

## Assessment of the Fish and Plankton Biodiversity in the Bay of Bengal, Cox's Bazar, Bangladesh

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**Abstract:** The Bay of Bengal is considered a rich diversified fisheries resource with a significant role in the aquatic ecosystem, fisheries biodiversity and economic condition. The present study was conducted to assess the present status of fisheries resources especially fish abundance, plankton abundance, diversity index and water quality parameters at the Bay of Bengal, the Cox's Bazar, Bangladesh. Water quality parameters and plankton communities were measured by using appropriate types of equipment and plankton nets. The temperature, pH, salinity and DO of water were recorded in the range of  $22\pm 0.32$  to  $32\pm 0.29^\circ\text{C}$ ,  $6.2\pm 0.13$  to  $7.7\pm 0.17$ , 21 to 35‰ and 2.01 to 6.44ml/l, respectively in the Bay of Bengal. A total of only 74 fish species belonging to 13 orders and 36 families were documented in the sampling area of the Bay of Bengal during the study period. The total number of identified genera of phytoplankton and zooplankton was 45 and 25, respectively in the Bay of Bengal. This study showed that the fish and plankton diversity indices in the Bay of Bengal were a good and productive region for fish species and the plankton community.

**Key words:** Bay of Bengal • Diversity Index • Fisheries Resources • Plankton • Richness

### INTRODUCTION

The Bay of Bengal of Bangladesh is one of the world's richest ecosystems characterized by higher productivity and unique mangrove influences [1]. Among the 66 large marine ecosystems of the world, the large marine ecosystem of the Bay of Bengal is the largest [2]. It is in the northeastern part of the Indian Ocean surrounded by India in the west and northwest, Bangladesh in the north, Myanmar and the Andaman and Nicobar Islands in the east. There are many countries dependent on the Bay of Bengal in South Asia and Southeast Asia. The Bay of Bengal, which is 2090 km long and 1600 km wide with an average depth of more than 2600 m, occupying an area of about 2, 172, 000 km<sup>2</sup> and the Nicobar Islands separate it from the Andaman Sea, its eastern arm [1]. Bangladesh has a coastline of 480 km along the North and Northeast part of the Bay of Bengal. It has an internal estuarine water area of 7325 sq. nautical miles up to 10 fathoms of baseline depth, an EEZ of 41, 040 sq. nautical miles and the continental shelf of 2480 sq.

nautical miles; the total marine water area is about 48, 365 sq. nautical miles which is almost as big as the country itself [3]. The countries 710 km coastline has created a large community of people dependent on coastal and marine resources for their food and livelihood. People of Bangladesh are very much dependent on fish catches from the Bay of Bengal to meet their dietary protein needs. The coastal and marine fishery and its related industries are a very big employment sector of the country providing a livelihood for millions of people. The Bay of Bengal is rich in biodiversity of fishes, crabs, shrimps, birds, marine turtles and other aquatic flora and fauna. The Bay of Bengal Large Marine ecosystem provides the habitats, supplies nutrients and acts as the breeding ground for all these species. In the Bay of Bengal, 36 species of marine shrimps are available among them *Penaeide* shrimps are the most important in economic value. About 151 genera of mollusks have been identified by the researchers which include at least 336 species. Also, 3 lobsters and 31 species of turtles and tortoises of which 24 live in freshwater are found in

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Bangladesh. Bangladesh is blessed with 168 seaweeds, 3 sponges, 15 crabs, 10 frogs, 3 crocodiles, 24 snakes, 3 otters, 1 porcupine and 9 dolphins species in the water of the Bay of Bengal [4]. Numerous invertebrates in the country are yet to be identified. There may be some fauna species that are yet to be found on the coast. The IUCN Bangladesh Red Data Book [5] has enlisted 442 marine fishes, 22 amphibians, 17 marine reptiles, 388 resident birds, 240 migratory birds and 3 species of marine mammals in Bangladesh and among the marine and migratory species of animals, 4 fishes, 5 reptiles, 6 birds and 3 mammals are threatened. Planktons are primary producers that play key roles in aquatic food webs such as mediating the transfer of energy among the trophic levels in food chains [6]. Al, *et al.* [7] found that a total of 42 phytoplankton species was identified, including 13 common and 13 dominant species belonging to eight divisions. This natural resource can be dangerously affected by climate change. Evidence is accumulating on the long-term changes in seawater temperature, acidity, deoxygenating, cyclones and sea level in the Bay of Bengal large marine ecosystem. These changes have an impact on ocean productivity, habitats and biological processes. Fisheries, particularly traditional fisheries, will be the most vulnerable to climate change [8]. In Bangladesh, the enhancement in the flow of tourists to the coastal region, especially Cox's Bazar sea beach over the past five years. Accordingly, the Bay of Bengal is getting polluted by releasing pollutants into the water. If this continues to grow undeterred, the tourism industry will become one of the biggest contributors of pollutants to the Bay of Bengal and hence want to the biggest threat to future health. These changes directly affect aquatic primary productivity and ecology of aquatic organisms. Therefore, it is urgent to assess the present status of fish and plankton biodiversity and productivity of the Bay of Bengal for proper utilization and future development. So, the primary objective of this study is to understand the current condition of fish and plankton biodiversity in the Bay of Bengal.

