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The biodiversity of fish in transboundary rivers from north-eastern Bangladesh

MAHMUDUL HASAN*, ZAHID HASAN ANIK[1] AND IFTHEKAR ISLAM TUSAR[1]
Department of Fisheries, Bangamata Sheikh FojilatunnesaMujib Science and Technology University, Jamalpur-2012, Bangladesh
[1]Evolution and Diversity Research Laboratory, Bangamata Sheikh FojilatunnesaMujib Science and Technology University, Jamalpur-2012, Bangladesh
*Corresponding author's email: mhasan@bsfmstu.ac.bd

Abstract. The biodiversity of freshwater fish is disappearing at an alarming rate around the globe, with transboundary rivers in Bangladesh being especially vulnerable. From October to December 2023, we surveyed the fish biodiversity of 11 transboundary rivers in north-eastern Bangladesh using the available literature and online FishBase data for species identification. We also added a small number of specimens from our previously examined samples that comprised of 74 fish species belonging to eight orders and twenty-four families. Our survey results indicate that the order Cypriniformes had the biggest number of species (38%), followed by the orders Siluriformes (30%), Perciformes (24%), Clupeiformes (3%), Synbranchiformes (1%), Beloniformes (1%), and Tetraodontiformes (1%). Less than 30% of the entire studied area had 26 fish, indicating that the fish population was confined to a relatively limited region. The total number of species was lower than that we had anticipated, which explains the declining trend of the fish biodiversity in the transboundary rivers of north-eastern Bangladesh. Our survey data have allowed us to gain some early understanding of the hidden biodiversity of fish in these rivers, which may prove useful to other researchers conducting follow-up studies. Since there is currently no published description of the ichthyofaunal diversity in transboundary rivers, the current data on 74 species of ichthyofauna will be useful to future researchers, planners, and policymakers. In order to safeguard the faunal composition of a riverine ecosystem, more efforts incorporating genetic data will be helpful in detecting the biodiversity of fish as well as the cryptic species of other transboundary riverine systems. These efforts will also reinforce the need to re-evaluate the checklist and promote sustainable conservation directions.
Keywords: Transboundary river, Fish biodiversity, Ichthyofauna

Introduction

A river is considered transboundary if it crosses at least one political boundary, such as an international border or a border inside a state. Bangladesh's rivers are not dispersed equally. From the northwest of the northern region to the southeast of the southern region, the quantity and magnitude of rivers gradually increase. With the exception of those in the hilly subregion of Chittagong, all transboundary rivers are a part of the Ganges, Brahmaputra, and Meghna river systems (Hossain 2016). Bangladesh is home to more than 400 rivers. Merely 54 of them are transboundary rivers, of which 3 share with Myanmar and 54 with India (Afroze and Rahman 2013). Long riverine migrations, unrestricted by political boundaries, are an intrinsic inclination of most freshwater fish. However, in transboundary riverine systems, there is frequently an impact on the fair distribution of biological resources, particularly for ichthyofauna. Therefore, measuring spatial diversity and preserving biodiversity components in transboundary areas are crucial tasks for safeguarding any nation's rich biodiversity (Kundu *et al*. 2022).

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In the British era, Hamilton (1822) began the study of the freshwater fish fauna of Bangladesh. Following numerous authors' reviews, comments, and editions, Ahmed (1953) identified 106 freshwater fish species in East Pakistan, which is now Bangladesh. Rahman (2005) offered a thorough checklist that included 265 freshwater species and was updated with keys, images, and descriptions. In a recent paper, Hossain *et al*. (2012) stated that, rather than 265 species, Bangladesh has 293 freshwater species (including a few fish from coastal regions that travel to rivers without changing their body physiology). The biodiversity and ecosystem of our country have declined (Hossain 2014), but the number of species in Bangladesh is growing year over year (Habib *et al*. 2018). This is related to the theory that numerous species, like frogs (Hasan *et al*. 2012), have similar morphologies but different genetic makeups and that these species should be investigated in every river, canal, harbor, seashore, etc. Because prior to conservation, identification of species is important.

Just 11 rivers—such as the Someshwai, Vogai, Nitai, Jadukhata, and Chillakhali—out of 54 were taken into consideration for this research. The study locations mostly encompass the border areas of the Sherpur, Netrokona, Mymensingh, and Sunamganj districts (see Figure 1). It appears that there is little research on fish from transboundary rivers in Bangladesh's northeast. In an effort to create an accurate and error-free list of freshwater species in Bangladesh, current research is being conducted to reveal the hidden variety of fish found in transboundary rivers. Accordingly, this study aims to achieve the following goals: a) evaluation of fish from transboundary rivers; and b) precise identification of fish according to their natural state for conservation purposes.

Materials and Methods

Collection and preservation of fish sample

The study was carried out from for three months from October to December 2023, A small number of specimens from our earlier research were also included (Hasan *et al*. in preparation). Throughout the study period, data was gathered on a monthly basis in order to meet the requirements of the research objectives. The conditions dictated a change in the sample frequency.

