

STATUS OF FISH SPECIES DIVERSITY IN GHAGHAT RIVER IN NORTHERN BANGLADESH

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Abstract

Fish species diversity and its conservation status of Ghaghat river in northern region of Bangladesh was investigated by field sampling using a taxonomic guide, FishBase data and International Union for Conservation of Nature (IUCN) conservation index. The study revealed that a total of 55 species of fishes belonging to 45 genera, 22 families and 9 orders were found in the river. Among the identified fish orders, Cypriniformes was the highest diverse group with 34% species abundance followed by Siluriformes and Perciformes with 24% each. On the other hand, fishes under the orders Beloniformes, Decapoda, and Tetradontiformes were the least abundant (2%). Fish species diversity was found prominent during the monsoon. Based on IUCN conservation index 6(11%), 10(18%) and 7(13%) species in Ghaghat river were identified as critically endangered, endangered and vulnerable respectively. A total 14 types of fishing gear under 8 major groups were found to operate in the studied river, which included some banned gears like gill net and seine net. An effective conservation strategy needs to be developed to stop indiscriminate fishing and to conserve the fish biodiversity in Ghaghat river.

Keywords: Fish, biodiversity, ghaghat river, conservation.

Introduction

Bangladesh is blessed with a large number of rivers including tributaries of about 700 covering a total length of about 24,140 km (Rashid, 1991). Total fish production of the country was 38.78 lakh MT in 2015-16, where the contribution of inland open water fisheries is 4.60% (1.78 lakh MT) (DoF, 2017). The open water bodies are habitat of 265 freshwater fish species (Rahman, 2005). Therefore, rivers have rich fish biodiversity (Rahman *et al.*, 2015). Unfortunately, due to overfishing, indiscriminate harvesting of fry and fingerlings, construction of roads and

barrages, pollution, using of banned fishing gears fish biodiversity is declining (Rahman *et al.*, 2016).

The Ghaghat river (236 km long) is a tributary of Tista river, originated at Jaldhaka in Nilphamari district and after passing through Gaibandha town (few km north of Fulchhari Ghat) joins to the Brahmaputra river (Banglapedia, 2012). In the northern part of Bangladesh the Ghaghat river is an important inland open water-body and a vital breeding ground of many freshwater fish species, therefore, plays a significant role in the fisheries sector of the country. However,

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fish catch and species diversity in most of the river are declining day by day. There is no previous research on fish biodiversity, fishing gears, fish availability of Ghaghat river, which consequently would limit the establishment of management and biodiversity conservation strategies. Therefore, the present study was conducted to gather fish biodiversity information and baseline data to reveal the present status of the Ghaghat river.

Materials and Methods

Study area

The investigation was carried out in four sampling sites (station 1 to 4) in the main river basin (Fig. 1) for recording available fish species diversity. The prime criteria for site selections were higher fishing intensity and the presence of a good number of fishermen in the locality.

Sample collection

Sampling was carried out at all the stations during day and night with the help of professional fishermen covering pre-monsoon (Mid April-Mid June), monsoon (Mid June-Mid August) and post-monsoon (Mid August-Mid October) period in the year 2017. Fish samples were also collected from local fish landing centers and markets. Fishes were caught by means of traditional fishing gears like cast net (jhaki jal), seine net (ber jal), lift net (dharmo jal), hook (borshi) and traditional fish trap locally called bair. Twenty throw and twenty hauls were considered by cast net and lift net in each time during the sampling. Fishing traps were set at the stations during the late afternoon and kept for overnight to check the trapped species in the following morning.

