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Fish fauna of the Brahmaputra River, Bangladesh: richness, threats and conservation needs

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Abstract

The Brahmaputra River is one of the largest rivers in the world as well as in Bangladesh. The present study was carried out for a period of one year from January to December 2013 with a view to assessing the availability of fishes in the river with species emphasis on species richness, existing threats and conservation issues. Daytime and night sampling were carried out in three sites located along the upstream to downstream course of the river on a monthly basis. Three fishing gears including cast net, seine net and drag net and one fishing trap were employed to collect fishes. A total of 67 finfish species including 63 indigenous and 4 exotic/alien species have been recorded belonging to 46 genera, 24 families and 8 orders. Cypriniformes and Cyprinidae were the most dominating order (21 species) family (15 species) of native fishes. A small portion (2%) of native fishes was globally threatened. Over one third of total species (38%) were considered threatened to extinct species in Bangladesh. Population trend of over two third of total fish species was Declining in the river. Major threats were alien/invasive species, banned fishing gears and loss of habitats.

Keywords: Brahmaputra River, conservation, fish fauna, population trend, freshwater

INTRODUCTION

Freshwater habitats of Bangladesh are very rich supporting at least 265 finfish (Rahman 2005) and 24 prawn species (DoF 2015). But in recent times, a large portion of total freshwater fish species are facing threat to extinction. According to Froese and Pauly (2015) there are 243 species are currently present in the country including endemic, native, introduced and reintroduced species. Already 54 fish species have been declared threatened to extinct by IUCN Bangladesh (2000). In a more recent research, Hossain (2014) declared that a total of 30 riverine finfish species have been extinct from Bangladesh. Several research findings confirmed that loss of aquatic biodiversity, in terms of species composition and abundance, is very much conspicuous in the freshwater habitats of Bangladesh, primarily in rivers (Chaki *et al.* 2014; Galib *et al.* 2013; Joadder *et al*. 2015; Mohsin *et al*. 2013, 2014).

No specific study on the determination of causes leading to loss of aquatic biodiversity was also found in the country. But, assessment is essential to detect the key drivers for this loss and to develop an appropriate management technique for both the biota and their habitat. Failing to do so, it would not be possible to implement sustainable management techniques.

The Brahmaputra is one of the major rivers in Bangladesh. No previous study on ichthyofauna was recorded by the research inside the territory of Bangladesh. However, Boruah and Biswas (2002) carried out a research in the upper Brahmaputra basin in India and described the ecohydrology and ichthyofauna of the river. Several rivers

and wetlands (locally known as *beel*) of north-west part of Bangladesh have been surveyed to list down the available fish and other species (Chaki *et al.* 2014; Galib *et al.* 2009a, 2013; Joadder *et al*. 2015; Mohsin *et al*. 2013, 2014) but less or no emphasis was given to the rivers of northern part of Bangladesh.

This study would be the first attempt to figure out the available fish fauna of the river Brahmaputra in Bangladesh. In addition to this one, this study also focused on the current threats to existing fish species and conservation issues.

METHODOLOGY

Study area and duration: The Brahmaputra River, originates in the Chemayung-Dung glacier, is one of the largest rivers in the world; with its basin covering areas in China, India and Bangladesh (Ahmed 2015). The total length of the river from its source in southwestern Tibet to the mouth in the Bay of Bengal is about 2,850 km; including Padma and Meghna rivers up to the mouth (Ahmed 2015). Inside Bangladesh territory, Brahmaputra-Jamuna is 276 km long, of which Brahmaputra is only 69 km (Ahmed 2015).

Three sites (Table 1) located along the upstream to downstream course of the river were sampled for a period of one year from January to December 2013. All three sampling sites are in Gaibandha district of Bangladesh- Chandipur of Sundarganj Upazila (sub-district), Mollarchar of Gaibandha proper Upazila and Fulchari Ghat of Fulchari Upazila (Figure 1).