## MATERIALS AND METHODS

**Study Area:** The 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. The study was carried out in Cox's Bazar, southeastern Bangladesh and it is situated along the Bay of Bengal about 60 miles (100 km) south of the Chittagong area from July 2017 to November 2018 (Fig. 1).

**Physicochemical Conditions of Water:** During the study period, physicochemical conditions of water were recorded regularly. Water temperature was recorded with a digital thermometer once per month from different places of the Bay of Bengal in Cox's Bazar, Bangladesh. Dissolved oxygen (DO) concentration was determined using a DO meter (Model: DO-5509, China) once per month from different places. pH was recorded using a portable digital meter (HI 98107, Romania) once per month. The water salinity was determined using a digital refractometer (ATAGO, S/Mill, salinity. 0-100 ‰, Japan).

**Collection and Identification of Plankton:** Plankton samples were collected from the Bay of Bengal in Cox's Bazar area. Phytoplankton and zooplankton samples were collected by using simple conical tow-net oblique, mesh size of which is 40 µm. The samples were preserved in 4% formalin in a plastic container for both qualitative and quantitative analysis. Phytoplankton cells were enumerated under a light microscope by using Sedwick-Rafter cells. A series of pencil and ink drawing on postcards of the species were prepared to identify the organisms. Identification was done by observation under a microscope and following the book: Division of Chlorophyceae-Chlorophyta [9].

**Counting of Plankton:** For phytoplankton counting, the Sedgwick-Rafter (S-R) cell was used which is 50 mm long, 20 mm wide and 1 mm deep. The number of phytoplankton in the S-R cell was derived from the following formula:

$$No. / ml = \frac{C \times 1000}{L \times D \times W \times S}$$

where,

C = Number of Organisms (phytoplankton and zooplankton) Counted.

L = Length of each strip (S-R cell length) in mm.

D = Depth of a strip (Whipple grid image width) in mm.

S = Number of strips counted

W = Width of the strip (Whipple grid image width) in mm.

Number of cells per mm was multiplied by a correction factor to adjust the number of organisms per liter.

**Data Collection of Fisheries Resources:** Data of fisheries resources of the Bay of Bengal in Cox's Bazar were collected by monthly routine investigations. The investigations were made by monitoring these local fish markets, fishery ghat and fisherman boats where fishes were captured and grounded after being caught.



Fig. 1: Map showing the study area of the Bay of Bengal, Cox's Bazar

**Identification of Fisheries Resources:** Fish and other samples were brought to the laboratory for double confirmation to identify the fish species. The collected data were identified based on the morphometric and meristic appearances according to the Talwar and Jhingran [10] and the books *i.e.* Freshwater fishes of Bangladesh [11], Encyclopedia of flora and fauna of Bangladesh [12] and the fish resources of the Bay of Bengal [13].

**Calculation of Diversity Indices:** In the present study Shannon-Wiener diversity (H), was calculated to obtain an estimation of species diversity using the following formulae:

Shannon-Wiener diversity index (H):

$$H' = -\sum_i^s (ni / N) \times \ln(ni / N)$$

Here, H' is the diversity index, ni is the density of i<sup>th</sup> species and N is the total density of species found at one sampling date, ln is the natural logarithm and Σ is the sum of the calculations.