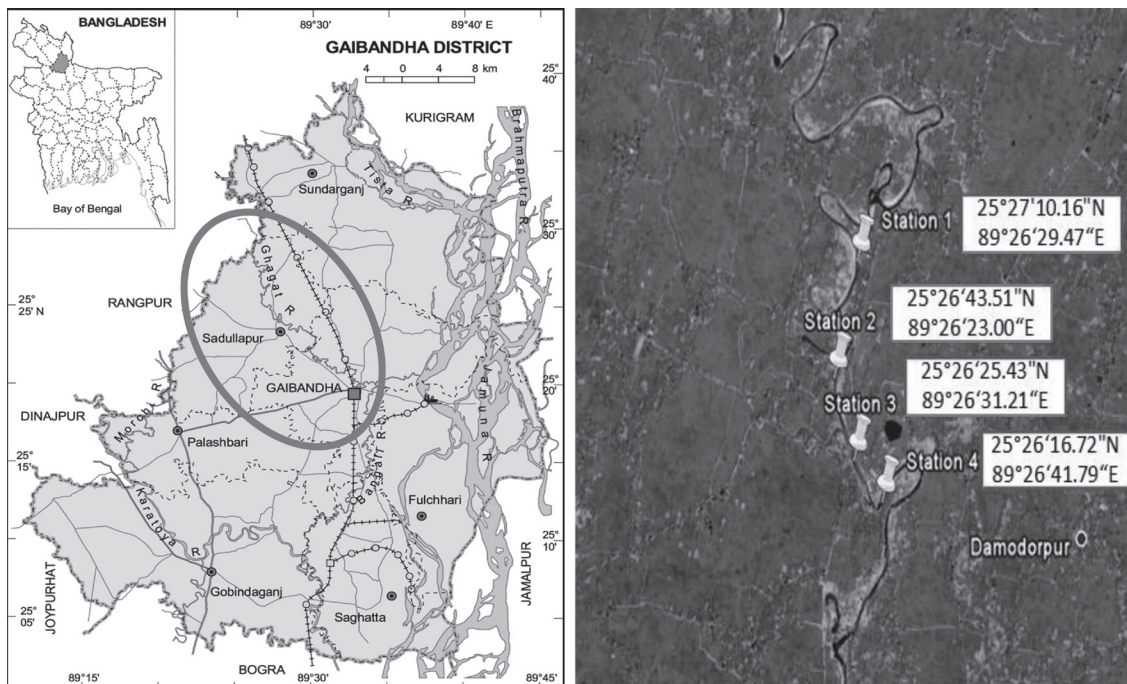


Fig. 1. Map of the study area (Left) with satellite image (Right) of Ghaghat river showing four sampling sites.

The collected specimens were identified primarily during sampling time. Unidentified samples were preserved in the plastic jar with 10% formalin and brought to the laboratory of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh to perform species identification.

Identification of fish sample

Fish samples were identified on the basis of morphometric and meristic characteristics. The collected specimens were identified up to species level according to the taxonomic guide of Rahman (2005) and Talwar *et al.* (1991). In addition, FishBase (Froese and Pauly, 2000) was used to remove taxonomy discrepancies.

Identification of fishing gear

Fishing gear including major species caught by the particular gear was surveyed by Participatory Rural Appraisal (PRA) through Focus Group Discussion (FGD) and Key Informant Interview (KII) with the fishermen in the sampling sites.

Determination of threatened and non-threatened fish status

The present status of threatened and non-threatened fish species was determined by using the Red Book of Threatened Fishes of Bangladesh (IUCN, 2015).

Data analysis

All the collected data were carefully checked recorded and analyzed using Microsoft Excel and presented in both graphical and tabular form.

Results and Discussion

Fishing gear

Different types of fishing gear operated in Ghaghat river, major fish species caught and the number of people engaged to operating the gears was recorded during the study period (Table 1). A total 14 types of fishing gear were recorded under 8 major groups such as gill net (current jal, fash jal), seine net (ber jal), cast net (jhaki jal), lift net (dharma jal, khora jal), push net (thela jal, moiya jal), trap (bar, dheal, polo), hook and line (chip borsh, wheel borsh), and wounding gear (koch). Jhakijal, ber jal, dharma jal, darki, dheal, and chip borshi were found mostly operated fishing gears in the study area.

