

A checklist of indigenous ichthyofauna in the Dhanu River and surrounding wetlands of Bangladesh: current status, population trends and threats

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ABSTRACT

This study was conducted in the Dhanu River and adjacent waters at Mithamain upazila (sub-district) under Kishoreganj district of Bangladesh to prepare a check list of available native fishes with their availability status, conservation perspectives, habitat preferences, population trends and intimidations. Data were collected monthly by direct field survey, focus group discussions, and personal interviews with fishers by using a semi-structured questionnaire and a pictorial check list of fish species. A total of 91 indigenous fish species of 59 genera belonging to 29 families under 11 orders were documented where 17.58% species was abundantly available, 27.47% was commonly available, 31.87% was moderately available and 23.08% was rarely available. Cypriniformes was found as the dominant order, consisting 37.36% of the fish species aggregation and Cyprinidae was the most dominant family with 32.97% of the entire species assemblage. Twenty four piscine species (26.37%) were under threatened category in Bangladesh which subsumed 3 critically endangered (3.29%), 11 endangered (12.08%), and 10 vulnerable species (10.99%). Notably globally threatened *Cirrhinus cirrhosus*, *Channa orientalis*, and *Wallago attu* were available there. Fish population trends of 24.18% and 59.34% of the entire fish species was found in decreasing trends in global and national level, respectively. Leading intimidation to the fish diversity was indiscriminately overfishing, followed by fishing by dewatering of wetlands, *katha* fishing method, use of deprecated fishing gears, climate change, etc. Minimization of anthropogenic impacts, assuring the flux of water round the year, enactments of fish laws, installation and management of fish sanctuaries, and raising public awareness can be effective for the conservation of existing fisheries resources.

Keywords: *Beel*, conservation, fish diversity, IUCN, native fishes.

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INTRODUCTION

Bangladesh is a realm of wetlands with a colossal area of open water fisheries resources comprising inland and marine fisheries (DoF 2018). Inland share of these resources has an irrevocable contribution in the economy and food habits of the Bangladeshi denizen (Kibria & Ahmed 2005; Hossain et al. 2006). Fish, the most consumed fisheries resource, has a wide range of species variation here and the number of fish species in wetlands differs from each other because of the distinction of ecology of those wetlands (Rahman 2005). Rahman (2005) recorded 265 indigenous freshwater fish species in Bangladesh, which were under 154 genera and 55 families. However, total 253 indigenous fish species were assessed by IUCN Bangladesh (2015) where 113 species were floodplain inhabitants, 104 were riverine and 36 were migratory species (travel floodplains and rivers) (IUCN Bangladesh 2015).

Haors are saucer or bowl shaped shallow depressions distributed along the north-eastern part of Bangladesh which include irrigation canals, large seasonally inundating agricultural lands and coalescence of hundreds of inter-affiliated *beels* (Hussain & Salam 2007; Pandit et al. 2015a; Pandit et al. 2015b, 2015b). *Beels* are permanent wetlands and constitute a major habitat for fish production (869 kg ha⁻¹) in Bangladesh. Total area of *beel* in Bangladesh is nearly 114,161 ha, which is a contributor of 2.32% fish of country's yearly fish production (DoF 2018). As good as 700 rivers with their ramifications interspersed in the country, shape a waterway of total length about 24,140 km (Banglapedia 2012; IUCN Bangladesh 2015; Arefin et al. 2018). These rivers are the main perennial freshwater wetlands of Bangladesh which provide habitats for feeding, breeding, and dry season shelter to various fish species (IUCN Bangladesh 2015) but there is a clear lack of information on the fish diversity of rivers in Bangladesh (Parvez et al. 2019).

The Dhanu, lower portion called the Ghorautra, is a tributary of the Meghna. It is a fine stream, navigable throughout the year, and makes its way towards the south from Sunamganj district and flows along the eastern part of Netrakona and Kishoreganj districts (Sachse 1917; Kabir et al. 2019). The river is also affluent with diversified aquatic resources and provide habitat for aquatic organisms including fishes and other aquatic fauna and flora (Kabir et al. 2019). Fisherman with different fishing boats and gears capture myriad number of diversified fishes from this river every day. Thus, this river has a material impact on the overall economy of this region (Kabir et al. 2019).

Natural resources are limited and their sustainable use is very much important for human being. For ascertaining it, biodiversity conservation is considered as major moves (Arefin et al. 2018). However, wild fish populations are disappearing gradually from the rivers, *haors*,

beels, floodplains, and other wetlands of Bangladesh due to degradation and loss of the natural habitat, overexploitation, climate change, aquatic pollution, and other manmade and natural causes (Galib et al. 2013; IUCN Bangladesh 2015; Pandit et al. 2015a; Pandit et al. 2015b; Sufian et al. 2017). Dhanu River has an auspicious water quality that bolsters variety of aquatic lives (Kabir et al. 2019) but fish biodiversity of the Dhanu River and adjacent *beels* are at the verge of disappearance. Many of the fishes may already have amid the vulnerable, endangered and critically endangered categories which are unknown due to lack of research work as no research on the fish biodiversity of the Dhanu River has yet been done. For this reason, there is no list of existing fish species. Worldwide events of unprecedented extinction of variety of species have come to light with the help of the study on biodiversity (Baillie et al. 2004) again, Huda et al. (2009) and Pandit et al. (2015a) maintained that, the biodiversity of fish should be known before apply a management tool on the fishery of a waterbody, which intimates the necessity of a profound research on fish biodiversity of these wetlands. At this circumstance, an erudite research work is aspired to get a narrated overview with an updated list of existing fish species of the river Dhanu and its adjacent waters beside, for planning subsequent steps for the efficacious management of these resources and their conservation as well. However, the specific objective of this study was to prepare a checklist of indigenous fish species including their present availability status in the Dhanu River and adjacent wetlands in relation to the national and global conservation statuses, habitat preferences, population trends and intimidations.

