



Checklist of fish species in the Shari-Goyain river, Bangladesh: Threats and conservation measures

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The study was conducted from September 2017 to August 2018 to investigate the fish diversity status of the Shari-Goyain river, in the northeastern part of Bangladesh. A total of 66 fish species belong to 9 orders and 27 families were identified. Among these, almost 80% of the total fish population was from the orders, Siluriformes, Cypriniformes, and Perciformes. Fishes from the family Cyprinidae (22.71%) were found to be most abundant. Among 14 common groups of fishes identified, the highest contribution (28.79%) was from the catfishes. Ten vulnerable, eight endangered, and one critically endangered fish species were recorded. Alarming, based on their availability, 25 % and 18 % of the entire fish community were found to be rare and very rare, respectively. The present study suggests various conservation initiatives entailing the establishment of the fish sanctuary, ranching of threatened fish species, strict enactment of fishing laws and community-based fisheries management.

[Keywords: Fish availability, Hazards, Management strategies, Shari-Goyain river, Threatened fish species]

Introduction

With nearly 800 fish species in fresh, brackish, and marine waters, Bangladesh has the 3rd largest fish diversity in Asia^{1,2}. Around 265 freshwater fishes are reported to be available in Bangladesh³, and the natural habitats of the majority of these species (~230) are rivers and their tributaries⁴. Over the years, riverine systems have been experiencing concentrated human intervention causing habitat loss and degradation; which has resulted in shifting many fish species to highly endangered phase^{5,6}. For instance, the International Union for Conservation of Nature (IUCN) Bangladesh 2015^(ref. 7) categorized 64 freshwater fish species as threatened. Among them 9 are critically endangered, 30 are endangered, and 25 are in vulnerable category. Furthermore, it has reflected in the overall fish production of the country where the contribution of inland capture fisheries has substantially plummeted from 63 % in 1982-83 to 28 % in 2017-18^(refs. 2,8). Hence, the management and conservation of fish diversity have drawn notable ecological importance in recent years.

The Shari-Goyain river is a trans-boundary river of Bangladesh originated from the Meghalaya state of

India. It enters into Bangladesh through Jaintiapur Upazila of Sylhet district and flows about 80 km in length and finally connects to the Surma river near Chhatak Upazila^{9,10}. However, it also offers income and food security for the people of the adjacent areas through plenty of fisheries activities¹¹. Knowledge of the fish biodiversity and their availability is required to ensure sustainable exploitation and proper management of fisheries resources. However, no published work is found regarding fish species diversity in this river. Moreover, it is said that in recent years, many species are rarely available, which were found abundantly in the previous decades. Therefore, this study was undertaken to prepare a checklist of fish species in the Shari-Goyain river to identify their vulnerability status as well as to suggest management strategies for their conservation.

Materials and Methods

The study was carried out in some areas of the Shari-Goyain river of Bangladesh over a period of one year from September 2017 to August 2018. Fish samples were collected fortnightly from fishermen during fish selling period from three local fish landing

centers on the nearby river banks namely Jalurmukh Bazar ($25^{\circ}1'26''$ N, $91^{\circ}56'4''$ E), Salutikor Bazar ($24^{\circ}59'26''$ N, $91^{\circ}51'5''$ E), and Badhaghat Bazar ($24^{\circ}56'51''$ N, $91^{\circ}48'1''$ E) (Fig. 1). Direct catching of fish was also observed during fishing in the three sites of the river for verification and validation of the fishers' perception. A variety of nets were found to be used to catch fishes including surrounding nets, gill nets, drift net, cast net, set bag net, lift net, push net, etc. Freshly caught fishes were immediately chilled with ice in iceboxes and subsequently transported to the laboratory in the Department of Aquatic Resource

Management, Sylhet Agricultural University, Sylhet. In the laboratory, samples were sorted and identified to species level based on their morphometric and meristic features^{3,12-16}.

