



AVAILABILITY OF MARINE FISHES IN COX'S BAZAR, BANGLADESH: A CASE STUDY ON THE BFDC LANDING CENTER

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ABSTRACT

Fish availability in the coastal landing center highlights the assumption of stocks in the marine fishing zone of the ocean. This study, therefore, aimed to analyze the availability of marine fishes in the Bangladesh Fisheries Development Corporation (BFDC) landing center, Cox's Bazar, Bangladesh between January 2021 and May 2021. A total of 54 species were recorded, of which 42 were marine fishes, 7 were shellfishes and 5 were large fishes. The dominant orders were Perciformes (56%), Scombriformes (17%) and Clupeiformes (10%). More than 56% of the total marine fishes were classified as *Least Concern*, nearly 10% were categorized as *Near Threatened* and 2% were marked *Vulnerable*. The dominant orders of shellfish were Portunidae (43%), followed by Penaidae (29%), Loligonidae (14%) and Octopopidae (14%). Shrimp *Penaeus monodon* had the highest consumer demand, whereas consumer demand for non-conventional shellfish was comparatively low. Most of the shellfish were categorized as *Least Concern*. Among large fishes, the wider availability of sharks (five species) and rays (two species) was observed in the winter and monsoon season, although the consumer demand for those large fishes was low. The *Vulnerable* sharks and rays were *Sphyma zygaena* and *Mobula birostris*. This study elucidates the present scenario of marine fishes in the BFDC fish landing center, Cox's Bazar, Bangladesh.

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INTRODUCTION

The Bay of Bengal is rich in marine resources, including marine fish, shellfish and large fish, which have great economic importance. A total of 475 species of marine bony fishes (including 50 cartilaginous fishes, 25 shrimp/prawns, 15 crabs and 5 lobsters) have been reported in the Bay of Bengal, Bangladesh (Hossain, 2001). Moreover, Habib and Islam (2020) recently documented 740 marine fish species of 389 genera in the Bay of Bengal, Bangladesh. There are also 53 species of sharks, skates and rays that appeared to be abundant in the Bay of Bengal. Three major groups of cephalopods (e.g. squid, cuttlefish and octopus) are also abundantly available on the Bangladesh coast. Additionally, more than 400 marine fish species are available in the Exclusive Economic Zone of Bangladesh, of which 33 are listed as *Threatened* in one way or another (Hoq, 2014). For instance, some marine fishes were assessed according to the categories from *Threatened to Endangered* on the International Union for Conservation of Nature (IUCN) Red List, such as giant grouper *Epinephelus lanceolatus* (*Threatened*), yellow seahorse *Hippocampus kuda* (*Threatened*), largetooth sawfish *Pristis microdon* (*Endangered*) and knifetooth sawfish *Anoxypristis cuspidate* (*Endangered*; Hoq, 2014).

The availability of fishes in the fish market and/or the fish landing center depends on several factors, such as season, consumer demand, prices and places where the fish market is established. For instance, since the annual catch of marine fin fishes (75% of the demersal catch in the marine waters of Bangladesh; Lamboeuf, 1987) were higher, the availability of those fin fishes in the marine fish landing center was usually higher than of non-conventional marine fishes (for example, squid, cuttlefish and octopus), although they have a high export value (Siddique et al., 2016).

Although there have been some studies on marine fish availability at the fish landing center Patuakhali, Bangladesh (Ahsan et al., 2014; Ali et al., 2017), there have been limited studies on the fish landing center at Cox's Bazar. Therefore, this study was carried out to investigate the availability of fish, shellfish and large fish species in the fish landing center at Cox's Bazar, Bangladesh. This study aims to provide an idea about the present status of biodiversity abundance, which will also help to confirm the IUCN Red List of *Threatened Species* in the Bay of Bengal, which is needed for conservation and management. It will also help identify the species that are extinct or moving toward extinction. The availability of marine fishes is further categorized according to consumer demand and season. Their status under threat of extinction is also discussed.

MATERIALS AND METHODS

This study was carried out to investigate the availability of fish, shellfish and large fish species in the BFDC fish landing center at Cox's Bazar, Bangladesh, including their consumer demand levels, season and status under threat of extinction. Because the landing center is close to the Bay of Bengal, copious amounts of brackish and marine water species were available (Fig. 1).