## RESULT AND DISCUSSION

**Physicochemical Conditions of Water:** In this study, physicochemical conditions of water were analyzed and the average values of temperature, pH, salinity and DO were shown in Table 1. The temperature, pH, DO and salinity of water were recorded in the range of 22±0.32

Table 1: Physicochemical conditions of water during study period in the Bay of Bengal, Cox's Bazar, Bangladesh

Water quality parameter	Range
Temperature	22±0.32 –32±0.29°C
pH	6.2±0.13 –7.7±0.17
Salinity	21–35‰
DO	2.01 –6.44 ml/l

to 32±0.29°C, 6.2±0.13 to 7.7±0.17, 21 to 35‰ and 2.01 to 6.44ml/l, respectively at the Bay of Bengal in the Cox's Bazar region. Bangladesh is situated in one of the world's largest delta and is interlaced with an intricate system of rivers and many tidal channels, which carry downstream a large quantity of sediment. The temperature distribution was found relatively uniform in subsurface water [14]. Physicochemical factors of coastal waters, mainly the temperature, pH, salinity and dissolved oxygen content are variable conditions due to the tides and also freshwater discharge by the network of rivers [15, 16]. The optimum temperature range (22-31°C) for the survival and best growth of primary production influences the diversity of zooplankton, fish and other aquatic organisms in the wetland ecosystem [17]. Chowdhury and Zafar [18] reported the water temperature ranges between 23-32°C during the spring period in parts of the Bay of Bengal, Bangladesh. This result is closely agreed with the present findings. But still, there is scant information about the subsurface water temperature off the Bangladesh coast in the Bay of Bengal. pH value plays a crucial role in any aquatic ecosystem and the suggested pH level of the water body is around 6.5 to 7.4 as it controls the growth

Table 2: List of fish species available in the Bay of Bengal during the study period

