Marine areas in comparison to terrestrial ecosystem are vast and there are areas where human penetration is recent and there are many sites human being has not reached yet or studied.

However, sea exploration is not the aims and objectives of MPAs, but scientific research and monitoring is essential and should be conducted within and outside MPAs, where it seems possible and appropriate, to understand marine environment, habitat and ecosystems little better than what is known to us and to provide valuable data, information and knowledge on changes on environment, habitat, ecosystem and biodiversity.

3.1.6.4 Public Awareness to Protect and Preserve MPA

No environmental initiative becomes successful, it does not matter how holistic it is, if human being living within periphery or loop of the area designated continue to put do harmful pressure on it. Best way of any compliance is active participation and cooperation of all stakeholders. Similarly, compliance with MPA regulations and management plans depends on the awareness and cooperation of the general public living or active within or peripheral areas of MPA designated.

Interpretation, information and knowledge dissemination on MPA and education programs on importance of preservation and protection of environment, habitat, ecosystem and biodiversity should be done so that public awareness is created and it is vital for the success of any MPA. It is necessary to explain in plain language the aims and objectives of MPA to general public, its expected benefits in short, medium and long term perspectives and to provide all information and appropriate activities within an area demarcated as MPA. Awareness should also be associated with plan for alternative AIGAs for the people to refrain from illegal/ destructive and provide support to management initiatives.

3.1.6.5 Periodic Review and Evaluation on MPAs

Each MPA should be evaluated periodically to monitor its progress in line with aims and objectives, with input from the public, to determine whether it is fulfilling its purposes. It is also important to monitor whether management plan is being followed or not. If purposes are not met or management are not properly executed; changes may be recommended to MPA implementations, rules and regulations or management team and management plans.

Proper review, examination, monitoring, observance, surveillance and evaluation can incorporate while reconsideration of the status of the MPA is anticipated. MPAs are not necessarily established in eternity, there is always scope for re-adjustments and remodeling. Climatic change alone can alter the aims and objectives of establishment of an MPA. Besides, many other factors can change, including changes in purposes, environmental conditions, as mentioned earlier - climate, and biodiversity. Periodic reviews will determine whether an existing MPA might be enlarged, sized-down, discontinued, relocated, or redesigned to serve the intended purposes for long run and changing scenario.
3.1.7 Step 7: Declaration of MPAs

Once the framework of a MPA is formulated, validated and finalized, it actually indicates the accomplishment of technical matters only. Main aspects of declaration and the subsequent protection to achieve the stated objectives are not only technical but administrative issue as well. Technical team can only suggest possible MPAs based on reasons but declaration must be made by the competent authority. Formulation of MPA framework is important but declaration of MPA by competent authority is obligatory on legal point of view. Thus, appropriate measures are necessary to convince the competent authority to declare a MPA.

3.1.7.1 Legal and Institutional framework for declaration of MPAs

The fisheries, marine fisheries and allied policies are needed to amend so that it could be “all clear-cut” or “an all inclusive” policy documents. Since, in the existing framework there is no specific marine environmental and/or ecosystem based policy, attempt should be taken to formulate a wide ranging policy document with a provision of routine review and follow-ups. In the modified marine policy paper need to be broadened to incorporate all necessary elements, reflecting sustainability based on long term perspectives and wider national marine development policy and planning framework. Declaration of MPA can be done either jointly or independently by the Ministry of Fisheries and Livestock and Ministry of Environment and Forests. There should be a national committee for MPA declaration, possibly headed by Ministry of Fisheries and Livestock. Also, there should be regional committees. The Marine Fisheries Ordinance, 1983 of Bangladesh though directly did not incorporated provisions on establishing MPA, but it has provision for protecting marine habitats and resources. Under these provisions the concept of MPA could be accommodated. However, designation and/or titling of newly created MPA will not be a problem as Bangladesh government is committed to establish of MPA in EEZ of Bangladesh part of BoB. If such provisions are missing or weak in the ordinance, the rules may be formed under the existing Marine Fisheries Ordinance 1983 or by amending it. The designation process on MPA may proceed alongside with the MPA management planning.

3.1.8 Step 8. Code of Conduct (COC) for Specialized MPAs

Code of conduct (COC) for a specialized MPA may be a smart decision prior to declaration of a MPA, especially in countries like Bangladesh where population pressure is tremendous and COC is needed before declaration of specialized MPAs. MPA associated with eco-tourism, commercial fishing grounds and popular sea beaches requires special attention. As mentioned earlier each MPA is a different entity and usually designated for a particular reasons. Therefore, MPA specific COC will be helpful for its management. As it was observed that one of the best tourist attractions in the country is facing abusive tourism, the St. Martin’s Island, over populated and to make things worse, heavy pressure during tourist season is endangering the delicate ecosystem of the tiny island; tourist collect coral samples, discards waste and commercial enterprises constructed infrastructure and service facilities to accommodate tourist needs making it an ECA and also it lead to over exploitation of coral reef dwelling fishes. Therefore, COC is urgently needed to protect some ECA and future MPA.

3.2 Selection, Designation and Management of MPA under Emergency Situation

3.2.1 Purpose

So far, MPA for preservation and protection of marine ecosystem and biodiversity has been described based on which a conventional MPA selections, designation and management plan has been discussed for a generalized framework preparation. However, some emergency situation may arise that make is necessary to take initiatives under unforeseen or emergency situations.
Under a natural disaster a drastic change in an ecosystem may occur; fishers’ greed on breeding ground of an endangered marine life or destruction of nesting ground of marine birds on an remote island may endanger a species’ existences, in such scenarios, government or any competent authority may designate an emergency MPA by order on an emergency basis, for short-term or medium term protection. This power may be used where the Minister is of the opinion that a marine resource, an ecosystem, or habitat is, or is likely to be, at risk.

This tool supplements others described earlier that could be used in emergency situations, such as fisheries closures for few days on migratory routes of hilsa in Bangladesh water during monsoon for a few days, or ban on disturbance to marine turtles when they come inshore to lay eggs on beaches.

3.2.2 Limits on Provisional or Emergency MPA Designation

An emergency or provisional MPA establishment order will remain in effect for a maximum of limits on days or weeks on year. The time limit can vary region to region, countries to countries. Say for example, Bangladesh banned fishing on gravid hilsa on its migratory route to breeding grounds for only 11 days. This period may be optimum to protect the resources from declining, however, this time period may be extended or decreased based on proper monitoring and evaluation.

Provisional or emergency MPA orders must be consistent with country’s law and should not contrarily other claims or livelihood options, land or sea area claims agreements that have been ratified or approved by an appropriate/competent authority.

3.3 Community Awareness and Learning on MPAs

Community awareness and learning on any protected areas including MPAs is very important for its effective operation and maintenance. Fruitful public private partnership is essential to effective management of Marine Protected Areas. Successful partnering depends on frequent inter-change of information and knowledge among the partners.

Besides, the aims and objectives of the MPA programs should be clearly defined and it must be understood by all concerned stakeholders. For community and public awareness and mass learning/education part of the program would necessitate the development of diverse tools for diverse stakeholders including school children, community people, resource users, public officials and other public agencies, and non-public agencies. A variety of instructive gears/materials can be used, e.g., awareness enhancing group discussions, general mass meetings, advertising material like posters, booklets, leaflets and audio-visual materials, videos.

Effective learning and community/group/users support can lessen enforcement necessities with the help of encouraging active involvement by interested communities, groups, parties; generating an awareness and understanding among common masses that show the way for better observance and compliances. Besides, creating a forum through active and voluntary partnering arrangements to address the concerns regarding the protection of habitat, species and ecosystem will be helpful. Here the effective management of the MPAs should follow a thematically ‘community based co-management’ system. Such tools establishment and management of sanctuaries have been proved to be fruitful, certainly with variations depending on the time and efforts made by the public and private institutions. While the models would need to be customized but the lessons learned document of the IPAC (integrated Protected Area Co-management) project could be a lesson to take into account.
3.4 Education-by-hands-on training and awareness building

The main aim of formulating the MPA framework is to make it workable, implementable stage by stage so that the main objectives are fulfilled. Therefore, it is essential to arrange hands-on trainings information sharing sessions among the partners, stakeholders so that effective management of MPAs could be done. The design of the MPA framework should be routinely validated to facilitate methods of reorganization and adaptation to assemble the needs of site/s of MPAs and partners/stakeholders associated. A pilot project with MPA will be helpful to manage a real field level Marine Protected Areas actually designed to implement.
Chapter 4
Proposed MPA sites
Some suggestions on MPA were received during stakeholder’s consultations. These are very preliminary suggestions; on the spot inspections, more information and screening are needed for further steps towards MPA designations. Nonetheless, suggestions made by people indeed a good inventiveness as success of any future MPA as that will depend on cooperation, activities and willingness to cope with the new situations of grass root people is important. It is necessary to create awareness on importance of creation of MPAs and how it is going to improve the quality of lives of the people who currently depends on natural resources in long run by local influential people. A large number of sites mentioned by the concerned people specially those who are directly engaged with fishing are mainly short sighted based on their experience on fishing and resource exploitation.

Almost all discussed wants protection of habitat, suggested sites for AOS but wants their fishing rights; fishing period should not be touched. Most of the suggested sites with rationales and brief comments, if there are any, are documented below. Since relatively large number of sites has been advocated /suggested/mentioned; all does not caries same or similar significance. However, to avoid top down approaches all areas mentioned by participants in the dialogue are listed through priority basis with their location by longitude and latitude. A few sites mentioned by FGD participants were not traced or synonymous with other sites were avoided. Therefore, the sites are categorized on priority basis as (a) Area of significance (AOS), (b) Area of interest (AOI), (c) Area of curiosity (AOC) and (d) Area of mind (AOM).