The sampling and investigation were carried out between January 2021 and May 2021. Sample collection, documentation and identification were done during the study period. All species found in the landing center were collected and recorded carefully. Local name, common name, photograph, seasonal availability and abundance of all species were documented for further analysis and cross-checking. Seasonal variation, availability and demand for the identified species were collected from the local fishermen and commission agents through interviews and discussions. The species were then identified according to their morphometric and meristic characteristics and systematically classified accordingly.

RESULTS AND DISCUSSION

The availability of marine fishes at the fish landing center is listed in Table 1. A total of 54 species were recorded, of which 42 were marine fish species, 7 were shellfish species and 5 were large fish species. A total of 8 orders and 25 families of marine fishes were observed. The dominant order was Perciformes, which comprises 22 species, followed by Scombriformes (7 species) and Clupeiformes (4 species). The lowest orders of marine fishes were Aulopiformes (2 species), Anguilliformes (1 species), Silluriformes (2 species), Pleuronectiformes (1 species) and Istiophoriformes (1 species). On average, Perciformes comprised approximately 56% of total marine fishes, followed by Scombriformes (17%), Clupeiformes (10%), Aulopiformes (5%), Siluriformes (5%), Anguilliformes (3%), Pleuronectiformes (2%) and Istiophoriformes (2%; Fig. 2A). The dominant family was Scomridae, which comprised 5 species (*Rastrelliger kanagurta*, *Auxis rochei*, *Scomberomorus guttatus*, *Euthynnus affinis* and *Thunnus obesus*), followed by Carangidae (*Parastromateus niger*, *Scomberoides tala*, *Atropus atropus* and *Alectis ciliaris*), Sciaenidae (*Protonibea diacanthus*, *Pterotolithus maculatus* and *Pennahia anea*) and Plynemidae (*Eleutheronema tetradactylum*, *Polynemus paradiseus* and *Leptomelanosoma indocum*). The rest of the families usually comprised from 1 to 2 species (Table 1, Fig. 2B).

The availability of marine fishes at the Cox's Bazar landing center varied according to species, season and consumer demand to some extent (Table 1). For instance, the availability of some fishes (i.e. *Pampus argenteus* and *Euthynnus affinis*) was higher during the winter, which might be due to their breeding season.