Based on the seasonal availability the fish species were categorized into four groups: available throughout the year in large amounts (TYL), throughout the year in a small amount (TYS), rare (R), and very rare (VR)^{6,17}. Besides, to accumulate data on the availability of fish along with the threats to fish diversity and conservation measures, survey was carried out using a semi-structured customized

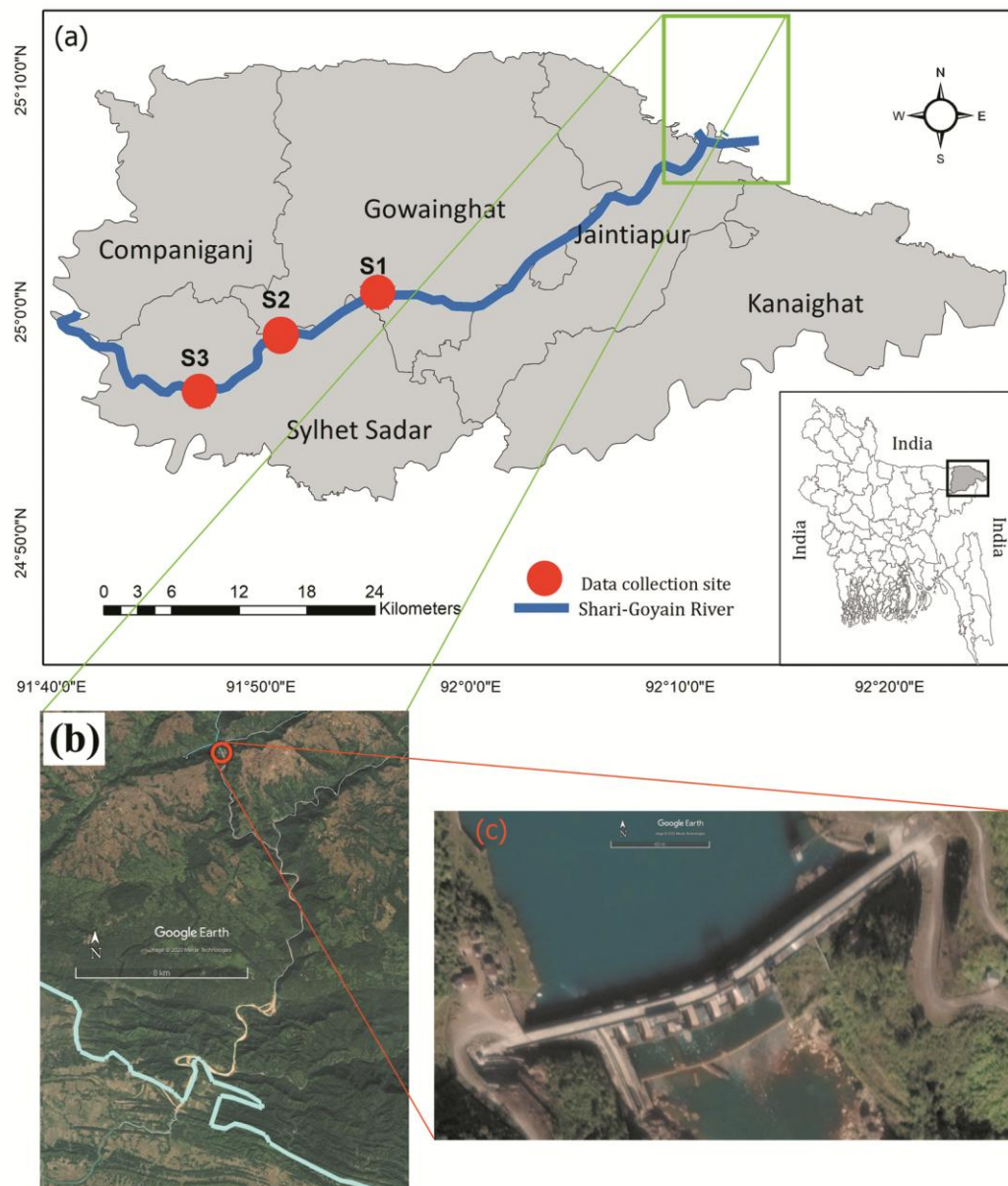


Fig. 1 — Geographical location of the Shari-Goyain river showing three study sites (S₁ - Jalurmukh Bazar, S₂ - Salutikor Bazar, and S₃ - Badhaghat Bazar)

questionnaire. A draft questionnaire was pre-tested at the field level and later revised accordingly before the survey. A total of 63 face to face interviews with fishers and fish traders were carried out for this study covering about 24.71 % of the total community. In addition to the personal interview, five focus group discussions were carried out with local peoples to pinpoint the threats. Moreover, in order to formulate a list of recommendations for the conservation of fish species respective government and NGO personnel, local teachers, leaders, experienced fishers, and senior citizens as well as available literature were consulted. The obtained data were analyzed using GraphPad Prism Version 8 and Microsoft Excel 2013.

