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Status of Fish Availability and Fishing Gears of Nabaganga River at Jhenaidah District, Bangladesh

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ABSTRACT

The study was conducted from December 2022 to November 2023 to investigate the fish availability and fishing gears in the Nabaganga River at Jhenaidah district. Data were collected through questionnaire, interview and direct observation method. Species of the studied river, gear type and CPUE were estimated. During the study period, 27 species of fish under 7 orders and 14 families were identified in the Nabaganga River. Cypriniformes was the most dominant order constituting 40.74% of the total fish population followed by the Perciformes (22.22%), Siluriformes (14.81%), Clupeiformes (7.41%), Channiformes (7.41%), Beloniformes (3.7%) and Mastacembeliformes (3.7%). Population trends among the 27 species, 25.93% were decreasing, 33.33% were declining and 40.74% were unknown. The study disclosed 6 types of fishing gears which are broadly categorized as nets, traps, and hooks and lines. The average catch composition was found for *Ber jal* (12.5±0.90 kg/day) followed by Current jal (8.0±1.80 kg/day). The catch composition of *Jhaki jal, Thela jal, Polo and Chip borshi* were 4.25±0.5 kg/day, 2.75±1.32 kg/day, 1.25±0.05 kg/day and 1.95±0.04 kg/day, respectively. The lowest catch composition was measured for *Polo* (1.25±0.05kg/day). Negative activities, like destructive gears, agrochemical uses, and barrage construction were identified as causes for declining fish availability in the Nabaganga River.

Introduction

Bangladesh is blessed with her vast fisheries resources due to favorable climate condition and geographical location. There are 845399 ha of inland closed waters (pond and ditches, 410683 ha; oxbow lake or baor, 5671 ha; semi-closed floodplains, 149004 ha, and shrimp farms, 262980 ha) and 3860772 ha of inland open waters (rivers and estuaries, 853863; Sundarbans, 177700 ha; *beels*, 114161 ha; kaptai lake, 68,800 ha, and floodplains, 2646248 ha) along with huge areas of the Bay of Bengal in Bangladesh which are highly potential for fisheries sector. The production of inland fishes and other fisheries items both capture and culture was 40,52,701 mt in 2021-2022 where 13,21,631 mt from inland capture fisheries and 27,31,070 mt from inland culture fisheries. Only 14.83% (7.06 lakh mt) of the national total production comes from marine water resources, whereas 85.17% (40,52,701 mt) comes from inland water resources (DoF, 2023).

Within the extensive interior fisheries resources, rivers and *beels* hold great growth

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potential. *Beels* have extremely productive soil and abundant plant and animal life. Large and small indigenous fish with a variety of dietary and feeding habits find excellent natural habitats in *beels*. In order to feed, spawn, and grow during the monsoon, a large number of fish, prawns, and other species migrate from the nearby rivers and canals into the *beels*' waterlogged sections. River is also a big reservoir of fishes and other fisheries items. There are 260 freshwater species in Bangladesh (DoF, 2023). Among them 143 species of 260 freshwater fish are regarded as small indigenous species (SIS) (Rahman, 2005). These species were all discovered to be present in *beel* and river water sources. One of the main concerns is the declination in the number of freshwater fish species available in Bangladesh where 25.3% (64 species) were classified as threatened (IUCN, 2015). Among them, 30 species is endangered fish, 25 species is vulnerable fish, and 9 species is critically endangered fish. Now-a-days, one of Bangladesh's biggest issues is the continuous decline in aquatic biodiversity in natural waters (Galib *et al.* 2009; Chaki *et al.* 2014). Fish species were diminishing due to habitat degradation, unplanned and uncontrolled development along the riverbank, water abstraction for agriculture and drinking, massive siltation, overfishing and industrial and domestic pollution. Major concerns about the decreased availability of freshwater species include the indiscriminate harvesting of fish fry and fingerlings, modification through different fishing gears and reduction of water flow and loss of fish habitat (Hanif *et al*. 2015; Hossain *et al*. 2015).

According to a study by Islam *et al.* (2016), the number of fish species in the Nabaganga River decreased from 41 to 35 between 1970 and 2014, with six species already extinct. Once the rivers are the store house of 260 species of fishes but at present only few percentages of fishes were available (Chandra and Kumar, 2015). Study regarding fish status and fishing gears in Nabaganga River is very rare. Therefore, the present study was taken to know the status of fish and fishing gears of Nabaganga River at Jhenaidah district in southwestern Bangladesh.

