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Current Status and Richness of Fishes in the Old Brahmaputra River of Bangladesh

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ABSTRACT

The study, conducted from July 2019 to June 2020, aimed to assess fish richness and status in the Old Brahmaputra River, covering the stretch from Defla bridge (Islampur upazila) to Sharifpur (Jamalpur Sadar upazila). A total of 53 fish species was collected which belongs to 6 orders and 20 families. Among them catfish, loach, carp, barb, minnow, snakehead, clupeid, perch, mullet, eel corresponds to 16, 5, 6, 5, 5, 2, 2, 5, 2, 2 and 3 nominal fish species, respectively. Further, two additional fish species (*Xenentodon cancila*, *Glossogobius giuris*) was also documented. The Cyprinidae family recorded the highest number of species (21), while only one species was found in each of the Belonidae, Engraulidae, Clupeidae, Balitoridae, Erethistidae, Heteropneustidae, Siluridae, Gobiidae, Sciaenidae, Anabantidae, and Osphronemidae families. Of the 53 species; 13 was categorized as threatened, 2 species critically endangered [*Bagarius bagarius, Sisor rhabdophorous*], 7 species endangered [*Botia lohachata, Barilius vagra, Crossocheilus latius, Clupisoma garua, Rita rita, Mastacembelus armatus*] and 4 species vulnerable [*Sparata aor, Wallago attu, Gudusia chapra, Sicamugil cascasia*]. Exotic fish species (*Cyprinous carpio* var. *communis*) was recorded. The Simpson's Diversity Index (SID= 0.9586) demonstrated high levels of diversity across these groups. This investigation not only highlights the species richness of Old Brahmaputra River but also aids in identifying key faunal elements of high conservation significance and assessing their potential risk of extinction. To restore the fish biodiversity of the Old Brahmaputra River proper conservation and management policy should be taken immediately.

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Introduction

Bangladesh is a biologically rich country with paramount water resources and aquatic biodiversity. The major fisheries occur in rivers, ponds, haors, baors, flood lands, ditches, canals, ox-bow lakes, kaptai lake, brackish and marine water bodies that together offers enormous opportunities for fisheries development (Rahman et al., 2012). Fisheries play a significant role in socio-economic development, nutrition, employment, poverty alleviation of huge number of population and foreign exchange earnings in the economy of Bangladesh (Raushon et al., 2017). It is a riverine country with about 700 rivers and tributaries which constitute a waterway of total length about 24,140 km (Ahmed et al., 2013).The Padma, the Meghna and the Brahmaputra are the major rivers of the country which comprising one of the most productive freshwater fisheries in the world (Hossain, 2014)There are 57 international rivers flow through Bangladesh of which 54 rivers flow directly from India and 3 from Myanmar (Afroz and Rahman, 2013).

The Brahmaputra River is one of the major river of Bangladesh with total length about 3000 km (Afrose and Ahmed, 2016). The main channel of the Brahmaputra River flowing through Bangladesh is known as the Jamuna and the old channel is known as the Old Brahmaputra River (OBR) which arises near Bahadurabad at Dewangonj upazilla and run through Mymensingh to the south and at Bhairab bazar it falls into the Meghna. Once upon a time the OBR was the main flow of the Brahmaputra – Jamuna river system. The massive siltation has threatened the existence of this river and its water capacity is gradually being reduced and turned into a narrow river. This river once the blessings for the Bangladesh providing fishing, communication and irrigation facilities are now drying up and the fishermen who lives beside the river are facing hardship due to lack of fish in the river(Afrose and Ahmed, 2016).The complete drying up in many places of the OBR is a common scenario during dry season which is exaggerated to fish population. The OBR is also considered as an important spawning and feeding ground for riverine fishes of Bangladesh(Ahmed et al., 2012)For the balance of ecosystem and ensure the food security there is no alternatives to increase fish production and conserve aquatic biodiversity.