The small initiative tried to identify at least some potential areas where a few pilot scales MPA could be begin with. It will be first step towards right direction. It is difficult to forecast based on little information and facts to suggest 11,167 km², as future MPA. It pilot initiative appears successful, outreach to could be expanded to enlarge the loop. Even current PA is not big enough to cover 11,167 km²; a mere declaration without judicious study/observation will not be praiseworthy. The initiative is expected to create awareness among coastal dwellers and stakeholders that MPA indeed will address the followings:

- MPAs are potentially powerful tool with both biodiversity conservation and fisheries management outcomes. To gain the most benefits, the two concepts need to be bridged.
- Need to create consciousness, support good practices and learn more.
- Also information is needed on bio-ecological, socio-economic and governance aspects of the MPA.
## Site Specific MPA List

<table>
<thead>
<tr>
<th>Si. No</th>
<th>Site/Name of Site</th>
<th>Categories &amp; Comments</th>
<th>Geographic Location</th>
<th>Current Status &amp; Agency to be vested**</th>
<th>Reason/s</th>
<th>Current Specific Threat (if, there is any)</th>
<th>Anthropogenic</th>
<th>Natural</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nijhum Dweep</td>
<td>AOS</td>
<td>Noakhali 22°35.92&quot;N 90°59'57.63&quot;E</td>
<td>DoF/DF/PC</td>
<td>This small island is already under PA by department of forestry. The peripheral water around the island is claimed to be breeding ground of some important commercial species like Hilsa (Tenualosa ilisha), over fished, breeding ground &amp; nursing ground; Koral/Sea bass (Lateolabrax sp.) &amp; other species like Tiger fish; critically endangered in the red list of IUCN, Bangladesh (2000).</td>
<td>A popular tourist site; bad tourist management and abusive collections of terrestrial &amp; aquatic samples</td>
<td>Sillerosion</td>
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<tr>
<td>2</td>
<td>Sumermed Island</td>
<td>AOS</td>
<td>20-25 km South of Nijhum Dweep, 21°47'52.50&quot;N 90°59'46.34&quot;E</td>
<td>DoF</td>
<td>The site was also suggested by same participants of workshop and FGD group in Noakhali. The submerged char is reported to be habitat of many marine organisms (fish, Penaeus monodon, Pargassus anguarius, shrimp Penaeus monodon, Golden bottlenose dolphins Tursiops truncatus). The char rise above sea level during low tide and submerge during high tide.</td>
<td>Over-fishing, irresponsible exploitation of fish &amp; other aquatic organism</td>
<td>Not known</td>
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<tr>
<td>3</td>
<td>Karing Char</td>
<td>AOS</td>
<td>Noakhali 22°26'6.60&quot;N 1°11'55.78&quot;E</td>
<td>DoF</td>
<td>The site was also suggested by the same group mentioned above in Noakhali and reportedly important as nursing ground for many marine lives including some fish mentioned above (Tenualosa ilisha, Penaeus monodon, Macrobrachium Rosenbergii).</td>
<td>Over-fishing specifically on under sized</td>
<td>Not known</td>
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<tr>
<td>4</td>
<td>St. Martin’s Island (Narikel Dinjira)</td>
<td>AOS</td>
<td>Cox's Bazaar 20°36'50.30&quot;N 92°19'36.07&quot;E</td>
<td>PA</td>
<td>This is the only coral reef based island in the country and a ECA, heavily populated and a tourist attraction. The island itself could be declared as a PA on ecotourism with strict restrictions on number and activities. There are 114 reported coral reef fishes in EEZ of BoB, and most of the species are available around this island. Surrounding sea, coral attoll is suggested to be AOS for future MPA. Important species using the surrounding sea of St. Martin island and its adjacent sea is habitat of Lobster, Panulirus polymorphus, Panulirus versicolor, Thenus orientalis;</td>
<td>Very popular tourist area, bad tourist management and abusive collections of terrestrial &amp; marine samples</td>
<td>Heavy siltation from Nafriver during monsoon</td>
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<tr>
<td>No.</td>
<td>Area</td>
<td>Area Type</td>
<td>Coordinates</td>
<td>Description</td>
<td>Populations &amp; Uses</td>
<td>Geographical Features</td>
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<td>5</td>
<td>Shahpari Dweep</td>
<td>AOS</td>
<td>20°45'25.50&quot;N 92°19'40.91&quot;E</td>
<td>Sea area southern tip of Teknaf peninsula. Due to its proximity to coral reef based island most of the above mentioned species are reportedly available in this habitat at a lesser scale. Participants mentioned this area.</td>
<td>Popular to unser site, over fishing on larval marine lives by collection of post larvae of shrimp.</td>
<td>Sand deposition in coast area.</td>
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<td>6</td>
<td>Bangla Channel</td>
<td>AOS</td>
<td>20°42'6.23&quot;N 92°19'33.78&quot;E</td>
<td>Same as above</td>
<td>Heavy traffic of fishing &amp; other boats</td>
<td>Sedimentation by river flow.</td>
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<td>7</td>
<td>Naf river Estuary</td>
<td>AOS</td>
<td>20°44'3.80&quot;N 92°21'7.37&quot;E</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
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<td>8</td>
<td>Bakhkhali Estuary</td>
<td>AOS</td>
<td>21°27'36.27&quot;N 91°55'43.99&quot;E</td>
<td>Estuary at the mouth of Bakhkhali river in Cox’s Bazar. Polluted by fishing boat discard. Important nursing ground for P. monodon and M. rosenbergii.</td>
<td>Same as above</td>
<td>Same as above</td>
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<td>9</td>
<td>Sonadia Island</td>
<td>AOS</td>
<td>21°28'34.25&quot;N 91°55'17.62&quot;E</td>
<td>Off shores island in Cox’s Bazar estuary adjacent to Moeshkhali Island. Seasonally used a huge dry fish yard. Southern part of adjacent sea is reportedly good bed of many shells Trochus niloticus, Anadara granosa, Lambis lambis and echinodermus usually starfish etc.,...</td>
<td>Tourist site, Fish drying yard.</td>
<td>Same as above</td>
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<tr>
<td>Page</td>
<td>Location</td>
<td>CR/BD</td>
<td>Description</td>
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<td>10</td>
<td>Ghotibhangha</td>
<td>AOS</td>
<td>Cox's Bazaar SL#: 8 to 10, may be combined in one MPA DoF/DF: Southern tip of Moeshkhali island. Important nursing ground for many marine lives mentioned in Sonadia; besides it was once important shellfish ground, now with alarming rate of decline of species like Crab; Scylla olivacea, Scylla sp; Oyster; Placuna placenta; Clam; Perna viridis; Ornamental shell; Tonna tessellate, Oliva oliva at off shore area. Reported as nursing ground for many marine species of fishes. Over-exploitation of aquatic resources.</td>
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<td>11</td>
<td>Rivers &amp; Part of BoB at Sundarbans (East)</td>
<td>AOS</td>
<td>Bagerhat CR/BD: 22°16'46.78&quot;N 89°43'50.16&quot;E DoF/DF: Part of rivers, cricks and their tributaries flowing inside Sundarbans (East) and adjacent sea southward. Habitat for many marine lives and many of them are over fished and reportedly declining; salt water crocodile (Crocodylus porosus); different species of dolphins; Hump-backed dolphin (Sousa chinensis); Irrawaddy dolphin (Orcaella brevirostris); spotted dolphin (Stenella attenuata); spinner dolphin (Stenella longirostris); different shrimp species (P. monodon, P. indicus, Parapeneaeopissoculptilis, Metapeneaeus monoceros; Sea Snake, 11 species of sea snakes common narrow-head sea snake (Hydrophis curtus) pelagic sea snake (Pelamisplaturus); Sea bird &amp; Seagul; 20 species, Mainly Gull; Larus brunniceps, Larus murinus, and tern (Sterna hirundo, Sterna hirundo); different species of fish (Latka, Haplopteron, Epinephelus lanceolatus), Polydactylus paradiseus, Epinephelus lanceolatus, Acanthopagrus latipes, Pomadysys argenteus, Johnius borneensis, shark (Carcharhinus melanopterus; milk shark kamot ' Rhipidura monodon; Dog fish; Scylla olivacea; hammer headed shark; Schizam yaena; skate; Rhincodon typus; and many other brackish water and salt water species. Over-exploitation of aquatic resources, often poisoning Salinity increase.</td>
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<td>12</td>
<td>Rivers, part of BoB at Sundarbans (West)</td>
<td>AOS</td>
<td>Khulna CR/BD: 22°17'35.53&quot;N 89°28'41.88&quot;E DoF/DF: Part of rivers, cricks and their tributaries flowing inside Sundarbans (south) and adjacent sea southward. Important habitat of many important marine lives mentioned above for Sundarbans (East). Same as above. Same as above.</td>
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<td>No.</td>
<td>Area Description</td>
<td>AOI</td>
<td>Location</td>
<td>PA</td>
<td>Protection Status</td>
<td>Conservation Area Information</td>
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<td>13</td>
<td>Rivers, part of BoB at Sundarbans (South)</td>
<td>AOS</td>
<td>Satkhira 21°54'19.67&quot;N 89°4'52.76&quot;E</td>
<td>PA</td>
<td>Do/F/DF</td>
<td>Part of rivers, creeks and their tributaries flowing inside Sundarbans (West) and adjacent sea southward. Important habitat of many important marine lives mentioned above for Sundarbans (East).</td>
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<td>14</td>
<td>Part of Swatch of no ground famous for Dolphin population</td>
<td>AOS</td>
<td>G. Khuha 21°17'59.53&quot;N 89°30'29.52&quot;E</td>
<td>Do/F/DF</td>
<td>Same as above</td>
<td>This location is known breeding and feeding ground for dolphins and other cetaceans. This is also important fishing ground as well. Presence of many fish probably lures dolphins in the site. Therefore, part of it may be designated as MPA for cetaceans</td>
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<tr>
<td>15</td>
<td>Chakaria Sundarbans</td>
<td>AOI, SL# 12 to 14 may be combined in one MPA</td>
<td>Cox’s bazaar 21°38'22.32&quot;N 92°0'4.19&quot;E</td>
<td>Do/F/DF</td>
<td>Converted to shrimp farms; over exploitation on coastal marine resources</td>
<td>This was second biggest mangrove forested area in Bangladesh after Sundarbans as single entity. Roughly 3000 ha of forested lands has been converted into shrimp farming sites. The mangrove forested area and its peripheral rivers are claimed to be nursing grounds for many marine lives. Surrounding sea, estuaries and rivers suggested to be AOS for future MPA. Reported to be habitat and nursing ground of many marine lives (Fish, Latiescokarifer, Epinepheluslanceolatus, Polyductyulusparadisiacus, Acanthopagruslatius, Pomadasyssargenteus, Selipinnabrevipes, Eleutheroneumatetradactylum); Fhana, anchovy; Selipinnabreviceps; crab (Scolya olivacea, Scylla sp) shrimp and prawn Panaeusmonodon, Macrobrachiumroenbergii, Oyster; Placuna placenta, Crim: Pernavidi; sea birds; Gul; Larusbrunnicephalus; Larusvirdiulus; and tern (Sternahirundo, Sterna bengalensis)</td>
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<tr>
<td>16</td>
<td>Parky sea beach area</td>
<td>AOI</td>
<td>Chittagong 22°11'23.89&quot;N 91°48'56.26&quot;E</td>
<td>Do/F</td>
<td>Sea pollution due to commercial activity</td>
<td>This located Karnafuly river mouth to Potenga sea beach area reported to be breeding and nursing ground of some important marine species;</td>
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<tr>
<td>17</td>
<td>Sandweep Channel</td>
<td>AOI</td>
<td>Chittagong 22°35'29.11&quot;N 91°33'5.64&quot;E</td>
<td>Do/F</td>
<td>Soil erosion and siltation</td>
<td>The sea between Chittagong coast line and Sandip Island; reported to be breeding and nursing ground of some important marine species;</td>
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<tr>
<td>18</td>
<td>Karnaphuli Estuary</td>
<td>AOI</td>
<td>Chittagong 22°13'18.51&quot;N 91°48'14.57&quot;E</td>
<td>Do/F</td>
<td>Siltation</td>
<td>Estuary at the mouth of Karnapuli river at Chittagong coast; reported to be breeding and nursing ground of some important marine species;</td>
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<tr>
<td>19</td>
<td>Sea &amp; beach along Himchori to Inani</td>
<td>AOI</td>
<td>Cox’s Bazaar Sea &amp; beach along Himchori to Inani 21°20'6.38&quot;N 92°21'19&quot;E</td>
<td>Do/F/DF</td>
<td>Soil erosion at beach area</td>
<td>Part of Cox’s Bazar to tip of Teknaf peninsula. Gradually becoming busy tourist site. This part of the beach was once known nesting ground for some marine turtles; loggerhead (Carettacaretta); green turtle (Chelonia mydas); hawksbill (Eretmochelysimbricata); and leatherback (Dermochelys coriacea), the adjacent part of the sea is reportedly good bed of many shells Trochus nilicus, Anadara granosa, Lambis lambis and echinoids, usually starfish etc., (Cenometrabea, Stephanometra, Popular tourist site, abusive tourist management; over fishing on larval marine lives by collection of post larvae of shrimp)</td>
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<td>No.</td>
<td>Area</td>
<td>AOI</td>
<td>Coordinates</td>
<td>Description</td>
<td>Status</td>
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<td>20</td>
<td>Anadat Manik</td>
<td>AOI</td>
<td>21°51'30.51&quot;N 90°4'41.68&quot;E</td>
<td>Tilt site was suggested by workshop and FGD groups in Chandpur areas. Chandpur being the hisla harvesting and landing site, most suggestions for AOS are hisla protection areas. Hisla (Tenuosilalis), over fished, the site is also breeding &amp; nursing ground of hisla; Koral/Sea bass (Lateviscalcariif) considered as Riverine &amp; estuary based fish, currently overfished; Pangas (Pangasiuspangasius) is also overfished, Haushpata: Dasyatisbenetti; Riverine and estuarine fish Rita, Rita rita, endangered and in red list of IUCN. Bangladesh (2000), Bacha: Eutrophichthysmurus, mainly river and estuarine fish. Not in red list but Eutrophichthysvachasimiliar species andfically endangered and In red list.</td>
<td>Siltation</td>
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<tr>
<td>21</td>
<td>Jalliar Char</td>
<td>AOI</td>
<td>22°25'32.34&quot;N 91°15'22.52&quot;E</td>
<td>The site was suggested to be AOS for duel purposes of plantation and adjacent seas for the protection of marine lives. Reportedly habitat for Riverine and estuarine fishes mentioned above for Anadat Manik river Mouth</td>
<td>Siltation</td>
<td></td>
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<tr>
<td>22</td>
<td>Thengar Char</td>
<td>AOI</td>
<td>22°22'57.77&quot;N 91°24'19.28&quot;E</td>
<td>Same as above suggested as PA by Workshop and FGD groups. Reportedly habitat for Riverine and estuarine fishes mentioned above for Anadat Manik river Mouth</td>
<td>Siltation</td>
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<td>23</td>
<td>Modher Char</td>
<td>AOI</td>
<td>22°15'48.92&quot;N 91°19'18.97&quot;E</td>
<td>Same as above suggested as PA by Workshop and FGD groups. Reportedly habitat for Riverine and estuarine fishes mentioned above for Anadat Manik river Mouth</td>
<td>Siltation</td>
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<tr>
<td>24</td>
<td>Jahaja Char</td>
<td>AOI</td>
<td>22°32'44.73&quot;N 91°19'18.97&quot;E</td>
<td>Same as above suggested as PA by Workshop and FGD groups. Reportedly habitat for Riverine and estuarine fishes mentioned above for Anadat Manik river Mouth</td>
<td>Siltation</td>
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<tr>
<td>25</td>
<td>Duclar Char</td>
<td>AOI</td>
<td>21°45'35.53&quot;N 89°32'28.08&quot;E</td>
<td>Same or Similar to those of Sundarbans East, South and West suggested earlier in AOS</td>
<td>Fish drying yard, Marine discards, Siltation, salinity increase</td>
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<tr>
<td>26</td>
<td>Kotka</td>
<td>AOI</td>
<td>21°50'48.29&quot;N 89°49'2.45&quot;E</td>
<td>Same or Similar to those of Sundarbans East, South and West suggested earlier in AOS</td>
<td>Tourist site and abusive tourist management, Salinity increase</td>
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<td>27</td>
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<td>28</td>
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<td>29</td>
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<td>32</td>
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<td>33</td>
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<td>Bishkhali</td>
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<td>37</td>
<td>Paika River</td>
<td>AOC</td>
<td>Patuakhali</td>
<td>DoF</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
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<tr>
<td>38</td>
<td>Char Alexander</td>
<td>AOC</td>
<td>Bhola -Laxmiapur</td>
<td>DoF</td>
<td>Same as above</td>
<td>Same as above</td>
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<td>39</td>
<td>Lolla River</td>
<td>AOC</td>
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<td>40</td>
<td>ChotoBojhi</td>
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<td>DoF</td>
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<td>Same as above</td>
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<tr>
<td>42</td>
<td>Chalna</td>
<td>AOC</td>
<td>Greater Khuna</td>
<td>DoF/DF</td>
<td>Same as above</td>
<td>Same as above</td>
<td>Same as above</td>
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</tr>
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</table>