Materials and methods

Study site and period

The current study was carried out in the "Nabaganga River" under the Sadar upazila of Jhenaidah district (Fig. 1). The study was conducted from December 2022 to November 2023.

Fig. 1. Geographical location of the study area (Nabaganga River)

Data collection method

Survey method

Survey methods were used to gather preliminary data on the availability of fish species, various types of gear, and catch per unit effort in the research area.

Interview method

The necessary information was gathered through in-person interviews, in-depth conversations with local fishermen, and direct observation using a tested, verified questionnaire that had been updated before usage.

Direct observation

Direct observation method was also applied for the data collection for the study.

Identification of the collected sample

By analyzing morphometric and meristic (if necessary) traits along with specimen color from various literature, the gathered fish samples were identified. The fish species were identified mostly using A. K. Ataur Rahman's taxonomic key (Rahman, 2005). The fish species were categorized using both local and English names and classified according to order. Make an effort to offer a comprehensive list of fish scientific

Table 1. List of fish species in Nabaganga River

Order	Family	Scientific name	Local name	Local status	Global status	Population trends
Cypriniformes	Cyprinidae	*Labeo rohita*	Rui	LC	LC	Declining
		Gibelion catla	Katla,Katol	VU	LC	Declining
		Cirrhinus cirrhosis	Mrigal, Mirka	NT	VU	Decreasing
		Labeo bata	Bata	LC	LC	Unknown
		Hypophthalmichthys molitrix	Silver carp	LC	NT	Unknown
		Puntius sarana	Sarputi	NT	LC	Declining
		Puntius ticto	Tit puti	LC	LC	Unknown
		Amblypharyngodon mola	Mola,Moa	VU	LC	Decreasing
		Cyprinus carpio var. communis	Japanirui,Common carp,Carpu	NT	VU	Declining
		Lepidocephalus guntea	Puiya, Gutum	VU	LC	Decreasing
		Esomus danricus	Darkina, Dankana	VU	LC	Declining
Siluriformes	Bagridae	*Mystus tengara*	Bajari tengra	EN	LC	Unknown
		Ompok pabda	Madhu pabda	EN	NT	Decreasing
	Heteropneustidae	*Hetropneustes fossilis*	Shing	LC	LC	Unknown
	Clariidae	*Clarias batrachus*	Magur	LC	LC	Declining
Clupeiformes	Notopteridae	*Notopterus notopterus*	Pholi	VU	LC	Declining
	Clupeidae	*Corica soborna*	Kachki	LC	LC	Decreasing
Perciformes	Anabantidae	*Trichogaster lalius*	Lal kholisa	VU	LC	Unknown
		Anabas testudineus	Koi	VU	LC	Unknown
	Nandidae	*Nandus nandus*	Meni,Veda,Roina	VU	NT	Decreasing
	Cichlidae	*Oreochromis mossambicus*	Tilapia	NT	LC	Unknown
	Gobidae	*Glossogobius giuris*	Bele	VU	LC	Unknown
	Ambassidae	*Chanda ranga*	Chanda	VU	LC	Decreasing
Mastacembeliformes	Mastacembelidae	*Macrognathus aculeatus*	Tara baim	VU	LC	Unknown
Channiformes	Channidae	*Channa striatus*	Shol	EN	LC	Declining
		Channa orientalies	Cheng, Gachua	VU	LC	Declining
Beloniformes	Belonidae	*Xenentodon cancila*	Kakila, kakle	LC	LC	Unknown

*VU=Vulnerable; LC=Least concern; EN=Endangered; NT=Near threatened, IUCN Bangladesh (2015). Red list of Bangladesh, Volume 5: Freshwater fishes.

names using the most recent guide (Talwar and Jhingran, 1991).

Estimation of catch per unit effort (CPUE)

For each type of gear, CPUE kg/day was recorded. An electric balance at the study site was used to determine CPUE.

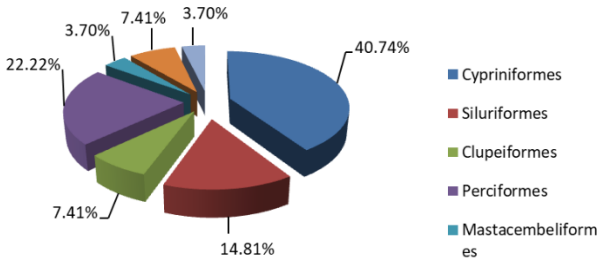

Fig. 2. *Percentage composition of total fish species under different order.*

Data processing and analysis

Following various office resources, online resources, and reference books, the pertinent data and documents are examined and assessed. All of the information gathered was meticulously recorded and summarized. To understand the current situation, all of the information that had been gathered was assembled, examined, and tabulated using Microsoft Excel.