MATERIALS AND METHODS

Study area and period: The current study was conducted in the Dhanu River and surrounding *beels* of Mithamain upazila (sub-district) under Kishoreganj district of Bangladesh. Mithamain is located between 24°49' and 25°06' north latitudes and 91°27' and 91°49' east longitudes (Fig. 1). To collect primary data on fish availability, the study area was divided into 8 sampling sites and data were collected from each site starting on July 2016 to June 2018. Sampling spots were 4 sites in the Dhanu River, Farua *Beel*, Nikla *Beel*, Khunkhuni *Beel* and Deodhuri *Beel* (Fig. 1).

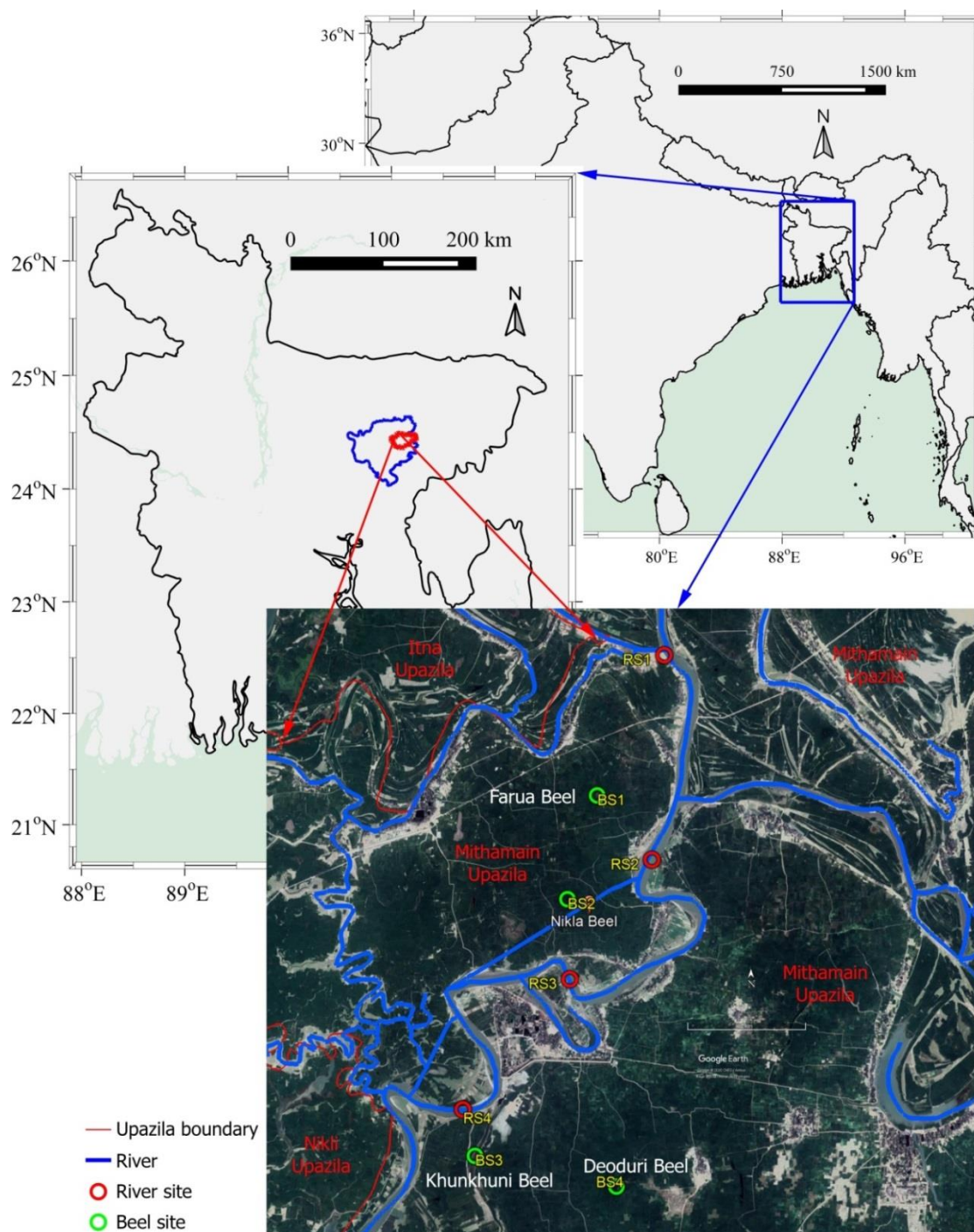


Figure 1. Study area showing 4 river sites: RS1, 2, 3, 4 and 4 beel sites: BS1, 2, 3, 4.

Data collection framework: The data were gleaned monthly from the sampling sites by field survey. Information about present condition of existing fishes were collected by means of personal interview with fishermen, fishing vessel owners, retailers, fish traders, native people, riverside residents and other forthcoming people from the sampling areas. Focus group discussions were also performed in fish landing centers, fish markets and fishers' villages

near those selected sampling sites with a pictorial check list of indigenous fish species and a semi-structured questionnaire.

Fish specimen collection and identification: Samples of different fish species were collected directly from the catch of fishermen, fish landing stations of the selected sites and from fish markets as well. The collected fish samples were identified in the field to the species level by the examination of the morphometric and meristic attributes, following some previously published documents (Talwar & Jhingran 1991; Rahman 2005; Siddiqui et al. 2007). The fish samples which found difficult to identify in field were preserved in 10% buffered formalin and transported to the laboratory of the Department of Aquatic Resource Management, Sylhet Agricultural University, Sylhet for perfect identification. Identified species of fish were ramified into 4 categories based on their availability while the gathered information from the interviews and records of fish catch of 140 fishers took into account. The categories are: abundantly available (AA): species perennially available in a conspicuous manner; commonly available (CA): species generally observed throughout the year; moderately available (MA): species observed infrequently in the study area; and rarely available (RA): species observed occasionally 1-2 times per year. IUCN red list (IUCN Bangladesh 2015) and internet source (<http://www.fishbase.org>) were used to ascertain the tenable scientific names of the obtained fish species. The national and global conservation statuses and population trends were determined by following (IUCN Bangladesh 2015) and (IUCN 2019).