Previous research by Raushon et al., 2017 and Bashar et al., 2020 examined the biodiversity of OBR in the Mymensingh districts, while Hasan and Tripti, 2021 investigated the biodiversity of OBR from Fulchari, Gaibandha, to Melandah, Jamalpur. No effort was undertaken to evaluate the present status and species richness of OBR from Defla bridge at Islampur upazila to Sharifpur in Jamalpur sadar upazila within Jamalpur district. Consequently, this study aimed to evaluate the present status and abundance in OBR for the benefit of the extensive fisheries community and ichthyologists to comprehend the diversity of fish in this particular segment of OBR.

Materials and Methods

Study area

The study areas are located near the southern bank of the river OBR and it covered from Defla bridge at Islampur upazila to sharifpur at sadar upazila of Jamalpur district that ranged approximately 20 km long. The samples and data were collected from Defla bridge at Islampur upazilla and Sharifpur under Jamalpur sadar upazilla of the OBR basin.

Sample collection

The study was conducted for a period of 12 month from July 2019 to June 2020. Data was collected monthly basis during the study period. Systematic monthly visits were made to the selected areas and samples were collected from the fisherman when they were fishing in the river. All collected specimens were preserved in specialized glass jar/container with 90% Ethanol at Evolution and Diversity Research Laboratory, Department of Fisheries, Jamalpur Science and Technology University, Jamalpur.