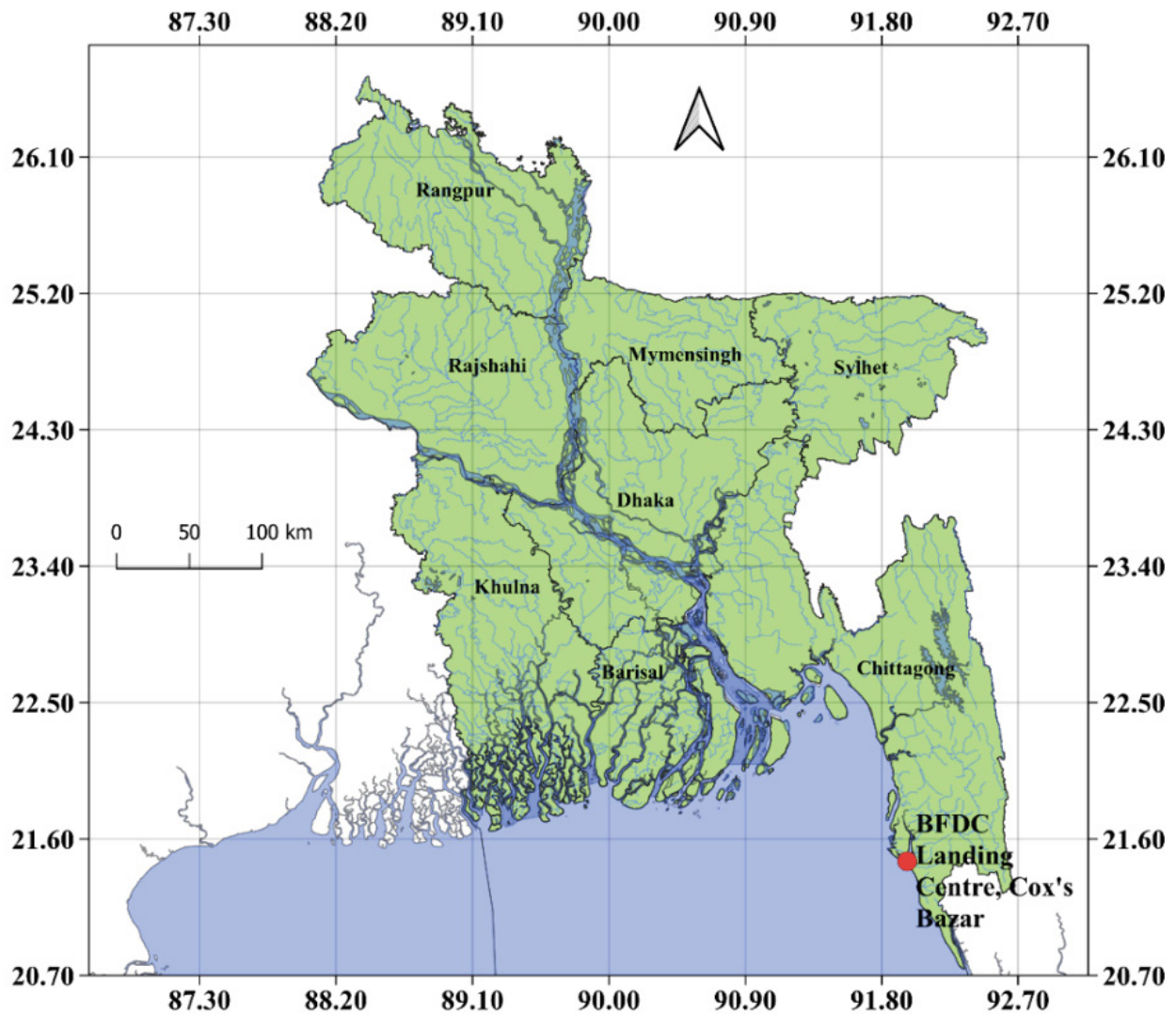


Fig 1. Location of Bangladesh Fisheries Development Corporation (BFDC) landing center, Cox's Bazar, Bangladesh

The availability of rupchanda *Pampus argenteus*, for instance, was observed throughout the year, with two breeding periods during April and October (Akhter et al., 2020). Although the availability of medium-sized hilsa *Tenualosa ilisha* was observed during the winter, the standard size of hilsa was usually observed during the monsoon season (September–October) because of their breeding season (Rahman et al., 2012). In contrast, the availability of some fishes (i.e. *Scomberoides tala*, *Mene maculate* and *Priacanthus hamrur*; Table 1) was lower during winter, although their consumer demand was also lower.

The consumer demand for some marine fishes (i.e. *Auxis rochei*) was comparatively high throughout the year. Consumer demand for fishes depends on factors such as fish type, fish price, consumer income and taste (Dey et al., 2008; Rahman et al., 2012). The consumer demand for marine fishes is generally lower than for freshwater fishes, which might be due to higher prices and lower availability in the domestic markets, although the demand for hilsa

is always much higher due to its taste and traditional purposes for the Bangladeshi people. The demand for fishes is mainly influenced by consumer income. Dey et al. (2008) stated that the income elasticity of all fish types consistently decreases as the per capita household expenditure level increases, but none of the fish types become an inferior good in the highest income quartile. According to the global IUCN Red List (IUCN, 2021), among the observed marine fish species found in the landing center, 56% species were designated as *Least Concern*, 22% were *Not Evaluated*, 10% were *Near Threatened*, 10% were *Data Deficient* and 2% were *Vulnerable* (Fig. 2C). The *Near Threatened* species were *Protonibea dliacanthus*, *Harpodon nehereus* and *Arius gagora*, and the *Vulnerable* species was *Thunnus obesus*. The relative contribution of Bombay duck *Harpodon nehereus* to total fish production decreased from 1.79% during 2002–2003 to 1.55% during 2018–2019, although the production of Bombay duck has increased by twofold during the last two decades (DoF, 2021).