Order	Family	Species	Local name	Common name	IUCN status in		No. of Species	Diversity index (H')	
					Present status	Bangladesh			
Carcharhiniformes	Carcharhinidae	<i>Scoliodon laticaudus</i>	Thutte hangor/ hangar	Spadnose shark/Dog fish	CA	NT	4	3.2	
		<i>Carcharhinus melanopterus</i>	Hangor	Shark, Dog shark	CA	NT		3.4	
		<i>Rhizoprionodon acutus</i>	Hangor	Milk shark	MA	LC		2.2	
Rajiformes	Sphyrnidae	<i>Sphyrna blochii</i>	Haturi hangor	Hammer headed shark	MA	EN		2.8	
	Rhinobatidae	<i>Rhinobatos granulatus</i>	Pitambori	Skate	RA	CR	1	1.3	
Anguilliformes	Congridae	<i>Conger cinereus</i>	Kamila	Indian conger eel	RA	LC	2	1.4	
		<i>Ariosoma anago</i>	Kamila	Silvery Conger	RA	DD		1.2	
Clupeiformes	Clupeidae	<i>Tenulosa ilisha</i>	Ilish	Hilsa shad	CA	LC	8	4.2	
		<i>Ilisha filigera</i>	Choukka	Big eye ilisha	CA	DD		3.9	
		<i>Sardinella frimbriata</i>	Kolombo	Sardine	MA	LC		3.6	
		<i>Sardinella melanura</i>	Chapila/Takhia	Sardine	CA	LC		3.8	
	Chirocentridae	<i>Chirocentrus dorab</i>	Karati chela	Wolf-herring	MA	LC		2.9	
	Engraulidae	<i>Setipinna taty</i>	Teilla phasa	Hairfin anchovy	CA	LC		3.4	
		<i>Thryssa mystax</i>	Phasa	Moustached thryssa	CA	LC		3.2	
			<i>Coilia dussumieri</i>	Pointed tail	Anchovy olua	MA	LC		2.8
	Myctophiformes	Harpadontidae	<i>Harpadon nehereus</i>	Loitya machh	Bombay duck	CA	NT	1	3.7
		Ariidae	<i>Arius spp.</i>	Kata machh	Cat fish	MA	LC	1	3.3
Siluriformes	Synodontidae	<i>Saurida tumbil</i>	Tiktiki machh	Lizard fish	MA	LC	1	3.1	
Aulopiformes	Platycephalidae	<i>Platycephalus indicus</i>	Murbaila	Flat-head fish	MA	DD	1	2.9	
Scorpaeniformes	Carangidae	<i>Parastromateus niger</i>	Hail chanda	Black pomfret	CA	LC	41	3.4	
Perciformes	Scomberoides commersonianus	<i>Chapa kori</i>	Chapa kori	Talang queenfish	CA	DD		3.6	
		<i>Selar boops</i>	Moori	Oxeye scad	MA	LC		2.1	
		<i>Megalaspis cordyla</i>	Kauwa	Hardtail scad	MA	LC		2.1	
		<i>Carangoides malabaricus</i>	Malabar moori	Malabar cavalla	MA	LC		2.4	
	Drepanidae	<i>Drepane longimana.</i>	Pann machh	Sickle fish	MA	DD		2.3	
	Ephippidae	<i>Ephippusorbis</i>	Spade fish	Hatirkaan	MA	DD		2.1	
	Gerreidae	<i>Gerres filamentosus</i>	Dom machh	Silver biddies	MA	LC		2.3	
		<i>Pentaprion longimanus</i>	Jagiri	Silver biddies	CA	LC		3.4	
	Leiognathidae	<i>Leiognathus brevisrostris</i>	Taka chanda	Pony fish	RA	DD		1.2	
	Lobotidae	<i>Lobotes surinamensis</i>	Samudra koi	Triple tail	RA	DD		1.3	
Lutjanidae	<i>Lutjanus johnii</i>	Ranga choukka	Red snapper	CA	LC		3.1		
	<i>Lutjanus sanguineus</i>	Ranga choukka	Blood snapper	CA	LC		3.3		
	<i>Lutjanus malabaricus</i>	Ranga choukka	Malabar redsnapper	CA	LC		3.2		
Menidae	<i>Mene maculata</i>	Tek chanda	Moon fish	MA	DD		2.9		
Mullidae	<i>Upeneus sulphureus</i>	Sonali Bata	Goat fish	CA	LC		3.4		
	<i>Liza subviridis</i>	Bata	Mullet	MA	DD		2.4		
	<i>Mugil cephalus</i>	Khorul bata	Grey mullet	MA	LC		2.5		
Nemipteridae	<i>Nemipterus bipunctatus</i>	Lalmach	Threadfin breams	MA	LC		2.3		
	<i>Nemipterus japonicus</i>	Rupban	Threadfin bream	CA	LC		3.1		
Priacanthidae	<i>Priacanthus tayenus</i>	Parimachh	Purple-spotted big eye	CA	LC		3.6		
Polynemidae	<i>Polynemus indicus</i>	Lakhua	Indian salmon	CA	LC		3.4		
	<i>Polynemus paradiseus</i>	Tapsi	Paradise threadfin	MA	LC		2.7		
	<i>Eleutheronema tetradactylum</i>	Thailla	Fourfinger threadfin	RA	DD		1.3		
Pomadasyidae	<i>Pomadasy hasta</i>	Sada datina	White grunter	CA	LC		3.6		
	<i>Pomadasy argenteus</i>	Datina	Silver grunter	CA	LC		3.5		
	<i>Pomadasy maculatus</i>	Guti datina	Blotched grunter	MA	DD		3.7		
	Siaenidae	<i>Johnius spp.</i>	Lalpoa, Rupali poa	Croaker	MA	DD		3.1	
	<i>Otolithoide sargenteus</i>	Bara poa, Lambu	Bronze Croaker	MA	DD		2.7		
	<i>Pterolithus maculates</i>	Gutipoa	Spotted Croaker	CA	LC		3.6		
	<i>Otolithes ruber</i>	Poa	Tiger toothedcroaker	MA	DD		2.1		
	<i>Argyrosomus amoyensis</i>	Poa	Amoy Croaker	MA	DD		2.4		
	<i>Dendrophysa russelii</i>	Dharipoa	Goatee croaker	MA	DD		2.2		
	<i>Panna microdon</i>	Chottalambu	Panna croaker	RA	DD		1.5		
	<i>Penna hiaanea</i>	Sadapoa	Greyfin jewfish	RA	DD		1.4		
	<i>Protonibea diacanthus</i>	Kala poa	Black spotted croaker	RA	DD		1.2		
	Theraponidae	<i>Terapon jarbua</i>	Barguni	Therapon perch	MA	LC		2.4	
	Sillaginidae	<i>Sillago domina</i>	Hundra baila	Lady fish	MA	DD		2.8	
	Sphyaenaidae	<i>Sphyaena forsteri</i>	Dharkuta	Barracuda	MA	DD		2.7	
	Trichiuridae	<i>Lepturacanthus savala</i>	Churi machh	Ribbon fish/Hair tail	CA	DD		3.3	
		<i>Trichiurus lepturus</i>	Churi machh	Large-headed Ribbon fish	CA	LC		3.6	
Pleuronectiformes	Psettodidae	<i>Psetodes erumei</i>	Samudra serboti	Indian halibut	MA	DD	2	2.4	
	Cynoglossidae	<i>Cynoglossus puncticeps</i>	Kukurjeeb	Tongue sole	RA	NE		1.4	
Scombriformes	Scombridae	<i>Scomberomorus guttatus</i>	Maitya/Surma	King Mackerel	MA	DD	9	2.7	
		<i>Scomberomorus commerson</i>	Maitya/Surma	Spanish mackerel	MA	DD		2.4	
		<i>Euthynnus affinis</i>	Bom maitta	Mackerel tuna	CA	LC		3.4	
		<i>Katsuwonus pelamis</i>	Bom maitta	Striped tuna	CA	LC		3.7	
		<i>Thunnus obesus</i>	Bom mitya	Big-eye tuna	MA	VU		2.4	
		<i>Auxis rochei</i>	Bom mitya	Bullet tuna	CA	LC		3.2	
		<i>Rastrelliger kanagurta</i>	Champa/Ailla	Indian Mackerel	CA	DD		3.4	
		<i>Pampus argenteus</i>	Foli chanda	Silver Pomfret	CA	DD		3.6	
		<i>Pampus chinensis</i>	Rup chanda	Chinese Pomfret	CA	DD		3.3	
	Myliobatiformes	Dasyatidae	<i>Himantura uarnak</i>	Sapla pata	Stingray	RA	VU	2	1.2
Dasyatidae		<i>Dasyatis spp. (5-6 species)</i>	Haush pata	Stingray	RA	DD		1.1	
Rhinopristiformes	Rhinidae	<i>Rhynchobatus djiddensis</i>	Skate	Pitambori	RA	CR	1	1.3	
Average								2.72±.083	