Data analysis: Microsoft Office Excel, ver. 2010 was used for making simple statistical analysis and graphical demonstrations of accumulated data and for this, obtained data were uploaded in a computer after collection.

RESULTS AND DISCUSSION

Diversity of Fish Species: Eight sampling sites represented the existence of 91 indigenous fish species which were under 59 genera, 29 families and 11 orders (Table 1).

Table 1. List of recorded fish species in the River Dhanu and surrounding beels.

Sl. no.	Taxonomic position	English name	Local name	Present status	Conservation status		Habitat	Population trend	
					BD	Global		BD	Global
	Anguilliformes								
	Anguillidae								
1	<i>Anguilla bengalensis</i>	Indian mottled eel	Bamosh	RA	VU	NT	R	DE	UN
	Beloniformes								
	Belonidae								
2	<i>Xenentodon cancila</i>	Freshwater garfish	Kaikya, kakila	CA	LC	LC	B	UN	UN
	Hemiramphidae								
3	<i>Hyporhamphus limbatus</i>	Congaturi halfbeak	Ekthote, subol	MA	LC	LC	R	UN	ST
	Clupeiformes								
	Clupeidae								
4	<i>Corica soborna</i>	The Ganges river sprat	Kachki	CA	LC	LC	R	UN	UN
5	<i>Tenualosa ilisha</i>	Hilsa	Ilish	RA	LC	LC	R	IN	DE
6	<i>Gudusia chapra</i>	Indian river shad	Chapila	AA	VU	LC	R	DE	DE
	Engraulidae								
7	<i>Setipinna phasa</i>	Gangetic hairfin anchovy	Phasa	RA	LC	LC	R	DE	UN
	Cypriniformes								
	Cyprinidae								
8	<i>Amblypharyngodon mola</i>	Mola carplet	Mola	MA	LC	LC	B	DE	ST
9	<i>Chela cachius</i>	Silver hatchlet barb	Chhep chela	MA	VU	LC	R	DE	UN
10	<i>Esomus danricus</i>	Flying barb	Darkina	MA	LC	LC	B	DE	ST

11	<i>Osteobrama cotio</i>	Cotio	Dhela	RA	NT	LC	R	DE	UN
12	<i>Rasbora daniconius</i>	Slender barb	Darkina	RA	LC	LC	B	DE	UN
13	<i>Rasbora rasbora</i>	Gangetic scissortail rasbora		MA	NT	LC	B	DE	UN
14	<i>Salmophasia acinaces</i>	Silver razorbelly minnow	Chela	RA	DD	LC	R	DE	UN
15	<i>Salmophasia bacaila</i>	Large razorbelly minnow	Katari chela	MA	LC	LC	R	DE	ST
16	<i>Salmophasia phulo</i>	Finescale razorbelly minnow	Fulchela	CA	NT	LC	R	DE	UN
17	<i>Gibelion catla</i>	Catla	Catla	RA	LC	LC	R	DE	UN
18	<i>Cirrhinus cirrhosus</i>	Mrigal carp	Mrigal	MA	NT	VU	R	DE	DE
19	<i>Cirrhinus reba</i>	Reba carp	Laccho	CA	NT	LC	R	DE	ST
20	<i>Devario devario</i>	Sind danio	Chapchela	MA	LC	LC	B	DE	UN
21	<i>Labeo bata</i>	Bata labeo	Bata	RA	LC	LC	R	UN	UN
22	<i>Labeo boga</i>	Boga labeo	Bhangan	RA	CR	LC	R	UN	UN
23	<i>Labeo calbasu</i>	Black rohu	Kalibaosh	CA	LC	LC	R	IN	UN
24	<i>Labeo gonius</i>	Kuria labeo	Gonia	CA	NT	LC	R	DE	UN
25	<i>Labeo pangusia</i>	Pangusia labeo	Ghormaach	RA	EN	NT	R	DE	DE
26	<i>Labeo rohita</i>	Rohu	Rui	MA	LC	LC	R	DE	UN
27	<i>Puntius chola</i>	Chola barb	Chola punti	MA	LC	LC	B	UN	UN
28	<i>Pethia conchoniis</i>	Rosy barb	Kanchan punti	MA	LC	LC	B	UN	UN
29	<i>Pethia gelius</i>	Golden dwarf barb	Gili punti	MA	NT	LC	B	UN	UN

30	<i>Pethia guganio</i>	Glass barb	Mola punti	MA	LC	LC	B	UN	UN
31	<i>Pethia phutunio</i>	Spottedsail barb	Phutani punti	RA	LC	LC	B	UN	UN
32	<i>Systomus sarana</i>	Olive barb	Sarpunti	AA	NT	LC	B	DE	UN
33	<i>Puntius sophore</i>	Spotfin swamp barb	Jat punti	AA	LC	LC	B	UN	UN
34	<i>Puntius terio</i>	One spot barb	Teri punti	RA	LC	LC	B	UN	UN
35	<i>Pethia ticto</i>	Ticto barb	Tit punti	CA	VU	LC	B	DE	UN
36	<i>Securicula gora</i>	Chela gora	Ghora chela	CA	NT	LC	B	DE	UN
37	<i>Salmophasia acinaces</i>	Silver razorbelly minnow	Chela	RA	LC	LC	R	UN	UN
	Cobitidae								
38	<i>Botia dario</i>	Queen loach	Rani mach	MA	EN	LC	B	UN	UN
39	<i>Lepidocephalichthys annandalei</i>	Annaldale loach		RA	VU	LC	B	DE	UN
40	<i>Lepidocephalichthys guntea</i>	Guntea loach	Gutum	CA	LC	LC	B	DE	ST
41	<i>Canthophrys gongota</i>	Gongota loach	Ghora gutum	MA	NT	LC	R	DE	UN
	Cyprinodontiformes								
	Aplocheilidae								
42	<i>Aplocheilus panchax</i>	Blue panchax	Kanpona	CA	LC	LC	B	UN	UN
	Mugiliformes								
	Mugilidae								
43	<i>Rhinomugil corsula</i>	Corsula	Corsula	MA	LC	LC	R	UN	UN