Table 1: Details of sampling sites

Site	*Location*	*Coordinates*
I	Chandipur	25°32’ N, 89°40’ N
II	Mollarchar	25°24’ N, 89°39’ N
III	Fulchari Ghat	25°18’ N, 89°37’ N

Sampling methods: Daytime (9:00-17:00) and night (20:00-05:00) sampling was carried out at all the sampling spots on a monthly basis during the one year study. Fishing was done with the help of professional fishermen in the river. Three fishing gears including cast net, seine net and drag net and one fishing trap (Kholsun) were employed to collect fishes and also allowed to sample a wide range fish size. The mesh size of fishing nets varied between 1 and 5 cm.

Preservation and identification of fish species: Specimen of rare species was collected and preserved only. Representative specimen were fixed in 20-30% formalin solution and transferred to the Aquatic Biodiversity Lab at the Department of Fisheries, University of Rajshahi. In laboratory collected specimens were washed thoroughly and stored in 10% formalin solution in glass jars.

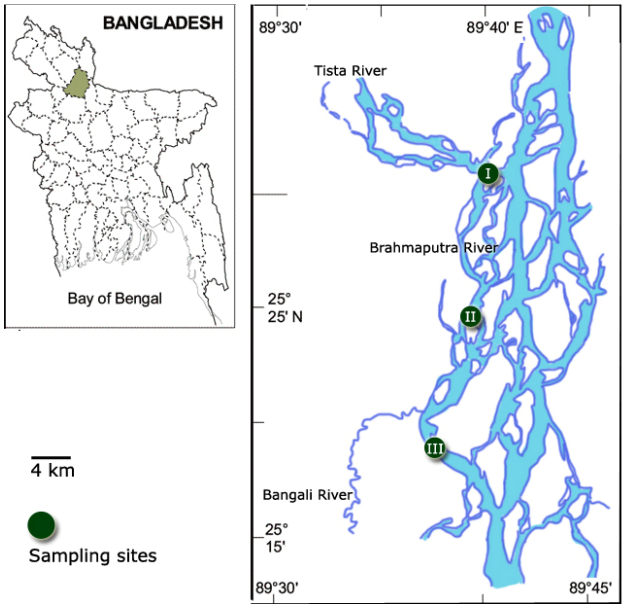

Figure 1: Map of the Brahmaputra River in Gaibandha district of Bangladesh showing the sampling sites; (I) Chandipur, (II) Mollarchar and (III) Fulchari Ghat

The fishes were identified following standard literature (Bhuiyan 1964; Rahman 2005, 1989; Talwar and Jhingran 1991). Later, they were classified according to Nelson (2006).

Conservation status and population trend: Based on the database of IUCN (2015) global conservation status and global population trend of a particular species were determined. Local conservation status is based on books of threatened fishes by IUCN Bangladesh (2000). Local population trend was determined by interviewing the professional fishermen in the study areas. A total of 75 fishermen, 25 from each sampling site, were asked to state the present status of each species compared to the status of concerned species 20 years ago. They were not asked to provide statistical data but to rank each species as: Decreasing or Increasing or Stable or Unknown, just like the population trends categories of IUCN. The rank of species came out from the majority of fishermen was considered only. All the fishermen had a fishing experience of at least 20 years in the river Brahmaputra and they were selected randomly for interview.

Data analysis: Simple descriptive analysis and graphical presentation of data were carried out using Microsoft Excel (version 2007). In addition to this one, SPSS (Statistical Packages for Social Sciences, version 15.00) was also used.

RESULTS AND DISCUSSION

Fish species richness: Over the study period, a total of 9837 individuals belonging to 67 finfish species including 63 indigenous and 4 exotic/alien species have been analyzed and identified from the river Brahmaputra (Table 1 and 2). Indigenous fishes were belonging to 46 genera, 24 families and 8 orders. Cypriniformes was the most dominating order with 21 fish species followed by Siluriformes (19 species) and Perciformes (15 species) (Figure 2 and Table 1). Among the families, Cyprinidae was the most diversified with 15 species followed by Bagridae (6 species) and Cobitidae (5 species) and others (Table 1).