Table 1. Available marine fishes at the Bangladesh Fisheries Development Corporation (BFDC) landing centre, Cox's Bazar, Bangladesh

SL No.	Groups	Scientific Name (SN)	Common Name (CN)	Local Name (LN)	Seasonal variation	Availability	Demand	IUCN Red List Status
Fishes								
01	Barramundi	<i>Lates calcarifer</i>	Giant sea perch	Koral/Bhetki	Winter	Medium	High	LC
02	Butterfish	<i>Stromateus chinensis</i>	Chinese pomfret	Rup Chnda	Monsoon-Autumn	High	High	NE
03		<i>Stromateus argenteus</i>	Silver pomfret	Foli Chnda	Winter	High	High	NE
04		<i>Parastromateus niger</i>	Black pomfret	Kalo Chanda	Winter	High	High	LC
05	Snapper	<i>Lutjanus lemniscatus</i>	Yellow-streaked snapper	Lal Koral	Winter	High	High	LC
06	Lizardfish	<i>Harpodon nehereus</i>	Bombay duck	Loittyta	Monsoon	High	High	NT
07		<i>Saurida tumbil</i>	Greater lizardfish	Bele/Ahila	Monsoon	High	Low	LC
08	Herring	<i>Tenualosa ilisha</i>	Hilsa herring	Ilish	Monsoon	High	High	LC
09		<i>Ilisha filigera</i>	Coromondel Ilisha	Dhela	Winter	High	High	DD
10		<i>Chirocentrus dorab</i>	Dorab wolfherring	Korati Chela	Winter	Low	High	LC
11	Anchovy	<i>Coilia dussumieri</i>	Pointed tail anchovy	Olua	Monsoon	Medium	High	LC
12	Catfish	<i>Arius gagora</i>	Gagora catfish	Chika Guijja	Winter	Low	High	NT
13		<i>Nemapteryx nenga</i>	Engraved catfish	Mat	Monsoon	Low	High	NE
14	Threadfin	<i>Eleutheronema tetradactylum</i>	Fourfinger Threadfin	Tailla	Winter	High	High	NE
15		<i>Polynemus paradiseus</i>	Paradise Threadfin	Topse	Winter	Low	High	LC
16		<i>Leptomelanosoma indicum</i>	Indian Threadfin	Lakkha	Summer-Monsoon	Low	High	NE
17	Tuna and Mackerel	<i>Euthynnus affinis</i>	Mackerel Tuna	Bom Maitta	Winter	High	High	LC
18		<i>Scomberomorus guttatus</i>	Indo-pacific King Mackerel	Maitta	All Season	High	High	DD
19		<i>Auxis rochei</i>	Bullet Tuna	Boma Maitta	All season	High	High	LC
20		<i>Thunnus obesus</i>	Bigeye Tuna	Tuna	Monsoon	High	High	VU
21		<i>Rastrelliger kanagartha</i>	Indian Mackerel	Bora	Winter	Low	High	DD
22	Croaker	<i>Pennahia anea</i>	Bigeye croaker	Kadi Poa	Monsoon-Summer	High	High	LC
23		<i>Protonibea diacanthus</i>	Black spotted croaker	Boro Kalo Poa	Monsoon-Winter	Low	High	NT
24		<i>Pterolithus maculatus</i>	Blotched tiger-toothed croaker	Chilik Poa	Winter	Medium	High	LC
25	Grouper	<i>Epinephelus chlorostigma</i>	Brown spotted grouper	Bol	Monsoon, Winter	Low	High	LC
26	Queenfish	<i>Scomberoides tala</i>	Barred Queenfish	Chapa Machh	Winter	High	High	LC
27	Barracuda	<i>Sphyræna putnamae</i>	Sawtooth Barracuda	Dharkuta	Very rare	Low	High	DD
28	Trevally	<i>Atropus atropus</i>	Cleft belly Trevally	Tak Chanda	Winter	High	High	LC
29		<i>Alectis ciliaris</i>	Threadfin Trevally	Tobol/Kartik	Winter	Low	High	LC
30	Sillago	<i>Sillaginopsis panjius</i>	Flathead Sillago	Tular Dandi/Ondhua	Monsoon	High	High	NE
31		<i>Sillago sihama</i>	Silver Sillago	Shundori machh	Monsoon	High	High	LC

Continued. Table 1.