The site was suggested as an important area for breeding ground for some important Riverine and estuarine fish like Hilsa, Tenuakobisha, Sea bass, vetchi, koral, Latescalkanther, mullets Liza sp., and prawn irood. Macrobanchium rosenbergi-lairing-ground.

Over exploitation of resources by catching undersized fish and shrimps.

This sites was cited as important habitat, breeding and nursing ground for some important and over-exploited commercial fishes like Hilsa, Tenuakobisha, lilitaha; Pangas, Pangasius, panga, Riverine and estuarine fish in the redlist of IUCN, Fnasa, anchovy, Setipinnabreviceps; Taposi; Paradise threadfin. The site is near heavily populated area and resources are being overexploited.
<table>
<thead>
<tr>
<th>No.</th>
<th>Location</th>
<th>AOC</th>
<th>Coordinates</th>
<th>DF/DF</th>
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<tr>
<td>43</td>
<td>Mongla</td>
<td>AOC</td>
<td>Bagerhat 22°28’14.92&quot;N 89°35’38.63”E</td>
<td>DoF/DF More or less same as Chinha</td>
<td>Same as above</td>
</tr>
<tr>
<td>44</td>
<td>Chinha</td>
<td>AOC</td>
<td>Bagerhat 22°24’11.60”N 89°37’10.07”E</td>
<td>DoF/DF More or less same as Chinha</td>
<td>Same as above</td>
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<tr>
<td>45</td>
<td>Joymuni</td>
<td>AOC</td>
<td>Greater Khulna 22°21’55.31”N 89°38’54.03”E</td>
<td>DoF/DF More or less same as Chinha</td>
<td>Same as above</td>
</tr>
<tr>
<td>46</td>
<td>Matamuhuri Estuary</td>
<td>AOC</td>
<td>Chittagong-Co x’s Bazaar coast 21°26’59.21”N 91°55’37.15”E</td>
<td>DoF/DF Estuary at the mouth of Matamuhuri river at Chittagong coast was cited by some as important habitat for some commercial species and nursing ground for many marine Ives; Pangas, Pangasius, Pangasius, Riverine and estuarine fishin the red list of IUCN; Tapos (Paradise threadfin: Polyduclus, Spadelfish: Scoliodonticatus; different shrimp species (P. monodon, P. indicus, Parapeneaeopispissculptilis, Metapeneaemonoceros; hanger, Susuk dolphin (Sousa chinenisa); Irrawaddy dolphin (Orcella brevirostris); spotted dolphin (Stenellalatensnata); spinner dolphin (Stenellalongirostris); Nuniarmach; Photobatesauvaci; Sepia pharaonis; Crab; Scylla olivacea, Scylla sp. )</td>
<td>The site is near heavily populated area and resources are being overexploited, sea pollution by urban waste</td>
</tr>
<tr>
<td>47</td>
<td>Sitakundu coast</td>
<td>AOC</td>
<td>Chittagong 22°35’40.46”N 91°36’17.70”E</td>
<td>DoF/DF More or less same as Matamuhuri Estuary</td>
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<tr>
<td>48</td>
<td>Mirerbari Coast</td>
<td>AOC</td>
<td>Chittagong 22°41’51.14”N 91°30’0.28”E</td>
<td>DoF/DF More or less same as Matamuhuri Estuary</td>
<td>Same as above</td>
</tr>
<tr>
<td>49</td>
<td>Moheshkhali channel</td>
<td>AOC</td>
<td>Chittagong-Co x’s Bazaar coast 21°29’35.08”N 91°58’32.83”E</td>
<td>DoF/DF More or less same as Matamuhuri Estuary</td>
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<tr>
<td>50</td>
<td>Kutubdia Channel</td>
<td>AOC</td>
<td>Chittagong-Coxt’s Bazaar coast 21°47′7.33″N 91°52′47.52″E</td>
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<td>More or less same as Matamuhuri Estuary</td>
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<tr>
<td>51</td>
<td>Pechar Dweep</td>
<td>AOC</td>
<td>Cox’s Bazar 21°19′28.52″N 92°1′53.64″E</td>
<td>PA</td>
<td>This small site is a coral atoll without human settlers adjacent to St. Martin Island, hence included in AOC mentioned earlier</td>
</tr>
<tr>
<td>52</td>
<td>Halda River</td>
<td>AOC</td>
<td>Chittagong 22°29′1.53″N 91°53′1.76″E</td>
<td>PA</td>
<td>This not a marine habitat but a single entity of community based PA for fisheries importance in a hilly creek system where inbred free Indian major carp broods are protected for natural fish seed collections. Some biologist believes there are a few endemic PW species exists there but is no published support materials in favor of this claim.</td>
</tr>
<tr>
<td>53</td>
<td>Char Kuli-kumri</td>
<td>AOM</td>
<td>Bhola 21°54′23.78″N 90°37′49.91″E</td>
<td>DoF/DF</td>
<td>Very few information was provided by informant’s about status of the site and why it is important and deserve to be nominated as a protected area. Participants appeared to uncertain and most of them about hilsa (Tenualosaill-sha) and most FGD members focused the type of fish they usually catch. However, since these names were suggested by the participants we recorded all the sites name so that in future validation could be done.</td>
</tr>
<tr>
<td>54</td>
<td>Dhal Char</td>
<td>AOM</td>
<td>Bhola 21°53′51.60″N 90°48′11.27″E</td>
<td>DoF/DF</td>
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</tr>
<tr>
<td>55</td>
<td>Char Hazari</td>
<td>AOM</td>
<td>Bhola 22°39′7.95″N 90°45′21.79″E</td>
<td>DoF/DF</td>
<td>Same as above</td>
</tr>
<tr>
<td>56</td>
<td>Char Laxmi</td>
<td>AOM</td>
<td>Bhola 22°20′18.67″N 90°51′27.62″E</td>
<td>DoF/DF</td>
<td>Same as above</td>
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<tr>
<td>57</td>
<td>Islam Char</td>
<td>AOM</td>
<td>Noakhali 22°26′43.21″N 91°16′28.99″E</td>
<td>DoF/DF</td>
<td>Same as above</td>
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<tr>
<td>58</td>
<td>Bodnari Char</td>
<td>AOM</td>
<td>Bhola 22°23′9.77″N 91°0′58.33″E</td>
<td>DoF/DF</td>
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<tr>
<td>59</td>
<td>Jaglar Char</td>
<td>AOM</td>
<td>Bhola 22°23′38.05″N 90°58′15.56″E</td>
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<td>60</td>
<td>Kalami Char</td>
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<td>Noakhali-Laxmipur</td>
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<td>61</td>
<td>Pasihur</td>
<td>AOM</td>
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<tr>
<td>62</td>
<td>Dacope</td>
<td>AOM</td>
<td>G. Khulna 22°24'46.49&quot;N 89°26'52.07&quot;E</td>
<td>DoF/DF</td>
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<tr>
<td>62</td>
<td>Dacope</td>
<td>AOM</td>
<td>G. Khulna 22°24'46.49&quot;N 89°26'52.07&quot;E</td>
<td>DoF/DF</td>
<td>Same as above</td>
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<td>63</td>
<td>Rampal</td>
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<td>G. Khulna 22°33'01.48&quot;N 89°38'57.17&quot;E</td>
<td>DoF/DF</td>
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<td>64</td>
<td>Munshigonj</td>
<td>AOM</td>
<td>Satkhira 22°16'16.25&quot;N 89°11'58.48&quot;E</td>
<td>DoF/DF</td>
<td>Same as above</td>
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<td>65</td>
<td>Ashashuni</td>
<td>AOM</td>
<td>Satkhira 22°16'16.25&quot;N 89°11'58.48&quot;E</td>
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<td>66</td>
<td>Koyra</td>
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<td>67</td>
<td>Shibsa</td>
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<td>G. Khulna 21°59'39.77&quot;N 89°32'17.31&quot;E</td>
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<td>68</td>
<td>Nollan</td>
<td>AOC</td>
<td>G. Khulna 22°25'33.68&quot;N 89°27'7.92&quot;E</td>
<td>DoF/DF</td>
<td>More or less same as Chalna</td>
</tr>
</tbody>
</table>