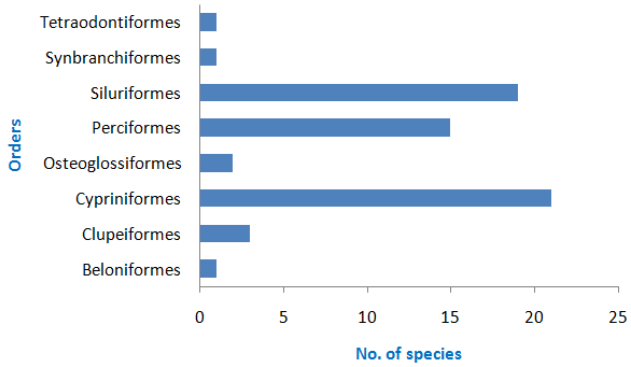

Figure 2: Number of indigenous fish species of different orders in the Brahmaputra River.

No previous study was found on fish fauna of the Brahmaputra River in Bangladesh and thus, it was not possible to compare the present findings with previous one. Such difficulty was also faced by several other researchers while working with assessing fish fauna in various water bodies of country (Galib *et al.* 2013; Mohsin *et al*. 2013, 2014). However, Boruah and Biswas (2002) recorded a total of 167 fish species from the upper Brahmaputra River in India of which 30% of the total species were of ornamental importance. This result is much higher than that of the present findings. A clear difference in richness of fish fauna between parts of the Brahmaputra River in India and Bangladesh was revealed from this study reflected critical conditions of fishes in Bangladeshi part of river.

In comparison to other water bodies of Bangladesh, the fish species richness in the Brahmaputra was quite similar to several rivers and wetlands. The number of fish species recorded in the present study (67 species) was found higher than the fish species recorded in the Andharmanik River of Patuakhali district and Bookbhara Baor of Jessore district, where 53 and 38 fish species were found respectively (Mohsin *et al.* 2009, 2014). Quite similar number of fish species was recorded from the Halti Beel (63) (Imteazzaman and Galib 2013), Atrai River (74) (Chaki *et al.* 2014) and Padma River (Joadder *et al.* 2015).

The most abundant native fish species was *Puntius sophore* which contributed 10.02% of the total fish abundance followed by *Esomus danricus* (9.11%), *P. chola* (6.53%), *Chanda nama* (6.37%) and so on (Table 1). The rarest two species of native fishes were *Sperata aor* and *Labeo angra* (0.02% each of the total fish harvested) (Table 1).

Conservation status: Global conservation status of majority of native fish species (82%) was Least Concern followed by Near Threatened (9%) (Figure 3). A small portion (2%) of the indigenous fish species found in the study areas was Threatened globally. Nearly two fifth of the total indigenous fish species (24) in the river were ranked as Threatened to Extinct in Bangladesh under three categories: Vulnerable (13%), Endangered (16%) and Critically Endangered (9%) (Figure 4). However, more than half of the total native fish species was of Not Threatened status.

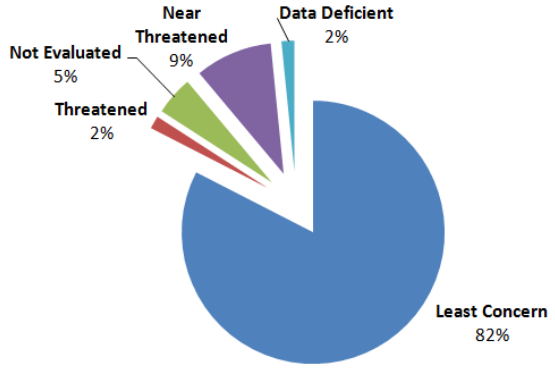

Figure 3: Global conservation status of indigenous fishes of the Brahmaputra River