We visited several locations along the river where fishermen were collecting and catching fish (Fig. 1). In addition, we visited other marketplaces along the riverbank at various times. The morning and evening fish markets are typically where we locate our samples the best (fish obtained by gill net, cast net, seine net, hook, and line). With the assistance of nearby fishermen, we visited the locations and took samples. If needed, we visited nearby fish shops to gather more samples. The Evolution and Diversity Research Laboratory (EDRL) at Bangamata Sheikh Fojilatunnesa Mujib Science and Technology University (BSFMSTU), Jamalpur, 2012, is where the location, gender,

photo, and voucher number of these samples were kept. Additionally, with authorization from the Bangladesh Border Guard (BGB) and the Border Security Force (BSF), we attempted to visit the river stretch that is part of "No Man Lands" areas. These fish were later preserved in a saturated DMSO/NaCl solution or 95% ethanol. To conduct this work, an ethics letter (memo no. 37.01.0044.064.05.001.24.553) was obtained from Bangamata Sheikh FojilatunnesaMujib Science and Technology University (BSFMSTU) authorities.

Based on current taxonomy knowledge and fisheries science literature, we recognized the collected species (Rahman 2005). If necessary, we also adhere to the species names that have been accepted by the Fish Base online portal. As much as possible, every fish species was collected from the 11 chosen sites, ranging from Sherpur to the Sunamganj region. The EDRL, BSFMSTU received these fish species, identified them, and conserved the samples in 99% ethanol for upcoming morphological and molecular research. Figure 1 provides information about the gathering of fish specimens.

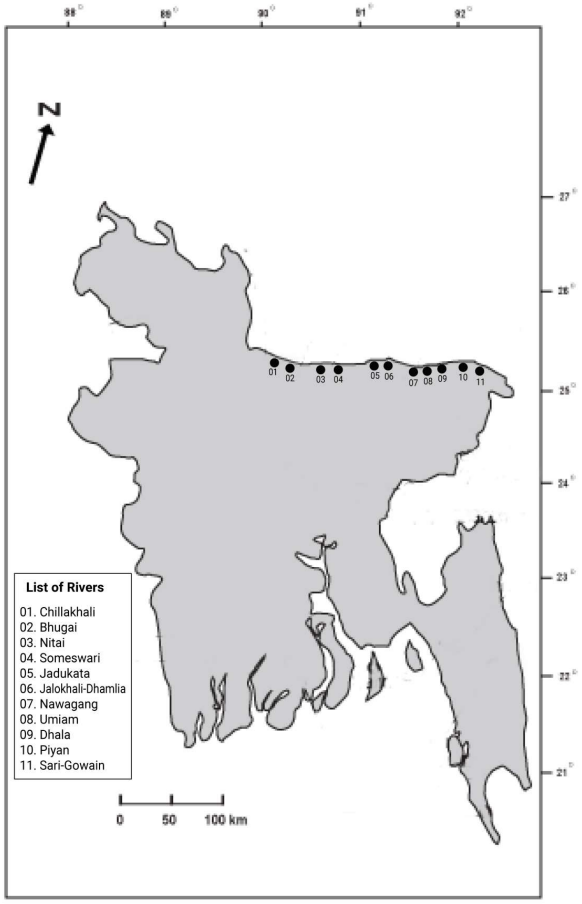

Fig. 1. Fish sampling sites (black circle) from north-eastern transboundary rivers in Bangladesh.

Results

The transboundary rivers in north-eastern Bangladesh are home to a diverse range of fish species, according to preliminary analysis of the data gathered. Different river systems have varying levels of species richness, which is impacted by things like anthropogenic disturbances, water quality, and river shape. Table I and Fig. 2 show the 74 species of freshwater fish that we have gathered divided into 23 families and 8 orders. Order Cypriniformes has the greatest number of species (38%), while Siluriformes, Perciformes, Clupeiformes, Cyprinidontiformes, Synbranchiformes, Beloniformes, and Tetraodontiformes have the following numbers: 30, 24, 03, 02, 01, 01, and 1%, respectively.

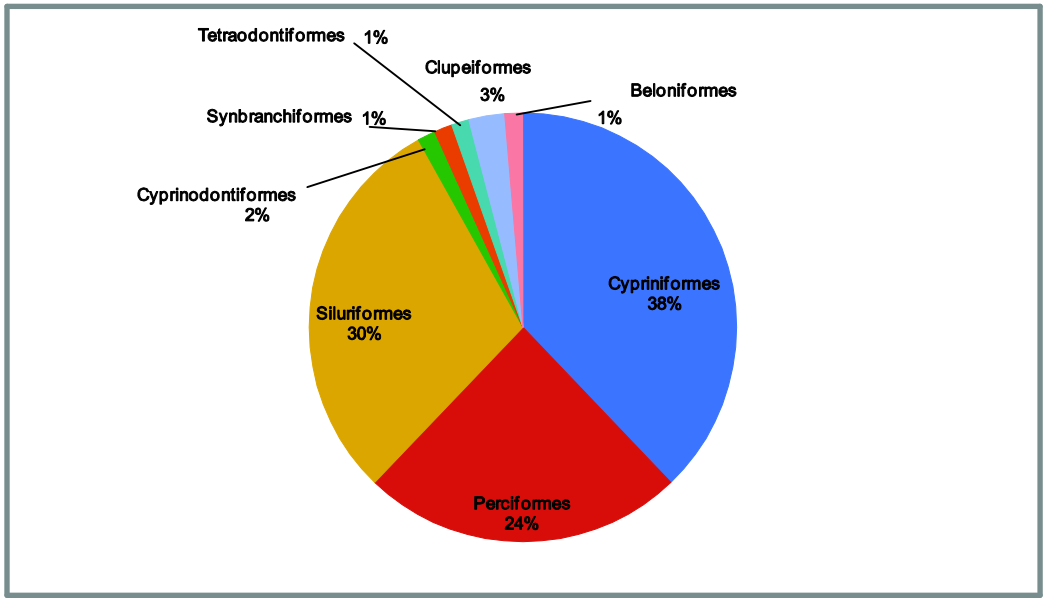

Fig. 2. Order wise species distribution.