	Osteoglossiformes								
	Notopteridae								
44	<i>Chitala chitala</i>	Humped featherback	Chital	RA	EN	NT	R	DE	DE
45	<i>Notopterus notopterus</i>	Grey featherback	Kanla	MA	VU	LC	B	DE	ST
	Perciformes								
	Gobiidae								
46	<i>Glossogobius giuris</i>	Bareye goby	Baila	CA	LC	LC	R	UN	UN
	Channidae								
47	<i>Channa marulius</i>	Giant snakehead	Gazar	AA	EN	LC	B	DE	UN
48	<i>Channa orientalis</i>	Smooth-breasted snakehead	Raga	CA	LC	VU	B	DE	DE
49	<i>Channa punctata</i>	Spotted snakehead	Lati	CA	LC	LC	B	DE	ST
50	<i>Channa striata</i>	snakehead murrel	Shol	AA	LC	LC	B	DE	ST
	Badidae								
51	<i>Badis badis</i>	Blue perch	Napit koi	CA	NT	LC	B	UN	UN
	Ambassidae								
52	<i>Chanda nama</i>	Elongate glass perchlet	Lomba chanda	AA	LC	LC	B	DE	DE
53	<i>Parambassis baculis</i>	Himalayan glassy perchlet	Kata chanda	RA	NT	LC	B	DE	DE
54	<i>Parambassis lala</i>	Highfin glassy perchlet	Ranga chanda	MA	LC	NE	B	UN	DE
55	<i>Pseudambassis ranga</i>	Indian glassy fish	Gol chanda	AA	LC	LC	B	UN	ST

69	<i>Hemibagrus menoda</i>	Menoda catfish	Ghagla	CA	NT	LC	R	DE	UN
70	<i>Mystus bleekeri</i>	Bleeker's mystus	Gulsha tengra	CA	LC	LC	B	UN	UN
71	<i>Mystus cavasius</i>	Gangetic mystus	Golsha	CA	NT	LC	R	DE	DE
72	<i>Mystus tengara</i>	Tengara mystus	Bujuri tengra	AA	LC	LC	B	UN	UN
73	<i>Mystus vittatus</i>	Asian striped catfish	Tengra	CA	LC	LC	B	UN	DE
74	<i>Rita rita</i>	Rita	Rita, rida	MA	EN	LC	R	DE	DE
75	<i>Sperata aor</i>	Long-whiskered catfish	Ayre	AA	VU	LC	R	DE	ST
76	<i>Sperata seenghala</i>	Giant river-catfish	Guijja ayre	CA	VU	LC	R	DE	UN
	Siluridae								
77	<i>Ompok bimauculatus</i>	Butter catfish	Kani pabda	MA	EN	NT	B	DE	UN
78	<i>Ompok pabda</i>	Two stripe gulper catfish	Madhu pabda	CA	EN	NT	B	DE	DE
79	<i>Ompok pabo</i>	Pabo catfish	Pabda	RA	CR	NT	B	DE	DE
80	<i>Wallago attu</i>	Freshwater shark	Boal	AA	VU	VU	R	DE	DE
	Sisoridae								
81	<i>Bagarius bagarius</i>	Gangetic goonch	Baghair	MA	CR	NT	R	DE	DE
	Pangasiidae								
82	<i>Pangasius pangasius</i>	Yellowtail catfish	Pangas	RA	EN	LC	R	DE	DE
	Clariidae								
83	<i>Clarias batrachus</i>	Walking	Magur	CA	LC	LC	B	DE	ST

		catfish							
	Heteropneustidae								
84	<i>Heteropneustes fossilis</i>	Stinging catfish	Shing	AA	LC	LC	B	UN	ST
	Chacidae								
85	<i>Chaca chaca</i>	Squarehead or angler catfish	Chaka	MA	EN	LC	B	DE	DE
	Synbranchiformes								
	Synbranchidae								
86	<i>Monopterus cuchia</i>	Gangetic mudeel	Kuchia	MA	VU	LC	B	DE	UN
	Mastacembelidae								
87	<i>Macrognathus aral</i>	One-stripe spiny eel	Tara baim	MA	DD	LC	B	UN	ST
88	<i>Macrognathus aculeatus</i>	One-stripe spiny eel	Tara baim	AA	NT	NE	R	UN	UN
89	<i>Mastacembelus armatus</i>	Spiny eel	Sal baim	CA	EN	LC	R	DE	ST
90	<i>Macrognathus pancalus</i>	Stripped spiny eel	Chikra baim	AA	LC	LC	B	DE	UN
	Tetraodontiformes								
	Tetraodontidae								
91	<i>Tetraodon cutcutia</i>	Ocellated puffer fish	Potka	CA	LC	LC	B	UN	UN

*NE = Not Evaluated, NT = Near Threatened, LC = Least Concerned, VU = Vulnerable, EN = Endangered, DD = Data Deficient, CR = Critically Endangered, IN = Increasing, ST = Stable, DE = Decreasing, UN = Unknown, B = *Beel*, R = River