The use of banned fishing gears was one of the main reasons of loss of biodiversity around the world (Harrison and Stiassny, 1999; Allan *et al.*, 2005; Dudgeon *et al.*, 2006). According to a study of Afrose and Ahmed (2016), over exploitation is responsible for 42% of fish diversity loss in the Brahmaputra river of Bangladesh. Indiscriminate fishing by gill net, seine net even in the breeding season is also responsible for the decline in fish catch and species composition. Rahman *et al.* (2015) found that fish diversity is declining in a river of Bangladesh due to overfishing and use of non-selective fishing gears like seine net, gill net and push net. Some gears with small mesh size such as: seine net, cast net, push net, lift net could act as non-selective for the certain group of fishes, which could lead to a huge quantity of immature fish being caught (Adebisi, 1998).

Fish species diversity

A total 55 species of fishes were recorded in Ghaghat river during the study belonging

Table 1. Different types of fishing gears recorded for fishing in Ghaghat river

Gear type	Local name	Fish species caught	Operational fishermen (No.)
Gill net	Current jal	<i>Mystus vittatus, Puntius ticto, Channa punctatus, Eutropiichthys murius</i>	1-2
	Fash jal	<i>Mystus bleekery, Tenuulosa ilisha, Sperata aor</i>	1-2
Seine net	Ber jal	<i>Amblypharyngodon mola, Laubuca laubuca, Puntius ticto, Trichogaster fasciata, Labeo rohita, Catla catla</i>	8-10
Cast net	Mut jal, Jhaki jal	<i>Puntius ticto, Trichogaster fasciata, Labeo bata, Labeo rohita</i>	1
Lift net	Dharma jal	<i>Puntius ticto, Mystus bleekery, Amblypharyngodon mola, Osteobrama cotio</i>	1-2
	Khara jal	<i>Labeo rohita, Catla catla, Mystus bleekery, Puntius ticto, Wallago attu</i>	1-2
Push net	Thela jal	<i>Mystus bleekery, Puntius ticto, Rasbora rasbora, Channa punctatus, Glossogobius giuris</i>	1
	Moiya jal	Small fishes	1-2
Darki	Trap	<i>Puntius ticto, Channa punctatus, Heteropneustes fossilis, Clarias batrachus, Mastacembelus armatus</i>	1
	Dheal	<i>Puntius ticto, Channa punctatus, Heteropneustes fossilis, Clarias batrachus, Mastacembelus armatus</i>	1
	Polo	<i>Mystus bleekery, Puntius ticto, Channa punctatus, Glossogobius giuris</i>	1
Hook and line	Chip borshi	<i>Puntius ticto, Wallago attu, Mystus bleekery, Channa punctatus, Labeo rohita</i>	1
	Wheel borshi	<i>Puntius ticto, Wallago attu, Mystus bleekery, Channa punctatus, Labeo rohita</i>	1
Wounding	Koch	<i>Channa punctatus, Channa striatus</i>	1

to 9 orders, 22 families and 45 genera (Table 2). The most dominant fish order was Cypriniformes (34%) contributing 19 fish species in 13 genera followed by Siluriformes and Perciformes both consist of 24% of the species biodiversity (Fig. 2). The other orders were Synbranchiformes, Osteoglossiformes, Clupeiformes consisted of 5, 4 and 3%, respectively of the total species caught. The rest 3 orders were: Beloniformes, Tetradontiformes, and Decapoda each had 2% species composition.

During the study, a great variety of fish species were recorded from 22 diversified families. Among those Cyprinidae was the most species rich family accounting for 29.09% of the total number of species recorded with 10 diversified genera (Figure 3). Other noticeable families were Bagridae (9.09% species), Channidae (7.27 % species), Cobitidae, Mastacembilidae, Osphronemidae and Schilbeidae (5.45% species each). The lowest percentage of fish (1.82%) were recorded from the family Anabantidae, Belonidae, Cichlidae, Clariidae,

Table 2. Fish diversity and present status of threatened and non-threatened species of Ghaghat river in the northern region of Bangladesh

