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Diversity and Community Structure of Marine Fishes in the Lower Meghna River Estuary, Bangladesh: A Case Study in Hatiya and Nijhum Dwip

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ABSTRACT

Hatiya and Nijhum Dwip are the most two important islands in the Meghna River Estuary in Bangladesh, especially in terms of marine fisheries resources. The purpose of the study was to investigate the diversity and community structure of marine fishes in these areas during pre-monsoon. A total of 27 fish species were found under 9 orders, among which 40.7% were frequent, 25.92% were moderately frequent, and 33.33% of species were less frequent. Perciformes and Siluriformes orders were found to be dominant ones. The flathead sillago *Sillaginopsis panijus*, Paradise threadfin *Polynemus paradiseus* and Engraved catfish *Nemopteyrx nenga* were the most dominant and frequently available in all stations. Moreover, the Bombay duck *Harpadon nehereus* was dominant at the Tamaraddi Ghat (20.68%), Kazir Bazar (11.84%) and Oskhali Bazar (11.59%), whereas the Panna croaker *Panna microdon* was dominant at Namar Bazar (11.86%), Nijhum Dwip. Hilsa *Tenualosa ilisha* and Asian sea bass *Lates calcarifer* showed lower abundance (<5%). Higher values of marine fish species diversity, evenness and richness were found at Hatiya. Although 80% of marine fish species were least concern and near threatened, a sustainable marine fisheries management plan would be highly recommended to conserve these fishery resources.

INTRODUCTION

Fish biodiversity in estuarine and coastal areas in Bangladesh is quite rich including 475 species of marine bony fishes of which, 50 cartilaginous fishes, 25 shrimp/prawns, 15 crabs, and 5 lobsters **(Hossain, 2001)**. Environmental degradation, industrial pollution,

and climate change has threatened this biodiversity over the last two decades **(Khan *et al*., 2019)**. Additionally, estuarine fishes are likely to be threatened due to competition for water, habitat alteration, introduction of exotic species, and commercial exploitation **(Moyle & Leidy, 1992)**. Globally, several marine fish species are listed as near threatened and vulnerable including the Bombay duck *Harpadon nehereus*, the gagora catfish *Arius gagora*, the yellowfish tuna *Thunnus albacares* and the bigeye tuna *Thunnus obesus* **(Habib & Islam, 2020; IUCN, 2021)**. To conserve these resources, proper managemental policies and activities need to be addressed. The Government of Bangladesh, for instance, established different acts, rules, ordinances, regulations, and policies for proper management of the fisheries resources. Additionally, some sustainable strategies and management approaches for instance marine protected areas, fish sanctuaries, co-management, and community-based management, have been promoted **(Sarker *et al*., 2021; Islam *et al*., 2022)**. However, predominantly, an understanding of biodiversity and the current status of particular regions is quite necessary for sustainable fisheries management.

The Meghna River Estuary, a unique combination of freshwater, brackish, and marine environments, is one of the largest estuaries on the earth in terms of sediment-water discharge located at the central part of the coastline of Bangladesh. The area is characterized by high levels of hydro-dynamic activity. Erosion and deposition occur concurrently and the rates of both are high. The area is periodically subjected to several storms and cyclones. The sediment discharge from the Meghna River is the highest and the water discharge is the third highest among all the river confluences in the world. Due to the high sediment discharge, lands are eroded and reformed. The water flow patterns also shift in the Meghna River Estuary **(BWDB, 1999; Sayed *et al*., 2018)**. These changes will affect fish species, with significant impacts on their spawning, feeding, breeding, and migration **(Hossain *et al*., 2012; Islam *et al*., 2012; Shaha *et al*., 2022)**.

Hatiya and Nijhum Dwip are two important islands in the Meghna River Estuary. Nijhum Dwip is a small, remote island in Bangladesh that is located in the Meghna Estuary and surrounded by the Bay of Bengal on the south and west. The Ministry of Fisheries and Livestock, Bangladesh declared the Nijhum Dwip as a marine protected area (area 3,188km^2) in 2019 to conserve the spawning and migrating grounds of hilsa, dolphins, porpoises, sharks, rays, and marine turtles **(Rashid, 2019)**. Although there are several studies on the entire fish biodiversity at Hatiya and Nijhum Dwip islands **(Hossain *et al*., 2012; Mostafa *et al*., 2018; Shaha *et al*., 2022)**, there are limited studies focused on the diversity of marine fishes. The purpose of this study was to investigate the diversity and community structure of marine fishes at Hatiya and Nijhum Dwip islands. The conservation status of those species was also observed. This baseline survey on fish biodiversity, therefore, is important to implement proper fisheries management plans in these regions.

MATERIALS AND METHODS

1. Study area

The study was conducted at Hatiya (i.e. Tamaruddin Ghat, Kazir Bazar and Oskhali Bazar) and Nijhum Dwip (i.e. Namar Bazar) during pre-monsoon where fish usually land from Meghna River Estuary and Bay of Bengal (Fig. 1). The landing centers at Kazir Bazar and Tamaruddin Ghat are located on the east and west coast of Hatiya, respectively. Oskhali Bazar is one of the biggest fish markets at Hatiya. Namar Bazar is located in the southern part of Nijhum Dwip.