Results and Discussion

A total of 66 fish species, grouped in 9 orders and 27 families, were documented in the Shari-Goyain river, Bangladesh (Table 1) through this study. Since this is the first documentation of the fish species composition of this river in recent years, the findings could not be compared with the previous study from the same river. Nevertheless, the current study would be valuable as baseline data for any forthcoming assessment of fish diversity. However, related results were found from a recent study on the Ratargul Swamp Forest which is an adjacent wetland connected to the Shari-Goyain river showing 62 fish species¹⁸ belonging to 9 orders and 27 families. Though the fish diversity observed in the present

Table 1 — List of fish species available in the Shari-Goyain river of Bangladesh

Order	Family	Scientific Name	Local Name	Group Name	Availability*	Threat Status**
Cypriniformes	Cobitidae	<i>Lepidocephalus guntea</i>	Gutum	Loaches	TYS	LC
		<i>Somileptes gongota</i>	Ghora Gutum	Loaches	VR	NT
	Cyprinidae	<i>Botia dario</i>	Rani	Loaches	R	EN
		<i>Labeo rohita</i>	Rui	Carps	TYS	LC
		<i>Catla catla</i>	Catla	Carps	TYS	LC
		<i>Labeo kalbasu</i>	Kalibaush	Carps	R	LC
		<i>Labeo gonius</i>	Gonia	Carps	TYL	NT
		<i>Cirrhinus cirrhosus</i>	Mrigal	Carps	TYS	NT
		<i>Cirrhinus reba</i>	Lachu	Carps	TYS	VU
		<i>Osteobrama cotio</i>	Dhela	Barbs and minnows	R	NT
		<i>Amblypharyngodon mola</i>	Mola	Barbs and minnows	TYL	LC
		<i>Puntius ticto</i>	Tit punti	Barbs and minnows	TYS	VU
		<i>Puntius sarana</i>	Sarpunti	Barbs and minnows	VR	NT
		<i>Puntius sophore</i>	Jatpunti	Barbs and minnows	TYL	LC
		<i>Esomusdanricus</i>	Darkina	Barbs and minnows	TYS	LC
		<i>Salmostoma phulo</i>	Fulchela	Barbs and minnows	R	NT
		<i>Securicula gora</i>	Ghora chela	Barbs and minnows	TYS	NT
		<i>Chela cachius</i>	Chhela	Barbs and minnows	R	VU
			Psilorhynchidae	<i>Psilorhynchus gracilis</i>	Balitora	Barbs and minnows
Perciformes	Ambassidae	<i>Pseudambassis lala</i>	Lal chanda	Perches	TYS	LC
		<i>Parambassis ranga</i>	Gol chanda	Perches	R	LC
		<i>Chanda nama</i>	Lamba chanda	Perches	TYL	LC
	Anabantidae	<i>Anabas testudineus</i>	Koi	Perches	TYS	LC
	Pristolepididae	<i>Badis badis</i>	Napit Koi	Perches	VR	NT
	Channidae	<i>Channa marulius</i>	Gozar	Snakeheads	VR	EN
		<i>Channa striatus</i>	Shol	Snakeheads	TYL	LC
		<i>Channa punctatus</i>	Taki	Snakeheads	TYL	LC

(Contd.)