NT= Near Threatened, VU= Vulnerable, EN= Endangered, LC= Least Concern, CR= Critically Endangered, DD= Data Deficient, CA= Commonly available species, MA= Moderately available species, RA= Rarely available species

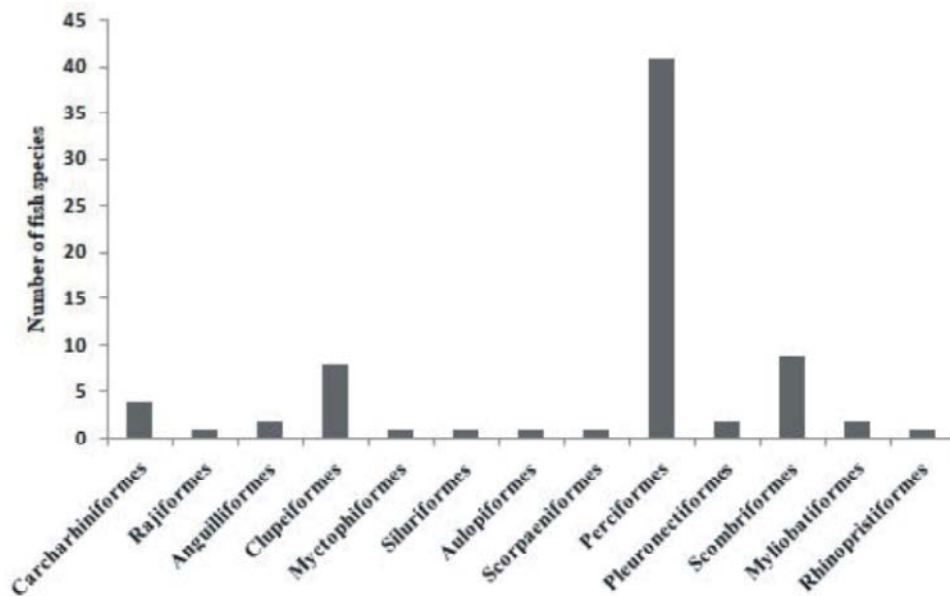


Fig. 2: Species richness of different fish orders in the Bay of Bengal during the study period