Order	Family	Scientific Name	Common Name	Local name	Availability	Present status (IUCN ,2015)			
						Local	Global		
Cypriniformes	Cyprinidae	<i>Puntius sophore</i>	Pool Barb	Jat Puti	TY, LM	NO	LC		
		<i>Puntius ticto</i>	Ticto Barb	Tit Puti	TY, LM	VU	VU		
		<i>Laubuca laubuca</i>	Indian Glassbarb	Chela	TYS, LAM	EN	LC		
		<i>Osteobrama cotio</i>	Cotio	Dhela	R	EN	NT		
		<i>Labeo rohita</i>	Rohu	Rui	TY, LM	NO	LC		
		<i>Hypophthalmichthys molitrix</i>	Silver	Silver	TY, LM	Exotic	NT		
		<i>Labeo bata</i>	Bata	Bata	TY, LM	EN	LC		
		<i>Gibelion catla</i>	Catla	Catla	TY, LM	NO	LC		
		<i>Cyprinus carpio</i>	Common Carp	Carpu	TYS, SM	Exotic	VU		
		<i>Puntius sarana</i>	Olive Barb	Sharputi	TY, LM	CR	NO		
		<i>Devario devario</i>	Sind Danio	Chebli	LM	NO	LC		
		<i>Cirrhinus cirrhosus</i>	Mrigal	Mrigel, Mirka	TYS, LM	NT	VU		
		<i>Labeo calbasu</i>	Orange-fin Labeo	Kalibaus	TYS, LM	EN	LC		
		<i>Labeo boga</i>	Boga Labeo	Bhangon	TYS	CR	CR		
		<i>Puntius terio</i>	Onespot Barb	Vati puti	TYS	NO	LC		
		<i>Rasbora rasbora</i>	Gangetic Scissortail Rasbora	Darkina, Dairka	TY,LM	EN	NT		
			Cobitidae	<i>Botia dario</i>	Bengal Loach	Bou Mach, Rani Mach	TYS, LAM	EN	EN
				<i>Amblypharyngodon mola</i>	Mola Carplet	Mola, Moa	TYS, LAM	NO	LC
				<i>Lepidocephalichthys guntea</i>	Guntea Loach	Gutum, Guchi	TYS, LM	NO	LC
		Siluriformes	Bagridae	<i>Mystus vittatus</i>	Striped Dwarf Catfish	Tengra	TY, LM	NO	LC
<i>Mystus bleekeri</i>	Days Mystus			Gulsha Tengra	TY, LM	NO	LC		
<i>Sperata aor</i>	Long Whiskarted Catfish			Air	TYS, LM	VU	VU		
<i>Rita rita</i>	Rita			Rita	TYS, LM	CR	EN		
Schilbeidae	<i>Chandramara chandramara</i>		Hobering Catfish	Gura Tengra	LM	DD	LC		
	<i>Eutropiichthys murius</i>		Batchwa Bache	Bacha Mach	LM	NO	LC		
	<i>Ailia coila</i>		Gangetic Ailia	Bashpata, Kajuli, Batasi	TY, LM	NO	LC		
	<i>Clupisoma garua</i>		Garua Bachcha	Gharua	LM	CR	EN		
Pangasiidae	<i>Pangasius pangasius</i>		Yellotail Catfish	Pangas	VR	CR	EN		
Heteropneustidae	<i>Heteropneustes fossilis</i>		Stinging Catfish	Shing, Shingi	R, SM	NO	LC		
Clariidae	<i>Clarias batrachus</i>		Philippine Catfish	Magur	R, SM	NO	LC		
Sisoridae	<i>Bagarius bagarius</i>		Dwarf Goonch	Baghair	VR	CR	DD		
Siluridae	<i>Wallago attu</i>	Wallago	Boal	TYS, LM	EN	VU			
Synbranchiformes	Mastacembelidae	<i>Mastacembelus armatus</i>	Zig-zag Eel	Baim	TY, LAM	EN	EN		
		<i>Macrogathus aculeatus</i>	Spiny Eel	Tara Baim	TYS, LM	VU	NT		
		<i>Macrogathus pancalus</i>	Barred Spiny Eel	Guchi Baim	TYS, LM	Not assessed	LC		