Table I. List of collected fish specimens with their IUCN status

Serial No	Order	Family	Species	Local Name	National Status	Global Status	Species ID
1	Cypriniformes	Cyprinidae	*Catla catla*	Catal	LC	NE	MHBSFMSTU-2420 Fish 1
2	Perciformes	Badidae	*Badis badis*	Napit koi	NT	LC	MHBSFMSTU-2120 Fish 2
3	Siluriformes	Siluridae	*Wallago attu*	Boal	VU	NT	MHBSFMSTU-2420 Fish 3
4	Cyprinodontiformes	Aplocheilidae	*Aplocheilus panchax*	Kan pona	LC	LC	MHBSFMSTU-3151 Fish 4
5	Perciformes	Channidae	*Channa punctata*	Taki	LC	LC	MHBSFMSTU-3010 Fish 5

6	Tetraodontiformes	Tetraodontidae	*Tetraodon cutcutia*	Potka	LC	LC	MHBSFMSTU-3010 Fish 6
7	Cypriniformes	Cyprinidae	*Danio devario*	Devari	LC	LC	MHBSFMSTU-3151 Fish 7
8	Perciformes	Anabantidae	*Anabas testudineus*	Koi	LC	DD	MHBSFMSTU-3140 Fish 8
9	Cypriniformes	Cyprinidae	*Amblypharyngodon mola*	Mola	LC	LC	MHBSFMSTU - 2420 Fish 9
10	Perciformes	Osphronemidae	*Colisa fasciata*	Kholisha	LC	LC	MHBSFMSTU - 3000 Fish 10
11	Perciformes	Osphronemidae	*Colisa lalia*	Lal Kholisha	LC	LC	MHBSFMSTU - 2120 Fish 11
12	Perciformes	Ambassidae	*Parambassis lala*	Lal chanda	LC	NE	MHBSFMSTU - 3030 Fish 12
13	Perciformes	Ambassidae	*Parambassis ranga*	Gol chanda	LC	LC	MHBSFMSTU - 3030 Fish 13
14	Synbranchiformes	Mastacembelidae	*Macrognathus pancalus*	Guchi baim	LC	LC	MHBSFMSTU - 2120 Fish 14
15	Siluriformes	Bagridae	*Mystus vittatus*	Tengra	LC	LC	MHBSFMSTU - 2120 Fish 15
16	Cypriniformes	Cyprinidae	*Puntius gelius*	Jeli puti	NT	LC	MHBSFMSTU - 3151 Fish 16
17	Siluriformes	Heteropneustidae	*Heteropneustes fossilis*	Shing	LC	LC	MHBSFMSTU - 3156 Fish 17
18	Siluriformes	Bagridae	*Hemibagrus menoda*	Gagla	NT	LC	MHBSFMSTU - 3030 Fish 18
19	Cypriniformes	Cyprinidae	*Osteobrama cotio*	Dhela	NT	LC	MHBSFMSTU - 3010 Fish 19
20	Cypriniformes	Cyprinidae	*Labeo calbasu*	Kali baush	LC	LC	MHBSFMSTU - 2412 Fish 20
21	Perciformes	Belonidae	*Xenentodon cancila*	Kakila	LC	NE	MHBSFMSTU - 3030 Fish 21
22	Perciformes	Ambassidae	*Chanda nama*	Lomba chanda	LC	LC	MHBSFMSTU - 3030 Fish 22
23	Clupeiformes	Clupeidae	*Gudusia chapra*	Chapila	VU	LC	MHBSFMSTU - 3156 Fish 23
24	Cypriniformes	Cyprinidae	*Labeo gonius*	Goniya	NT	LC	MHBSFMSTU - 3000 Fish 24
25	Perciformes	Nandidae	*Nandus nandus*	Meni	NT	LC	MHBSFMSTU - 3070 Fish 25
26	Siluriformes	Bagridae	*Rita rita*	Rita	EN	LC	MHBSFMSTU - 2412 Fish 26
27	Perciformes	Mastacembelidae	*Macrognathus aral*	Tara baim	DD	LC	MHBSFMSTU - 2412 Fish 27
28	Cypriniformes	Cyprinidae	*Puntius terio*	Teri puti	LC	LC	MHBSFMSTU - 3000 Fish 28
29	Cypriniformes	Cyprinidae	*Puntius ticto*	Tit puti	VU	LC	MHBSFMSTU - 3000 Fish 29
30	Perciformes	Gobiidae	*Glossogobius giuris*	Bele	LC	LC	MHBSFMSTU - 2412 Fish 30
31	Cypriniformes	Cobitidae	*Botia dario*	Bou	EN	LC	MHBSFMSTU - 3150 Fish 31
32	Perciformes	Osphronemidae	*Colisa labiosa*	Kolisha	LC	LC	MHBSFMSTU - 3150 Fish 32
33	Cypriniformes	Cobitidae	*Somileptus gongota*	Puiya	NT	LC	MHBSFMSTU - 2120 Fish 33
34	Cypriniformes	Cobitidae	*Lepidocephalichthys guntea*	Gutum	LC	LC	MHBSFMSTU - 3000 Fish 34