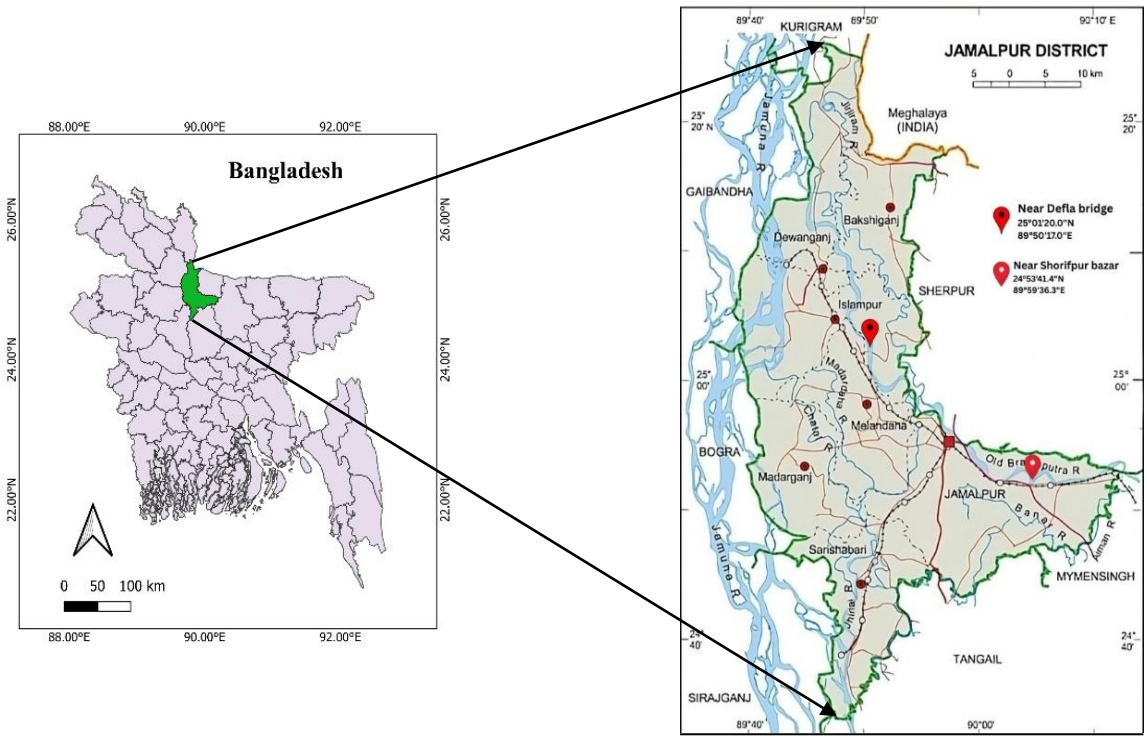

Figure 1. Showing map of the study site at the Old Brahmaputra River

Identification and data collection

Species identification was carried out using standard fisheries literature (Rahman, 2005; Talwar and Jhingran, 1991) along with taxonomic keys and online resources such as FishBase and the Catalog of Fishes (Fricke et al., 2024). We found out the conservation status of these species based on the database of IUCN national (2015) and IUCN international (2021). Primary data on the concerned species were collected from the fisherman and local peoples. Relevant data such as local name, source, distribution and availability of the species etc. were collected from the study sites. Research article on the freshwater fish fauna of Bangladesh was consulted towards compiling the past data of abundance and availability for evaluating biodiversity status.

Data analysis

The abundance and related analyses were calculated by using Microsoft Excel. The status of fish diversity was assessed using the Diversity Index (D), as established by Simpson (1949).

Diversity Index (D) measures evenness in species abundance. $D = \sum n\ (n-1)/N\ (N-1)$

In this investigation, Total 798 individuals were collected,

$D = \sum n\ (n-1)/N\ (N-1)$

$=26360/798\times797$

$=26360/636006$

$D=0.0414$

Simpson's Index (SID) $=1-D$

$= 1- 0.0414$

$= 0.9586$

Results

Fifty-three species were recorded from the OBR during the study period represented by catfish, loach, barb, minnow, carp, perch, snakehead, eel, clupeid, mullet and miscellaneous species. Different groups, abundance, national biodiversity status and individual numbers are shown the Table 1.

Table 1. Different groups, abundance, national biodiversity status and individual numbers of species.

Order Name	Family Name	Sl no.	Scientific name	Group Name	Abundance	Biodiversity status	Number of individuals(n)
Cypriniformes	Balitoridae	1	*Acanthocobitis botia*	Loach	Less Common	LC	4
	Cobitidae	2	*Somileptes gongota*		Less Common	NT	3
		3	*Botia dario*		Less Common	EN	6
		4	*Botia lohachata*		Less Common	EN	4
		5	*Lepidocephalus guntea*		Common	LC	22
	Cyprinidae	6	*Amblypharyngodon mola*	Barb	Common	LC	41
		7	*Esomus danricus*		Common	LC	37
		8	*Puntius ticto*		Abundant	LC	43
		9	*Puntius sophore*		Less common	LC	16
		10	*Osteobrama cotio*		Less Common	NT	13
		11	*Salmostoma bacaila*	Minnow	Abundant	LC	19
		12	*Crossocheilus latius*		Common	EN	47
		13	*Aspidoparia joya*		Abundant	LC	33
		14	*Barilius barila*		Less Common	DD	4
		15	*Barilius vagra*		Rare	EN	1
		16	*Labeo calbasu*	Carp	Less Common	LC	6
		17	*Labeo rohita*		Less Common	LC	4
		18	*Cyprinus carpio* var. *communis*		Less Common	LC	2
		19	*Catla catla*		Less Common	LC	3
		20	*Cirrhinus cirrhosus*		Less Common	NT	2
		21	*Cirrhinus reba*		Common	NT	29
Siluriformes	Bagridae	22	*Mystus cavasius*	Cat fish	Common	NT	38
		23	*Mystus vittatus*		Common	LC	43
		24	*Rita rita*		Less Common	EN	5
		25	*Sperata aor*		Rare	VU	3
	Erethistidae	26	*Conta conta*		Less Common	NT	9
	Heteropneustidae	27	*Heteropneustes fossilis*		Less common	LC	6
	Schilbidae	28	*Ailia coila*		Abundant	LC	49
		29	*Clupisoma garua*		Abundant	EN	38
		30	*Eutropiichthys murius*		Common	LC	21
		31	*Eutropiichthys vacha*		Common	LC	11
	Siluridae	32	*Wallago attu*		Rare	VU	5
	Sisoridae	33	*Bagarius bagarius*		Rare	CR	3