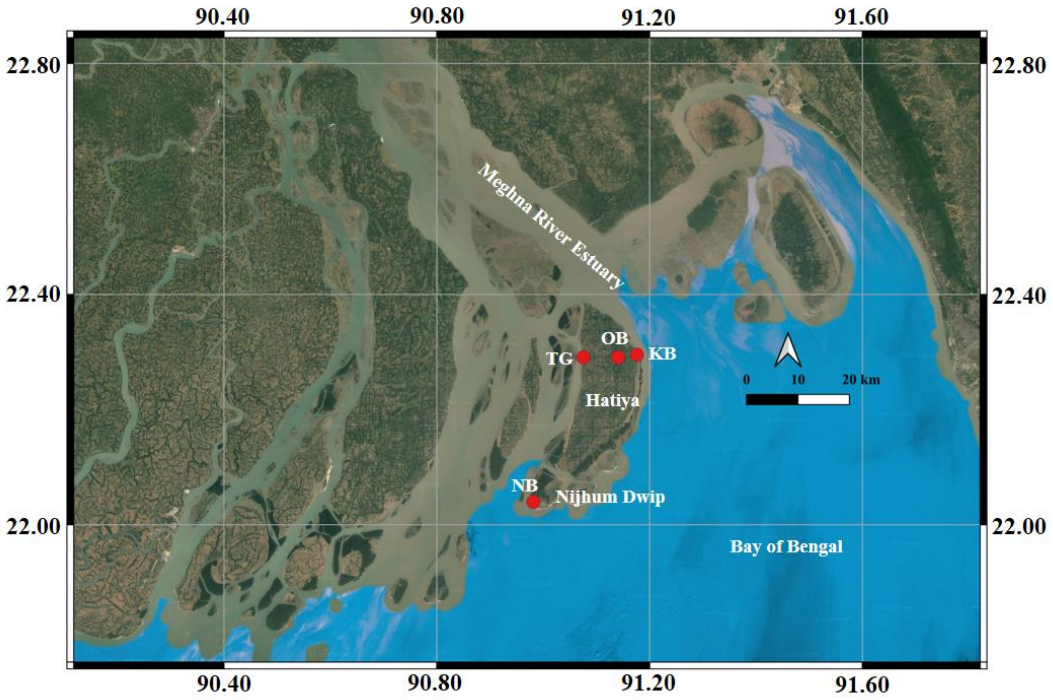

Fig. 1. Map showing study areas (marked by red color) including Tamaraddi Ghat (TG), Oskhali Bazar (OB) and Kazir Bazar (KB) of Hatiya and Namar Bazar (NB) of Nijhum Dwip, Bangladesh (Source: QGIS software)

2. Methods

The samplings were carried out from February to March 2024. Fish species were collected and recorded carefully. The species were identified by examining their morphometric and meristic characteristics, and followed the guidelines described by **Hossain *et al*. (2010)** and **Habib and Islam (2020)**. The conservation status of each species was complied from **IUCN (2021)**.

The relative abundance (p_i) is the proportional representation of a species in a sample. The relative abundance (p_i) of each species is expressed as $p_i = (n_i/N)\times100$,

where n_i is the number of individuals of the same species and N is the total number of individuals for all species. The relative frequency of fishes was determined by the equations as F (%) = (n/N)×100, where F (%) is the frequency of species, n is the frequency of a particular species, and N is the total number of sites. The frequency of occurrence was categorized as frequent (>75%), moderate frequent (50-74.99%), less frequent (25-49.99%) and rare (<24.99%).

Shannon-Wiener diversity (*H'*) values were calculated using the formula **(Shannon, 1949)**, $H' = -\sum^{s}_{i=1}(p_i)$ (ln p_i), where *H'* = diversity index, p_i = the proportion of the entire community made up of species *i* (*i* = 1, 2, 3,... s), *s* = number of species, ln = natural logarithm. The Simpson dominance index (*D*) was calculated by using the formula **(Simpson, 1949)**: $D = 1-[\sum n_i(n_i-1)/N(N-1)]$, where *D* is the Simpson dominance index, *N* is the total number of individuals of all species, and n_i is the number of individuals of a particular species.

Margalef's index (*d*) of diversity has been calculated using the formula **(Margalef, 1968)**: $d = (S-1)/\ln N$, where *d* is the Margalef's Richness Index, *S* is the total number of species in the sample, and *N* is the total number of individuals. The Pielou evenness index (J′) was determined using the formula **(Pielou, 1966)**: J'= *H'*/ln *S*, where J' is the Pielou evenness index, *H'* is the Shannnon-Wiener diversity index, and *S* is the total number of species.

3. Data analysis

The data set was analyzed using Microsoft Excel and IBM SPSS statistics 21. The hierarchical cluster analysis was performed by heatmap using "pheatmap" packages in R, version 4.0.5 **(R Development Core Team, 2021)**. The data set for the total and relative abundances of fish was converted to logarithmic form. All the analyses were done at a 5% (P<0.05) significance level

RESULTS

1. Abundance of marine fishes at Hatiya and Nijhum Dwip, Bangladesh

A total of 27 fish species were recorded at Hatiya and Nijhum Dwip (Table 1). At Hatiya, the highest number of species and abundance were found at Oskhali Bazar (26,2070 individuals), followed by Tamaraddi Ghat (15,1644 individuals) and Kazir Bazar (11,1318 individuals). Constantly, a lower number of species and abundance were recorded at the Namar Bazar, Nijhum Dwip (11,1012 individuals) (Fig. 2).