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Order	Family	Scientific Name	Local Name	Group Name	Availability*	Threat Status**	
Siluriformes		<i>Channa orientalis</i>	Cheng	Snakeheads	TYL	LC	
	Gobiidae	<i>Glossogobius giuris</i>	Bele	Mudskippers	TYS	LC	
	Mugilidae	<i>Rhinomugil corsula</i>	Khorsula/Khalla	Mulletts	R	LC	
	Nandidae	<i>Nandus nandus</i>	Meni/veda	Perches	TYS	NT	
	Osphronemidae		<i>Colisa chuna</i>	Koiya Chata.	Perches	TYS	LC
			<i>Colisa fasciatus</i>	Colisha	Perches	TYS	LC
	Sciaenidae	<i>Johnius coitor</i>	Poa	Croakers	VR	LC	
	Ariidae	<i>Hemibagrus menoda</i>	Gagla	Catfishes	VR	DD	
	Bagridae		<i>Sperata aor</i>	Ayer/aor	Catfishes	R	VU
			<i>Sperata seenghala</i>	Guizza	Catfishes	R	VU
			<i>Rita rita</i>	Rita	Catfishes	VR	EN
			<i>Mystus cavasius</i>	Gulsha	Catfishes	TYL	LC
			<i>Mystus tengra</i>	Bujuri tengra	Catfishes	R	LC
			<i>Mystus vittatus</i>	Tengra	Catfishes	TYL	LC
	Clariidae	<i>Clarias batrachus</i>	Magur	Catfishes	R	LC	
	Heteropneustidae	<i>Heteropneustes fossilis</i>	Shing	Catfishes	R	LC	
	Schilbeidae		<i>Eutropiichthys vacha</i>	Bacha	Catfishes	TYS	LC
			<i>Ailia punctata</i>	Baspata	Catfishes	TYS	LC
			<i>Ailia coila</i>	Kajuli	Catfishes	R	LC
			<i>Clupisoma garua</i>	Ghaura	Catfishes	R	EN
			<i>Neotropius atherinooides</i>	Batasi	Catfishes	TYS	LC
	Siluridae		<i>Wallago attu</i>	Boal	Catfishes	TYS	VU
			<i>Ompok pabda</i>	Madhu pabda	Catfishes	TYS	EN
		<i>Ompok bimaculatus</i>	Kani pabda	Catfishes	TYS	EN	
Sisoridae		<i>Bagarius bagarius</i>	Baghair	Catfishes	VR	CR	
		<i>Gagata gagata</i>	Gang tengra	Catfishes	VR	LC	
Synbranchiformes	Mastacembelidae	<i>Mastacembelus pancalus</i>	Guchi baim	Eels	TYL	LC	
		<i>Macrogathus aculeatus</i>	Tarabaim	Eels	TYS	NT	
		<i>Mastacembelus armatus</i>	Shal baim	Eels	R	EN	
	Synbranchidae	<i>Monopterusuchia</i>	Kuiccha	Eels	R	VU	
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Kakhila	Gars	TYL	LC	
		<i>Hyporhamphus limbatus</i>	Ekthota	Gars	R	LC	
Osteoglossiformes	Notopteriidae	<i>Notopterus notopterus</i>	Foli	Feather backs	TYL	VU	
		<i>Notopterus chitala</i>	Chitol	Feather backs	VR	EN	
Clupeiformes	Clupeidae	<i>Gudusia chapra</i>	Chapila	Clupeids	TYL	VU	
		<i>Tenualosa ilisha</i>	Ilish	Clupeids	TYS	LC	
		<i>Corica soborna</i>	Kachki	Clupeids	TYL	LC	
Anguilliformes	Anguillidae	<i>Anguilla bengalensis</i>	Bamas	Eels	VR	VU	
Tetraodontiformes	Tetraodontidae	<i>Tetraodon cutcutia</i>	Potka	Puffer fishes	TYS	LC	

*R – rare, VR – very Rare, TYS – throughout the year in small amounts, and TYL – throughout the year in large amounts. **LC – least concern, NT – near threatened, DD – data deficient, VU – vulnerable, EN – endangered, and CR – critically endangered (IUCN Bangladesh 2015^(ref. 7))

study was smaller than that of other rivers of northeastern Bangladesh^{19,20}, it can be attributed to the smaller length (~ 80 km) of this river¹⁰.