		34	*Gagata cenia*		Abundant	LC	19
		35	*Gagata gagata*		Abundant	LC	39
		36	*Gagata youssoufi*		Common	NT	33
		37	*Sisor rhabdophorus*		Rare	CR	1
Perciformes	Mastacembelidae	38	*Mastacembelus armatus*	Eel	Common	EN	5
		39	*Mastacembelus pancalus*		Common	LC	36
		40	*Macrognathus aculeatus*		Less Common	DD	6
	Ambassidae	41	*Chanda nama*	Perch	Common	LC	44
		42	*Pseudambassis ranga*		Common	LC	31
	Anabantidae	43	*Anabus testudineus*		Less Common	LC	3
	Osphronemidae	44	*Colisa fasciatus*		Less Common	LC	11
	Sciaenidae	45	*Johnius coitor*		Less Common	LC	4
	Gobidae	46	*Glossogobius giuris*	Miscellaneous species	Abundant	LC	28
	Channidae	47	*Channa punctatus*	Snakehead	Common	LC	9
		48	*Channa striatus*		Less Common	LC	5
Clupeiformes	Clupeidae	49	*Gudusia chapra*	Clupeid	Less Common	VU	7
	Engraulidae	50	*Setipinna phasa*		Rare	LC	2
Beloniformes	Belonidae	51	*Xenentodon cancila*	Miscellaneous species	Abundant	LC	6
Mugilliformes	Mugillidae	52	*Sicamugil cascasia*	Mullet	Less Common	VU	3
		53	*Rhinomugil corsula*		Common	LC	23

Figure 1. Picture of fish species recorded during the investigation (size not in scale)

Acanthocobitis botia

Somileptes gongota

Botia dario

Botia lohachata

Lepidocephalus guntea

Amblypharyngodon mola

Esomus danricus

Puntius ticto

Crossocheilus latius

Salmostoma bacaila

Osteobrama cotio

Puntius sophore

Aspidoparia joya

Barilius barila

Barilius vagra

Labeo calbasu

Figure 1. Picture of fish species recorded during the investigation (size not in scale) **(Contd.)**

Cirrhinus cirrhosus

Catla catla

Cyprinus carpio var. *comunnis*

Labeo rohita

Cirrhinus reba

Mystus cavasius

Mystus vittatus

Rita rita

Ailia coilia

Heteropneustes fossilis

Conta conta

Sparata aor

Clupisoma garua

Eutropiichthys murius

Eutropiicthys vacha

Wallago attu

Gagata youssoufi

Gagata gagata

Gagata cenia

Bagarius bagarius

Sisor rhabdophorus

Mastacembelus armatus

Mastacembelus pancalus

Macrognathus aculeatus

Colisa fasciatus

Anabus testudinius

Pseudambassis ranga

Chanda nama

Johnius coitor

Glossogobius giuris

Channa punctatus

Channa striatus

Sicamugil cascasia

Xenentodon cancila

Setipinna phasa

Gudusia chapra

Rhinomugil corsula

Various groups of fish recorded during the study period

Throughout the investigation, different types of fish group were recorded including carp (11.32%), perch (9.43%), snakehead (3.77%), cat fish (30.18%), eel (5.66%), barb (9.43%), minnow (9.43%), loach (9.43%), mullet (3.77%), clupeid (3.77%) and miscellaneous (3.77%). Figure 2