SL No.	Groups	Scientific Name (SN)	Common Name (CN)	Local Name (LN)	Seasonal variation	Availability	Demand	IUCN Red List Status
32	Bullseye	<i>Priacanthus hamrur</i>	Moontail Bullseye	Ranga Chokha	Monsoon	Low	High	LC
33	Moonfish	<i>Mene maculata</i>	Moonfish	Tin Pata	Winter	Low	High	NE
34	Orb fish	<i>Ephippus orbis</i>	Orb fish	Hatir Kan	Summer-Monsoon	Low	High	NE
35	Sailfish	<i>Istiophorus platypterus</i>	Indo-pacific sailfish	Pakhi machh	Winter	High	High	LC
36	Dolphin fish	<i>Coryphaena hippurus</i>	Dolphin fish	Bela	Winter	Low	High	LC
37	Cobia	<i>Rachycentron canadum</i>	Cobia	Shamudrik Shol	Winter	Low	High	LC
38	Tongue Sole	<i>Cynoglossus lingua</i>	Long tongue sole	Pata machh	Winter	High	High	LC
39	Pike Eel	<i>Congresox talabonoides</i>	Indian pike conger	Kamila/Haila	Winter	High	High	NE
40	Sharksucker	<i>Echeneis naucrates</i>	Live sharksucker	Chaat machh	Winter	Low	High	LC
Shellfish								
01	Crustacean	<i>Penaeus monodon</i>	Black tiger shrimp	Bagda chingri	Cultured species	Low	High	LC
02		<i>Parapenaeopsis sculptilis</i>	Rainbow shrimp	Ruda chingri	Winter	High	High	LC
03		<i>Portunus sanguinolentus</i>	Three spot swimming crab	Kakra	Monsoon	High	High	NE
04		<i>Portunus pala-gicus</i>	Flower crab	Brouslin kakra	Monsoon/all season	High	Low	NE
05		<i>Panulirus homarus</i>	Mud spiny lobster	Lobster	Monsoon/all season	Medium	High	NE
06	Cephalopod	<i>Loligo edulis</i>	Swordtip squid	Nuilla	All season	High	Low	LC
07		<i>Octopus rugosus</i>	Grey octopus	Octopus	All season	High	Low	LC
Large fish								
01	Shark	<i>Sphyrna zygaena</i>	Smooth hammer-headed shark	Haturi hangor	Monsoon, Winter	High	Low	VU
02		<i>Carcharhinus amboinensis</i>	Pig-eye shark	Goboli hangor	Winter	High	Low	DD
03		<i>Carcharhinus dussumieri</i>	Whitecheek shark	Kalo lata hangor	Winter	Medium	Low	NE
04	Ray	<i>Himantura marginata</i>	Blackedge whipray	Pod moni	Winter	High	Low	DD
05		<i>Mobula birostris</i>	Giant oceanic manta ray	Badur machh	Winter	High	Low	VU

Note: The IUCN Red List categories LC, NE, NT, VU and DD represent *Least Concern*, *Not Evaluated*, *Near Threatened*, *Vulnerable* and *Data Deficient*, respectively

The availability of shellfish species in the fish landing center is shown in Table 1. The dominant order of shellfish species was Portunidae (43% of total shellfishes), followed by Penaeidae (29%), Loliginidae (14%) and Octopodidae (14%) (Fig. 3A). *Penaeus monodon* species in the landing center was mainly cultured. Other commercially important crustaceans included two crab species: *Portunus pelagicus* and *Portunus sanguinolentus*. Octopus and squid were more or less available throughout the year, whereas crustaceans were mostly found during the monsoon and winter seasons. The availability of these non-conventional fishes in the domestic fish market/fish landing center was

adequate, but their consumer demand in the local market was remarkably low despite the fact that they have a high export value. The major portion of these fishes was brought directly from the fisherman to the supplier before being landed at the fish landing center. In this study, 71% of the total shellfishes were designated *Least Concern* and 29% were *Not Evaluated* on the IUCN Red List (Fig. 3B). A total of five shark species (60% of the total large fish) and two ray species (40%) were recorded during the study period (Fig. 4A). Inconsistently, 31 shark species and 38 ray species were observed in the marine waters of Bangladesh (Hoq, 2014).