Results and Observation

Availability of fish species

In all, 27 fish species from the Nabaganga River, belonging to 7 orders and 14 families, have been counted and identified thus far in this study. A list of all the fish species that are currently available, together with information on their taxonomic position (order and family name), scientific name, local name, local status, global status, and population trends were observed (Table-1). According to the results of the current study, among the seven orders, the Cypriniformes accounted for 40.74% of the total fish population, while the Siluriformes made up 14.81%. The total number of fish species as follows: Clupeiformes (7.41%), Perciformes (22.22%), Channiformes (7.41%), Mastacembeliformes (3.7%), and Beloniformes (3.7%) (Table-1, Fig.02). Fish species availability was determined by their abundance while sampling and by conducting interviews with 20 fishermen.

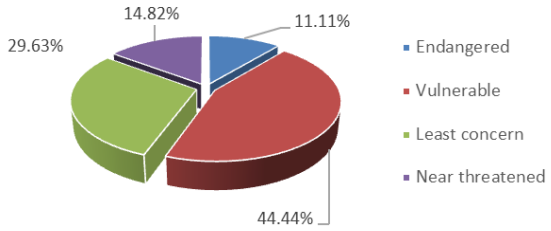

Fig. 3. Local status of fish species in Nabaganga River.

Local status of fish species in Nabaganga River

The fact that 27 of those species have been identified in the Nabaganga River is quite concerning. The local status of fish was divided into four categories: vulnerable (VU), endangered (EN), near threatened (NT), and least concern (LC). Among the 27 species, 11.11% were endangered, 44.44% were vulnerable, 14.82% were near threatened, and 29.63% were least concern (Fig. 3).

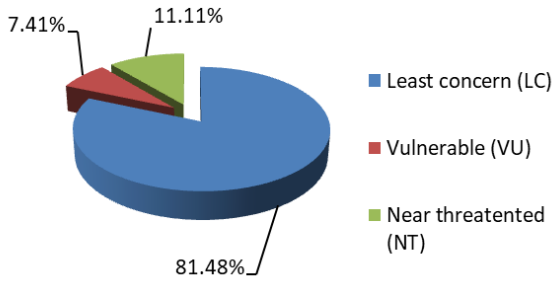

Fig. 4: Global status of fish species in Nabaganga River.

Global status of fish species in Nabaganga River

The three categories for fish global status were LC (least concern), VU (vulnerable) and NT (near threatened). Among the 27 species, 11.11% were near threatened, 7.41% were vulnerable, and 82.48% were least concern (Table-1, Fig. 4).

Population trends of fish species in Nabaganga River

Population trend was divided into three categories: declining, decreasing, and unknown. Among the 27 species, 33.33% were declining, 40.74% were unknown, and 25.93% were decreasing (Table-1, Fig. 5). In the present study it was observed and can be said that negative activities, like destructive gears, agrochemical use, and barrage construction are the main

Table 2. Illustration of available fishing gears with their fishing effort, catch composition and major species caught from Nabaganga River

Gear types	Local name	Fishing effort/day	CPUE (kg/effort)	Catch/day		Major species caught
				kg/day	Mean±SD	
Gill net	Current jal	2	3-5	6-10	8±1.80	Punti,Tengra,Khalisa,Kachki, Mola, Bele
Seine net	Ber jal	1-2	5-10	5-20	12.5±0.90	All species
Cast net	Jhaki jal	25-30	0.1-0.2	2.5-6	4.25±0.5	Shol,Taki,Rui, Darkina,Punti
Push net	Thela jal	40-50	0.05-0.1	1.5-4	2.75±1.32	Tengra, Punti, Darkina,Khalisa
Traps	Polo	50-100	0.01-0.02	0.5-2	1.25±0.05	Bata, Rui,Shol, Taki
Hook and line	Chip borshi	15-30	0.03-0.05	0.45-1.5	1.95±0.04	Tilapia, Tengra, Shing, Taki, Shol

*Jal= Fishing net, **CPUE= Catch per unit effort

causes for declining fish availability in the Nabaganga River.