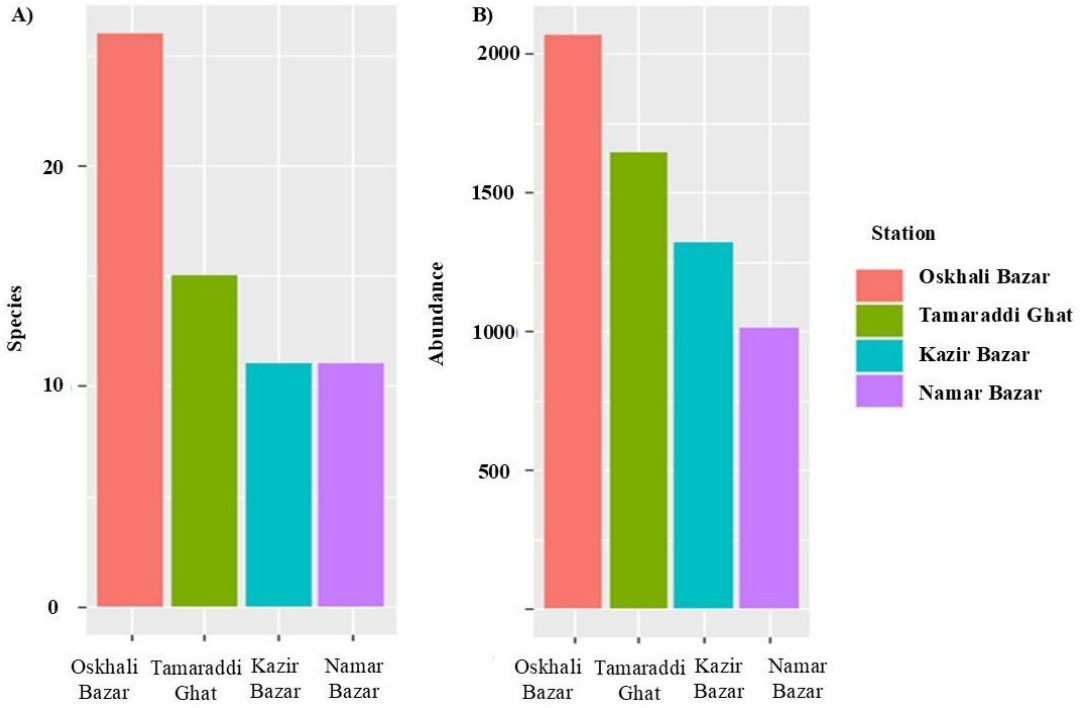

Fig. 2. (A) Number of species and **(B)** abundance of marine fishes at Oskhali Bazar, Tamaraddi Ghat, Kazir Bazar of Hatiya and Namar Bazar of Nijhum Dwip, Bangladesh

A total of 9 orders and 21 families were recorded (Table 1). The dominant order was Perciformes, which comprises 10 species (37.04% of total marine fishes). Silluriformes, Clupeiformes and Gobiiformes had 4 species (14.82%). Mugiliformes, Aulopiformes, Carangiformes, Pleuronectiformes and Anguiliformes had 1 species (3.7%). The dominant family was Gobiidae, which comprised 4 species (i.e. *Taenoides cirratus*, *T. buchanani*, *Oxyurichthys microlepis* and *Boleophthalmus boddarti*), followed by Pristigasterida (2 species; *Illisha megaloptera* and *Pellona ditchella*), Polynemidae (2 species; *Polynemus paradiseus* and *Elrutheronema tetradactylum*), Sciaenidae (2 species; *Otolithoides pama* and *Panna microdon*). The rest of the families comprised 1 species (Table 1). The results in Table (1) show that 40.7, 25.92 and 33.33% of fish were frequent, moderate frequent and less frequent, respectively.

Table 1. List of marine fish species found at Hatiya and Nijhum Dwip with their taxonomic state, scientific name, common name, local name, mean relative abundance, mean frequency, and IUCN conservation status

Order	**Family**	**Scientific name**	**Common name**	**Local name**	**Frequency**	**IUCN red list (Global)**	**IUCN red list (BD)**
Siluriformes	Arridae	*Nemapteryx nenga*	Engraved catfish	Kata	F	NE	DD
	Bagridae	*Mystus gulio*	Long-whiskers catfish	Sagorer tengra/gula	MF	LC	NT
	Ailidae	*Ailia coila*	Gangetic ailia	Bashpata	LF	NT	LC
	Pangasiidae	*Pangasianodon hypophthalmus*	Panga catfish	Sagorer pangus/samudrik pangus	MF	EN	NL
Clupeiformes	Clupeidae	*Tenualosa ilisha*	Hilsa shad	Ilish	F	LC	LC
	Engraulidae	*Coilia dussumieri*	Olua/Gold grenadier anchovy	Ulka boicha/holde boica	LF	LC	LC
	Pristigasteridae	*Ilisha megaloptera*	Bigeye ilisha	Chapila	MF	LC	LC
		Pellona ditchella	Indian pellona	Choukka	LF	LC	LC
Mugiliformes	Mugilidae	*Rhinomugil corsula*	Corsula mullet	Bata	F	LC	LC
Perciformes	Polynemidae	*Polynemus paradiseus*	Paradise threadfin/Taposi	Rickshaw	F	LC	LC
		Elrutheronema tetradactylum	Fourfinger threadfin	Tailla	LF	NE	NT
	Sillaginidae	*Sillaginopsis panijus*	Flathead sillago	Tular dandi	F	NE	LC
	Stromateidae	*Pampus chinensis*	Chinese pomfret	Rup chanda	F	NE	NT
	Latidae	*Lates calcarifer*	Asian sea bass	Koral	F	LC	NT

	Trichiuridae	*Trichiurus lepturus*	Largehead hairtail	Churi	MF	LC	NT
	Platycephalidae	*Platycephalus indicus*	Bartail flathead	Choda baila	LF	DD	LC
	Sciaenidae	*Otolithoides pama*	Pama croaker	Lal poa/Leijja poa	F	DD	LC
		Panna microdon	Panna croaker	Poa	F	LC	NE
	Sparidae	*Acanthopagrus datnia*	Bengal yellowfin seabream	Sagorer tilapia	LF	DD	NT
Aulopiformes	Synodontidae	*Harpadon nehereus*	Bombay duck	Loitta	F	NT	NT
Carangiformes	Carangidae	*Parastromateus niger*	Black pomfret	Kalo chanda	MF	LC	NT
Pleuronectiformes	Cynoglossidae	*Cynoglossus arel*	Largescale tonguesole	Kukur jeeb/ Kathal pata	MF	DD	LC
Anguiliformes	Muraenesocidae	*Muraenesox bagio*	Common pike conger	Sagorer kaikka	LF	LC	NT
Gobiiformes	Gobiidae	*Taenoides cirratus*	Bearded eel goby	Chewa	F	DD	NT
		Taenoides buchanani	Burmese gobyeel	Raja chewa	MF	DD	NT
		Oxyurichthys microlepis	Maned goby	Nuna baila	LF	LC	LC
		Boleophthalmus boddarti	Boddart's google-eyed maned goby	Dahuk/Dakila	LF	LC	LC

Note: F= Frequent, MF= Moderate frequent, LF= Less frequent, NE= Not evaluated, LC= Least concern, NT= Near threatened, EN= Endangered, DD= Data deficient, NE= Not evaluated, LC= Least concern, NT= Not threatened, NL= Not listed and DD= Data deficient.

2. Relative proportion of marine fish order at Hatiya and Nijhum Dwip, Bangladesh

Perciformes and Siluriformes were the most dominant order at Hatiya. The highest percentages of Perciformes were found at Kazir Bazar (67%), followed by Tamaraddi Ghat (56%) and Oskhali Bazar (43%). The highest percentages of

Siluriformes were found in Oskhali Bazar (21%), followed by Kazir Bazar (14%) and Tamaraddi Ghat (8%). At Namar Bazar, Nijhum Dwip, a higher percentage of Perciformes (64%), Siluriformes (15%) and Gobiformes (10%) were found. A minor proportion (<10%) of other orders (i.e. Mugiliformes, Aulopiformes, Carangiformes, Pleuronectiformes, Anguiliformes) were observed at four stations (Fig. 3).