Since no research work on fish biodiversity of the Dhanu River has been done, it deters any kind of comparison of the current findings. Alike limitation was also confronted by several other scientists while assessing fish diversity in different wetlands of Bangladesh (Galib et al. 2013; Mohsin et al. 2013, 2014; Galib 2015). However, the total identified fish species (91) from the study area were 35.00% of the total freshwater fish species (260) of Bangladesh

recorded by DoF (2018). This study area also covers 63.64% indigenous species of the *haor* basin (143) of Bangladesh (BHWDB 2012). Almost similar findings were documented by Gain et al. (2015) and they reported 95 fish species under 14 orders, 45 families and 77 genera from the Passur River. Joadder et al. (2015) reported 71 fish species from the Padma River, those were under 10 orders, 26 families, and 54 genera. Arefin et al. (2018) found 62 fish species under 23 families after investigating in the Rupsa River; Islam et al. (2019) recorded 75 fish species under 25 families from the Juri River in the *haor* basin of Sylhet district. All the above studies showed lower fish diversity compared to the present study. The possible reasons behind the availability of fish species in higher numbers in the present study areas may be suitable water quality (Kabir et al. 2019), geographical location of wetlands in the *haor* basin, and being a tributary of the biodiversity rich Meghna River. Pramanik et al. (2017) found 107 fish species searching the Meghna River, which are under 36 families and 13 orders. However, Mahalder & Mustafa (2013) got a better finding in fish species combination which is 126 finfish species contributing to 39 families from the *haor* region of Sunamganj.

In this study, the most dominant order was Cypriniformes that covers 37.36% of the fish species aggregation followed by Siluriformes (24.18%), Perciformes (19.78%), Synbranchiformes (5.49%), Clupeiformes (4.40%), and so on (Fig. 2). Galib (2015) recorded similar results from the Brahmaputra River where the highest 21 fish species made the Cypriniformes order dominant over Siluriformes (19 species), Perciformes (15 species), and so on. Hanif et al. (2016) and Sultana et al. (2017) also recorded Cypriniformes as the dominant order in the Gorai River and the wetlands of Chhatak, respectively.

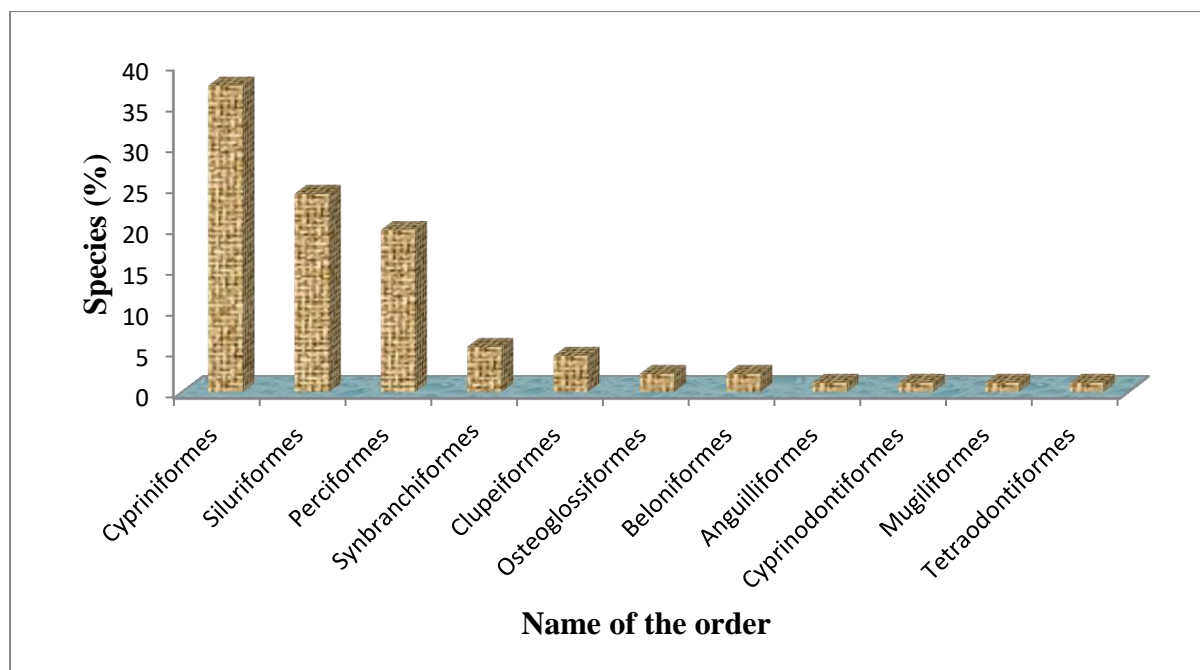


Figure 2. Status of fish species percentage against orders in the study area.

In this investigation Cyprinidae was found as the richest family with 30 species (32.97%) followed by Bagridae (8.79%), and others (Fig. 3). Galib (2015) reported Cyprinidae as most diversified family with 15 species in the Brahmaputra River followed by Bagridae (6 species) and so on. Cyprinidae was documented as dominant family by Joadder et al. (2015) in the River Padma, Mohsin et al. (2013) in the Upper Halda River, and Chaki et al. (2014) in the Atrai River. Rahman (2005) found the same family at the summit over all freshwater fish family of Bangladesh. However, there are variations in the species dominance within Cyprinidae family in different water bodies of Bangladesh which might be due to geographical and environmental disparities of those rivers.