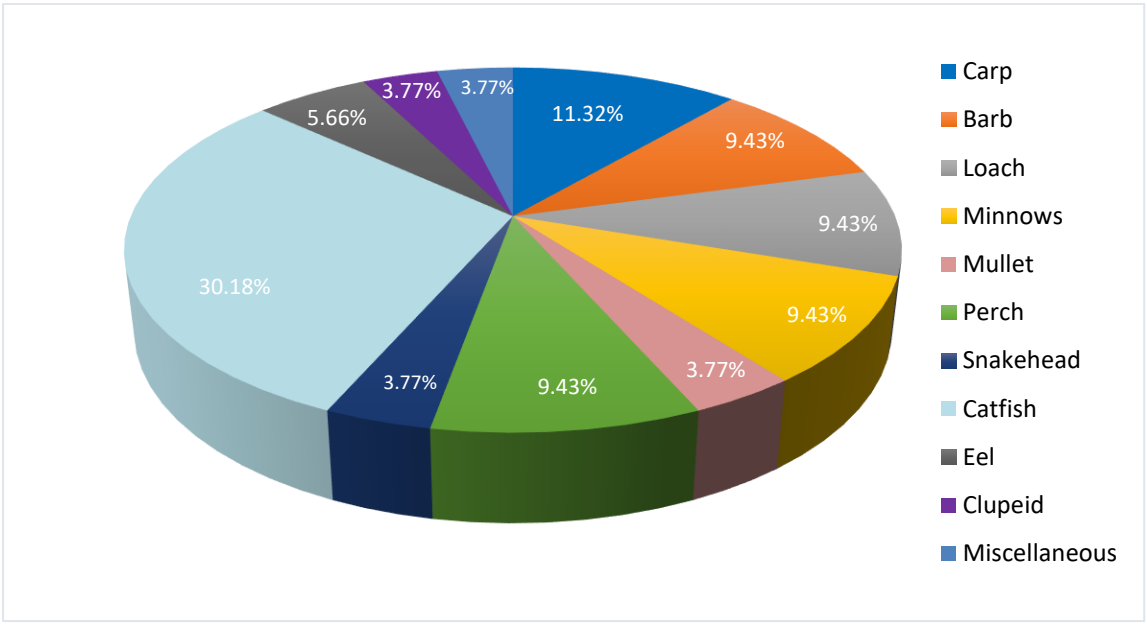

Figure 2. Various groups of fish recorded during the study period

Abundance of fish species found in the OBR

During the research period, four abundance categories were recorded in the Old Brahmaputra River: abundant (16.98%), common (30.18%), less common (41.50%), and rare (11.32%) (Figure 3).

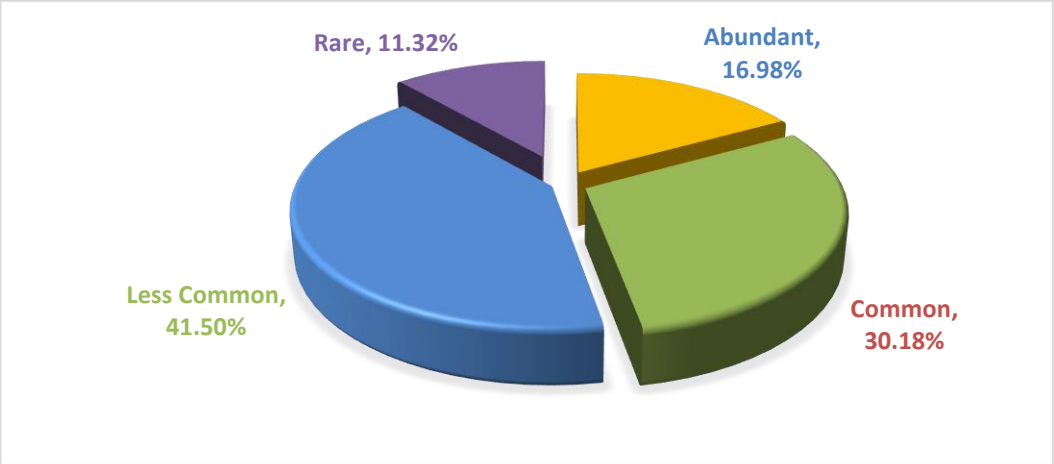

Figure 3. Abundance of fishes found during the research period

Threatened fishes found in the study area

During the study period there were a total of 13 threatened species out of 64 threatened species according to Red Book (Khan and Chowdhury, 2015). The critically endangered fish that were found in present study are *Bagarius bagarius, and Sisor rhabdophorus.*Seven endangered fishes found such as *Botia dario, Botia lohachata, Barilius vagra, Crossocheilus latius, Rita rita, Clupisoma garua, Mastacembelus armatus.* Four vulnarable fish found such as *Sperata aor, Wallago attu, Gudusia chapra, Sicamugil cascasia.* (Figure 4)