*Area of significance (AOS), (b) Area of interest (AOI), (c) Area of curiosity (AOC) and (d) Area of mind (AOM)

**DF: depart of Forestry; DoF: Department of Fisheries; PC: Parjatan Corporation (Tourist Bureau)**
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26Environmental Management and Biodiversity Conservation Plan for Bangladesh Sundarbans’ Biodiversity. 2012. DRAFT FINAL REPORT. VOLUME 2. IUCN-WB.


26BOBLME (2011) Fisheries catches for the Bay of Bengal Large Marine Ecosystem since 1950. BOBLME-2011-Ecology-16

27BOBLME (2011) Performance in managing marine resources in the Bay of Bengal BOBLME-2011-Ecology-17


29Sustainable Management of the Bay of Bengal Large Marine Ecosystem (BOBLME) GCP/RAS/179/WBG. Review of the Status of shared/common marine living resources stocks and of stock assessment capability in the BOBLME region.
30 IUCN, 1994 Guideline for Establishing Protected Areas

31 IUCN, 2012 Guidelines for applying the IUCN Protected Area Management Categories to Marine Protected Areas

Annexure

Annex 1: Renewable and Non-Renewable Marine Resources

1.1 Fishes

Bangladesh coastline is broken and made with mostly silt and sand with almost not stony beaches. The coast line of the country is roughly 714 km long, the EEZ is occupied with extended hollow continental shelf. The EEZ of the country has been extended to 112,192.4 km² after the verdict of ITLOS in 2012. The marine water and coastal waters of Bangladesh are rich in the diversity of fish and shellfish resources.

There is record of over 400 species (latest counts documented 402 marine species by Asiatic Society in 2009) of fin fish including sharks and rays, a number of shellfishes including 36 species of shrimp and a number of non-traditional species such as cuttle fish, octopus, oysters and mussels.

1.1.1 Fish resources

More than 90 species are commercially important of which hilsa fish is most important contributing over 40% of coastal landing*. Commercially, important species including the black-finned shark (Carcharinus melanopterus), Hammerheaded shark (Euphyra blochii), Blue-spotted sting ray (Dasyatis kuhlii), Sawfish (Pristis microdon), and devil ray (Mobula diabolus) among cartilaginous fishes. Other commercially important bony fishes include Wolf herring (Chirocentrus dorab), Bombay-duck (Harpadon nehereus), Conger eel (Congeroides teleboides), Flat-head mullet (Mugil cephalus), Fourfinger threadfin (Eleutheronema tetractylum), Giant-sea bass (Lates calcarifer), Lady-fish (Silloga shaham), Bluefin trevally (Caranx melampygus), Mackerel scad (Scambroides commersonianus), Triple-tall (Lobotes surinamensis), Long jewfish (Otolithooides parram), Panna croaker (Panna microdon), Indian mackerel (Rastrelliger kanagurta), King mackerel (Scomberomorus commerson), Pomphelet (Pampus argenteus), Whipfin mojarra (Gerres filamentosus), Red grunter (Pomadasys argenteus) etc*.

1.1.2 Fish Diversity

All fish available in Bangladesh EEZ is nutritionally edible, but not all of those are taken as food by majority of the population; sharks, rays, among fishes and many other sea foods like clams, oyster, abalone, crabs, other gastropods, and cephalopods are not eaten by main stream population. Not eaten locally but has demand elsewhere are currently harvested and exported. We do not know in detail the ecological, symbiotic or biodiversity related significances of most of the marine organisms available in EEZ of Bangladesh. As mentioned earlier, there are over 400 marine fish species in Bangladesh EEZ. Important among the marine fishes are sharks, skates and rays. There are 51 species of cartilaginous fishes recorded from Bangladesh of which 26 species are sharks* (carpet shark, zebra shark, whale shark, requiem shark, hound shark and Hammerheaded shark) under 3 orders and 9 families. There are 19 species of rays (butterfly rays, sting rays, eagle rays, devil rays, and cow nosed rays) under a single order and 5 families.
Electric rays (family: Narcinidae) include 3 species\(^a\), saw fishes (family: Pristidae) include 3 species and guitarfishes (family: Rhinobatidae) include only 4 species. The whale shark is the largest shark in Bangladesh waters attaining a length of 50 feet, this is also the largest living fish in the world that is a filter feeder. This is sluggish shark feeding primarily on plankton that it collects on a sieve-like mesh over its gills. It may also fed on small other pelagic species those comes to it huge mouth when straining the water\(^a\).

In the order Elopiformes, there exists a single family (Elopiade), a single genus and a single species, the big eye herring or Lady fish (*Elops machnata*), little information is available on the species.

There are 12 species of marine eels in EEZ of Bangladesh under 4 families and 9 genera. Marine eels carry no commercial importance in Bangladesh and these are less studied fish species in the country.

Among the fish order Clupeiformes includes the most important marine fishes of the country, the herrings, anchovies and big eyes; including national fish hilsha. This group contributes roughly 40% of marine catch in Bangladesh. This group is rich with record 14 genera and 24 species under 4 families.

Siluriformes is another group of fishes (Order) including catfishes. This group under a single family with 9 genera and 18 species. All marine catfishes belong in this group of bottom dwelling fleshy fish. Highly commercial in the country.

Aulopiformes are commonly known as Grinners. Few species like Bombay Duck (*Harpodon nehereus*) are highly commercial in Bangladesh. This “Order”of fish includes a total of 8 species under three families.

Gadiformes with two families and only three species under three genera is one of the smallest groups of fish. This group of fish has almost no commercial values.

Ophidiiformes is the family of Cusk eels, not commercial and having a few representative species in living conditions. So far in Bangladesh waters 2 species in one family and two genera were identified.

The fish belonging to the Order Lophiiformes though not commercials but strange group of deep sea fishes and popularly known as Monk fish. There are three families under the order with three families, three genera and only three species so far identified.

The flying fish, Garfishes and halfbeaks belongs to the order Beloniformes. There are three families in the order and 8 genera in those families. So far, a total of 11 species in 8 genera in this order has been identified in Bangladesh waters.

The Spinyfishes, Esquirel fishes and Slimeeheads belongs to the order Beryciformes and have three families with 5 species. Some of these species carries economic significance like white tail seuirrelfish.
The Order, Zeiformes have only two families, two genera and only two species. These fish has no commercial importance and one of the less studied species.

The famous and popular sea horse fish falls in the category of Syngnathiformes with two families and three species.

The colorful and pretty Scorpion fishes and flatheads belong to the order, Scorpaeniformes. This group has 6 families and 11 species. These species has minor economic values but good species as large marine aquarium fish.

Perciformes is by far the biggest group of fish under Bangladesh waters. Almost half of recorded species in the EEZ of country belongs to this order. There are 53 families so far recorded in the family with over two hundred species. Many of them are commercially important. Among the commercial important families are; Serranidae, Theraponidae, Priacanthidae, Sillaginidae, Lactorididae, Rachycentridae, carangidae, Coryphaenidae, Leiognathidae, Lutjanidae, Garreidae, Haemulidae, Sparidae, Lethrinidae, Nemipteridae, Scaenidae, Serranidae, Pomacentridae, and Polynemidae.

Carangidae is the largest family of Perciformes fish which includes mackerels and scads. There are record 29 species in 16 genera. Most species of this group are fast moving highly predatory that hunts in the waters above reefs.

Groupers of the family Serranidae is a large family of Marine fishes characterized by an oblong body, more or less compressed, covered with adherent scales of moderate or small size. Most of the species in the group inhabits inshore coral reefs. There are 10 species under 4 genera. Drums croakers (Family: Sciaenidae) are commercially important fishes known to produce drumming sound with aid of their swim bladder. There are about 14 species under 10 genera in EEZ of Bangladesh.

The demersal fishes of the family Pomacentridae are one of the most abundant groups of coral reef fishes. Few are more than 15 cm in length, and are typically highly colored. They are deep bodied, active and aggressive with small mouth. They display remarkable diversity with regard to feeding habits and behavior. There are 13 species under 10 genera in EEZ of Bangladesh. Snappers of the family Lutjanidae have deep body, a continuous slightly notched dorsal fin, and a slightly forked tail fin. There are 10 species of fish in this family under a single genus. These are important food and sports fish in Bangladesh waters.

Scombridae is the family of the mackerels, tuna, and bonitos, including many of the most important and familiar food fishes. The family is represented by 10 species under 7 genera in Bangladesh part of Bay of Bengal.

Threadfins (Polynemidae) resemble mullets but are different group of fish. The Indian salmon (Leptomelanosoma indicum) was one of the most prized and important fish in Bangladesh and currently rare. There are records of existence of 6 species of this group of fish under 4 genera.
The Gobies, which are considered very prominent among the fish fauna of Bangladesh, are diversified group. The commonest of all gobies in Bangladesh is the *Belo* or *Bailla*. The mud skippers are also belongs to this group.

Scorpaeiformes with 6 families and 14 species in Bangladesh waters is also a fairly big group of fishes. They have large, heavily ridged and spined head and also possess venomous spine at dorsal side.

### 1.1.3 Fish Species under Threat of Extinction currently or in long run

A total of 402 marine fish species has been listed as marine fish fauna in Bangladesh waters of EEZ. Out of these species, 33 are listed as somewhat threatened for a reason or other. However, only are listed in IUCN red list (IUCN 2000) as endangered species those needs special protection measures.