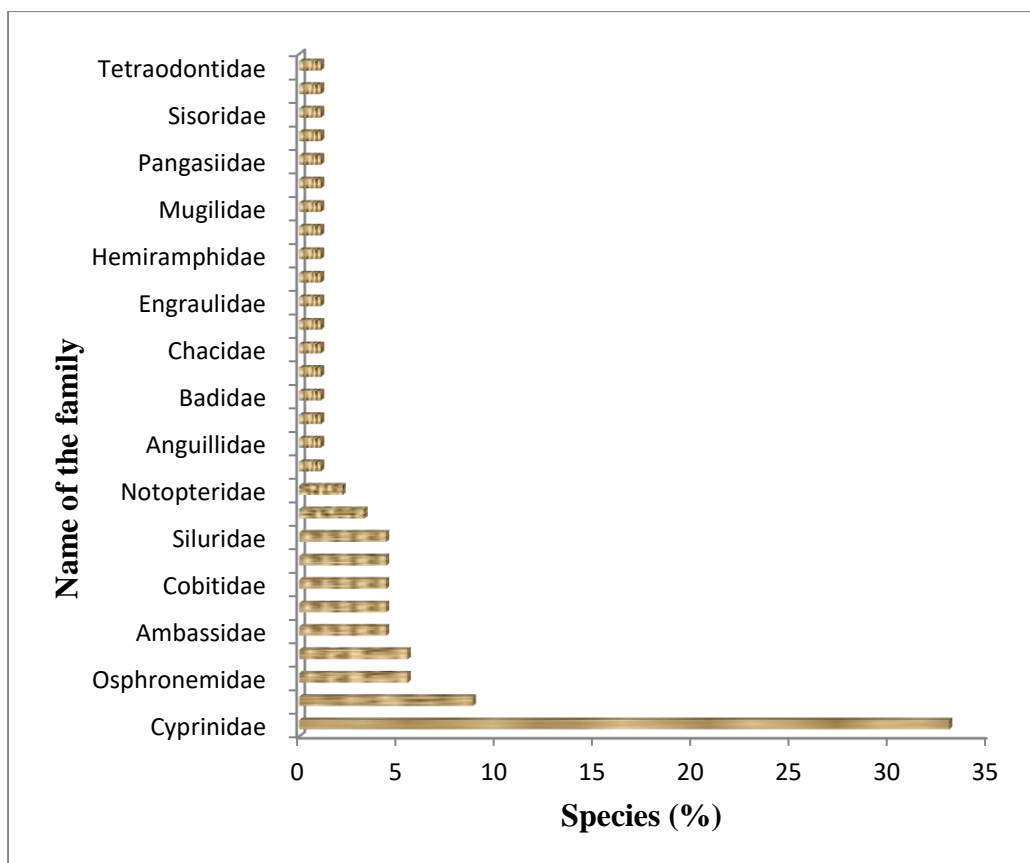


Figure 3. Status of fish species percentage against families in the study area.

Present availability status of indigenous fish fauna: This research showed that, there were 16 abundantly available, 25 commonly available, 29 moderately available and 21 rarely available fish species in the area of investigation (Fig. 4). It is indicated almost a quarter of fish species was in rarely available category whose occurrences were sporadic. Local fishers opined that, these species are going to be disappeared very soon.

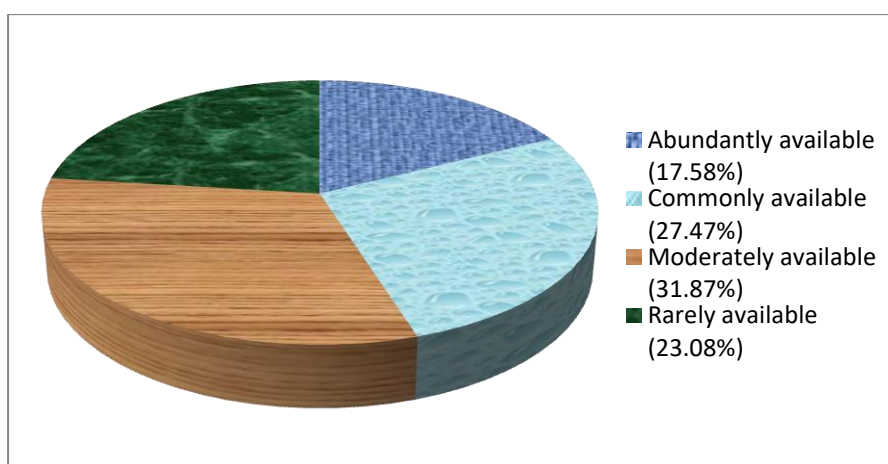


Figure 4. Present fish diversity status of the study area.

Islam et al. (2015b) enlisted 24 fish species in commonly available category, 16 in moderately available and 18 in rarely available category from the wetlands of Sylhet district. Arefin et al. (2018) found 14 species as commonly available (23%), 28 species as moderately available (45%), and 20 species as rarely available (32%). The availability status of fishes in the study area is disparate a bit from the above studies, which might be due to the differences of geographical location, study period, study duration, water quality and differences in the hazards on each water bodies.

Habitat based status of fish fauna: In Bangladesh there are three lucid and well known categories of freshwater loving fishes based on their residential status, viz. riverine, migratory and floodplain resident species. For instance, during the dry season when water level of the floodplains reaches to its nadir, several floodplain dwelling species take shelter in nearby perennial water bodies like rivers and deeper *beels* (IUCN Bangladesh 2015) which makes the categorization more complex. However, maximum lifespan of freshwater fishes is spending in rivers and/or perennial *beels*. Hence, in the present survey, amid the total existing fish species found, 54.95% were *beel* residents and rest 45.05% were detected as riverine dwellers (Fig. 5). Their availability status showed that highest portion of riverine resident species (31.71%) was found under rarely available category (Fig. 6).

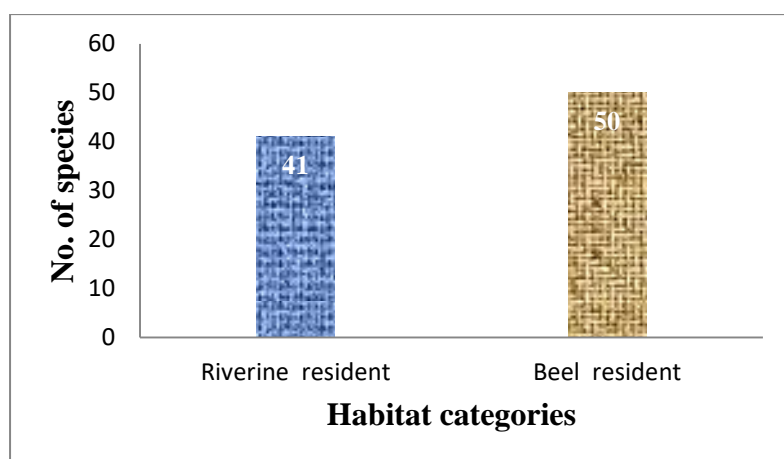


Figure 5. Habitat preference of the freshwater fishes in the study area.