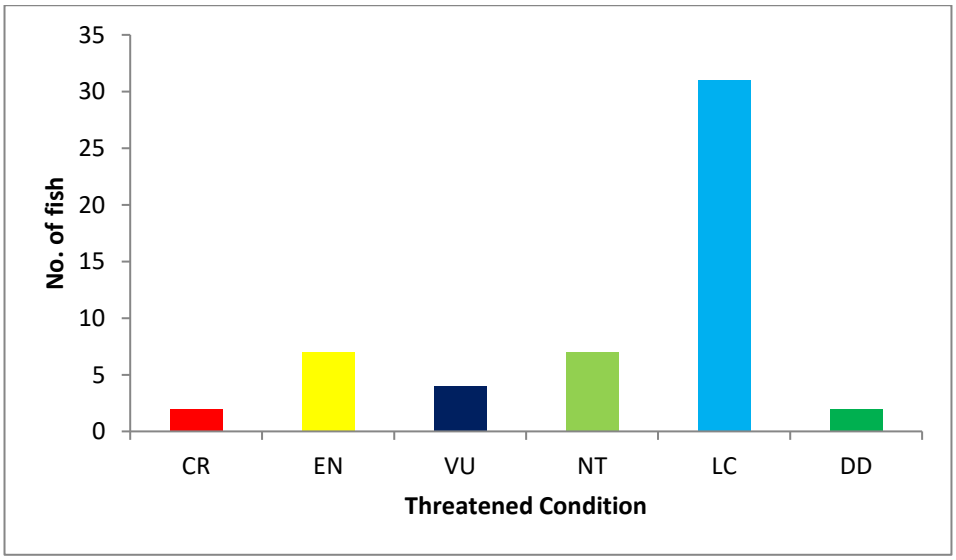

Figure 4. Threatened fishes found in the study area

Comparison with previous investigations in OBR

The present study recorded 53 fish species from the Old Brahmaputra River, whereas Afrose and Ahmed, 2016, Raushon et al., 2017 and Bashar et al.,2020 documented 39, 55, and 49 species, respectively; Galib, 2015 reported a total of 67 species (Figure 5).

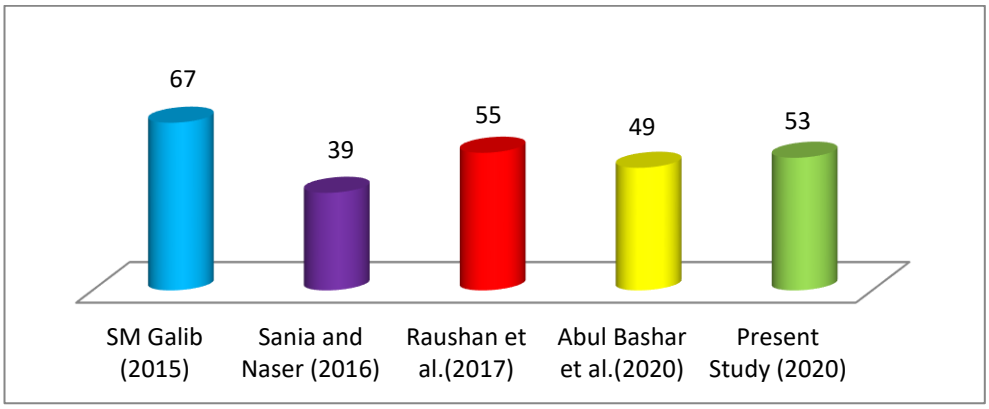

Figure 5. Comparison of fish species found in the study period with recent past years in the OBR

Comparison of present fish diversity in the OBR with earlier riverine studies

In this study, 53 fish species were identified from the Old Brahmaputra River, while earlier studies reported 53 in the Andharmanik and Chitra rivers, 55 in the Ghaghat, 63 in the Choto Jamuna, 74 in the Atrai, and 107 in the Meghna River (Figure 6).