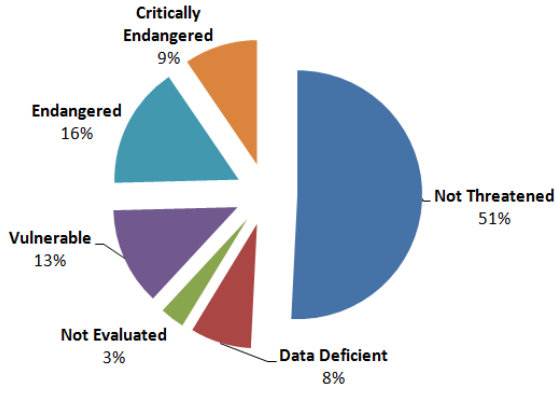

Figure 4: Local conservation status of native fishes of the Brahmaputra River

Table 1: Native fish species in the Brahmaputra River

Systematic position and Scientific names of fishes	*Conservation status*		*Population Trend*		*Fish species at stations (%)*			
	*Global**	*Local***	*Global**	*Local*	*I*	*II*	*III*	*All*
Beloniformes								
Belonidae (Needlefishes)								
Xenentodon cancila (Hamilton, 1822)	LC	NO	UN	DE	0.94	0.81	0.18	0.68
Clupeiformes								
Clupeidae (Herrings, shads, sprats, and others)								
Gudusia chapra (Hamilton, 1822)	LC	NO	DE	ST	5.52	6.13	5.21	5.63
Corica soborna Hamilton, 1822	LC	NO	UN	DE	2.69	3.03	3.13	2.93
Engraulidae (Anchovies)								
Setipinna phasa (Hamilton, 1822)	LC	NO	DE	DE	0.58	0.46	0.54	0.53
Cypriniformes								
Balitoridae (River loaches)								
Acanthocobitis botia (Hamilton, 1822)	LC	DD	DE	UN	0.55	0.50	0.40	0.49
Cobitidae (Loaches)								
Botia dario (Hamilton, 1822)	LC	EN	UN	DE	0.55	0.50	0.47	0.51
Botia lohachata Chaudhuri, 1912	NE	EN	NE	DE	0.84	0.71	0.61	0.73
Lepidocephalichthys guntea (Hamilton, 1822)	LC	NO	UN	DE	1.44	1.05	1.26	1.26
Lepidocephalichthys irrorata Hora, 1921	LC	DD	UN	DE	0.24	0.06	0.00	0.11
Somileptus gongota (Hamilton, 1822)	NE	NO	NE	DE	0.89	0.71	0.57	0.74
Cyprinidae (Minnows or Carps)								
Amblypharyngodon mola (Hamilton, 1822)	LC	NO	ST	ST	3.48	2.69	2.41	2.92
Cabdio morar (Hamilton, 1822)	LC	DD	UN	ST	1.49	1.67	1.62	1.59
Gibelion catla (Hamilton, 1822)	LC	NO	UN	DE	0.08	0.03	0.00	0.04
Esomus danricus (Hamilton, 1822)	LC	DD	ST	ST	8.39	9.26	9.92	9.11
Labeo angra (Hamilton, 1822)	LC	NO	ST	DE	0.03	0.03	0.00	0.02
Labeo bata (Hamilton, 1822)	LC	EN	UN	DE	0.84	0.99	0.75	0.86
Labeo rohita (Hamilton, 1822)	LC	NO	UN	DE	0.44	0.25	0.11	0.28
Cirrhinus reba (Hamilton, 1822)	LC	VU	ST	ST	2.67	2.73	2.41	2.61
Osteobrama cotio (Hamilton, 1822)	LC	EN	UN	DE	0.31	0.22	0.29	0.27
Puntius chola (Hamilton, 1822)	LC	NO	UN	ST	6.01	6.63	7.11	6.53
Puntius sarana (Hamilton, 1822)	LC	CR	UN	DE	0.26	0.25	0.04	0.19
Puntius sophore (Hamilton, 1822)	LC	NO	UN	ST	9.02	9.91	11.53	10.02
Puntius ticto (Hamilton, 1822)	LC	VU	UN	DE	0.92	0.74	0.72	0.80
Salmophasia bacaila (Hamilton, 1822)	LC	NO	ST	ST	2.88	2.76	2.41	2.70
Salmophasia phulo (Hamilton, 1822)	LC	NO	UN	ST	3.56	3.93	3.99	3.80
Osteoglossiformes								
Osteoglossidae (Osteoglossids or Bonytongues)								
Chitala chitala (Hamilton, 1822)	NT	EN	DE	DE	0.21	0.12	0.22	0.18
Notopterus notopterus (Pallas, 1769)	LC	VU	UN	DE	0.58	0.43	0.47	0.50
Perciformes								
Ambassidae (Asiatic Glassfishes)								
Chanda nama Hamilton, 1822	LC	VU	DE	ST	5.65	6.60	7.11	6.37
Parambassis lala (Hamilton, 1822)	NT	NE	DE	DE	0.31	0.12	0.04	0.17
Parambassis ranga (Hamilton, 1822)	LC	VU	ST	ST	5.67	5.79	6.00	5.80
Anabantidae (Climbing Gouramies)								
Anabas testudineus (Bloch, 1792)	DD	NO	UN	DE	0.16	0.06	0.00	0.08