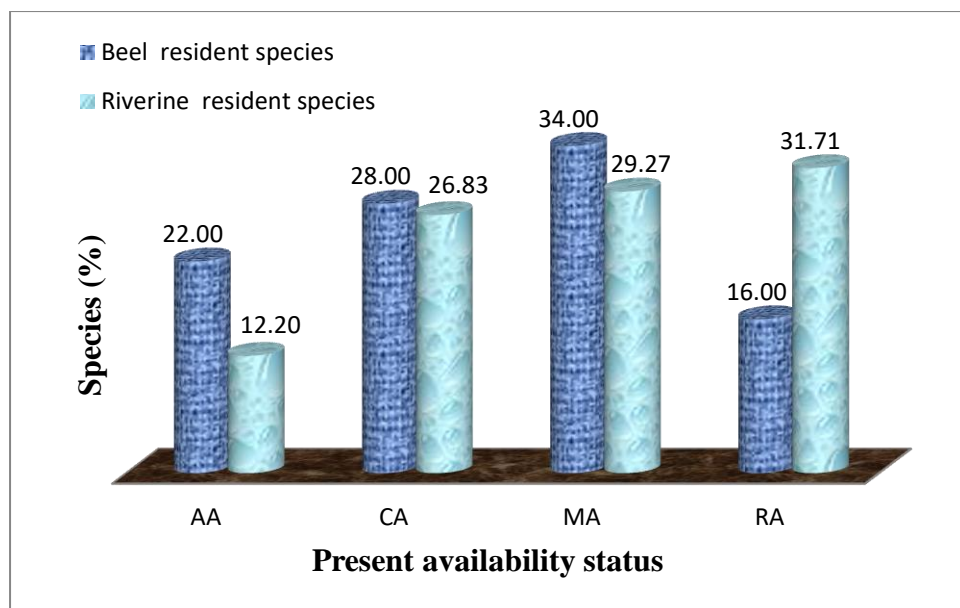


Figure 6. Present availability status of beel and riverine resident species.

Global conservation status of fish species: Pursuant to the global conservation status, the highest percentage fish species was occupied by the least concern category (84.62%) followed by near threatened (9.89%), vulnerable (3.30%), and not evaluated (2.20%) (Fig. 7). It might be notable that 3 globally threatened fish species namely *Cirrhinus cirrhosus*, *Channa orientalis*, and *Wallago attu* were found MA, CA and AA, respectively in the study area. Similar result was found by Galib (2015) in the Brahmaputra River where majority of the indigenous fish species (82.00%) was under least concern where the near threatened (9.00%), not evaluated (5.00%), threatened (2.00%), and data deficient (2.00%).

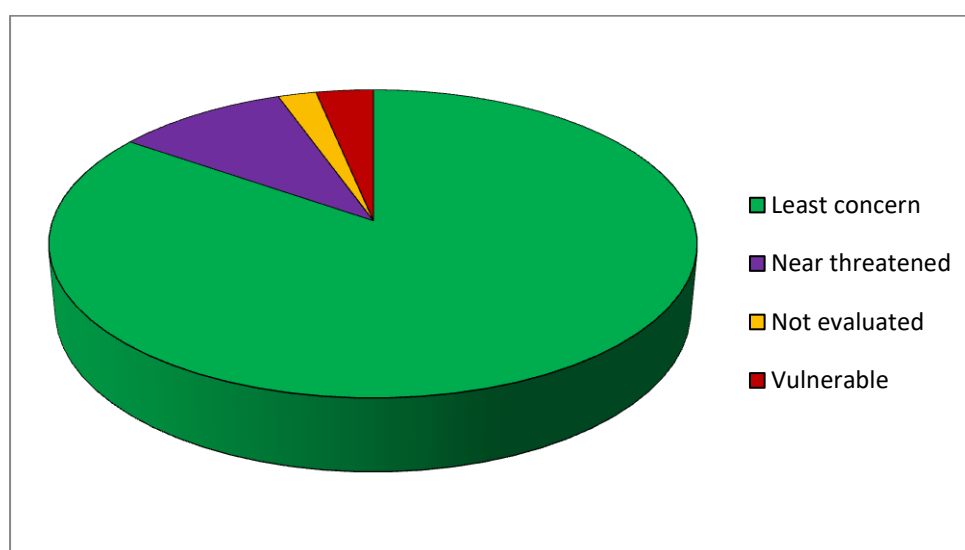


Figure 7. Global conservation status of fish species.

Local conservation status of fish species: In case of the recorded 91 fish species, the zenith position was occupied by least concern category with 49 species (53.84%) followed by near threatened (17.58%), endangered (12.08%), vulnerable (10.99%), critically endangered (3.29%), and data deficient (2.19%) (Table 2). However, 26.37% fish species of the present study was under the threatened category of IUCN Bangladesh (2015). Pramanik et al. (2017) found 20% of the total identified species in threatened condition in the Meghna River where 2% species were in critically endangered, 7.48% endangered and 10.28% vulnerable condition.

Table 2. Local conservation status of fish species.

Status	IUCN, BD 2015 status	Present study		
		No. of species	% among 91 species	Species presence (%) comparing IUCN status
CR	9	3	3.30	33.33
EN	30	11	12.09	36.67
VU	25	10	10.99	40.00
NT	27	16	17.58	59.26
LC	122	49	53.85	40.16
DD	40	2	2.20	5.00
Total	253	91	100	35.97

Global population trend: According to global population trend, highest percentage of the fish species of the present study was unknown category (57.14%) followed by decreasing (24.18%) and stable (18.68%) (Fig. 8). Similar trend was found in the Brahmaputra River by Galib (2015) where highest percentage of the fish species was unknown category (57%) followed by decreasing (25%), stable (13%) and not evaluated (5%). Joadder et al. (2015) mentioned the population trend of 51% fish species of Padma River as unknown and almost 24% were of declining status.

