

## Computational study of Richness and Diversity Indices of fish species in rivers and other wetland areas and fish marketplaces under Kurigram District, Bangladesh

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### Abstract

The present study revealed that a total of 101 indigenous species of large fish (28 species) and Small Indigenous fish (73 species) belonging to 63 genera and 31 families were observed and identified while 17 exotic fish species were found under 5 families. Among the indigenous species, the highest number of species were found in family Cyprinidae and Bagridae with a relative diversity of 28.28% and 11.11%. In case of group species richness, highest number 27 fish species were found in catfish group followed by 12 species of carp, 8 species of each barbs and minnows, 6 species of eel fish, 8 species of loaches, 4 species of each prawn, snake-headed or airbreathing fish and glass perches, 3 species of each climbing perches and clupeid, 2 species of each goby fish, knifefish and puffer fish, and rest of the group true perch, leaf fish, halfbeak fish, Needlefish, mullet fish, anchovies and killifish has one species. Of the total species, 47 species were considered as least concerned, 10 species as vulnerable, 11 species as endangered, 11 species as critically endangered, 14 species as nearly threatened and 8 species as data deficient. Considering the seasonal variation for all selected areas simultaneously, Shannon-Weaver diversity (H) index were found ranged from 3.53 (May) to 4.37 (January) where the highest Shannon -Weaver diversity index value 4.37 were found in winter season while 3.01 in Phulkumar, 3.73 in Dudhkumar, 3.87 in Dharla, 3.67 in Tista and 3.79 in Brahmaputra were recorded separately.

**Keywords:** Large fish; SIS; Biodiversity status; Brahmaputra; Dharla; IUCN

### 1. Introduction

Bangladesh is commonly known as Delta Island in the South-Asian region and situated in the northeastern part of the South Asia and lies between 20°34' and 26°38' North longitudes and 88°01' and 92°41' East latitudes. The country is bordered by India on the West, North and North-East (2400km land frontier) and Myanmar on the Southeastern tip (193km land and water frontier). On the contrary, long deltaic coastal region is about 710km stayed on Southern part and almost all rivers and streams flowing into the Bay of Bengal [1]. Total landform is 148,460 km<sup>2</sup> (57,320 mi<sup>2</sup>), among this land boundaries 4,413 km (2742.1 mi) and a total coastline of 580 km (360.4 mi) [2]. Among of this 22km is territorial waters and exclusive economic zone of the country is 370 km. This landmass spreads out at the junction of the Indian and Malayan sub-regions collectively known as Indo-Malayan zoogeographic realm. Formed by a deltaic plain, Bangladesh is virtually the only drainage outlet for a vast complex river basin made up of the Ganges (local name the Padma), the Brahmaputra and the Meghna rivers and their network of tributaries [1]. There are 700 rivers including tributaries and distributaries; total length about 24,140 km that have created one of the largest networks in the world [3] and covered about 7% of the country's surface area. The Padma, the Jamuna and the lower Meghna are the widest rivers, with the latter expanding to around 8 km across in the wet season, and even more during the floods [4]. Brahmaputra is the 22<sup>nd</sup> longest (2,850 km) and the Ganges is the 30<sup>th</sup> longest (2,510 km) river in the world [3]. The

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Padma unites with the Jamuna (main channel of the Brahmaputra) and later joins the Meghna to eventually empty into the Bay of Bengal. The other small rivers are the Buriganga, the Sitalakhya, the Gumti, the Tista, the Atrai, the Korotoa, the Mohananda, the Madhumati and many others [4]. Many tiny hilly streams, winding seasonal creeks and muddy canals (khals) are also noticed in Bangladesh [3].

However, directly, or indirectly about 12% people relies on sector of fisheries to maintain of their livelihoods. Bangladesh is considered one of the major fish producing country according to the fisheries statistics of Bangladesh (2018-2019, with 43.84 lakh metric tons fish production [5]. Bangladesh Island fisheries are the most important fisheries resources, ranking 3<sup>rd</sup> in fisheries production of Island throughout the world [6]. About 6.7 million ha inland water areas found in Bangladesh, among them open water capture fisheries were 94% and 6% for closed water culture fishery [1]. Rivers cover about 479,735 ha area of the total land area and more than 50% of its territory under true wetlands like estuaries (551,828 ha), Haor and Beel (114,161 ha), floodplains (5,486,609 ha), mangrove environments, and the Kaptai Lake (68,800 ha), these are the inherent water resources [5]. These fisheries resources have been playing a vital role in the economic sector and also in the nutritional purpose specially for the poor people of Bangladesh. Ponds, ditches, oxbow lakes (channel of dead rivers) are some other waterbodies behind with those resources are also blessing for Bangladesh.