35	Cypriniformes	Cobitidae	*Lepidocephalichthy sberdmorei*	Puiya	LC	LC	MHBSFMSTU - 3030 Fish 35
36	Cypriniformes	Cobitidae	*Lepidocephalichthy sannandalei*	Gutum	VU	LC	MHBSFMSTU - 3030 Fish 36
37	Cypriniformes	Cyprinidae	*Puntius phutunio*	Puti	LC	LC	MHBSFMSTU - 2120 Fish 37
38	Clupeiformes	Clupeidae	*Corica soborna*	Kachki	LC	LC	MHBSFMSTU - 2120 Fish 38
39	Siluriformes	Bagridae	*Mystus tengara*	Tengra	LC	LC	MHBSFMSTU - 3030 Fish 39
40	Cypriniformes	Cyprinidae	*Reba nandina*	Reba	NT	LC	MHBSFMSTU - 3030 Fish 40
41	Siluriformes	Sisoridae	*Bagarius bagarius*	Baghair	CR	NT	MHBSFMSTU - 2420 Fish 41
42	Cypriniformes	Cyprinidae	*Crossocheilus latius*	Bata	EN	LC	MHBSFMSTU - 3000 Fish 42
43	Cypriniformes	Cyprinidae	*Puntius sophore*	Jati puti	LC	LC	MHBSFMSTU - 3030 Fish 43
44	Siluriformes	Siluridae	*Ompok pabda*	Pabda	EN	NT	MHBSFMSTU - 3030 Fish 44
45	Siluriformes	Schilbeidae	*Clupisoma garua*	Ghaura	EN	NE	MHBSFMSTU - 2420 Fish 45
46	Siluriformes	Schilbeidae	*Eutropiichthys vacha*	Bacha	LC	LC	MHBSFMSTU - 2420 Fish 46
47	Siluriformes	Schilbeidae	*Pseudeutropius atherinoides*	Batasi	LC	LC	MHBSFMSTU - 3030 Fish 47
48	Siluriformes	Bagridae	*Sperata seenghala*	Guizza air	VU	LC	MHBSFMSTU - 2420 Fish 48
49	Siluriformes	Schilbeidae	*Ailia coila*	Kajoli	LC	NT	MHBSFMSTU - 2420 Fish 49
50	Cypriniformes	Cyprinidae	*Cirrhinus reba*	Reba	NT	LC	MHBSFMSTU - 3030 Fish 50
51	Perciformes	Gobiidae	*Awaous grammepomus*	Bele	VU	LC	MHBSFMSTU - 3000 Fish 51
52	Siluriformes	Bagridae	*Batasio batasio*	Tengra	NT	LC	MHBSFMSTU - 3050 Fish 52
53	Cypriniformes	Cyprinidae	*Salmo stomabacaila*	Chela	LC	LC	MHBSFMSTU - 3050 Fish 53
54	Cypriniformes	Cyprinidae	*Salmo stomaphulo*	Ful chela	NT	LC	MHBSFMSTU - 2420 Fish 54
55	Cypriniformes	Cyprinidae	*Esomus danricus*	Darkina	LC	LC	MHBSFMSTU - 2420 Fish 55
56	Siluriformes	Schilbeidae	*Ailia punctata*	Kajoli	LC	NE	MHBSFMSTU - 3030 Fish 56
57	Siluriformes	Bagridae	*Mystus cavasius*	Tengra	NT	LC	MHBSFMSTU - 3000 Fish 57
58	Siluriformes	Bagridae	*Mystus bleekeri*	Golsa tengra	LC	LC	MHBSFMSTU - 2420 Fish 58
59	Cypriniformes	Cyprinidae	*Danio rerio*	Zebra	NT	LC	MHBSFMSTU Fish 50
60	Perciformes	Channidae	*Channa orientalis*	Raga	LC	LC	MHBSFMSTU Fish 9
61	Perciformes	Channidae	*Channa marulius*	Gojar	EN	LC	MHBSFMSTU Fish 23
62	Cypriniformes	Psilorhynchidae	*Psilorhynchus balitora*	Balitora	LC	LC	MHBSFMSTU Fish 29
63	Siluriformes	Bagridae	*Sperata aor*	Air	VU	LC	MHBSFMSTU Fish 30

64	Perciformes	Sciaenidae	*Johnius vogleri*	Poa	-	LC	MHBSFMSTU Fish 33
65	Siluriformes	Chacidae	*Chaca chaca*	Venga chaca	EN	LC	MHBSFMSTU Fish 38
66	Cypriniformes	Cyprinidae	*Amblypharyngodon microlepis*	Mola	LC	NE	MHBSFMSTU Fish 45
67	Beloniformes	Hemiramphidae	*Hyporhamphus limbatus*	Ektuitta	LC	NE	MHBSFMSTU Fish 53
68	Perciformes	Channidae	*Channa striata*	Shol	LC	LC	MHBSFMSTU Fish 54
69	Perciformes	Sciaenidae	*Johnius coitor*	Poa	LC	LC	MHBSFMSTU Fish 76
70	Cypriniformes	Cyprinidae	*Tor tor*	Mohashol	CR	NT	MHBSFMSTU Fish 80
71	Siluriformes	Sisoridae	*Hara hara*	Kutakanti	LC	LC	MHBSFMSTU Fish 83
72	Siluriformes	Sisoridae	*Gagata youssoufi*	Gang tengra	NT	LC	MHBSFMSTU Fish 84
73	Siluriformes	Bagridae	*Rama chandramara*	Gura tengra	LC	LC	MHBSFMSTU Fish 87
74	Cypriniformes	Cyprinidae	*Rasbora daniconius*	Darkina	LC	LC	MHBSFMSTU Fish 96