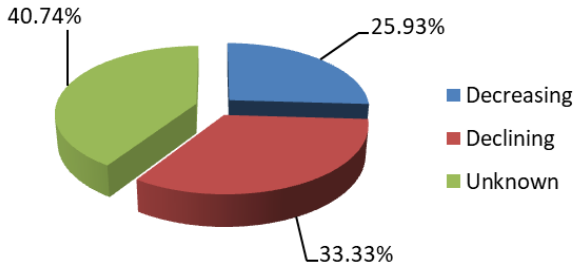

Fig. 5. Population trends of fish species in Nabaganga River.

Fishing gear used in Nabaganga River

Throughout the study period, six different types of fishing gear were observed being used to collect fish from this river. Three main categories were used to classify all of these different kinds of gear. These categories include one form of trap (*Polo*), four types of nets (Gill net, Seine net, Cast net, and Push net), and one type of hooks and lines (*Chip Borshi*). In the study region, it was found that a number of variables, including rainfall and water levels (both current and depth), affected how the gears operated. Depending on the water level and fish species availability throughout the year, different types of gear, mesh sizes, and lengths are used.

Catch composition

In the Nabaganga River, fish catch per day for each type of fishing gear were estimated (Table 02 and Fig. 6). The average catch composition for *Ber jal* was determined as 12.5±0.90 kg/day, whereas in case of *Current jal* it was 08±1.80 kg/day. The catch per day of *Polo, Jhaki jal, Thela jal,* and *Chip Borshi* was 4.25±0.50 kg/day, 2.75±1.32 kg/day, 1.25±0.05 kg/day and 1.95±0.04 kg/day, in that order. *Polo* had the lowest catch composition, measuring 1.25 kg per day. Negative activities, like destructive gears, agrochemical uses, and barrage construction were identified as causes for declining fish availability in the Nabaganga River.

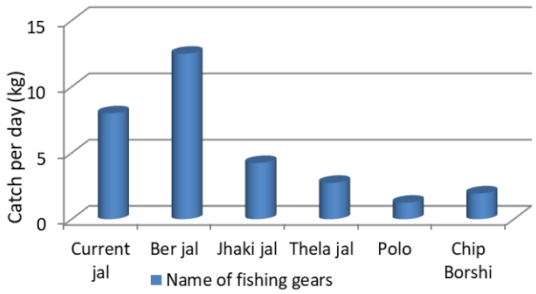

Fig. 6. Representation of catch composition per day by respective fishing gears.

Discussion

In the study region, a total of 27 species of fish representing 7 orders and 14 families were found. These results are essentially in line with those of Rubel *et al*. (2016), who examined the Lohalia River's fish availability. In the Lohalia River, they found 30 species of fish from 16 orders and 7 families. During a study in the Andharmanik River, Ali *et al*. (2020) found 93 different species of fish, which are organised into 66 genera, 45 families, and 14 orders. Perciformes (27.65%) was the most prevalent order, followed by Clupeiformes (7.45%), Mastacembeliformes (4.26%), Cypriniformes (20.21%), and Siluriformes (21.28%). The percentage compositions of the 93 fish species in the river were determined to be, respectively, 14%, 11%, 6%, and 59% for the vulnerable, endangered, critically endangered, and not threatened species. These results are mostly consistent with the current study and from all the literature it can be said that the number of species is reduced. Negative activities, like destructive gears, agrochemical use, and barrage construction were identified as causes for declining fish availability in the Nabaganga river.

Among the 27 fish species that have been identified, the greatest number (12) have been classified as vulnerable (44.44%). 8 species rated as least concern (29.63%), 3 species rated as endangered (11.11%) and 4 species rated as near threatened (14.82%) follow this. About 20% of the 21 species that have been detected in the Meghna River are threatened; two species (2%) were evaluated to be critically endangered, eight species (7.48%) to be endangered and eleven species (10.28%) to be vulnerable (Pramanik *et al*. 2017).

According to the IUCN World Status Report (2015), this river had the highest percentage of fish species in the least concern category (81.84%), followed by near threatened (11.11%) and vulnerable (7.41%). In the Brahmaputra River, Galib (2015) found nearly comparable results: 82% of native fish species were classified as least concern, followed by near-threatened (9%), not evaluated (5%), threatened (2%), and data-deficient (2%). Rahman *et al.* (2012) stated that a total of 34 species were recorded as threatened in the Padma River. Among them, 12.50% were vulnerable, 21.25% were endangered and 8.75% were critically endangered. According to Mondol *et al.* (2015), 18.37% were very rare while 40.82% were rare. 30.61% were found throughout the year in a small amount while only 6.12% were available throughout the year in a large amount in the Karatoya River. In the Rupsha River, 14 species were identified as threatened, among them 5 (35.71 %) species as vulnerable, 8 (57.14 %) species as endangered and 1 (7.14 %) species as critically endangered. However, alarmingly 31.25% of the fish species found during the study are categorized as very rare while 17.18% species were grouped as rare due to low catch amount. On the other hand, 28.13% species were found in small quantities while only 23.44% species were available in large quantities throughout the year (Hossain *et al*., 2016).