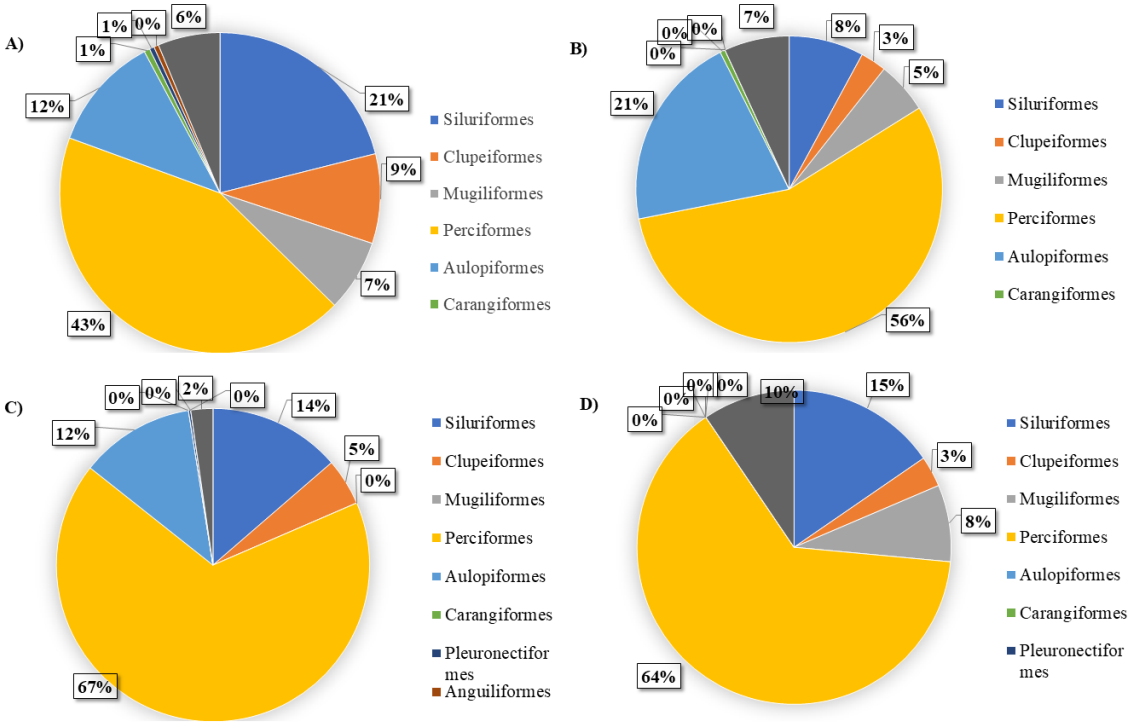

Fig. 3. (A) Relative proportion of marine fish orders at Oskhali Bazar, **(B)** Tamaraddi Ghat, **(C)** Kazir Bazar of Hatiya and **(D)** Namar Bazar of Nijhum Dwip

3. Relative proportion of marine fish species at Hatiya and Nijhum Dwip, Bangladesh

At Oskhali Bazar, Hatiya, the highest abundance was recorded for *Sillaginopsis panijus* (14.49%) and *Polynemus paradiseus* (14.49%), followed by *Harpadon nehereus* (11.59%), *Nemapteryx nenga* (8.45%), *Mystus gulio* (7.25%), *Rhinomugil corsula* (7.25%) and *Panna microdon* (5.80%). Comparatively low abundance (<5%) were observed in *Coilia dussumieri*, *Lates calcarifer*, *Otolithoides pama*, *Pellona ditchella*, *Acanthopagrus datnia*, *Pampus chinensis*, *Elutheronema tetradactylum*, *Trichiurus lepturus*, *Platycephalus indicus*, *Parastromateus niger*, *Cynoglossus arel*, *Muraenesox bagio* and *Taenoides cirratus* (Fig. 4).

At Tamaraddi ghat, Hatiya, the highest abundance was recorded for *Polynemus paradiseus* (22.81%), followed by *Harpadon nehereus* (20.68%), *Sillaginopsis panijus* (12.17%), *Panna microdon* (10.64%), *Trichiurus lepturus* (7.91%) and *Taenoides cirratus* (6.57%). Comparatively low abundance (<5%) were observed in *Otolithoides*

pama, *Parastromateus niger*, *Taenoides buchanani*, *Rhinomugil corsula*, *Pampus chinensis*, *Lates calcarifer* and *Nemapteryx nenga*.

At Kazir Bazar, Hatiya, the highest abundance was observed for *Polynemus paradiseus* (30.73%), followed by *Sillaginopsis panijus* (22.76%), *Nemapteryx nenga* (13.66%), *Harpadon nehereus* (11.84%), *Panna microdon* (10.62%). Comparatively low abundance (<5%) was observed in *Tenualosa ilisha*, *Ilisha megaloptera*, *Pampus chinensis*, *Lates calcarifer* and *Taenoides cirratus*.

At Namar Bazar, Nijhum Dwip, the highest abundance was recorded for *Polynemus paradiseus* (31.62%), followed by *Sillaginopsis panijus* (16.80%), *Panna microdon* (14.82%), *Nemapteryx nenga* (11.86%), *Oxyurichthys microlepis* (8.30%) and *Rhinomugil corsula* (7.91%). Comparatively low abundance (<5%) were observed in *Mystus gulio*, *Tenualosa ilisha*, *Lates calcarifer* and *Otolithoides pama*.