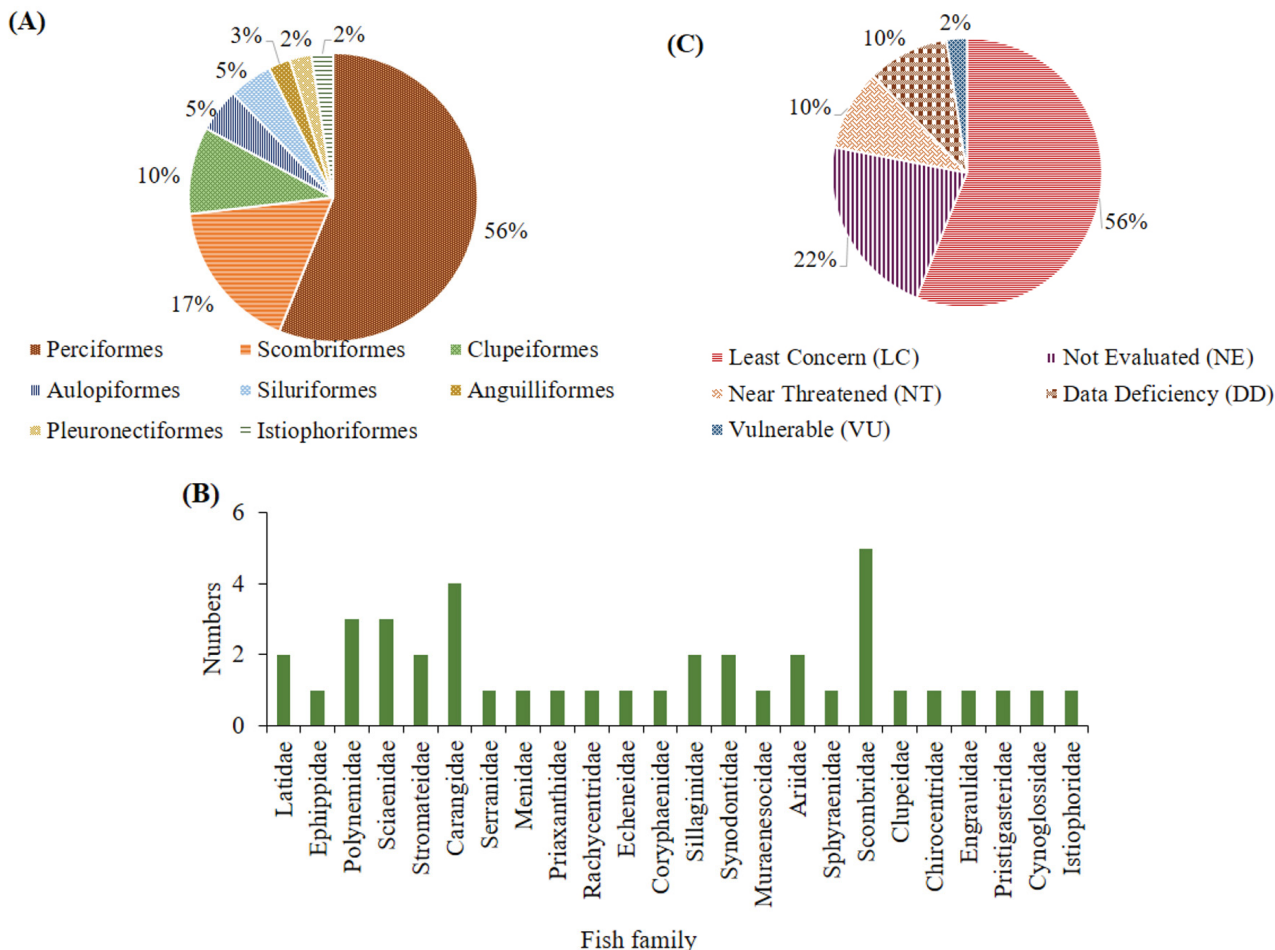


Fig 2. (A) Percentage share of different orders of the available marine fishes at the BFDC landing center, Cox's Bazar. (B) Different families of the available marine fishes at the BFDC landing center, Cox's Bazar. (C) Percentage share of Red List status of the available marine fishes at the BFDC landing center, Cox's Bazar