According to the correspondent, declining (25.93%) and decreasing (33.33%) are the next two categories of fish species in the river after unknown (40.74%). Galib (2015) found evidence of a similar population trend in the Brahmaputra River, where the largest percentage of fish species (57%) belonged to an unknown group, followed by decreasing (25%), stable (13%), and not evaluated (5%).

According to the current study, there are six different kinds of fishing gear used in the Nabaganga River. These can be broadly categorized into three basic groups: nets, traps, hooks, and lines. These categories include one form of trap (Polo), four types of nets (Gill net, Seine net, Cast net, and Push net), and one type of hooks and lines (*Chip borshi*).

In order to assess the current state of the fisheries on the Meghna River of Bangladesh, Hasan *et al.* (2016) conducted a survey. During the study period, eleven different types of nets, including gill nets, seine nets, drag nets, set bag

nets, lift nets, cast nets, etc. as well as two types of traps were found to be in use.

There were 19 different kinds of fishing gear were identified in the old Brahmaputra River. The push and lift nets came in second with a fishing effort of 0.0224 gear/haul/day, while the seine net recorded the highest catch per unit effort (CPUE) of 5.56 kg/gear/day. CPUE and fishing effort for traps were 3.74 and 0.0034, respectively, but those for hook and line (1.38 and 0.0048). In terms of net types, the highest CPUE (2.44 kg/gear) was found just before the pre-monsoon in June and the lowest (1.49 kg/gear) was found in the dry season in January. In contrast, the highest and lowest CPUE (3.0 kg/gear and 0.5 kg/gear) were noted in the same period for traps (Saberin *et al*. 2018). According to Ahmed *et al*. (2022), the catches of multi-meshes set bag nets were highest in February (7.87± 0.74 kg/fisherman/day). Barrier nets came in second (5.41±0.32 kg/fisherman/day) in January, gill nets came in third (5.21±0.45 kg/fisherman/day) in the month of June, other nets came in fourth (3.79±0.47 kg/fisherman/day) in November and seine nets came in fifth (3.24±0.24 kg/ fishermen/day) in the month of January. The monsoon season (3.83±0.5) and the dry season (4.25±0.41) had the highest CPUE (kg/fishermen/day).

Throughout the study period, six different types of fishing gear were observed being used to collect fish from this river. Three main categories were used to classify all of these different kinds of gear. These categories consist of one type of hooks and lines, four types of nets, and one type of trap. The fact that these are still hidden from fish underwater means that fish cannot escape from their *current jal*. Fish can escape through other kinds of nets because they remain considerably more noticeable. Using *current jal* in open water bodies is still permitted despite a nearly ten-year ban, which kills young fish and reduces fish stocks overall. Also, because of low dams, *Banas*, and *Bhendi Jal* (the local name), all of the river's inlets and outlets are obstacles.

Conclusion

It was observed in the current investigation that the number of fish species in the Nabaganga River had decreased. Cypriniformes was the most dominant group among 7 orders (Beloniformes, Channiformes, Cypriniformes, Siluriformes, Clupeiformes, Mastacembeliformes, and Perciformes) in Nabaganga River. Six types of fishing gears were observed being used to collect fish from this river. Three main categories were used to classify all of these different kinds of gear (hooks and lines, net and trap). Fishes are decreased due to low dams, banas, barricade and using of *Bhendi Jal* (gill net). The wise use of fish and fisheries resources requires the implementation of environmentally conscious exploitation practices as well as financial assistance from government and non-government organizations is indispensable with the intension of initiating further surveys, research, monitoring and raising awareness among the people for better management and conservation of fisheries resources and use of eco-friendly fishing equipment in Nabaganga River of Bangladesh.

Authors' Contribution

Conceptualization, SNJ; Formal analysis, SNJ; Methodology, SNJ; Investigation, MRN; Writing-original draft preparation, SNJ and MRN; Writing-review and editing, SNJ and MRN; supervision, SNJ. Both authors have read and agreed to the published version of the manuscript.

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