Most of the fishes harvested from this river belong to the orders Siluriformes, Cypriniformes, and Perciformes contributing nearly 80 % of the total fish species. Remaining 20 % of the fishes were in the orders, Synbranchiformes, Clupeiformes, Beloniformes, Osteoglossiformes, Anguilliformes, and Tetraodontiformes (Fig. 2). These findings are found in parallel with several studies on the fish biodiversity in

different types of freshwater bodies of Bangladesh, where they reported Siluriformes, Cypriniformes, and Perciformes as the most prevailing orders^{3,17,18,21}.

Fishes in the family Cyprinidae were found to be the more abundant (22.71 %) in this river, followed by Bagridae (9.08 %), Schilbeidae (7.57 %), and Channidae (6.05 %). Cobitidae, Siluridae, Mastacembelidae, Ambassidae, and Clupeidae constituted 4.55 % each in the total fish population. The contribution of Sisoridae, Notopteriidae, and Osphronemidae was 3.00 % each (Fig. 3). Researchers also found Cyprinidae family as

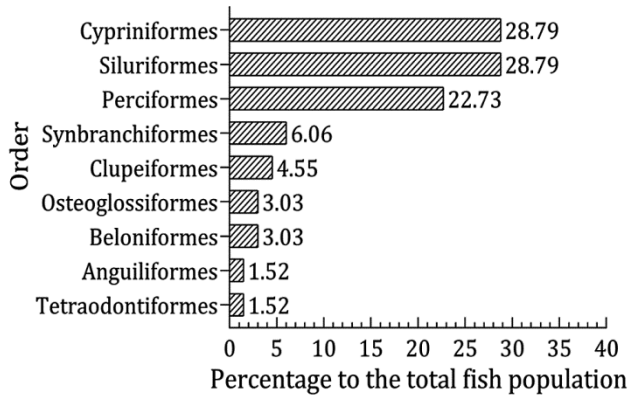


Fig. 2 — Composition of fish species under different orders available in the Shari-Goyain river

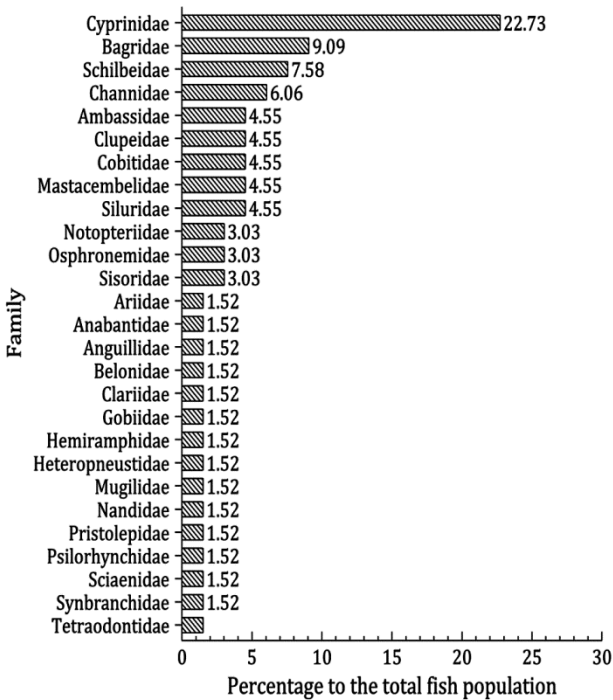


Fig. 3 — Contribution of the family to the fish population in the Shari-Goyain river

the dominant family of fishes in other rivers of Bangladesh like the Brahmaputra²², the Kushiara²⁰, the Choto Jamuna²³, and the Halda²⁴. Fourteen common groups of fishes were recorded through this study where catfishes (28.79 %) were found to be the most prominent group in the Shari-Goyain river followed by barbs and minnows (15.15 %), perches (12.12 %), carps (9.09 %), eels (7.58 %) and snakeheads (6.06 %). Contribution of clupeids and loaches was 4.55 % each, and featherbacks and gars contributed 3 % each in the total fish population. Goby, croaker, mullet, and puffer comprised 1.5 % each (Fig. 4).