There are certain marine fish those maybe threatened elsewhere but relatively available in good number in Bangladesh waters and vice versa. List of endangered, threatened and extremely rare and at the verge of extinction species in Bangladesh EEZ are listed below.

**Table 3:** List of fish species under Threat of Extinction currently or in long run

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Status in BD waters</th>
<th>Presence in IUCN red list</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Carcharhinus dussumieri</em></td>
<td>Wide cheek shark</td>
<td>Near Threatened</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Carcharhinus falciforms</em></td>
<td>Silky shark <em>Stickle</em> shark</td>
<td>Vulnerable by overfishing</td>
<td>No</td>
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<tr>
<td><em>Carcharhinus macloti</em></td>
<td>Hardnose shark <em>Ganges</em> shark</td>
<td>Near Threatened</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Gyphus gangeticus</em></td>
<td>Ganges Shark</td>
<td>Critically endangered</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Rhizoprionodon acutus</em></td>
<td>Milk shark</td>
<td>Vulnerable by overfishing &amp; pollution</td>
<td>No</td>
</tr>
<tr>
<td><em>Eusphyra blochii</em></td>
<td>Winghead shark</td>
<td>Near Threatened by harvest</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Sphyra lewini</em></td>
<td>Scalloped <em>Hammerheaded</em></td>
<td>Threatened worldwide not in BD</td>
<td>No</td>
</tr>
<tr>
<td><em>Gymnura poecilura</em></td>
<td>Long tail butterfly Ray</td>
<td>Vulnerable by overfishing</td>
<td>No</td>
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<tr>
<td><em>Aetobatus narinari</em></td>
<td>Spotted Eagle Ray</td>
<td>Near Threatened</td>
<td>No</td>
</tr>
<tr>
<td><em>Astomyaeaus nicholoi</em></td>
<td>Banded Eagle Ray</td>
<td>Vulnerable by overfishing</td>
<td>No</td>
</tr>
<tr>
<td><em>Mobula japonica</em></td>
<td>Spinetail Mobula</td>
<td>Very high Vulnerability</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Anoxtaypris cupidate</em></td>
<td>Saw shark</td>
<td>Endangered</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Pristis microdon</em></td>
<td>Longtooth Sawfish</td>
<td>Endangered</td>
<td>Yes</td>
</tr>
<tr>
<td><em>Gymnothorax favagineus</em></td>
<td>Leopard Moray</td>
<td>Very rare</td>
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<tr>
<td><em>Escualosa thoracata</em></td>
<td>White sardine</td>
<td>Overfishing by set bag-net</td>
<td>No</td>
</tr>
<tr>
<td><em>Plotosus lineatus</em></td>
<td>Striped catfish</td>
<td>Overfishing</td>
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</tr>
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<td><em>Hippocampus kuda</em></td>
<td>Sea-horse</td>
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<tr>
<td><em>Epinephelus lanceolatus</em></td>
<td>Giant grouper</td>
<td>Threatened</td>
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<td><em>Epinephelus malabaricus</em></td>
<td>Malabar grouper</td>
<td>Overfishing</td>
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<td><em>Lutjanus gibbus</em></td>
<td>Hampback snapper</td>
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<tr>
<td><em>Pamadysys argentus</em></td>
<td>Silver grunter</td>
<td>Threatened by over fishing</td>
<td>No</td>
</tr>
<tr>
<td>Common Name</td>
<td>Scientific Name</td>
<td>Threat Status</td>
<td>Status</td>
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<td>--------------------------</td>
<td>--------------------------------</td>
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<tr>
<td>Lined Silver Grunter</td>
<td><em>Pamadysys hasta</em></td>
<td>Threatened by overfishing</td>
<td>No</td>
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<tr>
<td>Yellow-fin goatfish</td>
<td><em>Mullloidichthys vanicolensis</em></td>
<td>Threatened due to coral destruction</td>
<td>No</td>
</tr>
<tr>
<td>Sulphur goatfish</td>
<td><em>Upeneus sulphureus</em></td>
<td>Threatened due to coral destruction</td>
<td>No</td>
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<tr>
<td>Great Barrakuda</td>
<td><em>Sphyraena barracuda</em></td>
<td>Rare in Bangladesh water</td>
<td>No</td>
</tr>
<tr>
<td>Fourfinger threadfin</td>
<td><em>Eleutheronema tetractylum</em></td>
<td>Overfishing</td>
<td>No</td>
</tr>
<tr>
<td>Indian threadfin</td>
<td><em>Leptomelasoma indicum</em></td>
<td>Overfishing</td>
<td>No</td>
</tr>
<tr>
<td>Blackspotted threadfin</td>
<td><em>Polydactylus sestarius</em></td>
<td>Overfishing</td>
<td>No</td>
</tr>
<tr>
<td>Bigeye Tuna</td>
<td><em>Thunnus obesus</em></td>
<td>Vulnerable</td>
<td>Yes</td>
</tr>
<tr>
<td>Swordfish</td>
<td><em>Xiphias gladius</em></td>
<td>Rare in BD waters</td>
<td>No</td>
</tr>
<tr>
<td>Sailfish</td>
<td><em>Makaira indica</em></td>
<td>Rare in BD waters</td>
<td>No</td>
</tr>
<tr>
<td>Silver Pomfret</td>
<td><em>Pomp argenteus</em></td>
<td>Overfishing</td>
<td>No</td>
</tr>
<tr>
<td>Chinese Pomfret</td>
<td><em>Pomp chinensis</em></td>
<td>Overfishing</td>
<td>No</td>
</tr>
</tbody>
</table>

### 1.2 Crustacean

Crustaceans are a large group of arthropods, comprising roughly 52,000 species[^4b]. Majority are aquatic, living in either fresh water or marine environments, but few groups like terrestrial crabs, terrestrial hermit crabs and wood lice are adopted to terrestrial life. Majorities are free living but a few are parasitic and sessile. So far 185 (under 89 genera and 45 families) species of crustaceans have been identified and described in details from Bangladesh’s marine and brackish water ecosystem with their ecological importance. However, the list is incomplete.

Most of the crustaceans are minute and smaller in sizes and are used as food organisms for other aquatic animals. Unfortunately, the ecological importance of most of the crustaceans species internets of their role in marine food chain, complex life cycles of associated organisms, their role within intra and inter- species relationships are not well understood as not so many detailed studies have been conducted, except their role as prey and predators, their importance as live food organisms. Beside some planktonic crustacean, notably copepods as live food organisms in hatcheries and some shrimps as sea food organisms farmed animals, biology and ecological relationships of the most of marine crustaceans has not studied yet.

Out of hundreds known crustaceans’ species, only a few are commercially harvested most of them from shrimps crab and lobster groups. Rests of the crustaceans are mostly unknown or mysteries creatures to us. Our knowledge on bulk of crustaceans is limited to their taxonomic nomenclature and their beneficial or harmful effects.

### 1.2.1 Shrimps and Shrimp like Creatures[^4b]

Most of the shrimps are edible. However exploitation and commercial harvesting of shrimps from marine environments depends on their body (tail usually) meat content and market value. There are different types of shrimps and shrimp like edible creatures as described below.
1.2.2 Mantis Shrimp

Mantis shrimps are elongated, flattened and shrimp-like or lobster like crustaceans. These groups of marine crustaceans are available on shallow bottom of sub-tropical sea including BOB. Mantis shrimp has minor economic value is Bangladesh but considers delicacy elsewhere. In Bangladesh these marine creature are non-target species and when harvested in bulk is used to produce fish-meal. It plays a predatory role in the stem.

1.2.3 Mantis Shrimp Diversity

A few species of this group from Bangladesh EEZ is identified and described. Little work on this group of marine fauna has been studied in detail to know their true diversity. All Mantis Shrimp available in Bangladesh and has little economic importance other than raw materials for scrap metal (low quality fish meal). However, we do not know their ecological, symbiotic or biodiversity related significances.

1.2.4. Mantis Species under Threat of Extinction immediately or in long run

Sincerely speaking, we know so little about these creatures that their ecological relationship with other animals or their role on marine habitat and food chain is still mysterious. However, their presence in marine bottom by-catch indicates these creatures are not threatened in BOB or EEZ of Bangladesh. One reason is that like elsewhere mantis shrimps are not commercially exploited and their exploitable stock has not studied yet.

1.2.5. Shrimps

As mentioned earlier, shrimps are perhaps most prized and most sought marine creatures as sea foods. Human interest on shrimps as edibles and delicacy is centuries old and their biology, ecology, habitat and reproductive cycles are well studied, at least for some commercial ones. Most commercial shrimps are in the order of decapods, like other important groups of crabs and lobsters. All shrimps are with well-developed rostrum and generally extending beyond eyes, always bearing more than three upper teeth. Marine shrimps are popularly known as penaeid shrimps and falls in eight families; Penaeidae, Solenoceridae, Sergestidae, Atyidae, Palaemonidae, Alpheidae, Hippolytidae and Pandalidae.

1.2.6 Shrimps Diversity

EEZ of Bangladesh is rich with shrimp fauna. As mentioned above shrimps, mostly marine are incorporated in 8 families, 18 genera and altogether roughly 58 species. Out of 58 species some shrimps also lives in freshwater and brackish waters but among some fresh water species their life cycles is not completed without salt water. All shrimp species are edibles and human interest on
these species as sea foods is also centuries old, however, some species are relatively small in sizes and has little commercial values.

Most popular marine shrimp, penaeid is also extensively harvested. Among the penaeid shrimps, the genus *Penaeus* contains 9 species and all species are commercially important due to their sizes, meat texture and are considered as delicacy among sea foods. Due to its demand in world market, their protection need is more urgent and MPA can save some of these species from over fishing.

Another important penaeid shrimp genus is *Metapenaeus* that contain 6 species. These all are also relatively larger shrimps and important food organisms and are also over-fished. Some species of *Metapenaeus* and *Penaeus* are so much over fished that their demand can’t be meet with wild supply and extensive studies on their life cycles has lead to mass seed production in hatcheries and commercial framing of these species. Besides these two commercial genera, other six genera *Parapeneopsis*, contains 5 species, *Metapenaeopsis* one species.

The family *Solenoceridae* with its one genus contains four species; family *Sergestidae* contains one genus with four species. Similarly, family *Atyidae* mostly contains fresh water 4 species. Family *Palaeomonidae* contains shrimp of freshwater and marine species. Fresh water giant prawn the largest shrimp among decapods belongs to this group. This family has 6 genera with the largest genus *Macrobrachium* with 12 species. Rest of the 7 genera each has a single species.

The family, *Alpheidae* has one genus and a single species. Similarly, family *Hippolytidae* is with a single genus and a species. The family, *Pandalidae* is also with a single genus and species.

### 1.2.7. Shrimp Species under Threat of Extinction immediately or in long run

Out of 58 species of shrimp identified and studied in EEZ of Bangladesh, estuaries and river mouth most of these are commercial in nature and extensively harvested. Heavy fishing pressure on *“Penaeus indicus, P. latifolius, P. monodon, P. penicillatus and Metapenaeus affinis* are relatively larger sized shrimps and subjected to over fishing is evident by gradual decline their biomass in commercial landings. However, none of the species is listed as threatened or endangered though commercial harvest of the some species does not seems profitable. This is good sign of their protection.