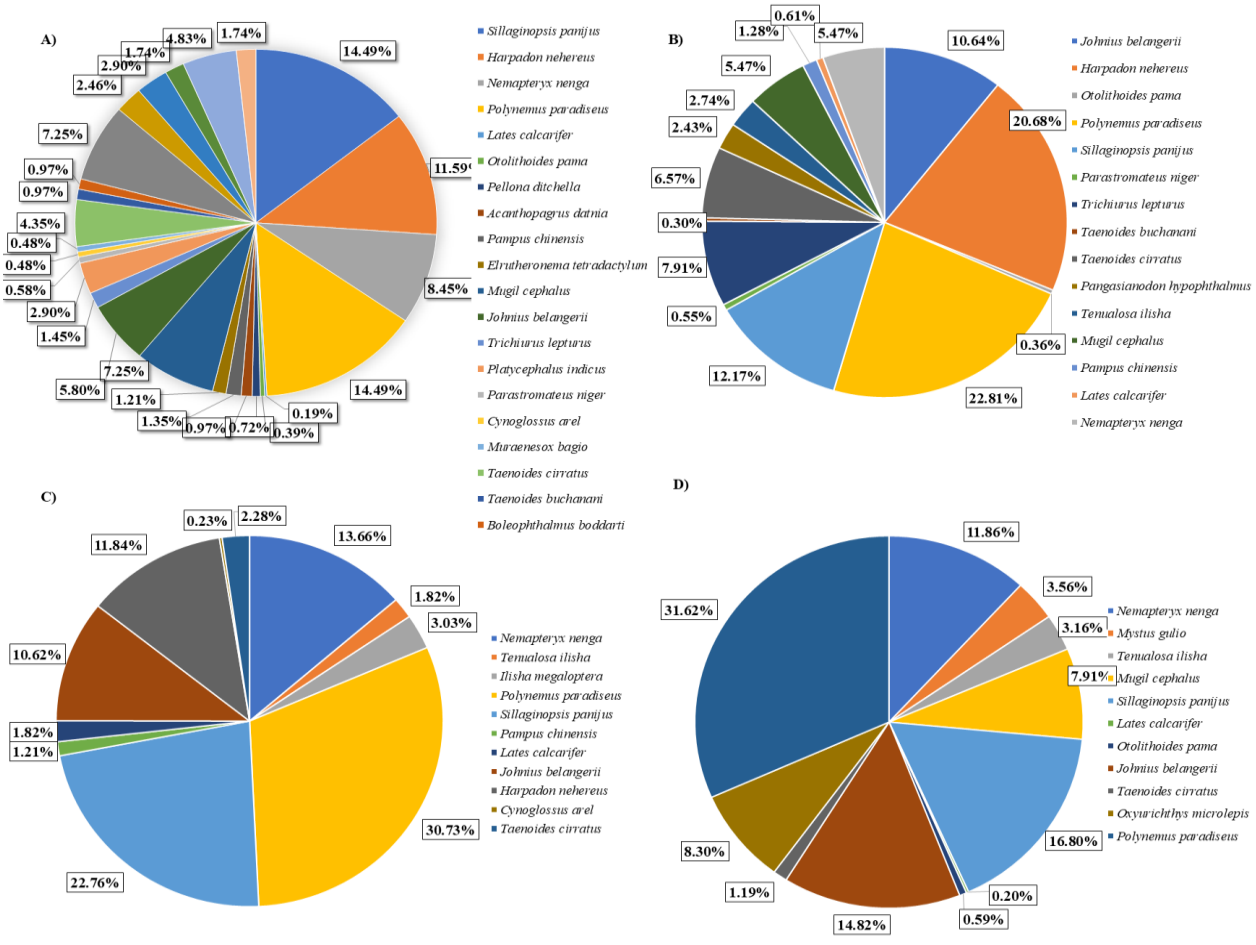

Fig. 4. (A) Relative proportion of marine fish species at Oskhali Bazar, **(B)** Tamaraddi Ghat, **(C)** Kazir Bazar of Hatiya and **(D)** Namar Bazar of Nijhum Dwip, Bangladesh

4. Diversity index of marine fish at Hatiya and Nijhum Dwip, Bangladesh

The highest values of Shannon-Wiener diversity index, Simpson dominance index, Pielou evenness index, and Margalef's richness index were found at Oskhali Bazar and the values were 2.789, 0.915, 0.856 and 3.274, respectively, followed by Tamaraddi Ghat; (2.223, 0.861, 0.8208 and 1.891, respectively), and Kazir Bazar (1.866, 0.8082, 0.7788 and 1.392, respectively). At the Namar Bazar, Nijhum Dwip, Shannon-Wiener diversity index, Simpson dominance index, Pielou evenness index, Margalef's richness index were recorded as 1.931, 0.821, 0.8053 and 1.445, respectively (Fig. 5).

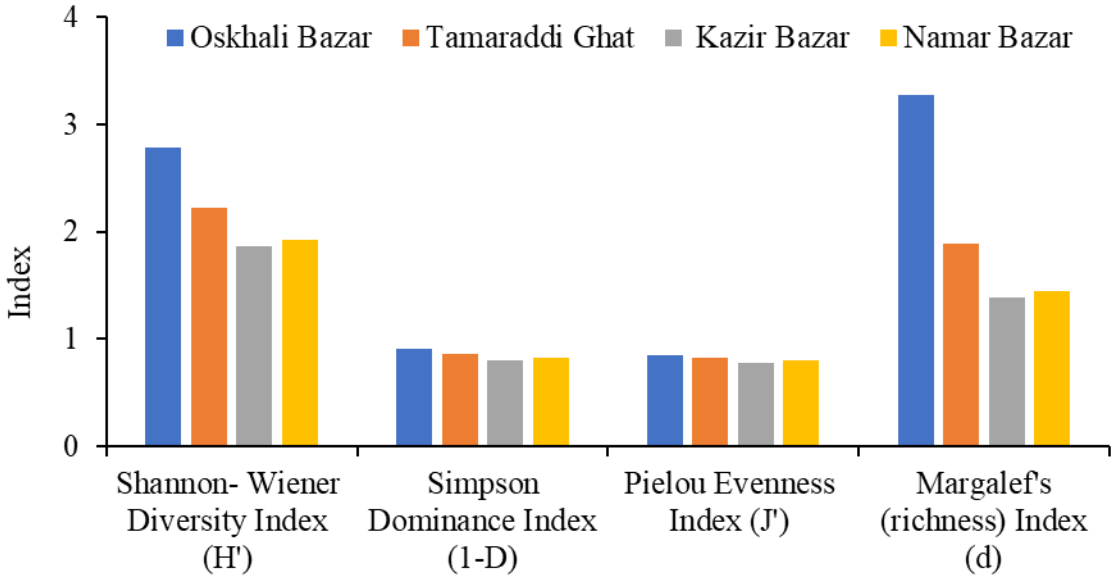

Fig. 5. Diversity index (Shannon-Wiener, Simpson Dominance, Pielou evenness and Margalef's richness) of marine fishes at Oskhali Bazar, Tamaraddi Ghat, Kazir Bazar of Hatiya and Namar Bazar of Nijhum Dwip, Bangladesh