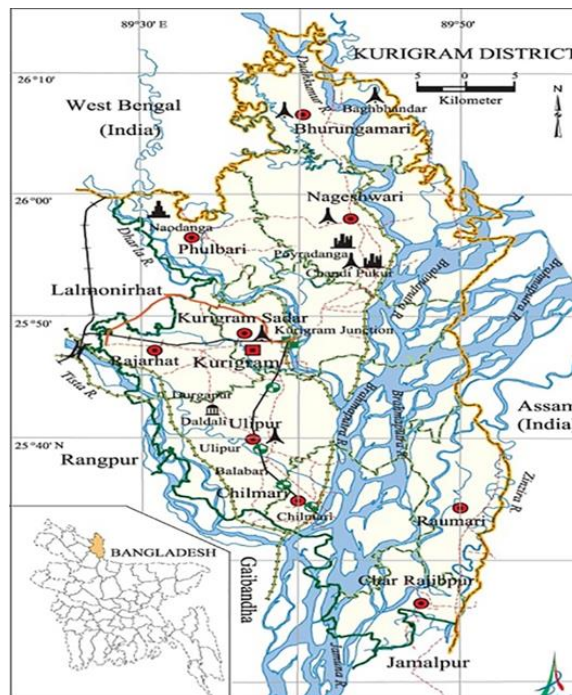
## 2. Material and methods

The present study was conducted in Bhurungamari, Nageshwari, Chilmari, Rowmari, Char Rajibpur and Kurigram upazila under Kurigram district. Kurigram district is the part of Rangpur Division and is the northern part of Bangladesh. It is bounded on the north part by Cooch Behar District of West Bengal, East by Assam, South by Jamalpur and Gaibandha District and West by Lalmonirhat, Rangpur District and West Benglal State of India. It lies between 25°23' and 26°14' north latitudes and between 89°27' and 89°54' east longitudes.

### 2.1. Study period

The study was conducted during January 2015 to December 2019.

### 2.2. Selection of area



**Figure 1** Map of study area (Kurigram District); (Source: <https://en.banglapedia.org/index.php/File:KurigramDistrict.jpg>)

**Table 1** Details of location of Study area

Upazila	River	Selected sites of river	Location	Beels	Location	Fish market	Location	Other Wetlands	Location
Bhurungamari	Phulkumar	Pathardubi	26.1609°N, 89.6152°E	Marasankosh Beel	26.0871°N, 89.7640°E	Bhurunga- mari market	26.1144°N, 89.6673°E	Paiker Chhara	26.0978°N, 89.713170
		Maidan	26.1555°N, 89.6117°E	Diadanga Beel	26.1645°N, 89.6572°E			Char Bhurungamari	26.1234°N, 89.7329°E
Bhurungamari/ Nageshari	Dhudhkumar	Shonahat ghatpar	26.0992°N, 89.7216°E	Naodangai Beel	26.0113°N, 89.6624°E	Berubari fish market	25.9514°N, 89.7472°E	Madhaikhal	25.9207°N, 89.7345°E
		Berubari	25.9479°N, 89.7665°E	Dharka Beel	26.0072°N, 89.6638°E			Char Berubari	25.9531°N, 89.7499°E
Kurigram	Dharla	Paurashava	25.8227°N, 89.6628°E			Kurigram fish market	25.8556°N, 89.6711°E	Chhatrapur	25.8253°N, 89.7050°E
		Kurigram Ghatpar	25.7892°N, 89.6880°E					Krihnapur	25.7855°N, 89.6870°E
Rajarhat	Tista	Khitab Khan	25.7777°N, 89.4869°E	Chakarpasa Beel	25.7851°N, 89.5411°E	Burirhat Bazar	25.7749°N, 89.4901°E		
		Cross Dam	25.7728°N, 89.4891°E						
Rowmari	Brahmaputra	Foluar char ghat	25.5780°N, 89.7947°E			Rowmari market	25.5753°N, 89.8327°E	Tapur Char	25.6389°N, 89.8255°E
		Rowmari Boat ghat	25.5669°N, 89.8087°E					Purar Char	25.6304°N, 89.8233°E
		Dighla para	25.5271°N, 89.7984°E					Bagua Banshdaha	25.6349°N, 89.8182°E

The Brahmaputra, Dharla, Tista, Dudhkumar, Phulkumar, were the main selected rivers for this study. The other selected wetland areas were Diadanga, Sarbajaya, Mara Sangkosh, Naodanga and Gushalka beels. Beside these, popular fish marketplaces were chosen under the Kurigram District for collecting the samples and essential information of samples. Geographically these areas were identified as most important and richful area for capturing fish, for availability of waterbodies, favorable resources and hospitable climate condition, low-lying agricultural field, conditioning soil form, cheap and enough labour and sufficient marketplace. For the data collection all sites were visited once in a month.