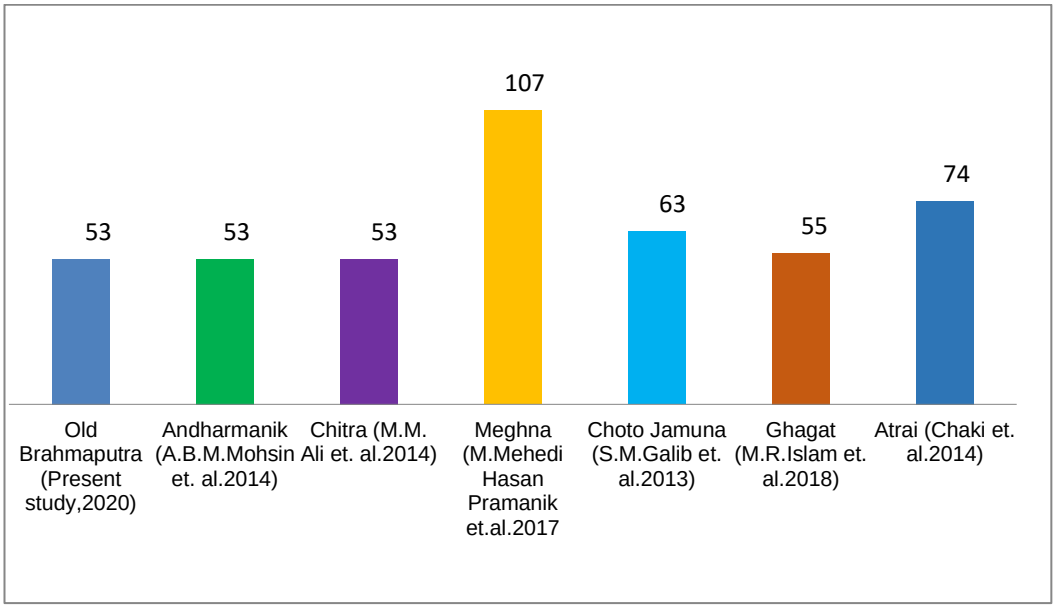

Figure 6. Comparison of present fish diversity in the OBR with earlier riverine studies

Discussion

OBR is one of the important drainage systems in Bangladesh which was a good harbor of many freshwater species. However, the number of freshwater species in OBR is declining comparing to previous study. Similar kind of research work has been done previously. Although the present study seems a repeated work, however its sampling sites are completely different from any other previous studies. So far, we know that this is a new attempt since 2021 (Hasan and Tripti) to assess again OBR biodiversity study in a new location. In addition, diversity index study in this area is a first-time novel approach to account the species richness in this river. During the study total 53 species of freshwater fishes belongs to 6 orders were recorded. Among them the dominant order was cypriniformes. Twenty-one species were recorded from the order cypriniformes, 16 species from siluriformes, 11 species from perciformes, 2 species from clupeiformes, 1 species from beloniformes and 2 species from mugilliformes. All of fish are categorized into 4 groups like abundant, common, less common and rare. From the present study, it was found that 9 species were abundant, 16 species were common, 22 species were less common, 06 species were rare.