5. IUCN Red List of marine fish at Hatiya and Nijhum Dwip, Bangladesh

According to the IUCN Red List Global **(IUCN, 2021)**, 52% were designated as Least Concerned, 15% were Not Evaluated, 22% were Data Deficient, 7% were classified as Near Threatened, and 4% under Endangered. In terms of the IUCN Red List of Bangladesh, the Least concerned accounted for 48%, Not threatened made up 41%, and 4% were Not evaluated and Not Listed, respectively (Fig. 6). Among the different fish orders, the majority of Anguiliformes, Carangiformes, Mugiliformes, and Clupeiformes species are categorized as Least Concerned (100%). The second largest group includes Pleuronectiformes (100%), Gobiformes (50%) and Perciformes (30%), which are categorized as the Data Deficient. In siluriformes, species are evenly distributed among

four categories such as Near Threatened, Not Evaluated, Least Concerned, and Endangered, each comprising 25% of the total species (Fig. 7).

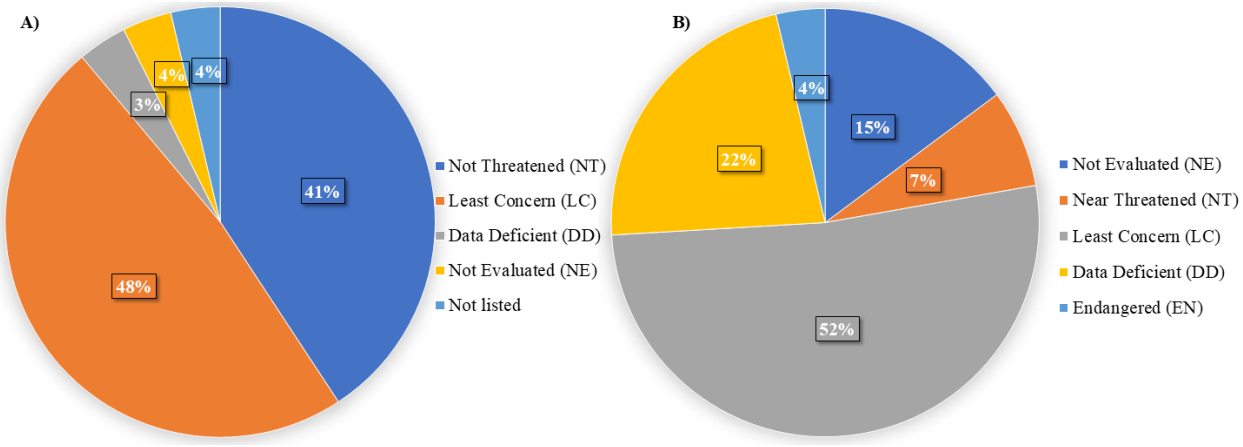

Fig. 6. The relative proportion of marine fishes based on IUCN Red List (A. National, B. Global) at Hatiya and Nijhum Dwip, Bangladesh

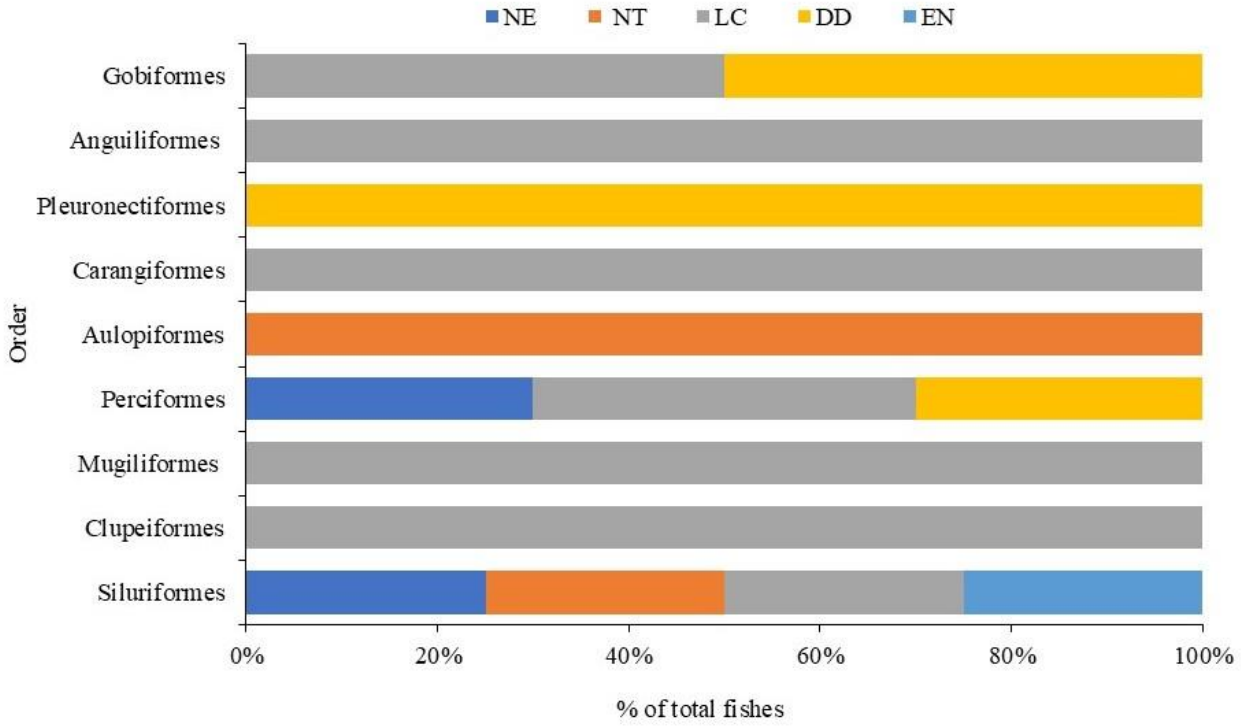

Fig. 7. Relative proportion of marine fish based on global IUCN Red List at Hatiya and Nijhum Dwip, Bangladesh