Order	Family	Scientific Name	Common Name	Local name	Availability	Present status (IUCN ,2015)	
						Local	Global
Perciformes	Osphronemidae	<i>Trichogaster fasciata</i>	Banded Gourami	Kholisa	TYS,LAM	NO	LC
		<i>Trichogaster chuna</i>	Honey Gourami	Chuna Khoilsha	LAM	NO	LC
		<i>Trichogaster lalius</i>	Dwarf Gourami	Lal Kholisha	LAM	NO	LC
	Ambassidae	<i>Chanda nama</i>	Elongated Glass Perchlet	Chanda, Lomba Chanda	LM	VU	LC
		<i>Pseudambassis ranga</i>	Indian Glassy Fish	Ranga Chanda	LM	LC	LC
	Gobiidae	<i>Glossogobius giuris</i>	Tank Goby	Bele, Baila	TYS, LAM	NO	LC
	Channidae	<i>Channa punctatus</i>	Spotted Snakehead	Taki, Shati	TY, LAM	NO	LC
		<i>Channa orientalis</i>	Walking Snakehead	Cheng	LAM	VU	LC
		<i>Channa striatus</i>	Striped Snakehead	Shol	VR	NO	LC
		<i>Channa marulius</i>	Great Snake head	Gojar	VR	EN	EN
	Nandidae	<i>Nandus nandus</i>	Gangetic Leaffish	Bheda, Meni	TYS, LAM	VU	NT
	Cichlidae	<i>Oreochromis mossambicus</i>	Indian Tilapia	Tilapia	VR	Exotic	Not assessed
		Anabantidae	<i>Anabas testudineus</i>	Climbing Perch	Koi	VR	Not assessed
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Freshwater Garfish	Kakila, Tin thuitta	TYS, LM	NO	LC
Clupeiformes	Clupeidae	<i>Corica soborna</i>	Ganges River Sprat	Kachki	TY	NO	LC
		<i>Temalosa ilisha</i>	Hilsa Shad	Ilish	SM	NO	LC
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Bronze Featherback	Foli	R, SM	VU	VU
		<i>Notopterus chitala</i>	Clown Knifefish	Chitol	R	EN	EN
Tetraodontiformes	Tetraodontidae	<i>Tetraodon cutcutia</i>	Ocellated Pufferfish	Potka, Tapa	LM	NO	LC
Decapoda	Palaemonidae	<i>Macrobrachium daganum</i>	River Prawn	Chingri	TYS	NO	LC

* Present status: DD=Data Deficient; LC=Least Concern; NO=Not Threatened; CR=Critically Endangered; EN=Endangered; NT=Near Threatened; VU=Vulnerable

* A vailability: TY=Throughout the year; TYS= Throughout the year in small amount; SM= Small amount during monsoon; LM= Large amount during monsoon; LAM= Large amount after monsoon; R= Rare; VR= Very rare

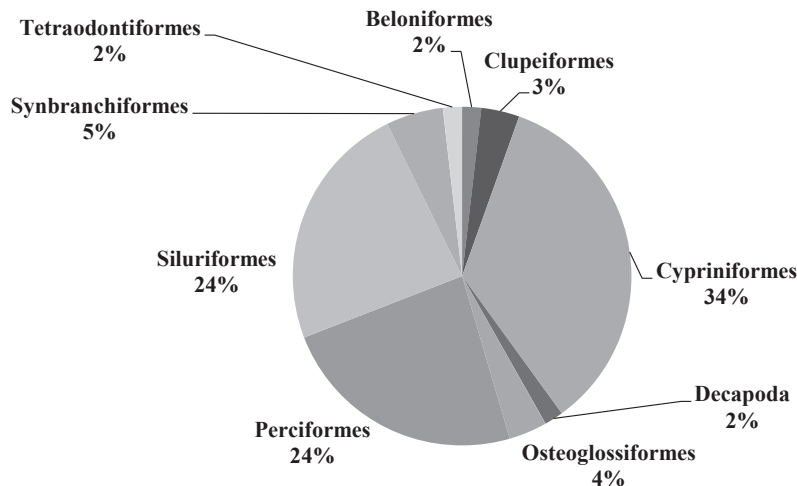


Fig. 2. Percentage of fish species according to the fish order in Ghaghat river.