of the aquatic organisms. Chowdhury and Zafar [18] recorded the range of pH value 6.0-7.8 during the spring period in parts of the Bay of Bengal. Salinity acts as a limiting factor that hugely influences the plankton community and some fish breeding period. Kumar, *et al.* [19] found a strong gradient of vertical salinity distribution in the upper 30m, ~1.5psu in the south and ~7psu in the north of 17°N, with considerable freshening towards the north between 30 and 100 meters the salinity changes with depth were gradual and below 100 meters were homogenous. Chowdhury and Zafar [18] recorded the range of salinity values 3.9-6.7‰ during the spring period in parts of the Bay of Bengal. Dissolved oxygen (DO) is an important physicochemical factor of the water body, which selects the natural strength of the water body and supports aquatic living organisms for better growth and survival [20]. Chowdhury and Zafar [18] recorded the range of DO value 1.94-6.32ml/l during the spring period in parts of the Bay of Bengal. The present findings show that the physicochemical condition of water in the Bay of Bengal of Cox’s Bazar is a productive region for both the fish and plankton communities.

**Fisheries Resources:** A total of 74 fish species belonging to 13 orders and 36 families were documented in the Bay of Bengal during the study period. A list of existing fish species with their taxonomic position (order and family name), scientific name, local name and IUCN status are presented in Table 2. Perciformes was the most dominant family contributing 41 species followed by

Carcharhiniformes (4), Rajiformes (1), Anguilliformes (2), Clupeiformes (8), Myctophiformes (1), Siluriformes (1), Aulopiformes (1), Scorpaeniformes (1), Pleuronectiformes (2), Scombriformes (9), Myliobatiformes (2) and Rhinopristiformes (1) ( Fig. 2). Quader [4] found 76 species in the coastal zone near Cox's Bazar region which was very close to the present study. Rahman, *et al.* [21] a total of 82 species of fish under 9 orders and 24 families were recorded in the Padma river and also found that Cypriniformes was the most dominant order of the total fish population. Rahaman, *et al.* [22] recorded 61 species under 13 orders and 29 families in the Meghna river. The present study reveals that the Bay of Bengal was found to be the richest habitat for fish species.

**Plankton Community:** The total number of identified genera of phytoplankton was 45 and the total number of zooplankton genera was 25 in the Bay of Bengal. Phytoplankton was included in the 11 groups of Bacillariophyceae, Chlorophyceae, Chrysophyceae, Coccolithophyceae, Coscinodiscophyceae, Cyanophyceae, Dinophyceae, Mediophyceae, Rhizosoleniaceae, Xanthophyceae and Zygnematophyceae (Table 3) while zooplankton included to Branchiopoda, Crustacea, Hydrozoa, Monogononta, Maxillopoda, Gastropoda and Polychaeta (Table 3). The highest numbers of phytoplankton were recorded from groups Bacillariophyceae, whereas the number of zooplankton groups, Maxillopoda, respectively in the Bay of Bengal (Table 3). According to Al, *et al.* [7] a total

Table 3: List of plankton genera found from the Bay of Bengal during study period