However real danger lies with *P. monodon*, the black tiger shrimpt that is commercially harvested, their broods are systematically caught for the hatcheries for seed production, their post larvae (PL) are indiscriminately harvested with mosquito nets in estuaries and sea beaches. Their existence is though not endangered or is not on red list of IUCN, but this species needs special protections for biological reasons as well as for the protection of livelihoods of fisher community. *Metapenaeus* and *Parapenaeopsis* genera also contain some species those are relatively smaller in sizes but have commercial importance and harvested but none of these species are threatened.

Besides, one major commercial important freshwater cum brackish water species *Macrobrachium rosenbergii* is subjected to over fishing due to brood, food and PL harvest from nature. But as a
species they do not face danger of extinction biologically, but dangerously declining their stocks in natural habitat.

1.2.8. Lobster

Bangladesh though has huge sea area under EEZ in BoB but the sea floor under Bangladesh sea areas is basically sandy in nature. There is no broken sea coast and stony beaches and sea bottom which can be defined as lobster bed. Therefore, lobster resources in EEZ of Bangladesh are few and commercially exploitable stocks are small. Therefore, the systematic lobsters harvesting method has not developed in the country and the lobsters landing in Bangladesh is considered as accidental catch with other bottom fish harvest. However, higher export price and increased demand has created situations that encourage fishermen to device new methods of lobster harvest in BoB.

1.2.9. Lobster Diversity

The available few species of lobster species in the country has been categories into two known families; Pallinuridae (spiny lobster and langoustes) and Scyllaridae (Slapper lobster). The Palinuridae family has only one genus and three species, all are commercial in nature and whatever numbers are harvested are exported. Both spiny and mud lobsters from Bangladesh has good demand abroad. The beautifully colored painted spiny lobster and its juveniles are recognized as aquarium specimen. The family Scyllaridae has a single genus and a single species.

1.2.10. Lobster species under Threat of Extinction immediately or in long run

Out of 4 species of lobster identified and studied in EEZ of Bangladesh are scarce but not threatened in any respect as systematically these are not exploited. Low fishing pressure on all four species of lobsters in EEZ of Bangladesh is a good sign of their survival in the habitat. All four species are relatively lucrative in sizesand has high market demand and also fetch high market value. No lobsters are catered in any Bangladesh restaurants and all harvested specimens are usually exported. However, none of the species is listed as threatened or endangered though commercial harvest of the some species does not seem profitable. This is good sign of their protection.

1.2.11. Hermit Crabs

Hermit crabs are mysteries creature, appendages are like crabs, but their tail is fused and they make house inside a shell of mollusk by attached the fused tail parts inside the wall of the shell it make houses. These animals are though mostly marine, but some of the species lives on land and adapted to territorial life. These creatures are not eaten in Bangladesh and has no commercial value but accidental catch by bottom trawling sometime used in poultry feed as calcium sources. Therefore, it may not be considered as renewable resources. Their role aquatic ecosystem is not well understood. In this report only sea based hermit crabs are included though there are land based animals of this group.
1.2.12 Hermit Crabs Diversity

In EEZ of Bangladesh there are two types of aquatic hermit crabs, shallow water and deep water types. There are two families, one in shallow water and the other in deep water habitat. Both families have one genus each and only one species in each genus. Since these creature finds and make housed inside the suitable shells of mollusk, in ancient times based on types of shells they were categorized in different species. Now, based on creature inside the shell, number of species has greatly reduced. There diversity in Bangladesh water now identified to only two species; Pagurus bernhardus (shallow water hermit crab) and Parapagurus nudus (deep water hermit crab). However, the number types of hermit crabs are not complete yet. Further studies are necessary as these were identified based on landings not by on the spot collection from sea bottom.

1.2.13 Hermit Crabs species under Threat of Extinction immediately or in long run

We actually know very little about these mysterious creatures, their actual life style, life cycles and how they find sufficient number of empty shells under opportunistic conditions and sustain their population and how they continue their lives when their body becomes bigger than the shells they used as home. The threats of the hermit crabs are not manmade except pollution, if there is any. Their complex life style may limit their population and ultimately endanger their lives and existences.

1.2.14 Crabs

Crabs are one of the most important sea food and considered delicacy in some parts of the world. The crab meat is eaten by minority people in Bangladesh and the crabs were not extensively harvested earlier until export market opened. Still there is little demand domestically and most of the crabs harvested are indeed goes to export market either as live organism or under frozen conditions.

There is indication that some species of crabs especially those lives in inter-tidal zone or in mud in mangrove forested areas are over fished. Due to its commercial prospect, coastal dwellers currently practicing crab fattening; harvesting the young individuals from wild and keep them in coastal ponds for certain period of time and provide them natural supplemental feeding of animal origin and let them grow and fleshy. The practice is getting popularity among coastal dwellers as alternative livelihood options.

1.2.15 Crabs Diversity

Crabs are one of the dominant groups of decapods after shrimps. Bangladesh sea waters harbors a large variety of crabs. There are 11 different families of crabs in Bangladesh and most families includes species those are marine. Out of 11 families only 2 families are exclusively fresh water origin, rest are partly or wholly marine.

There are 36 species of crabs in Bangladesh under 22 genera; and most of them are marine as mentioned earlier. The largest crab families are Ocypodidae and Daldorffidae with 9 species under
three genera and 9 species under 4 genera respectively. The family, **Portunidae** has also 4 genera and 8 species. Rests of the crab families are less diverse with lesser number of genus and species. Family, **Carphilidae** has a single genus and a single species. Similarly, **Potamidae** has two genera with only two species. **Parathelusidae** has one genus and one species; **Varunidae** with 2 genera and 2 species. The family **Grapsidae** has 4 genera but have only 5 species.

### 1.2.16 Crabs species under Threat of Extinction immediately or in long run

Crabs in Bangladesh water is not under danger of extinction though some species is under heavy fishing pressure like mud crab (**Scylla olivacea**) and mangrove crab (**Scylla serrata**). These two crabs are commercially collected from coastal muddy areas, Sundarbans and other mangrove forest shores. These species are vulnerable to human as they live near shore and inter-tidal zones and burrow holes in soft mud when water goes down with low tides. Fishers could easily identify their borrowing hole on exposed mud and collect them without any trouble. Habitat protection and species preservation by strict implementation of environmental regulations and proper stock management is needed. The forest department sometimes impose seasonal ban on crab harvest from the Sundarbans but that is not a permanent measure.

### 1.3 Mollusks

Mollusks are a large group of invertebrates, comprising thousands of species worldwide on land and in water. Some mollusk are famous and well sought sea food items like cephalopods (squid and cuttle fish), abalone, oysters, clams, mussels and scallop. Majority are aquatic, living in fresh water, brackish waters or marine environments. Majorities are sessile, but a few are parasitic. They constitute an important component of the marine biodiversity of Bangladesh. A total of 437 marine and brackish water molluscan species has been discovered in Bangladesh EEZ. They are divided in 20 orders, 90 families and 185 genera. The mollusk falls in 4 major classes of which names of some important groups of different classes are incorporated.

As mentioned earlier, so far over 4 hundred species of molluscan species have been identified and described in details from our marine and brackish water ecosystem with their ecological importance. Unfortunately, the ecological importance of most of the molluscan species interns of their role in marine food chain, complex life cycles of associated organisms, their role within intra and inter- species relationships are not well understood as not so many detailed studies has been conducted, except their role as important sea foods.

Out of hundreds known molluscan’ species, only a few are commercially harvested most of them for human and or animal foods. Shrimp farming in Bangladesh uses molluscan meat; shells of mollusks are used to prepare moist calcium carbonate. In Bangladesh currently a thriving industry has been formed to crush and made powder of mollusk shells to be incorporate in poultry feed where high egg yielding poultry birds need adequate calcium sources for egg shells.

### 1.3.1 Molluscan Diversity
Mollusks are of 4 classes; *polyplocaphora*, *gastropoda*, *cephalopoda* and *bivalvia*; and as mentioned above have 20 orders in 4 classes; 90 families and 437 species in Bangladesh marine and brackish water environments. By far, *gastropoda* and *bivalvia* are two largest groups with huge numbers of species. Some species of three classes of mollusks are edible and considered delicacy in many countries as sea foods and considered endangered due to over fishing. However, in Bangladesh local people except some tribal ones does not eat shell fishes and no species of the molluscan group is considered endangered or threatened due to human action or fishing. A great numbers of molluscan fauna available in Bangladesh are terrestrial, mostly gastropods. All other mollusk of 4 different classes are available in aquatic environment also mostly in salt and brackish waters.

The genus, *Cypraea* with 30 species is the biggest genus of mollusks in Bangladesh waters, under the family of *Cypraeidae*, order *Mesogastropoda* and class *gastropoda*. The second largest genus of mollusk is *Conus* with 14 species in the family of *Conidae*, order *Neogastropoda* under also in class *gastropoda*. Genus *Oliva* also a large group with 12 species in the family of *Oliviidae*, also in the order *Neogastropoda*; followed by genus *Thais* with 11 species in sub-family of *Thaidinae*, family *Muricidae* and also in order of *Neogastropoda*, Genus *Nerita* under family *Neritidae* order *gastrapoda* contains 10 species. Other species rich genus are *Strombus* (9 species, family *Vermelidae*); genus *Mitra* (9 species, family *Mitridae*); genus *Tellina* (7 species, family *Tellinidae*); genus *Nassarius* (7 species, family *Nassariidae*); genus *Mactra* (7 species, family *mactridae*); genus *Natica* (6 species, family *Naticidae*); genus *Crassostrea* (6 species, family *Ostreidae*); genus *Donax* (6 species, family *Donacidae*). Besides, these families and their representatives’ genera and associated species, there are many others in the mollusk group.

### 1.3.2 Molluscan species under Threat of Extinction immediately or in long run

Mollusk is a big group of animals usually remains beyond eyes and since they are mostly sedentary in nature and lives mostly at sea bottom, beneath the mud, sand, gravels and other substratum their presence always remain almost unnoticed, if not explored properly. Unlike fish mollusks can’t be harvested by conventional nets. Special devices are needed to collect those. Since locally shell fishes are not usually consumed and no species is exported therefore, their numbers are not threatened by fishing pressure.

A few studies has been conducted on molluscan population, its biology, life cycle, habitat, ecosystem and biodiversity, so, it is difficult to say whether there is any other causes other than manmade ones that may threaten their existence.

### 1.4 Cephalopods

Worldwide cephalopods are famous items in sea food dishes; octopus, squid and cuttlefish fisheries are in some countries are well developed and money earning enterprises. In Bangladesh mainstream population did not chose these marine animals as food items for unknown reasons, may be due to their appearance and fiction stories about these mystic marine creatures. Cephalopods are used as human foods by some tribal people and also used as animal feeds in
shrimp and poultry farming industries. All cephalopods in Bangladesh are accidental catch with fish harvest.

1.4.1 Cephalopods diversity

There are recorded 10 species of cephalopods in Bangladesh waters; commonly known nautilus one species in one genera (Nautilus); three cuttle fish species (2 species in the genera of Sepia and one species in Sepiella), two species of squid (one each in Lolioxus and Photololigo genera) is also available in EEZ of BoB. There are reported 4 species of octopuses in EEZ of BoB (one under Cistopus and three under Octopus).