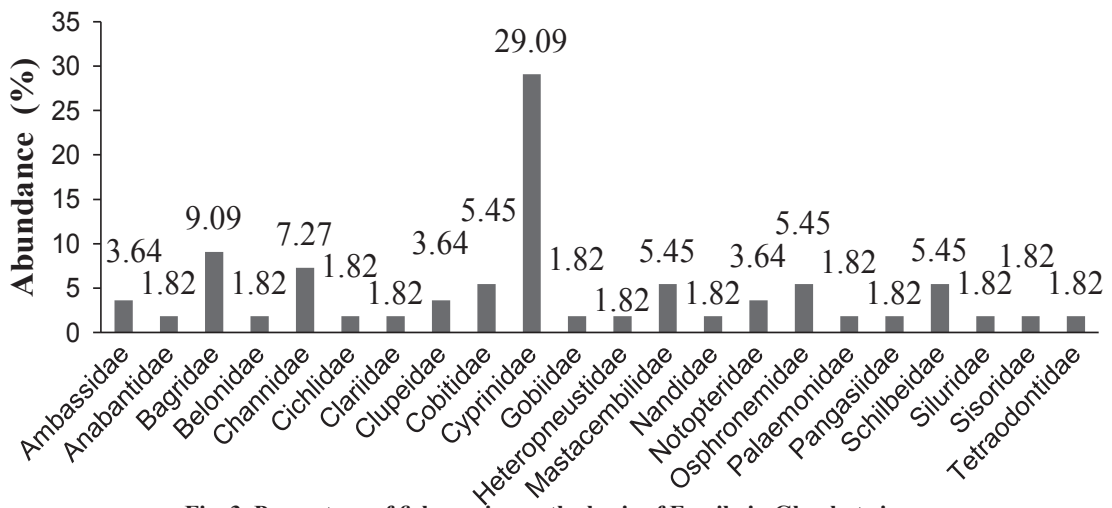


Fig. 3. Percentage of fish species on the basis of Family in Ghaghat river.

Gobiidae, Heteropneustidae, Palaemonidae, Pangasiidae, Siluridae, Sisoridae, and Tetraodontidae.

Among aquatic organisms in the world 40% species inhabit in the freshwaters, while the remaining 60% are in marine habitats (Leveque *et al.*, 2008). In the study, Cypriniformes fishes were the first and both of Siluriformes and Perciformes had the second abundant species group in the studied stream water at every season. Cyprinidae, Bagridae, Channidae, Cobitidae, Mastacembilidae, Osphronemidae and Schilbeidae were the most endemic species-rich families in the river. The most species-rich orders and families in the river were about similar to the freshwater bodies in the world. This suggests that a diverse group of fish in the Ghaghat river plays an important role in the freshwater fish species diversity of our country. Fish species richness in the river was low than the other big rivers in Asia might be because of the smaller area coverage (Fu *et al.*, 2003). The number and composition of fish species

in the present study had a slight different view from the two connected rivers (Tista/origin and Brahmaputra river). According to the study of Khan *et al.*, (2013), 42 fish species were found in Tista river where the Ghaghat river has 55 fish species. However, in the Brahmaputra river 67 fish species (46 genera) were identified by Galib (2015), which was higher than the Ghaghat river.