NB: IUCN Status Code: EX- Extinct, EW- Extinct in the Wild, RE- Regionally Extinct, CR- Critically Endangered, EN- Endangered, VU- Vulnerable, NT- Near Threatened, LC- Least Concern, DD- Data Deficient, NE- Not Evaluated. Postal Area Code:2120 - Jhinaigati, 2412 - JariaJhanjhail, 2420 - Susnng Durgapur, 3000 – SunamganjSadar, 3010 - Bishamsapur, 3030 - Tahirpur, 3050 - Ghungiar, 3140 - Kompanyganj, 3150 - Goainhat, 3151 - Jaflong, 3156 - Jainthapur

MHBSFMSTU-2420 Fish1 (*Catla catla*)

MHBSFMSTU-2120 Fish2 (*Badis badis*)

MHBSFMSTU-2420 Fish3 (*Wallago attu*)

MHBSFMSTU-3151 Fish 4 (*Aplocheilus panchax*)

MHBSFMSTU-3010 Fish5 (*Channa punctata*)

MHBSFMSTU-3010 Fish6 (*Chelonodon fluviatilis*)

MHBSFMSTU-3151 Fish7 (*Danio devario*)

MHBSFMSTU-3140 Fish8(*Anabas testudineus*)

MHBSFMSTU - 2420 Fish 9 (*Amblypharyngodon mola*)

MHBSFMSTU - 3000 Fish 10 (Colisa fasciata)

MHBSFMSTU - 2120 Fish 11 (*Colisa lalia*)

MHBSFMSTU - 3030 Fish 12 (*Parambassis lala*)

MHBSFMSTU - 3030 Fish 13 (*Parambassis ranga*)

MHBSFMSTU - 2120 Fish 14 (*Macrognathus pancalus*)

MHBSFMSTU - 2120 Fish 15(*Mystus vittatus*)

MHBSFMSTU - 3151 Fish 16 (*Puntius gelius*)

MHBSFMSTU - 3156 Fish 17 (*Heteropneustes fossilis*)

MHBSFMSTU - 3030 Fish 18 (*Hemibagrus menoda*)

MHBSFMSTU - 3010 Fish 19 (*Osteobrama cotio*)

MHBSFMSTU - 2412 Fish 20 (*Labeo calbasu*)

MHBSFMSTU - 3030 Fish 21 (*Xenentodon cancila*)

MHBSFMSTU - 3030 Fish 22 (*Chanda nama*)

MHBSFMSTU - 3156 Fish 23 (*Gudusia Chapra*)

MHBSFMSTU - 3000 Fish 24 (*Labeo gonius*)

MHBSFMSTU - 3070 Fish 25 (*Nandus nandus*)

MHBSFMSTU - 2412 Fish 26 (*Rita rita*)

MHBSFMSTU - 2412 Fish 27 (*Macrognathus aral*)

MHBSFMSTU - 3000 Fish 28 (*Puntius terio*)

MHBSFMSTU - 3000 Fish 29 (*Puntius ticto*)

MHBSFMSTU - 2412 Fish 30 (*Glossogobius giuris*)

MHBSFMSTU - 3150 Fish 32 (*Colisa labiosa*)

MHBSFMSTU - 3150 Fish 32 (*Colisa labiosa*)

MHBSFMSTU - 2120 Fish 33 (*Somileptus gongata*)

MHBSFMSTU - 3000 Fish 34 (*Lepidocephalichthys guntea*)

MHBSFMSTU - 3030 Fish 35 (*Lepidocephalichthys berdmorei*)

MHBSFMSTU - 3030 Fish 36 (*Lepidocephalichthys annandalei*)

MHBSFMSTU - 2120 Fish 37 (*Puntius phutunio*)

MHBSFMSTU - 2120 Fish 38 (*Corica soborna*)

MHBSFMSTU - 3030 Fish 39 (*Mystus tengara*)

MHBSFMSTU - 3030 Fish 40 (*Reba nandina*)

MHBSFMSTU - 2420 Fish 41 (*Bagarius bagarius*)

MHBSFMSTU - 3000 Fish 42 (*Crossocheilus latius*)

MHBSFMSTU - 3030 Fish 43 (*Puntius sophore*)

MHBSFMSTU - 3030 Fish 44 (*Ompok pabda*)

MHBSFMSTU - 2420 Fish 45 (*Clupisoma garua*)

MHBSFMSTU - 2420 Fish 46 (*Eutropiichthys vacha*)

MHBSFMSTU - 3030 Fish 47 (*Pseudeutropius atherinoides*)

MHBSFMSTU - 2420 Fish 48 (*Sperata seenghala*)

MHBSFMSTU - 2420 Fish 49 (*Ailia coila*)

MHBSFMSTU - 3030 Fish 50 (*Cirrhinus reba*)

MHBSFMSTU - 3000 Fish 51 (*Awaous grammepomus*)