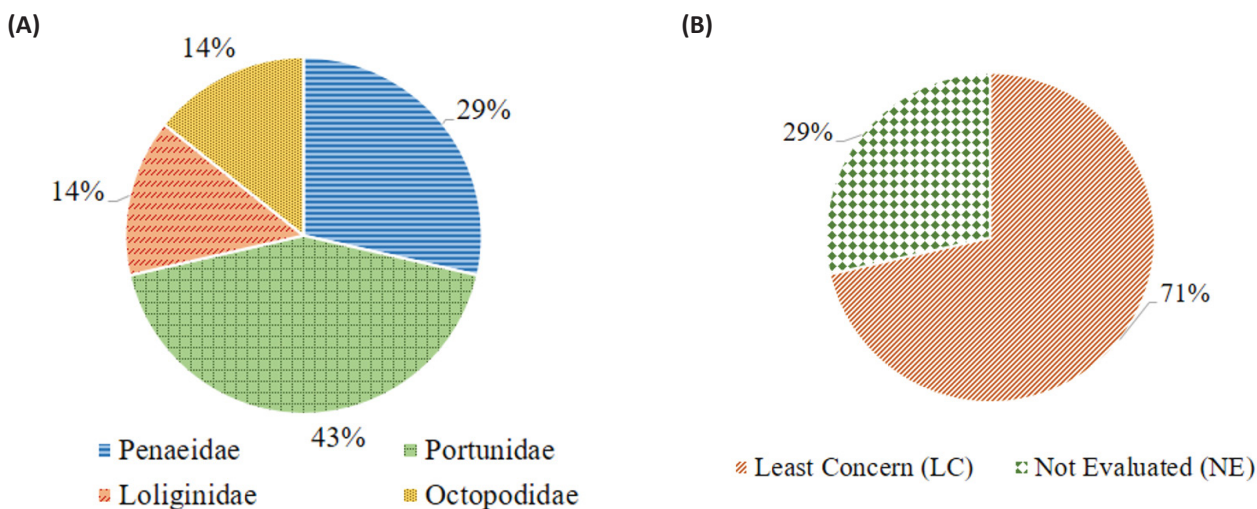
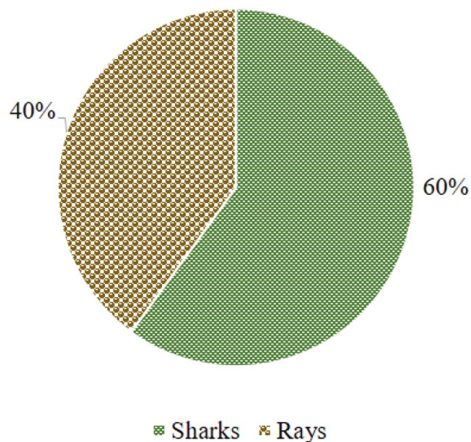


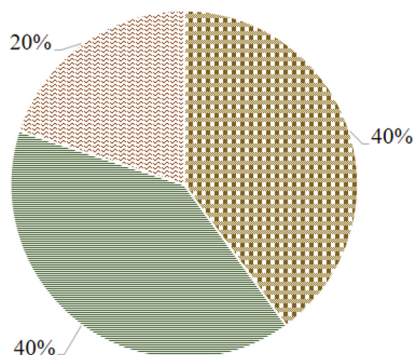
Fig 3. (A) Percentage share of different orders of the available shellfishes at the BFDC landing center, Cox's Bazar, (B) Percentage share of Red List status of the available shellfishes at the BFDC landing center, Cox's Bazar