Comparison of fish species recorded in the present study with recent years (2015–2020) in the Old Brahmaputra River revealed that the current total of 53 species exceeds the 39 reported by Afrose and Ahmed 2016. Conversely, it is quite comparable to the 55 species documented by Raushon et al., 2017 and 49 species by Bashar et al., 2020. However, Galib, 2015 identified 67 species, which is higher than the number recorded in the present study. Most recently (Hasan and Tripti, 2021) found only 21 species from OBR which is lower than the present study. These variations were occurred due to different sampling location and length of study area. These findings illustrate that fish species in the OBR from 2015 to resent are declining that may be due to habitat alternation by anthropogenic activities, water pollution, siltation of the river course, climate change and the breeding ground destruction along with heavy fishing pressure on stock made many of the fish species vulnerable to extinct (Hasan and Tripti, 2021)

Fish species richness in the Old Brahmaputra River (53 species) was comparable to that of the Andharmanik River in Patuakhali (Mohsin et al., 2014) and the Chitra River in southwest Bangladesh (Ali et al., 2014). A close number (55 species) was also observed in the Ghaghat River (Islam et al., 2018). However, higher diversity has been reported from the Choto Jamuna River (63 species; Galib et al., 2013), Atrai River (74 species; Chaki et al., 2014), and Meghna River (107 species; Pramanik et al., 2017).

During the study period 13 threatened species, 2 data deficient species, 7 near threatened species and 31 least concern species recorded according to Red Book (IUCN-Bangladesh 2015). There were two critically endangered fishes found in the present study such as *Bagarius bagarius, Sisor rhabdophorus.* It was remarkable that 2 critically endangered fishes found in the present study, both were cat fish. 7 endangered fishes found such as *Botia dario, Botia lohachata, Barilius vagra, Crossocheilus latius, Rita rita, Clupisoma garua, Mastacembelus armatus.* Among them only *Clupisoma garua and Mastacembelus armatus* were found in both the study site and rest of endangered fish found vary rare. Four vulnarable fish species were found in this study area such as *Sperata aor, Wallago attu, Gudusia chapra, Sicamugil cascasia.* In the present study 13 fish species found as threatened out of 53 of which critically endangered 3.77%, endangered 13.20% and vulnerable 7.54%.

Almost similar status recorded (Bashar *et al*., 2020) in the OBR where critically endangered 2.04%, endangered 14.29% and vulnerable 8.16%. But higher in the Padma River (Mohsin *et al*., 2013) where critically endangered 8.70%, endangered 13.04% and vulnerable 13.04%. In the Meghna River (Pramanik *et al.,* 2017) threatened fish species status was critically endangered 2%, endangered 7.48% and vulnerable 10.28%.

A total of 53 species, comprising 798 individuals were observed across 20 families of Osteichthyes classes. The diversity index (D) and Simpson's Diversity Index (SID) values highlight significant variations in diversity. A Simpson's Index (D) value of 0.04 indicates a low probability (4%) that two randomly selected individuals from the community belong to the same species. This low value reflects high biodiversity, suggesting that individuals are distributed across many different species with relatively balanced abundances. The Simpson's Index of Diversity (1 – D) quantifies the probability that two individuals randomly selected from a sample will belong to different species. In this study, the value of 0.95 indicates a high level of species diversity, suggesting that the community is composed of a well-distributed and taxonomically rich assemblage. This richness and evenly distribution reflect the relatively undisturbed aquatic habitats within OBR.

Conclusion

The study reveals a moderately rich and diverse fish community in the Old Brahmaputra River. This research contributes new insights by focusing on previously unstudied locations of the Old Brahmaputra River, recording 53 species from various groups, including several threatened species. While the findings indicate a decline in overall species richness compared to some earlier records, the high diversity index reflects a relatively balanced species distribution. The presence of critically endangered and endangered species signals ecological stress, emphasizing the necessity for targeted conservation actions and sustainable management to protect and restore the biodiversity of this important freshwater ecosystem.

Authors Contribution

Mohammad Rafiqul Bari: Design the research, collect data, analyze data, write the manuscript and finalize the manuscript. Habibur Rahman and Sabina Sultana: Partly supervise the whole work. Jebunnaher Khandaker and Rukunuzzaman Zim: Write the Introduction and review the manuscript, Mahmudul Hasan: Partly write the manuscript, overall proofread the manuscript and supervised it.

Conflict of interest

The authors declare that they have no competing interests.

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