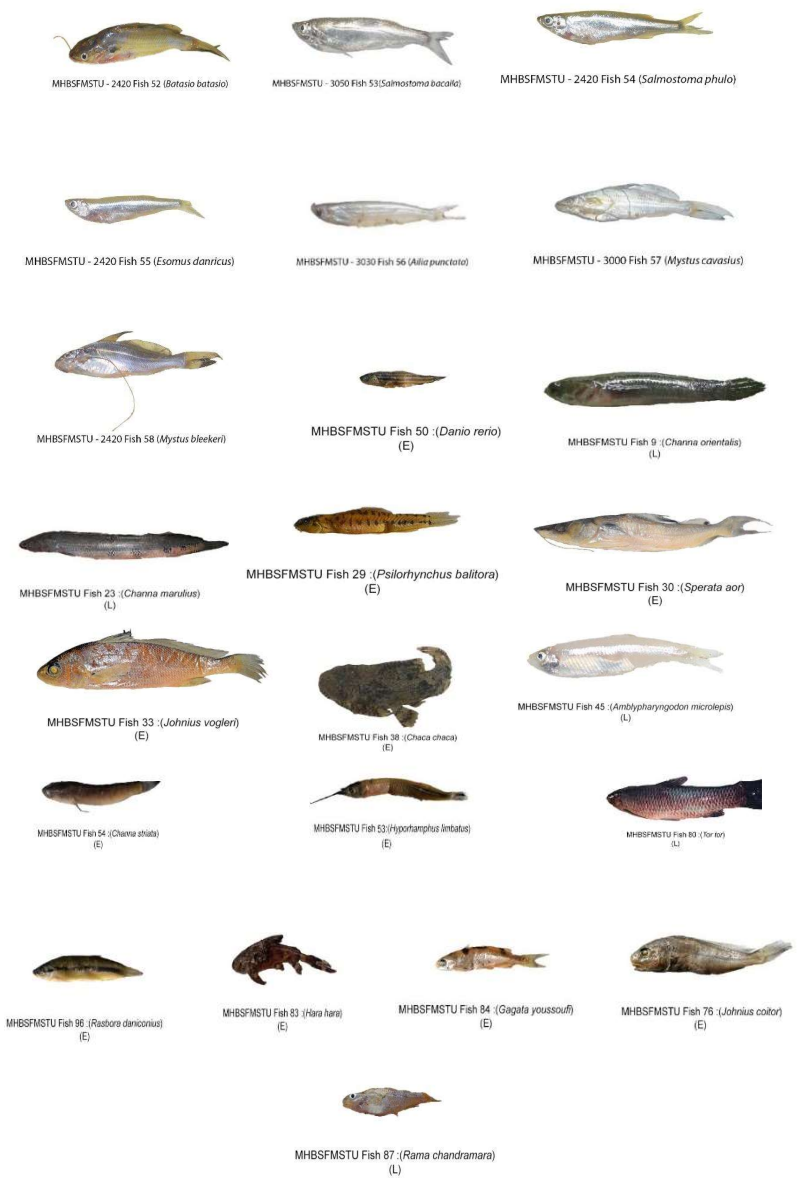

Fig. 3. Picture of collected fish specimens which corresponds to Table I.

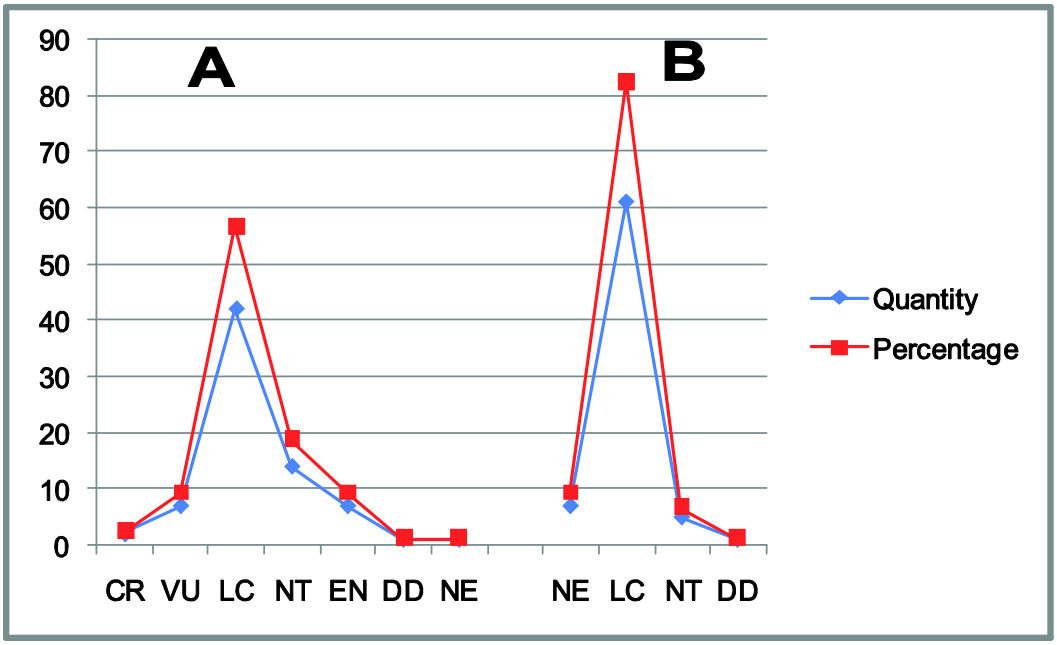

Fig. 4. Threatened level of our collected fish specimens based on – A) IUCN (2015) national categories and B) IUCN international categories.