Table 1: Continued.

Systematic position and Scientific names of fishes	*Conservation status*		*Population Trend*		*Stations (%)*			
	*Global**	*Local***	*Global**		*I*	*II*	*III*	*All*
Channidae (Snakeheads)								
Channa punctata (Bloch, 1793)	LC	NO	UN	ST	0.60	0.56	0.50	0.56
Channa striata (Bloch, 1793)	LC	NO	UN	DE	0.10	0.06	0.04	0.07
Gobiidae (Gobies)								
Glossogobius giuris (Hamilton, 1822)	LC	NO	UN	DE	2.82	2.69	2.01	2.55
Mastacembelidae (Spiny eels)					0.00	0.00	0.00	0.00
Macrognathus aculeatus (Bloch, 1786)	NE	NE	NE	ST	3.66	3.38	3.52	3.53
Mastacembelus armatus (Lacepède, 1800)	LC	EN	UN	DE	0.34	0.12	0.18	0.22
Mastacembelus pancalus (Hamilton, 1822)	LC	NO	UN	DE	0.63	0.77	0.54	0.65
Mugilidae (Mullets)								
Rhinomugil corsula (Hamilton, 1822)	LC	NO	UN	ST	0.37	0.12	0.04	0.19
Nandidae (Asian Leaffishes)					0.00	0.00	0.00	0.00
Badis badis (Hamilton, 1822)	LC	EN	UN	DE	0.60	0.37	0.47	0.49
Osphronemidae (Gouramies)								
Trichogaster chuna (Hamilton, 1822)	LC	NO	UN	DE	0.18	0.09	0.14	0.14
Trichogaster fasciata Bloch and Schneider, 1801	LC	NO	UN	DE	0.81	0.96	0.86	0.87
Trichogaster lalius (Hamilton, 1822)	LC	NO	UN	DE	0.42	0.46	0.54	0.47
Siluriformes (Catfishes)								
Bagridae (Bagrid Catfishes)								
Mystus cavasius (Hamilton, 1822)	LC	VU	DE	ST	4.63	4.83	4.81	4.75
Mystus tengara (Hamilton, 1822)	LC	NO	UN	ST	5.57	6.53	6.68	6.20
Mystus vittatus (Bloch, 1794)	LC	NO	DE	DE	0.94	0.74	0.43	0.73
Rita rita (Hamilton, 1822)	LC	CR	DE	DE	0.84	0.71	0.61	0.73
Sperata aor (Hamilton, 1822)	LC	VU	ST	DE	0.05	0.00	0.00	0.02
Sperata seenghala (Sykes, 1839)	LC	EN	UN	DE	0.26	0.22	0.04	0.18
Clariidae (Airbreathing catfishes)								
Clarias batrachus (Linneaeus, 1758)	LC	NO	UN	DE	0.05	0.00	0.04	0.03
Heteropneustidae (Airsac Catfishes)								
Heteropneustes fossilis (Bloch, 1794)	LC	NO	ST	DE	0.13	0.03	0.00	0.06
Pangasiidae (Shark Catfishes)								
Pangasius pangasius (Hamilton, 1822)	LC	CR	DE	DE	0.05	0.03	0.04	0.04
Schilbeidae (Schilbeid Catfishes)								
Ailia coila (Hamilton, 1822)	TH	NO	DE	DE	1.70	1.05	0.83	1.24
Clupisoma garua (Hamilton, 1822)	LC	CR	DE	ST	1.18	1.05	1.40	1.20
Eutropiichthys vacha (Hamilton, 1822)	LC	CR	DE	DE	0.55	0.19	0.43	0.40
Neotropius atherinoides (Bloch, 1794)	LC	NO	UN	DE	1.67	1.39	1.65	1.58
Siluridae (Sheatfishes)								
Ompok bimaculatus (Bloch, 1794)	NT	EN	UN	DE	0.63	0.53	0.68	0.61
Ompok pabda (Hamilton, 1822)	NT	EN	DE	DE	0.31	0.40	0.36	0.36
Wallago attu (Bloch & Schneider, 1801)	NT	NO	DE	DE	0.60	0.43	0.22	0.44
Sisoridae/Bagariidae (Sisorid Catfishes)								
Bagarius bagarius (Hamilton, 1822)	NT	CR	DE	DE	0.89	0.71	0.75	0.79
Gagata cenia (Hamilton, 1822)	LC	NO	UN	UN	0.94	0.74	1.04	0.90
Glyptothorax telchitta (Hamilton, 1822)	LC	DD	UN	ST	0.89	1.15	1.01	1.01
Synbranchiformes								
Synbranchidae (Swamp eels)								
Monopterus cuchia (Hamilton, 1822)	LC	VU	UN	DE	0.05	0.03	0.07	0.05
Tetraodontiformes								
Tetraodontidae (Puffers)								
Tetraodon cutcutia (Hamilton, 1822)	LC	NO	UN	DE	0.37	0.43	0.57	0.45