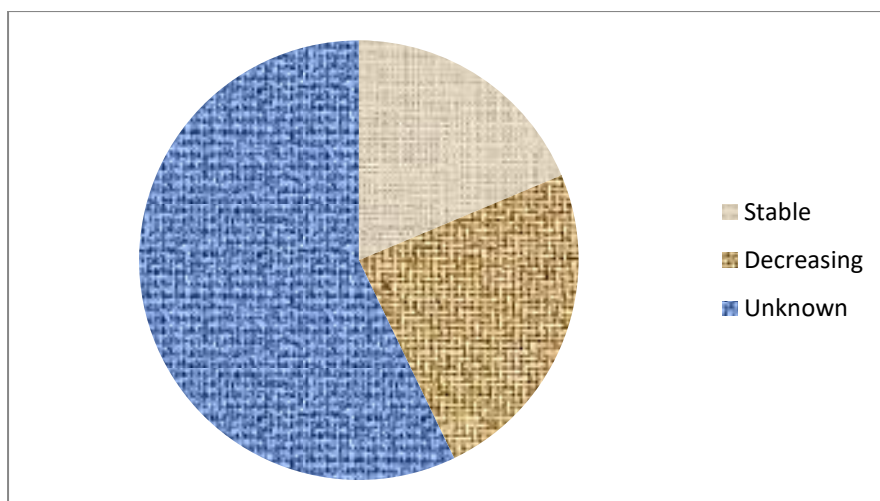


Fig. 8. Global population trend.

National population trend: The population trend of over half (59.34%) of fish species found in the present study was in decreasing trend in national level assessed by IUCN Bangladesh (2015) and only 2.20% was found increasing (Fig. 9). Galib (2015) found the population trend of more than two-third of the total native fishes in the Brahmaputra River were showing decreasing trend. A decreasing trend was recorded for the fish species in the River Padma too (Mohsin et al. 2013).

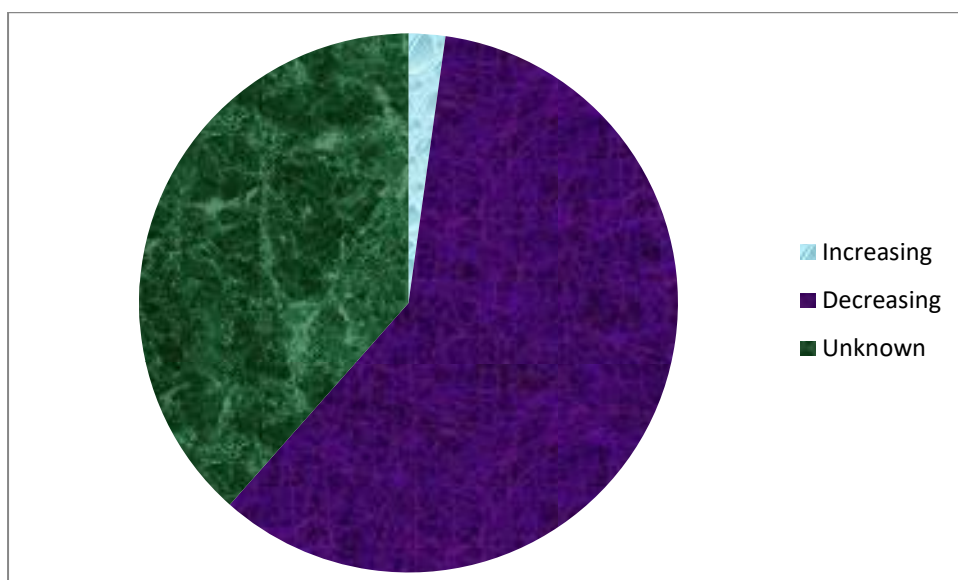


Fig. 9. National population trend.

Top ten threats to the fish diversity: According to the respondents (N = 90), many manmade and natural drivers are responsible for destroying fish biodiversity and habitats (breeding, feeding and nursing grounds) of the river and *beels*. The leading intimidations to the fish

diversity of the studied wetlands was indiscriminately overfishing, followed by fishing by dewatering of wetlands, *katha* fishing method, use of deprecated fishing gears, climate change, etc. (Table 3). Stoddard et al. (2006) found similar threats to the fish diversity of inland waters of Bangladesh. Rahman et al. (2012); Flowra et al. (2013); Islam et al. (2015a); Pandit et al. (2015a); Sultana et al. (2017); Arefin et al. (2018); Islam et al. (2019) found the similar types of causes responsible for species reduction in the inland waters of Bangladesh.

Table 3. Ten crucial threats to the fish biodiversity in the study area.

Sl. no.	Drivers affecting fish diversity	No. of respondents (%)
1	Indiscriminately overfishing	92.22
2	Fishing by dewatering of wetlands	87.78
3	<i>Katha</i> fishing method	86.67
4	Use of deprecated fishing gears	78.89
5	Climate change	75.56
6	Siltation and sedimentation	72.22
7	Intensification of agricultural farming	67.78
8	Natural drought in winter and summer seasons	66.67
9	Construction of development and communication infrastructures	58.89
10	Water pollution	51.11

CONCLUSION

Rich number of fish species during study period is a good allusion of healthy fish diversity in the waters which could be maintained and/or increased through further research and well management. On the contrary, poor availability status and decreasing trend of many fish species intimates the alarming present situation of the fisheries resources of these areas. Considering these facts, a becoming management is urgent for these water bodies to avert any kind of catastrophes of this natural asset in future. Reduction of anthropogenic impacts, maintaining water flow, enactments of fish laws, fish sanctuary establishment, and raising public awareness can be effective for the conservation of existing fisheries resources.

ACKNOWLEDGMENT

The authors are thankful to the Department of Aquatic Resource Management, Sylhet Agricultural University, Sylhet for providing laboratory facilities and fisher's community of the Dhanu River and adjacent waters for their co-operation to collect the data and identification of the fish sample.

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