Local IUCN category (2015) distribution

Least Concern (LC) represented the maximum number of fish species (42, or 57.8%), while Near Threatened (NT), Endangered (EN), Vulnerable (VU), and Critically Endangered (CR) represented the following percentages: 14 (19.0%), 7 (9.5%), 7 (9.5%), and 2 (2.7%), respectively. Most fish species that have been gathered (57.8%) are categorized as least concern, meaning that there is a low chance of their extinction on a national scale. Nonetheless, a sizeable fraction is classified as Near Threatened (19%), Endangered (9.5%), or Vulnerable (9.5%) by the IUCN, underscoring the need for conservation efforts for these species. The necessity of swift conservation action is highlighted by the existence of critically endangered species (2.7%). In order to assess the conservation status of two species, additional research is necessary as one lacks sufficient data (data deficiency) and the other was not included in the IUCN database.

IUCN global status distribution

The most number of fish species—61, or 82%—were classified as least concern (LC), but the numbers for endangered (EN), near threatened (NT), and data deficient (DD) were, respectively, 7, 9,5%, 5, 6.8%, 7, 9.5%, and 1 (1.5%). Further research is needed to determine the conservation status of species that have not been researched or for which there is insufficient data. Plans for monitoring and management should be established for near-threatened species to prevent them from becoming part of a more

significant category. All fish species should have habitat protection and conservation activities prioritized, regardless of their IUCN classification. The data distribution is left-skewed, with a small number of individuals representing the majority of species and a few species accounting for a larger share of the total. For instance, the combined number of members of the Cyprinidae, Siluriformes, and Perciformes families is more than 81%.

Discussion

In reality, it is impractical to assign names to every extant species, especially considering that many species confined to specific regions will go extinct before we can record them. It is crucial to have biological specimens that are properly identified and documented with a voucher number and high-resolution pictures. This is necessary to ensure consistency and validation of the species list, which in turn supports future research efforts (Vences 2020). Our current study focuses on species identification using morphological data. However, it is worth noting that our study includes proper voucher numbers and pictures of each specimen, which are often not seen in other contemporary researchers' studies (Nachman *et al*. 2023, Vences 2020). Hence, our distinctive study emphasizes the significance of preserving the fish biodiversity of transboundary rivers in north-eastern Bangladesh. The existence of native and traveling species emphasizes the ecological distinctiveness of these rivers, as well as the necessity for synchronized conservation endeavors across national boundaries. Nevertheless, the preservation of transboundary rivers encounters various obstacles, such as habitat deterioration, contamination, excessive fishing, and changes in water flow. Due to diminished precipitation and depleted groundwater and surface water resources, the rivers and wetlands are progressively desiccating and converting into narrow channels and farmland, leading to a further drop in the diversity and productivity of fish species (Hossain 2016). To tackle these difficulties, a comprehensive approach is needed that involves collaboration among neighboring nations, active involvement of local communities, the implementation of sustainable fisheries management practices, and the adoption of conservation policies that are founded on the principles of ecosystem preservation.

A river is classified as transboundary if it traverses multiple national or international borders (Afroze and Rahman 2013). In the past, there has been a notable lack of effort or accomplishment. We conducted a comprehensive assessment of the fish species diversity in 11 rivers that span beyond the borders of north-eastern Bangladesh (Sherpur to Sunamganj district). The study revealed a total of 74 fish species, encompassing those classified as critically endangered, endangered, and vulnerable. The distribution exhibited significant diversity, as 31 distinct species were observed in more than 50% of the rivers studied, while 17 species were detected in 30–50% of the rivers. The population of fish in the river—beel, haor, baor, etc.—is seeing a substantial decline. The findings of our recent survey conducted in the Old

Brahmaoutra river and partially in the Padma river (Hasan and Tripti 2021, Hasan *et al*. 2023) similarly demonstrated related outcomes. Furthermore, Hossain (2016) and Azadi and Arshad-Ul-Alam (2014) have also claimed that fish biodiversity has been rapidly decreasing over the years in the Sumeshwari River in Netrokona and the Sangu River in Bandarban, which is consistent with our own findings. This work uncovers the concealed richness of these rivers, and the associated supplementary data will aid the Freshwater Fish Specialist Group (FFSG) in revising the classification of various taxa in the IUCN system (Kundu *et al*. 2022).

Fish and fishery resources have a direct relationship with monetary value and are closely tied to human and commercial items (Sarkar and Pal 2018). Exotic or invasive species, on the other hand, can enter many geographical areas by crossing transboundary rivers and pose significant threats to indigenous species by invading their eco-regions (Collins *et al*. 2012). Transboundary rivers are highly susceptible to several factors, such as water abstraction, overfishing, siltation, pollution, river encroachment, and the introduction of alien species (Hossain 2016). The alterations pose a significant threat to the biodiversity of the ecosystems in these rivers and the organisms that reside within them. To safeguard our fishing resources, it is imperative that we promptly amend the rules and regulations in the nations that have a common water bodies with us.