** IUCN (2015); ** IUCN Bangladesh (2000); CR, Critically Endangered; DD, Data Deficient; DE, Decreasing; EN, Endangered; LC, Least Concern; NE, Not Evaluated; NO, Not Threatened; NT, Near Threatened; ST, Stable; TH, Threatened; VU, Vulnerable; UN, Unknown*

Considering the number of individuals harvested at each sampling station, more were caught at Station 1 than that of other two stations. A total of 3,825 individuals were caught and identified at Station 1 followed by Station 2 (3229 individuals), and Station 3 (2783 individuals). This also reflected that fish abundance was decreasing towards downstream.

A total of 54 freshwater fish species have been declared threatened to extinct in the red book of threatened fishes, published by IUCN Bangladesh (2000). So, nearly half of the total locally threatened fishes were recorded from the Brahmaputra River. Only 9 and 10 species of threatened fishes were recorded by Mohsin *et al.* (2009 and 2014) from the Bookbhara Baor and Andharmanik River which are much lower than that of present findings. However, this database has become quite back-dated and there is a conspicuous need for updated list of threatened fishes of Bangladesh.

Similar number of threatened fish species was also found in several other studies: 28 species in Chalan Beel (Galib *et al.* 2009a), 26 species in Padma River (Mohsin *et al.* 2013), and 22 species in Halti Beel (Imteazzaman and Galib 2013).

Table 2: Alien fish species in the Brahmaputra River

Fish name	*Common name*	*Availability*	*Population trend*
Cyprinus carpio specularis	Mirror carp	Round the year	IN
Hypophthalmichthys molitrix	Silver carp	Monsoon	IN
Aristichthys nobilis	Bighead carp	Monsoon	IN
Hypostomus plecostomus	Sucker Mouth	Irregular	IN

IN, Increasing

Population trend: Global population trend of more than half of the indigenous fish species was Unknown (57%) (Figure 5). However, status of one fourth of the total native fish species was found Decreasing. Stable population trend was found only 13% of the total native fish species in river.