Seasonal abundance status

Species availability pattern is summarized in Figure 4 and Table 2. Most of the Cypriniformes fishes including carps and other fishes were found throughout the year with a large quantity during the monsoon. Among the Cypriniformes fishes, *Osteobrama cotio* was rarely found in the Ghaghat river. Siluriformes fishes were largely abundant in the monsoon season except for stinging catfish (*Heteropneustes fossilis*), walking catfish (*Clarias batrachus*), Baghair (*Bagarius bagarius*) and Pangas (*Pangasius pangasius*) which were found rarely in the

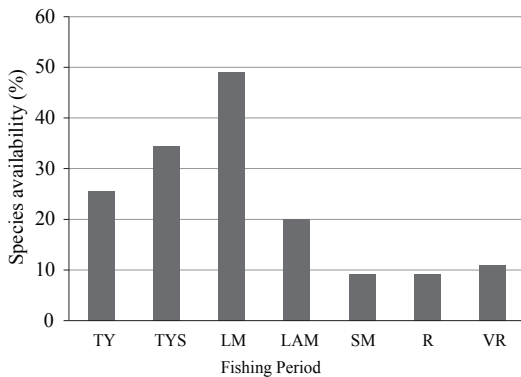


Fig. 4. Species availability (%) in Ghaghat river (TY=Throughout the year; TYS=Throughout the year in small amount; SM=Small amount during monsoon; LM=Large amount during monsoon; LAM=Large amount after monsoon; R=Rare; VR=Very rare).

river Ghaghat. In the study area, three species of Synbranchiformes were found belonging to the family Mastacembilidae which were available throughout the year with large (*Mastacembelus armatus*) and small quantities (*Macrognathus aculeatus* and *Macrognathus pancalus*). Fishermen of Ghaghat river confirmed that abundance of Perciformes fishes increases after the monsoon. Shol (*Channa striatus*), Gojar (*Channa marulias*) and Climbing perch (*Anabas testudineus*) were very rare in Ghaghat river. Two species each of Clupeiformes and Osteoglossiformes were found in the study area. A very small amount of Kachki (*Corica soborna*) and Ilish (*Tenualosa ilisha*) were found in the monsoon. However, Foli (*Notopterus notopterus*) and Chitol (*Notopterus chitala*) belonging to the order Osteoglossiformes found rarely in the study area. Each order of Beloniformes, Tetradontiformes and Decapoda had only one species which were Kakila (*Xentodon cancila*), Potka (*Tetradon cutcutia*) and river prawn (*Macrobrachium daganum*), respectively.

During the study, three exotic species: Silver carp (*Hypophthalmichthys molitrix*), Common carp (*Cyprinus carpio*), Tilapia (*Oreochromis mossambicus*) were found in the Ghaghat river. However, Bighead carp (*Aristichthys nobilis*), Sucker mouth (*Hypophthalmus plecostomus*), Silver carp (*Hypophthalmichthys molitrix*), Grass carp (*Ctenopharyngodon idella*) and Common carp (*Cyprinus carpio*) etc. are often found in the river of Bangladesh and India (Galib, 2015 and Galib *et al.*, 2013). Those exotic species may enter into the river during the annual flood from culture ponds. Introduction of exotic fish species in a certain environment could be a threat to the native species (Winemiller, 2018; Dudgeon *et al.*, 2006 and Schlaepfer *et al.*, 2011). Most of the fishes are available throughout the year but found in a large amount during and after the monsoon could be due to the breeding season for the maximum indigenous fishes.

Local and Global assessment of threatened and non-threatened fish species

The present status of fish was verified by the assessment of local and global context. The local context refers to the assessment of the status of a fish species within Bangladesh while global context refers to the status within the world. During the study out of total 55 fish species found in Ghaghat river, 23 species have considered as threatened according to IUCN Bangladesh (2015). Among those 11, 18 and 13% are categorized as Critically Endangered (CE), Endangered (EN) and Vulnerable (VU) respectively. About half of the total fish species (45%) sampled from the Ghaghat river are considered Not Threatened (NO) and 5% of them were exotic species (Fig. 5). According to the local conservation status of Bangladesh