Plankton	Group	Pre-monsoon		Monsoon		Post-monsoon	
		Genera/species	Diversity Index (H')	Genera/species	Diversity Index (H')	Genera/species	Diversity Index (H')
Phytoplankton	Bacillariophyceae	<i>Bacillaria paxillifera</i>	2.6	<i>Actinocyclus</i> spp.	1.5	<i>Bacillaria paxillifera</i>	3.7
		<i>Corethron criophilum</i>		<i>Asteromphalus</i> spp.		<i>Biddulphia sinensis</i>	
		<i>Eunotia</i> sp.		<i>Bacillaria paxillifera</i>		<i>Cocconeis placentula</i>	
		<i>Nitzschia</i> spp.		<i>Bacteriastrium comosum</i>		<i>Eunotia</i> sp.	
		<i>Licmophora</i> sp.		<i>Biddulphia sinensis</i>		<i>Gyrosigma eximium</i>	
		<i>Pseudonitzschia australis</i>		<i>Coscinodiscus granii</i>		<i>Nitzschia</i> spp.	
		<i>Dactyliosolen</i> spp.		<i>Coscinodiscus marginatus</i>		<i>Licmophora</i> sp.	
		<i>Coscinodiscus jonesianus</i>				<i>Pseudonitzschia australis</i>	
		<i>Ethmodiscus</i> spp.				<i>Cyclotella comta</i>	
		<i>Navicula</i> spp.				<i>Dactyliosolen</i> spp.	
						<i>Ethmodiscus</i> spp.	
						<i>Hemiaulus</i> spp.	
				<i>Navicula</i> spp.			
				<i>Nitzschia</i> spp.			
				<i>Pseudosolenia</i> sp.			
				<i>Rhizosolenia</i> spp.			
				<i>Thalassionema</i> spp.			
	Chlorophyceae	<i>Echinospaerella limnetica</i>	2.4	<i>Echinospaerella limnetica</i>	1.4	<i>Echinospaerella limnetica</i>	3.6
	Chrysophyceae	<i>Chromulina glacialis</i>	2.3	<i>Chromulina glacialis</i>	1.2	<i>Chromulina glacialis</i>	3.4
	Coccolithophyceae	<i>Phaeocystis sgllobosa</i>	2.6	<i>Phaeocystis sgllobosa</i>	1.4	<i>Phaeocystis sgllobosa</i>	3.3
	Coscinodiscophyceae	<i>Melosira</i> sp.	2.2	<i>Melosira</i> sp.	1.6	<i>Melosira</i> sp.	3.7
	Cyanophyceae	<i>Calothrix crustacean</i>	2.8	<i>Calothrix crustacean</i>	1.6	<i>Thalassiosira</i> sp.	
		<i>Chroococcus occidentalis</i>		<i>Gloeotrichia pisum</i>		<i>Calothrix crustacean</i>	3.6
		<i>Gloeocapsa magma</i>		<i>Microcystis</i> spp.		<i>Chroococcus disperses</i>	
		<i>Nostoc muscorum</i>		<i>Nodularia spumigena</i>		<i>Chroococcus occidentalis</i>	
		<i>Nodularia spumigena</i>				<i>Gloeocapsa magma</i>	
		<i>Nostoc muscorum</i>				<i>Microcystis smithii</i>	
	Dinophyceae	<i>Dinophysis acuminata</i>	2.4	<i>Ceratium fuscus</i>	1.6	<i>Nodularia spumigena</i>	
		<i>Gymnodinium helviticum</i>		<i>Gymnodinium helviticum</i>		<i>Nostoc muscorum</i>	
		<i>Gyrodinium</i> sp.				<i>Oscillatoria geminata</i>	
		<i>Prorocentrum micans</i>				<i>Planktothrix rubescens</i>	
						<i>Ceratium fuscus</i>	3.8
						<i>Gymnodinium helviticum</i>	
	Mediophyceae	<i>Odontella mobiliensis</i>	2.6	<i>Odontella mobiliensis</i>	1.3	<i>Gyrodinium</i> sp.	
	Rhizosoleniaceae	<i>Rhizosolenia</i> sp.	2.2	<i>Rhizosolenia</i> sp.	1.4	<i>Polykrikos schwartzii</i>	
	Xanthophyceae	<i>Centritractus belanophorus</i>	2.4	<i>Centritractus belanophorus</i>	1.3	<i>Prorocentrum micans</i>	
	Zygnematomyceae	<i>Gonatozygon aculeatum</i>	2.5	<i>Gonatozygon aculeatum</i>	1.2	<i>Protoperidinium depressum</i>	
		<i>Gonatozygon brebissonii</i>				<i>Odontella mobiliensis</i>	3.3
Average			2.45±0.17		1.41±0.15		3.52±0.18
Zooplankton	Branchiopoda	<i>Bosmina</i> sp.	2.4	<i>Bosmina</i> sp.	1.6	<i>Bosmina</i> sp.	3.7
		<i>Praunus</i> sp.		<i>Daphnia</i> sp.		<i>Praunus</i> sp.	
		<i>Daphnia</i> sp.				<i>Daphnia</i> sp.	
	Crustacea	<i>Acetes</i> spp.	2.6	<i>Acetes</i> spp.	1.4	<i>Acetes</i> spp.	3.9
		<i>Lucicutia flavicornis</i>		<i>Lucicutia flavicornis</i>		<i>Metapenaeus</i> spp.	
	Hydrozoa	<i>Aglaura hemistoma</i>	2.7	<i>Aglaura hemistoma</i>	1.6	<i>Lucicutia flavicornis</i>	
		<i>Chelophyes contorta</i>		<i>Liriope tetraphylla</i>		<i>Penaeus indicus</i>	
		<i>Liriope tetraphylla</i>				<i>Aglaura hemistoma</i>	3.6
	Monogononta	<i>Brachionus</i> sp.	2.5	<i>Brachionus</i> sp.	1.5	<i>Chelophyes contorta</i>	
	Maxillopoda	<i>Acartia</i> sp.	2.8	<i>Acartia</i> sp.	1.6	<i>Liriope tetraphylla</i>	
		<i>Calanopia minor</i>		<i>Calanopia minor</i>		<i>Brachionus</i> sp.	3.4
		<i>Calanus</i> sp.		<i>Calanus</i> sp.		<i>Acartia</i> sp.	3.7
<i>Cyclops</i> sp.			<i>Cyclops</i> sp.		<i>Calanopia minor</i>		
<i>Mesocyclops</i> sp.			<i>Mesocyclops</i> sp.		<i>Calanus</i> sp.		
<i>Diaptomus</i> sp.			<i>Diaptomus</i> sp.		<i>Candacia catula</i>		
<i>Diaptomus</i> sp.			<i>Mysidella</i> sp.		<i>Centropages</i> sp.		
<i>Oithona</i> sp.					<i>Cyclops</i> sp.		
Gastropoda	<i>Notobranchaea</i> sp.	2.5	<i>Notobranchaea</i> sp.	1.4	<i>Mesocyclops</i> sp.		
Polychaeta	<i>Paracartia</i> sp.	2.3	<i>Paracartia</i> sp.	1.3	<i>Diaptomus</i> sp.		
	<i>Pedinosoma curtum</i>		<i>Pedinosoma curtum</i>		<i>Oithona</i> sp.		
Average			2.54±0.17		1.49±0.12		3.56±0.24