5. Cluster analysis of marine fishes at Hatiya and Nijhum Dwip, Bangladesh

The two-way hierarchical cluster heatmap is presented in Fig. (8). In the vertical portion, the dendrogram provided two clusters: Tamaraddi Ghat, Oshkhali Bazar and Kazir Bazar of Hatiya had been confined in cluster 1, and Namar Bazar displayed in cluster 2. In contrast, the horizontal dendrogram rendered three clusters of marine fishes: *P. paradiseus*, *H. nehereus*, *S. panjius*, *N. nenga* and *J. belangerii* have been confined in cluster 1. *L. calcarifer*, *C. arel*, *T. buchanani*, *O. pama*, *P. niger*, *P. ditchella*, *M. bagio*, *P. chinensis*, *E. tetradactylum* and *A. datina* had been confined in cluster 2. Cluster 3 consists of *B. boddarti*, *I. megaloptera*, *P. hypophthalmus*, *C. dussumieri*, *A. coila*, *P. indicus*, *T. lepturus*, *T. Ilisha*, *T. cirratus*, *O. microlepis*, *M. gulio* and *R. corsula*

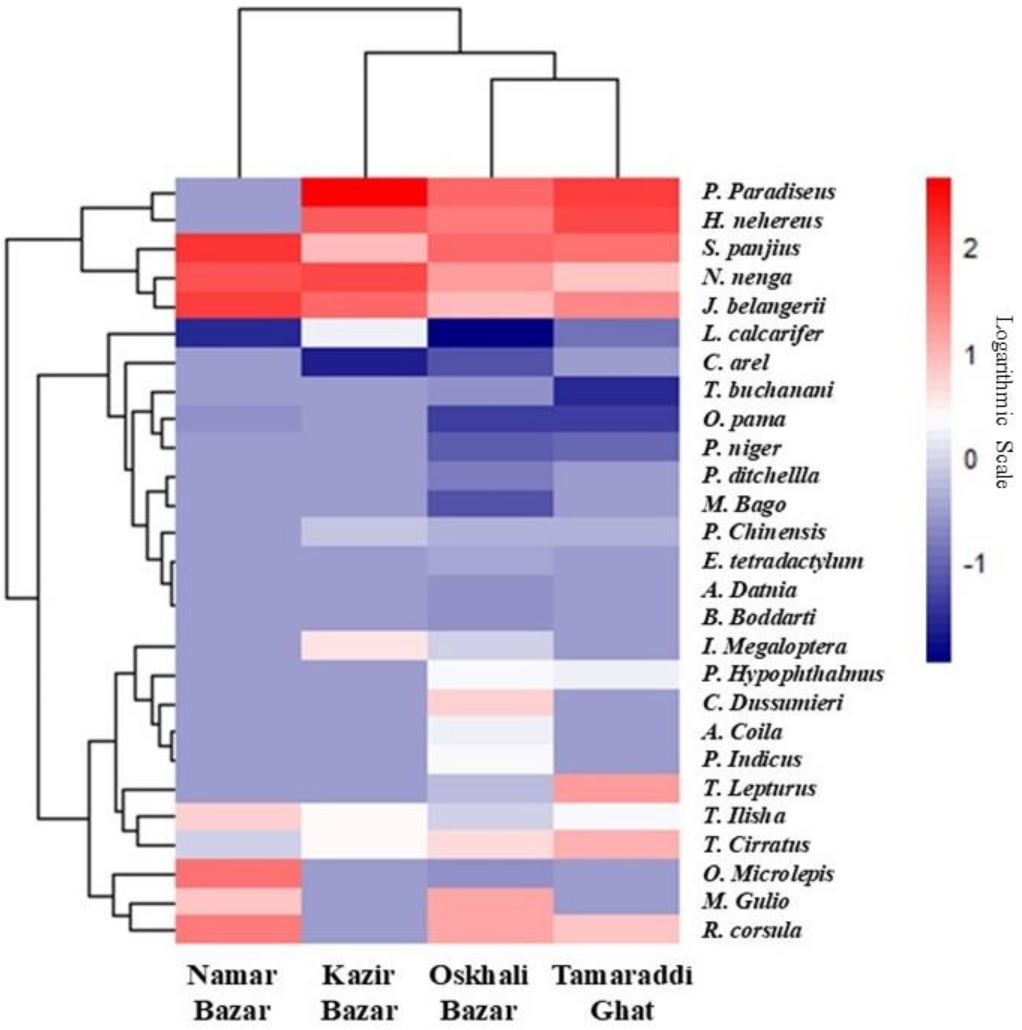

Fig. 8. Two-way hierarchial cluster heatmap of marine fish species at Hatiya and Nijhum Dwip, Bangladesh

DISCUSSION

In this study, the number of marine fish (27) at Hatiya and Nijhum Dwip was comparatively lower than the previous records (i.e. 53 species in MRE, **Hossain *et al*., 2012**; 47 species in Njhum Dwip, **Sarker *et al*., 2021)**, that might be due to variation of season, sampling locations and environmental parameters (i.e. temperature, pH and salinity). Some fish (i.e. Hilsa and Largehead Hairtail) were dominant during monsoon bringing huge river discharge, nutrients, food availability, and suitable environmental parameters; all these factors enhance growth, survival, feeding, breeding and spawning of fish **(Shaha *et al*., 2022a, b)**. Some other fish (i.e. Bombay duck, Asian sea bass, Panna croaker) were dominant during post-monsoon and pre-monsoon **(Shaha *et al*., 2022a)**. Salinity gradient could be one of the causative factors affecting the diversity and distribution of fish species in the Meghna River Estuary during post-monsoon, **(Shaha *et al*., 2022b)**. Fish biodiversity in the MRE is also comparatively lower than in other coastal waters of Bangladesh (i.e. Bakkhali River Estuary; **Rashed-Un-Nabi *et al*., 2011,** Naaf River Estuary; **Chowdhury *et al.* 2021**). Since 13 million tons of sediment is being transported every year through the MRE **(Rahman, 2013)**, it is assumed that huge sediment discharge may cause light limitation in waterbodies that limits organisms' growth. Further research could be suggested on this issue in the MRE.