Conclusions

Our study findings reveal that the fish population in the rivers of north-eastern Bangladesh exhibits both diversity and vulnerability. The presence of critically endangered and vulnerable species, along with dense populations and potential concealed variants, underscores the necessity for immediate conservation efforts. It also aids in the development of effective management strategies, ensuring the long-term survival of these unique transboundary freshwater ecosystems. In order to guarantee the stability and recovery of Bangladesh's fishery resources, as well as those of its neighboring countries, India and Myanmar, it is crucial for the governments of these nations to work together to create a favorable social and technological atmosphere. Crucial management techniques include adopting habitat restoration, ensuring gear selectivity, controlling fishing effort, imposing seasonal closures, outlawing destructive fishing practices, establishing fish sanctuaries, and allocating resources to varied fisheries. In order to ensure long-term and extensive growth in a region, it is essential to incorporate initiatives that focus on the preservation of habitats and species, effective management of river basins, and alignment with the interests of neighboring governments that share the same riverbanks.

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Literature Cited

Afroz, R. and M.A. Rahman. 2013. Transboundary River water for Ganges and Teesta Rivers in Bangladesh: An Assessment. *Glob. Sci. and Tech. J.*, 1(1): 100-111.

Ahmed, N. 1953. Fish Fauna of East Pakistan. *Pakistan J. Sci.*, 1: 18–24.

Azadi, M.A. and M. Arshad-Ul-Alam. 2014. Biodiversity and conservation of fin and shellfishes of the River Sangu, Bangladesh. *The Festschrift on the 50th Anniversary of The IUCN Red List of threatened Species TM, Dhaka, Bangladesh*: 67 –74.

Collins, R.A., K.F. Armstrong, R. Meier, Y. Yi Y, S.D. Brown, R.H. Cruickshank, S. Keeling, and C. Johnston, 2012. Barcoding and border biosecurity: Identifying Cyprinid fishes in the aquarium trade. *PLoS One*, 7: e28381.

Froese, R. and D. Pauly (eds.) 2024. FishBase. World Wide Web electronic publication. www.fishbase.org, version (02/2024).

Habib, K.A., A.K. Neogi, J. Oh, Y.-H. Lee and C.-G. Kim, 2018. *Chelonodontops bengalensis* (Tetraodontiformes: Tetraodontidae): A new species of puffer fish from the Northern Bay of Bengal based on morphology and DNA Barcode. *Ocean Sci. J.,* 54(1): 79–86.

Hamilton, F. 1822. *An account of the fishes found in the river Ganges and its branches*. Archibald Constable and Company, Edinburg. 405 p.

Hasan M. and S.M.I. Tripti. 2021. Biodiversity, threats and recommendation for conservation of fishes in the Old Brahmaputra River. *Bangladesh J. Fish.,* 33(2): 347–354.

Hasan, M., M.M. Islam, M.R. Khan, M.S. Alam, A. Kurabayashi, T. Igawa, M. Kuramoto and M. Sumida, 2012. Cryptic anuran biodiversity in Bangladesh revealed by mitochondrial 16S rRNA gene sequences. *Zool. Sci.*, 29(3): 162–172.

Hasan, M., Z.H. Anik and A. Kurabayashi, 2023. Assessment of fish biodiversity in the Padma river from Farakka Barrage point to the Shampur Nagar Ghat, Rajshahi, Bangladesh. *Bangladesh J. Fish.,*35 (1): 13–23.

Hossain, M.A.R. 2014. Habitat and fish diversity: Bangladesh perspective. pp 1–26. In: Wahab, M.A. M.S. Shah, M.A.R. Hossain, B.K. Barman and M.E. Hoq (eds.), Advances in Fisheries Research in Bangladesh:1. Proc. of 5th Fisheries Conference and Research Fair 2012.

Hossain, M.A.R. 2016. Biodiversity in the Transboudary River – Someshwari. *Policy Farming on Fish Biodiversity Management in Transboundary Rivers of South Asia SAARC Agriculture Center (SAC), South Asian Association for Regional Cooperation*, pp. 143-159

Hossain, M.A.R., M.A. Wahab and B. Belton, 2012. The checklist of the riverine fishes of Bangladesh. *FAN-Bangladesh*, 2: 29–39.

IUCN Bangladesh, 2015. *Red List of Bangladesh*. *Volume 5*. *Freshwater Fishes*. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka Bangladesh. 360p.

IUCN, 2023. The IUCN Red List of Threatened Species. Version 2023-1. https://www.iucnredlist.org. Accessed on April 12, 2024.

Kundu, S., S. Rath, Shangningam, K. Tyagi, K. Laishram, V. kumar and D. Banerjee. 2022. Genetic investigation of freshwater fishes from Indo-Nepal transboundary Gandak River. *Fish Taxax.,* 25: 1–8.

Nachman, M.W, E.J. Beckman, R.C.K. Bowie, C. Cicero, C.J. Conroy, R. Dudley, et al. 2023. Specimen collection is essential for modern science. PLoS Biol 21(11):

Rahman, A.K.A. 2005. *Freshwater fishes of Bangladesh*. Second Edition, Zoological Society of Bangladesh. Dhaka, Bangladesh. 394p.

Sarkar, T. and J. Pal. 2018. Diversity and conservation status of Ichthyofauna in the river Jaldhaka, West Bengal. *Int. J. Fish Aqu. Stu.*, 6: 339-345.

Vences, M. 2020. The promise of next-generation taxonomy. *Megataxa*, 1(1): 35-38.

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