The availability of sharks and rays was observed during the winter. Consistently, sharks were harvested in greater numbers between January and March, and the catch gradually fell after that (April–June), with the lowest catches recorded between July and September (Hoq et al., 2013). The size abundance percentages showed that sharks were mostly caught at small sizes (>30 cm), while skates and rays were caught at bigger (>50 cm) sizes. Although the availability of sharks and rays in the fish landing center was high, the consumer demand for these large fish was low, despite their high export value. Among the available sharks and rays, the commercially important species were *Carcharhinus amboinensis* and *Carcharhinus dussumieri* (Barua et al., 2014). Whitecheek shark *Carcharhinus dussumieri* is under threat of extinction at present or in the long run. Among the recorded large fish species, 40% were *Not Evaluated*, 40% were *Data Deficient* and 20% were classified as *Vulnerable* (Fig. 4B). The *Vulnerable* sharks and rays were *Sphyma zygaena* and *Mobula birostris*, respectively. The relative contribution of sharks, skates and rays to total fish production decreased from 0.25% (5,063 MT) during 2002–2003 to 0.10% (4,274 MT) during 2018–2019 (DoF, 2021). They are also especially *Vulnerable* to overfishing because of their mature and slow reproduction.

(A)



(B)



■ Vulnerable (VU) ■ Data Deficiency (DD) ■ Not Evaluated (NE)

Fig 4. (A) Percentage share of different orders of the available large fish at the BFDC landing center, Cox's Bazar, (B) Percentage share of Red List status of the available large fish at the BFDC landing center, Cox's Bazar

CONCLUSIONS

In conclusion, it was observed that the availability of marine fishes in the fish landing center was influenced by several factors, including fish species, season, prices, consumer preferences and income. The consumer demand for fishes, on the other hand, was influenced by fish species, prices, consumer preferences, income and taste. In the case of some commercially important marine fishes (hilsa), consumer demand was consistently related to availability. In contrast, consumer demand was inconsistently related to unconventional marine fishes (i.e. octopus and crab), despite the fact that they have a high export value. This study also discussed the IUCN Red List, which ultimately helps identify the current status of the common fish, shellfish and large fish species, and whether they need to be conserved or not. Some species were detected as *Endangered* and *Vulnerable*. Considering consumer preferences and market value, and to conserve species diversification of different fish, these *Threatened species* should be protected from going extinct. However, gaining knowledge based on species availability can help with learning about the peak seasons, variations in demand and, if necessary, protocols to follow for the proper management of the conservation of aquatic organisms.

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DOSTUPNOST MORSKIH RIBA NA COX'S BAZARU U BANGLADEŠU: STUDIJA SLUČAJA O ISKRCAJNOM CENTRU BFDC

SAŽETAK

Dostupnost ribe u obalnom iskrcajnom centru naglašava pretpostavku o stokovima u zoni morskog ribolova u oceanu. Cilj ovog istraživanja je analizirati dostupnost morskih riba u iskrcajnom centru BFDC na Cox's Bazaru u Bangladešu u razdoblju od siječnja do svibnja 2021. godine. Zabilježene su ukupno 54 vrste, od kojih su 42 morske ribe, 7 školjkaša i 5 velikih riba. Dominantni redovi su Perciformes (56%), Scombriformes (17%) i Clupeiformes (10%). Više od 56% ukupne morske ribe klasificirano je kao najmanje zabrinjavajuće vrste, a za razliku od toga, gotovo 10% morskih riba je gotovo ugroženo, a 2% je ranjivo. Dominantni redovi školjkaša su Portunidae (43%), zatim Penaidae (29%), Loligonidae (14%) i Octopopidae (14%). *Penaeus monodon* je najviše tražena od potrošača, dok je potražnja potrošača za nekonvencionalnim školjkama relativno niska. Većina školjkaša je iz skupine najmanje

zabrinjavajućih vrsta. Među velikim ribama, razmjerno veća dostupnost morskih pasa (5 vrsta) i raža (2 vrste) uočena je zimi i u razdoblju monsuna, iako je potražnja potrošača za tom megafaunom niska. Ranjivi morski psi i raže su *Sphyma zygaena* i *Mobula birostris*. Ova studija analizira trenutni sastav morskih riba u iskrcajnom centru BFDC na Cox's Bazaru u Bangladešu.

Ključne riječi: centar za iskrcavanje riba, morske ribe, školjkaši, Large fish, Cox's Bazar

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