Among nine orders, Perciformes, Clupeiformes, Aulopiformes, Gobiformes, and Siluriformes were the dominant orders at Hatiya and Nijhum Dwip. Perciformes and Clupeiformes are widely distributed species in the coastal areas of Bangladesh **(Rashed-Un-Nabi *et al*., 2011; Kamal *et al*., 2022)**. **Shaha *et al*. (2022b)** stated that Clupiformes, Gobiiformes, Siluriformes and others (i.e. Beloniformes, Decapoda, Mugiliformes) were found in Hatiya during the dry season when salinity was ~18 psu. Among Perciformes, Flathead sillago *Sillaginopsis panijus*, Paradise threadfin *Polynemus paradiseus* and Panna croaker *Panna microdon* were higher abundance. The Flathead sillago *Sillaginopsis panijus* is a common fish in the MRE. Moreover, this species can survive in adverse environmental conditions and migrate between marine and freshwater (amphidromous) **(Sabbir *et al*., 2021)**. This fish prefers shallow muddy bays and distributes widely in the marine and coastal waters of Bangladesh **(Islam *et al*., 2012)**. Croacker *Panna microdon* were usually found throughout the year at Hatiya **(Shaha *et al*., 2022b)**. Croacker fishery usually contributed 6.3% of the total marine catches from the Bay of Bengal **(DoF, 2020)**. While juvenile croakers are found in coastal waters, adults can move toward the shallow water of the Bay of Bengal **(Sabbir *et al*., 2021)**. Constantly, Chinese pomfret, Asian sea bass and Largehead hairtail have shown lower abundance during post-monsoon. In fact, the availability of Chinese pomfret *Pampus chinensis*, for instance, was observed throughout the year with high abundance during

April and October **(Akhter *et al*., 2020)**. The coastal waters of Bangladesh are suitable for larvae and juveniles of Asian sea bass *Lates calcarifer* from October to February, and then move to the sea to reach sexual maturity and breed (i.e. catadromous) during June and September **(Haque *et al*., 2023)**. Temperature, salinity, precipitation, chlorophyll-*a*, and primary production are recognized as critical indicators of the significant spawning and feeding seasons and grounds **(Khan *et al*., 2019; Shaha *et al*., 2022a; Aishy *et al*., 2024; Jahan & Mahmud, 2025)**.

In this study, a medium abundance of hilsa was recorded, although higher abundances of hilsa were recorded during monsoon **(Das *et al*., 2022)**. Meghna River Estuary is suitable for spawning and breeding of hilsa. Hilsa prefers relatively low salinity, strong tidal action, high turbidity, heavy siltation, and an abundance of plankton **(Alam *et al*., 2025)**. Gold grenadier anchovy *Coilia dussumieri*, Bigeye ilisa *Illisha megaloptera* and Indian pellona *Pellona ditchella* also common species at MRE and mangrove swamps, coastal waters and tidal rivers **(Islam *et al*., 2012; Siddique *et al*., 2021)**. These species migrate in large schools between open coastal areas and protected shallow areas for their reproductive and trophic needs**.** Gobiformes, and Siluriformes were another dominant orders. *Taenoides buchanani* is most popular species in Hatiya and Nijhum Dwip. **Latifa *et al*. (2015)** recorded 7 species of this genus in these regions. Although a lower abundance of this species was recorded, its higher abundance was recorded during January-April. *Nemapteryx nenga* and *Mystus gulio* are also common species at MRE, Sundarbans and tidal rivers of Bangladesh **(Islam *et al*., 2012)**.

Diversity indices are used to quantify the species diversity and numbers in a habitat. The mean value of Shannon-Wiener Diversity index (2.202) in this study is higher than that of **Mustafa *et al*. (2018)** (1.84) and lower than the value recorded in the study of **Sarker *et al*. (2021)** (2.44). The highest diversity index was observed in the dry season due to low water volume resulting in less dilution, while the lowest value was found during the monsoon due to the higher volume of water flow which resulted in more dilution. Simpson's diversity index (1 − D) value similarly varies from 0 to 1, and the greater the number, the more diverse the species are. This value is also lower than the previous record **(Mustafa *et al*., 2018)**. Pielou's evenness index (J') measures the evenness in which individuals are divided among the taxa present **(Sheldon, 1969)**. Margalef's richness is the simplest measure of biodiversity and is simply a count of the number of different species in a given area. The mean value of the evenness index (0.815) in this study is higher than that previously evaluated in the study of **Mustafa *et al*. (2018)**. In addition, the mean value of the richness index (2.001) is lower than that recorded by the previous authors due to lower species diversity. The seasonal difference in species diversity and evenness form a common phenomenon in the MRE. The main causes of the differences occurring in the biodiversity indexes are geographical area, survey duration, wind patterns, periodical fish movements for spawning and

reproduction, fishing technique, seasonal nutrition variations, and choice of fishing gear **(Rumeaida *et al*., 2014; Shamsuzzaman *et al*., 2017)**.

In this study, the conservation status of most of the species in Bangladesh was the least concern, while the conservation status of *Ailia coila* and *Harpadon nehereus* were near threatened on a global basis **(IUCN, 2021)**. In Bangladesh, the production of Bombay duck has increased by twofold during the last two decades **(DoF, 2020)**. There is no empirical data available on the annual production of *Ailia coila* in Bangladesh. However, approximately 30-80% of the decline trend of this species was recorded in West Bengal, India **(Patra *et al*., 2005; Mishra *et al*., 2009)**. Overexploitation, natural and anthropogenic causes are the major reasons attributed to the decline in these populations.

CONCLUSION

The Meghna River Estuary is one of the largest estuaries with diverse fishery species. This study recorded 27 species with dominant groups of Perciformes and Siluriformes. *Sillaginopsis panijus* and *Harpadon nehereus* were the most dominant species. Species abundance, diversity, evenness, and richness indices of fishes were comparatively higher at Hatiya. Although the conservation status of most fish species is the least concern and not threatened, a sustainable marine fisheries management plan would be highly recommended to conserve these fishery resources in Hatiya and Nijhum Dwip islands.

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