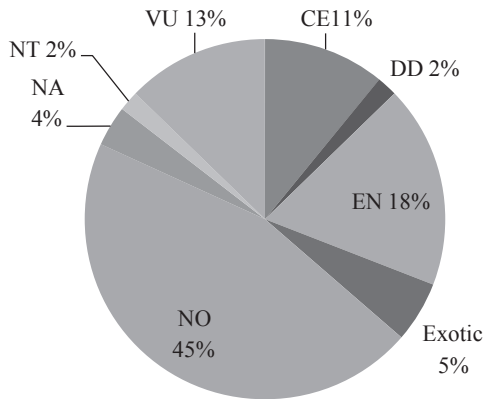


Fig. 5. Local conservation status of fishes of the Ghaghat River. (DD= Data Deficient, CE = Critically endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, NO = Not Threatened, NA = Not Assessed).

2% fish species are found Near Threatened (NT). In a global context, population trend of more than half (62%) of the fishes was free from any threats and 25% of the fishes were threatened of which 2% CE, 12% EN and 11% were VU among the total fish species (Fig. 6). There was no management strategy observed for the conservation of threatened fish species in the river.

According to the assessment of IUCN Bangladesh 64 freshwater fish species have found threatened (IUCN, 2015) which was 54 in 2000 (IUCN, 2000). Among the threatened fishes, 9, 30 and 25 species are identified as CE, EN, and VU respectively. On the other hand, 27 species are found NT, 122 species are the least concern (LC) and the rest of the species are considered as data deficient (DD) (IUCN, 2015).

In the Ghaghat river four wild indigenous fish species: *Heteropneustes fossilis*, *Clarias batrachus*, *Channa striatus*, *Anabus testudineus* are not considered as threatened

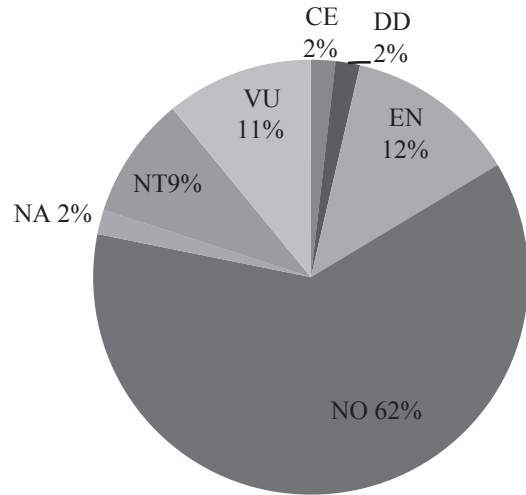


Fig. 6. Global conservation status of fishes of the Ghaghat River. (DD = Data Deficient, CE = critically endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, NO = Not Threatened, NA = Not Assessed).

by IUCN but would mark as vulnerable in near future because of their rare abundance. On the other hand, there was no scientific study and strategy observed for the management and conservation of existing and threatened fish diversity in the river. The freshwater ecosystems are experiencing much more decline of biodiversity than any other terrestrial ecosystem and if it continues, we will loss the chance to conserve the remaining biodiversity (Dudgeon *et al.*, 2006; Sala *et al.*, 2000). Risk of extinction of freshwater fishes is significantly higher than that of terrestrial organisms and 130 to 855 times more than natural destruction rates (Burkhead, 2012). Freshwater ecosystems are heavily impacted by human usages which lead to the most vulnerable situation to freshwater fishes. Excessive pressures on inland waters and freshwater fish biodiversity have been seen in Asia because of having perhaps over half

of the global human community (Dudgeon *et al.*, 2006). Therefore, documentation of all riverine biodiversity has enormous value.

Conclusion

The loss of biodiversity could be due to some major threats: over fishing, fishing during the breeding season, siltation, destruction of breeding ground, invasion by exotic species, and use of non-selective fishing gears. To stop the loss of biodiversity and retain the existing stocks the effective management strategies are very essential. Establishment of the fish sanctuary, dredging, awareness of using selective fishing gears, cessation over exploitation are required.

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