Over two-third of the total indigenous fish species was of Decreasing population trend in the Brahmaputra River (Figure 6). Stable status of population trend was found for nearly one-third naive fish species in river. A decreasing trend of fish species in the Padma River was also reported (Galib *et al.* 2009a, Mohsin *et al.* 2013; Samad *et al.* 2010).

Current threats: Four alien fish species were recorded in the Brahmaputra River (Table 2). The mirror carp, which was introduced in Bangladesh in 1979 by government of Bangladesh (Khaleque 2002), was harvested round the year from river. Silver carp and bighead carp (introduced in 1969 and 1981 by government of Bangladesh respectively) (Khaleque 2002) and recorded in monsoon season in the Brahmaputra River. Another species, the sucker mouth was introduced in Bangladesh in 1980 by the aquarium fish traders of country (Galib and Mohsin 2011). Increasing population trend was found for all the recorded alien species (Table 2).

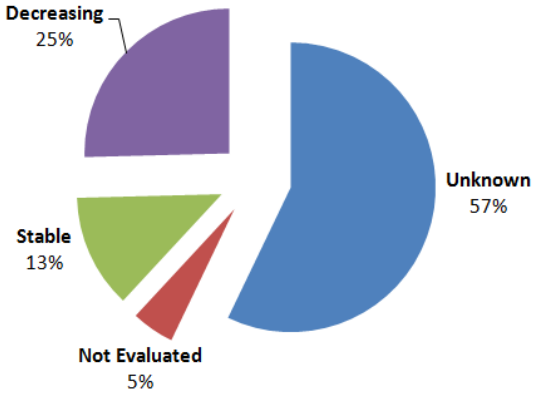

Figure 5: Global population trend of indigenous fishes of the Brahmaputra River

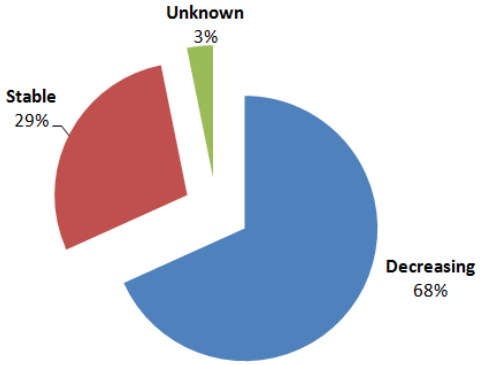

Figure 6: Local population trend of indigenous fishes of the Brahmaputra River

Many of the alien species are of invasive nature and can negatively affect the ecosystem as well as the biota living within it. So, permanent establishment of any non-native species into a water body, especially those are invasive in nature, poses a threat to native fish fauna. Sucker mouth catfish is of invasive nature and reported from several water bodies of Bangladesh including Gulshan Lake of Dhaka city, several ponds in north-west part of country (Galib and Mohsin 2011), and river Atrai (Chaki *et al.* 2014). This extremely hardy species can wipe out other

fish species from the water body (Rahman 2007; Galib and Mohsin 2010, 2011). Along with this species, many other aquarium fish and shellfish (primarily shrimp/prawns and snails) species are being imported from other countries and many of them were released into an open water body by the aquarists of the country which poses a serious threat to native biota. Several research findings reported permanent establishment of alien species into many water bodies of Bangladesh (e.g. Nile tilapia in the Kaptai Lake; FRSS 2010).

Fishing by banned and destructive fishing gears was also observed in river. This is a common scenario in natural waters of Bangladesh and reported earlier by several researchers (e.g. Galib *et al.* 2009a, 2009b, Mohsin *et al.* 2013). Loss of habitats by siltation and infrastructure was one of the threats to the biodiversity of the Brahmaputra River.

CONCLUSION

Further research should be carried out to assess the impacts of alien species on river ecosystem as well as on existing aquatic species within the habitat. In addition to this one, fishing by using banned or illegal fishing gears should strictly be prohibited. Appropriate conservation techniques, e.g. permanent sanctuary, should be established and its impact should be assessed by further research.

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