of 42 phytoplankton species were identified including 13 commons and 13 dominant species belonging to eight divisions in coastal waters in the northern Bay of Bengal, Bangladesh. Iqbal, *et al.* [6] reported that 27 genera of phytoplankton species from four divisions in the estuarine habitat of the south-eastern coast of Bangladesh. According to Rakhi, *et al.* [23] total of 20 and 17 genera of phytoplankton were recorded in Buriganga and Turag river, respectively and 6 major zooplankton taxonomic groups were also identified during monsoon in both rivers. Additionally, Rahaman, *et al.* [22] a total of 7 groups including 41 genera were of phytoplankton and 4 groups including 31 genera of zooplankton were recorded in the Meghna river. The present diversified planktons indicated that the Bay of Bengal is a good habitat for fish.

**Diversity Indices of Fish and Plankton:** In the study period, the values of Shannon-Wiener diversity indices of fish have a mean value of  $2.72 \pm 0.083$ . Phytoplankton diversity indices fluctuated with a mean of  $2.45 \pm 0.17$ ,  $1.41 \pm 0.15$  and  $3.52 \pm 0.18$  during pre-monsoon, monsoon and post-monsoon, respectively while zooplankton has fluctuated with a mean value of  $2.54 \pm 0.17$ ,  $1.49 \pm 0.12$  and  $3.56 \pm 0.24$  during pre-monsoon, monsoon and post-monsoon, respectively. According to Al, *et al.* [7], The highest species richness (2.32) and diversity (3.07) occurred in winter and both were lowest during the monsoon (1.03 and 2.03, respectively) while maximum abundance was in the post-monsoon (27, 736 ind./l) and the minimum was recorded in the monsoon (6524 ind./l). Islam, *et al.* [24] found that the fish, phytoplankton and zooplankton diversity indices were  $2.8 \pm 1.0$ ,  $3.10 \pm 0.17$  and  $3.13 \pm 0.58$ , respectively during the wet season. It indicated that the Bay of Bengal was a productive water body for fish biodiversity and the plankton community.

## CONCLUSION

The present study focuses on the diversity of fisheries resources at the Bay of Bengal, the Cox's Bazar, Bangladesh. Fisheries resources recorded during the study period have shown a good indication of rich aquatic biodiversity in the Bay of Bengal. The threatened fish species recorded from the studied area indicates the alarming threat to the present conservation status of fishes in Bangladesh.

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