1.4.2 Cephalopods species under Threat of Extinction now or in long run

Cephalopods are a small group of mystic marine animals under Bangladesh conditions and almost no studies on this important group of commercially important has been done here. All information of this group of animals comes from elsewhere. Only the presence of 10 species in EEZ of Bangladesh is authenticated. Most the cephalopods are accidentally caught in fishing or trawl nets and usually dried on open beach to made scrap meals with trash fish to be used in poultry and shrimp industries. Since their stock is unknown and there is no organized fishing targeting these animals so it is difficult to ascertain their status of vulnerability.

1.5 Marine Reptiles

There is a common assumption that reptiles are mostly terrestrial animals, but in fact there are many aquatic reptiles other than turtles and crocodiles. So far, it has been reported that there are 17 species of marine reptiles in the EEZ of Bangladesh. The marine/coastal reptiles in the country are categories into 3 families, of which only one crocodile species (Crocodylus porosus), family Crocodylidae is not true marine but lives in coastal swamp/estuary/coastal rivers/mangrove forest in mainly in Sundarbans.

Beside crocodiles, the other major group of reptiles appeals internationally for protection is green marine turtles, long headed turtles Hawksbill turtles etc. Beside crocodiles and turtles, other major marine reptiles are sea snakes.

1.5.1 Marine Reptiles Diversity

The most famous marine reptiles in Bangladesh waters are salt water crocodiles (Crocodylus porosus), family Crocodylidae. Besides, crocodiles other famous marine reptiles are turtles, but unlike crocodiles, turtles illustrate little more diversity. There are two families of sea turtles in the sea areas of Bangladesh; family Cheloniidae contains 4 species under 4 genera. The other family, Dermochelidae contains a single genus and a species.
Out of these five species of marine turtles occur in the territorial waters of Bangladesh, only three species have been confirmed to nest in Bangladesh. Among them, olive ridleys (*Lepidochelys olivacea*) and green turtles (*Chelonia mydas*) are common, while hawksbills (*Eretmochelys imbricata*) are rare. However, there was an anecdotal nesting record of a loggerhead (*Caretta caretta*) also exists.

Olive ridleys nest on sandy beaches all along the mainland coast and islands stretching from the Sunderban mangrove forests in the southwest (Dimerchar of Sundarban West Sanctuary and Dublar char of the Sunderbans, Bagerhat), to Dolghata of Moheshkhali, Cox’s Bazar and Bordail area of Cox’s Bazar-Teknaf and St. Martin’s Island in the southeast.

A total of 19 nesting sites have been identified in Bangladesh. Those are Bordal, Cox’s Bazar-Teknaf Peninsula, Dubla Island (Dublar Char), Egg Island (Dimer Char), Hiron Point, Inani, Katka Beach, Kocchopia, Kutubdia Island, Mandarbaria, Moheshkhali Island, Monkhalli, Najirertek, Nijhum Dwip, Sandweep Island, Shahporir Dweep, Sonadalia Island, Teknaf and St. Martins Island.

Harvesting marine turtles is illegal under the proposed *Bangladesh Wildlife Preservation Act 2008*, and also under the *Environment Conservation Act 1995*. Use of Turtle exclusion devices (TEDs) is limited at present. Amendment of *Bangladesh Wildlife Preservation Act - 1974* is under consideration for inclusion of marine turtles in the list of protected animals. However the GoB has given a blanket protection to all wildlife including marine turtles. The *Environment Conservation Act 1995* has restricted any killing or capturing of the marine turtles. Marine turtles have been included in the list of protected animals in the revised *Bangladesh Wildlife Preservation Act 2008*. It is currently in a draft form, yet to be approved by the Parliament.

- There should be one or two important nesting sites (among the 19 nesting sites) declared as protected area so that any future alterations of the nesting sites could be ensured.

The nesting area may be included in the proposed MPAs. If not they should highlighted and prioritized for protection.

Besides, crocodiles and turtles other important marine reptile groups are sea snakes. There are eleven species of sea snakes in Bangladesh water of EEZ in BoB. All sea snakes in EEZ of Bangladesh belong to a single family, *Hydrophiidae*.

Eleven sea snakes are in 5 genera of which the genus, *Hyrophis* contains maximum numbers, 7 species. Rest of 5 genera contains a single species each.

**1.5.2 Marine Reptiles species under Threat of Extinction immediately or in long run**

All Sea reptiles other than the sea snakes in BoB EEZ of Bangladesh are endangered animals. The number of marine crocodiles has declined so low that once it was considered also extinct or about to be extinct. Fortunately, efforts by forest department to artificial breeding and restocking the
creature in Sundarbans creeks and river may remove the danger of their extinction. However, release of few dozens of crocodiles in an ecosystem of several thousand km² is not enough to increase the population. The hatchery produced baby crocodiles are somewhat domesticated and they are not so familiar with their predators especially during early stages.

All sea turtles in Bangladesh waters are also endangered species. The causes of decline sea turtles are various; accidental catch by fishers in sea and their accidental death due to long submerged inside the nets suffocate them to die as turtles like all other reptiles are air breathing creature. Besides accidentally caught by fishers, natural population growth has greatly hampered by turtles egg collections by coastal dwellers as these eggs are considered as delicacy among tribal people in Bangladesh. Besides human dogs other land based reptiles and rodents systematically steals turtle eggs after laying on sea beaches by mother turtles and burring the eggs in sand holes.

It may be reported that turtles does not guard the eggs in incubation and loss is great. There were initiatives by some development organizations including IUCN to protect marine turtles by collecting fertilized eggs from sand holes on the beaches and incubating them to hatch and nursed them a while and then releasing these to open sea.

Besides, crocodiles and turtles sea snakes are not harvested commercially or intentionally. So sea snakes in Bangladesh water are not considered as endangered animals like sea crocodiles and sea turtles. The use of sea snakes’ in any form is absent in Bangladesh and little works has been done on these marine creatures. It may be mentioned that all marine reptiles needs terrestrial habitat for reproduction and all of them bury fertilized eggs inside beach based sand dunes that makes their babies vulnerable to predators.

The use of sea snakes’ in any form is absent in Bangladesh and little works has been done to know their vulnerability.

### 1.6 Marine Birds

The term marine birds are little bit confusing as all these birds though prey on marine other creatures but most of the sea birds spend most of the time on terrestrial environments specially on rocky or planted islands. However, the members of some sea bird families like, Laridae are generally considered sea birds as they spend most of the time on sea and exclusively prey on sea animals mostly fish. Other sea or marine birds uses their resting places on islands or seas coast on either trees or rocky shores, cliffs, side of mountains adjacent to sea.

Many birds are seen to circle and prey on fishing boat discards and always fishing boats and fish trawlers are surrounded by sea birds. Seagulls from ancient times were considered as friends of sailors as in absence of modern navigational equipments, the presence of sea gulls used to indicate to sailors that they are either near the ports or near the land.

#### 1.6.1 Marine Birds Diversity
The sea bird family, Larkidae represents by medium to large seabirds with stout bill, webbed feet and generally rounded tails. Most of the species of the family is easy to identify by observing white belly, pale grey to black back and wings, some with dark hood during breeding season. The family Larkidae contains 20 species in Bangladesh though it is reported that worldwide total number of bird species in the family is over 120 species.

There are 6 genera of sea birds with 20 species and one genus contains highest 9 species. Major types of sea birds in Bangladesh EEZ are Jaeger (Stercorarius parasiticus), Pomarine Skua (Stercorarius pomarinus), Indian Skimmer (Rynchops albicollis), brown headed gull (Larus brunnicephalus), yellow legged gull (Larus cachinnans), Heuglin’s gull (Larus heuglini), great black headed gull, (Larus ichthyaetus), common black-headed gull (Larus ridibundus), gull-billed tern (Gelochelidon nilotica), black headed gull (Sterna acuticaudata), little tern (Sterna albatrons), river tern (Sterna hirundina), lesser crested tern (Sternabengalensis), swift tern (Sterna bergii), Caspian tern (Sterna caspia), common tern (Sterna hirundo), Sandwichtern (Sterna sandvicensis), black-naped tern (Sterna sumatrana), whiskered tern (Chlidonias hybridus), and white-winged tern (Chlidonias leucophaeus). Besides, Herons, egrets, diving ducks, fish-eagles, ibises, sandpipers, spoonbills, plovers and their allies, some of which are winter migrants to coastal marine habitats may also be included in the marine birds.

1.6.2 Marine Birds species under Threat of Extinction now or in long run

Work on birds in Bangladesh condition is very scarce, works on sea birds is almost nil. Therefore, status of sea bird’s on vulnerability is difficult to ascertain. Since, Bangladesh does not have any barren hilly island to become sanctuary for diverse kinds of birds; habitat destruction of sea birds due to dense demographic distribution in coastal areas may become prime causes of endangering sea birds. Detailed studies on sea birds their habitat, life style, reproductive cycle, migration is urgently needed.

1.7 Cetaceans (Marine Mammals)

Marine mammals are whales, dolphin and porpoises and among them largest creatures on earth. Except sperm whales, killer whales and dolphins most cetaceans are not carnivore and can’t be blamed for livelihood of fishers like smaller cetaceans, dolphins which are often blamed for eating and driven away fish shoals thus affecting livelihoods of fishers. Though Bangladesh has a river dolphin (Ganges dolphin) a rare creature, but Bay of Bengal is not a rich ground for whales or dolphins. Information available on the occurrence of marine mammals in Bangladesh waters is scarce and insufficient. However, preliminary information on availability of marine cetaceans is not sufficient for their identification, mode of lives, ecological importance and effects on other marine lives.

The term marine mammals essentially include all mammals those thrive in sea water /sea and its adjacent habitats and on its contents for their whole lives. Here it may be mentioned that except cetaceans not all marine mammals spend their lives in water. Cetaceans can’t survive out of water though all marine mammals are air breathing. However, sea lion, seal, beavers spent considerable period of time on sea shore and only goes to sea when they need to prey for foods. The young
marine mammals other than cetaceans spend whole of their childhood on shore and depends on their parents for milk and initial external foods. The rich mammal grounds are usually in colder regions of the seas and ocean.

The world’s second largest documented population of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) lives at the northern tip of the Swatch-of-No-Ground (SoNG) in Bangladesh. The Eastern Sundarbans Reserved Forest is the only location in the world where Asia’s two last remaining species of freshwater dolphins, the Ganges River dolphin (*Platanista gangetica gangetica*) or Shushuk and Irrawaddy dolphin (*Orcaella brevirostris*), are known to co-occur. The Sundarbans and adjacent estuarine waters provide habitat for the world’s largest population of Irrawaddy dolphins, estimated at about 6,000 individuals, with about 450 occurring in the mangrove forest. A population of about 190 Indo-Pacific humpbacked dolphins (*Sousa chinensis*) individually identified through photo-ID, occupying coastal waters off Sundarban might be a new third form or subspecies. A population of about 1,400 Finless porpoises (*Neophocaena phocaenoides*) occupies the coastal waters of Bangladesh with a small subpopulation migrating into sundarban forest in the winter. A possible year round population of Bryde’s whale (*Balaenoptera edeni*) are present at the northern head of the SoNG (Fahmi & Mansur 2012*th*).

The Pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*S. longirostris*), rough toothed dolphin (*Steno bredonensis*), and the false killer whale (*Pseudorca crassidens*) also reside at the SoNG (Fahmi and Mansur 2012*th*).

- Cetacean diversity in Bangladesh should be conserved right now, while the current population sizes of a number of species at global risk are known to be sufficient for long-term survival if threats can be reduced.
- Protected area network should be used as a mechanism for coping with and better understanding the ecological impacts of declining freshwater supplies and global climate change.
- The Bangladesh Cetacean Diversity Project (BCDP) team suggested the Government of Bangladesh to declare, three new Wildlife Sanctuaries to conserve freshwater dolphins in the eastern Sundarbans mangrove forest. In January 2012, BCDP’s work led to the declaration of those channel segments as Wildlife Sanctuaries under the current Bangladesh Wildlife (Preservation) (Amendment) Act of 1974 (Fahmi and Mansur 2012*th*).
- The exact description of the location and area coverage should be collected from the Forest Department and mentioned in the proposed MPA doc.

### 1.7.1 Marine Mammals diversity

In Bangladesh water there reported 11 species of marine mammals, 8 of them belongs to the order *Cetacea*. As mentioned earlier all cetaceans are aquatic in their whole lives. Only the otters (order–*Carnivora*, family–*Mustelidae*) share both aquatic and terrestrial lives.
The marine mammals those which were reported from Bangladesh waters include Bryde’s whale (*Balaenoptera brydei*) and the Fin Whale (*Balaenoptera physalus*) belongs to the family- *Balaenopteridae*, and sperm whale (*Physester macrocephalus*) of family- *Physesteridae*. The occasional presence of these massive creatures in Bangladesh water do not necessarily means the Bay is their feeding, breeding grounds or migratory routes, the occasional presence may be due to stray movement of the whales as fishermen did not confirm the regular/routine/seasonal presence of these whales in Bangladesh waters.

Other marine mammals reported from this part of the aquatic world include Irrawaddy Dolphin (*Orcaella brevirostris*), the indo-pacific hump-backed dolphin (*Sousa chinensis*), the Pantropical spotted dolphin (*Stenella attenuata*), the spinner dolphin (*Stenella longirostris*), and the common bottlenose dolphin (*Tursiops truncatus*) under the family *Delphinidae*.

Besides, Indian Ocean finless porpoise (*Neophocaena phocaenoides*) family-*Phocoenidae*, the short clawed otter (*Aonyx cinerea*) and the smooth coated otters (*Lutra perspicillata*) of the family *Mustelidae* are reported marine mammals, seen or their dead bodies washed ashore on Bangladesh coast.

1.7.2 Marine mammals’ species under Threat of Extinction now or in long run

We have little information on marine mammals on Bangladesh waters. The presence of big whales in Bay of Bengal is not routine so it is difficult to say whether these are fauna of these parts of the seas or not. This is difficult to say the population of these massive creatures and their habitat, life cycles in Bangladesh waters to determine threat to these species or whether these are endangered or not. However, large cetaceans are threatened worldwide due to poaching by Japanese and Eskimos.

1.8 Marine Algae and Sea weeds

Though all southern parts of the country is exposed to sea but shoreline is devoid of stony formation or coral reef based hardy substratum except a few locations to provide substratum for extensive growth of algae and sea weeds. However, some areas in mangrove forest of Sundarbans where submerge tree roots and trees and in St. Martin islands few coral beds provide substratum for benthic algae and sea weed beds. Commercial prospect of exploitation of sea weeds is Bangladesh is limited as renewable resources. However, to protect the available marine algae and sea weeds is important as a few habitats of smaller sizes houses many species.

1.8.1 Algae and Sea weeds Diversity

There are reportedly 165 species of marine alage and sea weeds in EEZ of Bangladesh. 165 species belongs to 77 genera of Chlorophyta, Chrysophyta, Phaeophyta, Rhodophyta and Cyanophyta. Altogether there are 77 genera in above mentioned 5 groups.

1.8.2 Algae and weeds species under Threat of Extinction now or in long run
As mentioned earlier, suitable substratum for benthic algae and sea weed growth is limited and over exploitation and habitat degradation is threatening the existing algal and seed weed beds in coastal areas in the country. Besides increased turbidity in coastal water due to top soil washouts by rivers prevents transparency of coastal waters that is vital for sunlight penetration to shallow bottom for the growth of benthic algae and sea weeds.

1.9 Non-renewable Marine Resources

All over the world, continental shelf and shallow sea bottom is extensively explored for the exploitation of mineral resources either from the bottom mud/sands and submerged mountains or sea bottom underground. Exploration for mineral resources mainly for oil & gas in EEZ is going on for some time now in a limited scale and it is expected that more and extensive exploration will be undertaken in near future.

1.9.1 From Sea bottom

Prospect of mineral extraction from sea bottom under Bangladesh EEZ has not been properly explored yet. In future, it is very likely to take place. This is important to take into consideration, so that proposed MPA in EEZ is not hampered or other way, important MPA sites should not be disturbed for sea bottom mineral exploration.

1.9.2 Beneath Sea Bottom

Exploration for hydrocarbon, especially for natural gas and oil beneath the sea bottom is already underway in some blocks of EEZ and some others are under negotiations or already contracted with multinationals. MPA designation and exploration in identical sites may create conflict and while MPA sites are considered mineral exploration should be taken into considerations. When extensive drilling for exploration of natural gas or other hydrocarbons are done in future, precautionary measure should be taken to minimize the disturbance in habitat, ecosystem, sea pollution. Also whenever, a sea block is leased for mineral resource exploration, there should be a clause to quantify how much alteration in the ecosystem may occur to quantify and environment groups should be allowed to monitor the site/s of exploration.

Annex 2: Existing Coastal and Sea Based PA, ESA or Fishing Ban

As elsewhere in the country, most of the coastal protected areas in Bangladesh are also declared and mandated by forest department. Meanwhile, department of fisheries has also declared one marine sanctuary and some estuarine/river mouth based protected areas in the coast. The lists of PAs with sizes, location and are listed in table below.

Table 3: List of Protected Area

<table>
<thead>
<tr>
<th>Name of PA</th>
<th>Location</th>
<th>Area (km²)/stretch</th>
<th>Agency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nijhum Dweep</td>
<td>Noakhali</td>
<td>16.35 km²</td>
<td>FD</td>
<td>National park</td>
</tr>
<tr>
<td>Location</td>
<td>Area</td>
<td>Category</td>
<td>Status</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------</td>
<td>--------------</td>
<td>-----------------------------</td>
<td></td>
</tr>
<tr>
<td>Sunderbans (East)</td>
<td>Bagerhat</td>
<td>31.23 km²</td>
<td>FD</td>
<td>Wildlife sanctuary</td>
</tr>
<tr>
<td>Sunderbans (South)</td>
<td>Khuna</td>
<td>36.97 km²</td>
<td>FD</td>
<td>Wildlife sanctuary</td>
</tr>
<tr>
<td>Sunderbans (West)</td>
<td>Satkhira</td>
<td>71.50 km²</td>
<td>FD</td>
<td>Wildlife sanctuary</td>
</tr>
<tr>
<td>Char Kuksi-mukhi</td>
<td>Bhola</td>
<td>0.40 km²</td>
<td>FD</td>
<td>Wildlife sanctuary</td>
</tr>
<tr>
<td>Meghna river</td>
<td>Chandpur &amp; Lakshmipur</td>
<td>100 km stretch</td>
<td>DoF</td>
<td>Hilsa catch ban*</td>
</tr>
<tr>
<td>Meghna Estuary</td>
<td>Bhola</td>
<td>90 km stretch</td>
<td>DoF</td>
<td>Hilsa catch ban*</td>
</tr>
<tr>
<td>Tantullia river</td>
<td>Bhola &amp; Patuakhali</td>
<td>100 km stretch</td>
<td>DoF</td>
<td>Hilsa catch ban*</td>
</tr>
<tr>
<td>Andharmanki river</td>
<td>Patuakhali</td>
<td>40 km stretch</td>
<td>DoF</td>
<td>Hilsa catch ban**</td>
</tr>
<tr>
<td>Lower part of Padma river</td>
<td>Shariatpur</td>
<td>40 km stretch</td>
<td>DoF</td>
<td>Hilsa catch ban*</td>
</tr>
<tr>
<td>Cox’s Bazaar offshore</td>
<td>West of Cox’s Bazaar</td>
<td>100 km²</td>
<td>DoF</td>
<td>Black tiger breeding ground</td>
</tr>
</tbody>
</table>

* March to April, ** November to January

All permanent PA declared under the forest department of Bangladesh are protected throughout the year, some facultative/temporary area based ban on fishing is seasonal in nature especially during breeding season is effective for few months or days mostly for fish except peripheral water of a tiny small island. However, fish harvest is banned in a black tiger shrimp breeding ground throughout the year, except fishing for black tiger shrimp broods and gravid mother by bottom trawling.

**Ecologically Sensitive Areas (ESAs):** Based on the significance and ecological sensitivity, Ministry of Environment & Forest (MoEF) has declared a number of areas as Ecologically Sensitive Areas (ESAs) and Ecologically Critical Areas (ECAs) and Environmentally Protected Areas (EPAs), but there is not much information or study on the ESAs, ECAs and MPAs (Islam 2004). Here is brief of the ESAs:

- Mangroves
- Coral Reefs
- Sandy Beaches and Sand Dunes
- Mudflats
- Marine Wildlife Protected Areas
- Coastal freshwater bodies
- Salt Marshes
- Turtle Nesting Grounds
- Horseshoe crab Habitats
- Sea grass Bed
- Seaweed bed
- Birds Nesting Ground

**Ecologically Critical Areas (ECA’s):** In 1999, Department of Environment (DoE), Government of Bangladesh declared some area as Ecologically Critical Areas (ECA’s) in marine and freshwater ecosystem. They are: i. Sundarbans, ii. Cox’s Bazar-Teknaf sea beach, iii. St. Martin’s Island, iv. Sonadia Island, v. Hakaluki Haor, vi. Tanguar Haor, vii. Marjat Baor, viii. Gulshan Lake and ix. Buriganga, Shitalakhya, Turag and Balu Rivers. Later on, Sundarbans was withdrawn from the list and instead outside of Sundarbans Reserve Forest an area of 10 km extent was declared as ECA. In addition, MoEF declared some area as Environmentally Protected Areas (EPA’s) with a view to
save the natural habitat and to save the biotic flora and fauna of the area. The World Heritage Convention (WHC) declared "Sundarbans as natural and cultural sites of outstanding universal value" (Ramsar site no. 560). Considering the high biodiversity value of Bangladesh coast, some parts of the zone has been declared as protected areas. The Forest Department already declared 03 Wildlife Sanctuaries in the Sundarbans Reserve Forest (Table 3). There is prohibition of all kind of extraction, and fishing activities in the Wildlife Sanctuaries (Marufa 2012).