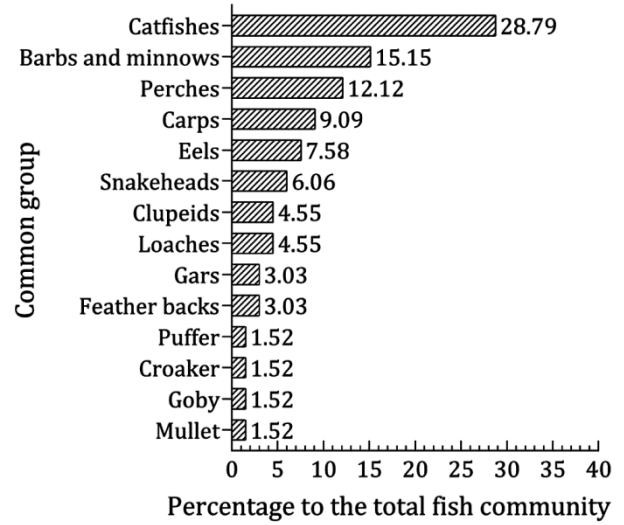


Fig. 4 — Percentage of common groups of fish documented in the Shari-Goyain river

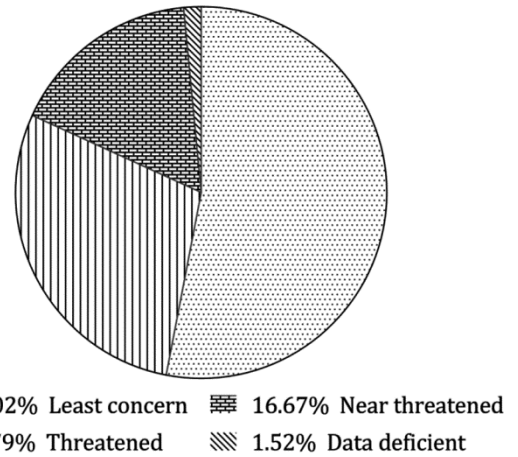


Fig. 5 — Percentage of fish species belonging to the categories of IUCN Bangladesh 2015^(ref. 7) in the Shari-Goyain river

According to the Red List of Freshwater Fishes published by IUCN Bangladesh 2015^(ref. 7), more than half of the existing fish species (53.02 %) of this river was found to be in the least concern (LC) category, while 16.67 % fish species recorded as near threatened (NT) and only 1.52 % as data deficient (DD). However, a total of 19 fish species was found to be threatened (28.79 % of the total available fish species; Fig. 5) of which 10 species were found as vulnerable (VU), 8 species as endangered (EN), and only one species as critically endangered (CR) (Fig. 6).

Eighteen percent of the total fish composition of Shari-Goyain was found to be very rare (VR), and around one quarter was found to be rare (R)¹⁹. Furthermore, about one-third of the total fish

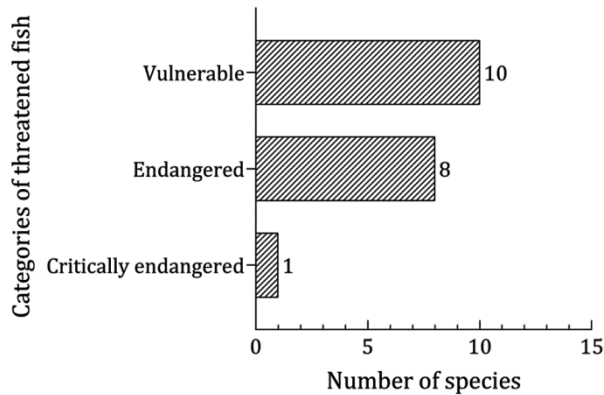


Fig. 6 — Number of threatened fish species found in the Shari-Goyain river

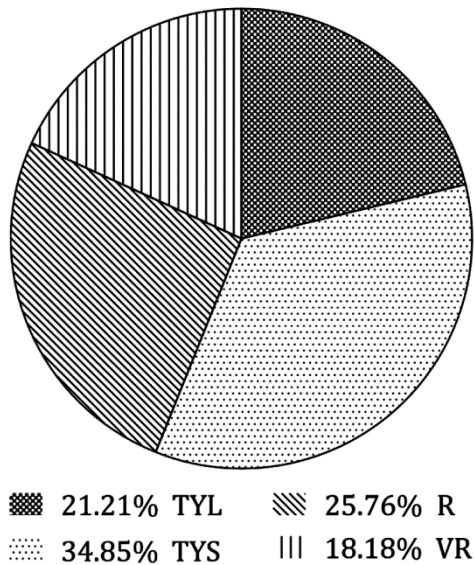


Fig. 7 — Percentage of fish on the basis availability in the Shari-Goyain river

population was available throughout the year in a small quantity (TYS), and only 21 % of fish were found throughout the year in large quantity (TYL) (Fig. 7). Researchers reported nearly half of the fish population as rare or very rare in the Padma⁶ and Rupsha²¹ rivers, which is consonant with the findings of present study. These results emphasize the necessity for immediate measures to conserve the fish diversity of the Shari-Goyain river.

During the data collection, respondents were asked about the possible threats to fish diversity of the Shari-Goyain river. They mentioned a wide range of threats including lack of water flow, water pollution due to coal mine drainage, siltation, water diversion, non-responsible fishing activities (overfishing,

harvesting of brood and juvenile fish, and destructive fishing practices such as catching fish by fine-meshed net and use of chemical poison during *katha* fishing (a type fish aggregating device or brush shelter from where fishes are harvested by fencing and seining)) and habitat destruction which have detrimental effects on aquatic fauna, mainly on fish. Such threats are also reported to cause fish diversity loss in various parts of Bangladesh^{6,21,25,26} and in India²⁷⁻²⁹.

At the upstream of the Shari-Goyain river the Leshka dam was constructed in Meghalaya, India which can be observed in the Google map (Fig. 1). Thus, this dam may have resulted in the decrease of the water flow substantially; especially in the dry season when the gates are closed to retain water. Over the years, sand and gravel are excavated through open-pit mining from the Shari-Goyain river, which is severely deteriorating the water quality of river and also destroying the natural habitat of fishes³⁰.

For conservation and better management of the fisheries resources of the Shari-Goyain river, the current study recommended various measures based on the survey and direct observations. The suggested measures are the identification of the spawning grounds of fish, the prohibition of destructive fishing exclusively during breeding season, ranching of endangered fish species, banning the use of fine-meshed net, establishment of fish sanctuaries, reduction of water pollution regulating the open excavation of sand and gravel, dredging the river to enhance water holding capacity and water flow, arranging training program and alternate livelihood options for fishers, ensuring their active participation in community-based fisheries management, formulating new regulation addressing the current situation, proper implementation of existing laws, and raising awareness among the people. Also, future research should focus on life-history traits and artificial breeding techniques of the above-mentioned threatened fish species to prevent them from extinction.

The current study has some minor drawbacks like limited areas of the Shari-Goyain river were covered through this research. Fish samples were collected from the fishermen rather than direct sampling through fishing by the researchers due to the limitation of manpower and monetary resources available for this study. Hence, collected fish sample sizes were also limited. In addition, the threats were assessed from the perception of the stakeholders through survey. Therefore, in depth study is required in future for more accurate information to find out better management strategies of the fisheries resources of this river.

Conclusion

This research is the first attempt to assess the fish diversity of the Shari-Goyain river. However, the present study mainly emphasized on the documentation of available fish faunal diversity in the river and observed a total of 66 fish species. Nevertheless, nearly half of the total fish composition found to be threatened or near threatened. This study also revealed that the fishes of the river studied are impinged by various anthropogenic stressors, and recommended a variety of conservation measures. Moreover, integration among government and non-government organizations and monetary support are essential to carry out any further studies, monitoring and raising awareness among the people for better management and conservation of fisheries resources of the Shari-Goyain river.

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Conflict of Interest

The authors declare no conflict of interest to the current manuscript.

Author Contributions

The study was conceived and designed by MRT & MK. All the data were collected by MRT & DP. MAH prepared the first draft of the manuscript with the assistance from AHAR. MAH, AHAR & TAS conducted the data analysis and preparation of figures. MAH & AHAR read and revised the manuscript. MK oversaw and acquired the funding for the entire research work.

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