### 2.3. Samples preserved

Samples were collected fortnightly from different points of river and wetlands by the help of fishermen of Kurigram district. Fish were caught using net, cast net, square lift net, conical trap, fish angles, monofilament fixed fill net, fish line and fish barrier. Samples were preserved with 10% formalin.

### 2.4. Primary data collection

For the primary data collection three methods were followed as Participatory rural appraisal (PRA) [7], Rapid market appraisal (RMA) [8] and Cross-check interviews with key informants [9]. For this study, PRA methods deals with the fishermen and fish traders of the study area and cross-check interviews were conducted with District and Upazila Fisheries Officers, researchers, nongovernment organization (NGO) workers and relevant project staffs.

### 2.5. Secondary data collection

Secondary data collected from different types of fisheries Books, Journals, Thesis, Organizations, and different website as Web of Science, B-on, Scopus, PubMed, Science Direct etc. Some essential steps were followed for the survey of this study which are outlined in Figure 2.

### 2.6. Data analysis

The data were analyzed by MS office (MS-word, excel and access). To avoid the error three replicates were used. Species diversity indices, i.e., Shannon-Weaver diversity index (H), Pielou's evenness (e), Margalef's richness index (D), Meahinick's index (use for a particular groups) and relative diversity were calculated of the study area by following ways:

Shannon-Weaver diversity (H) [10]:

$$H = \sum_{i=1}^s p_i \ln p_i$$

Pielou's evenness index (e) [11]:

$$e = H/H_{\max} \quad (H_{\max} = \ln S)$$

Margalef's richness index, D = (s-1)/(ln N) [12]

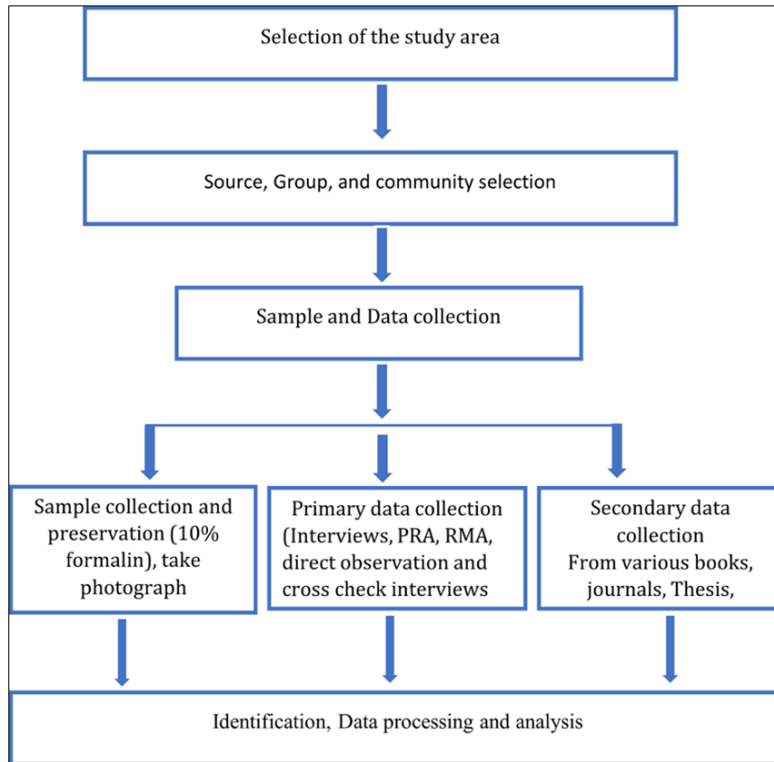
Where, Relative abundance,  $P_i = s/N$ , s = number of individuals of one species, N = total number of all individuals in the sample, ln = natural logarithm.

To measures of a particular group of species richness Meahinick's index (D) is used [13]:

$$D = \frac{s}{\sqrt{N}}$$

Relative diversity was analyzed using this formula [14]

$$\text{Relative diversity} = \frac{\text{Number of species in a family}}{\text{Total number of species}} \times 100$$



**Figure 2** Design of the research Methodology

### 2.7. Species identification

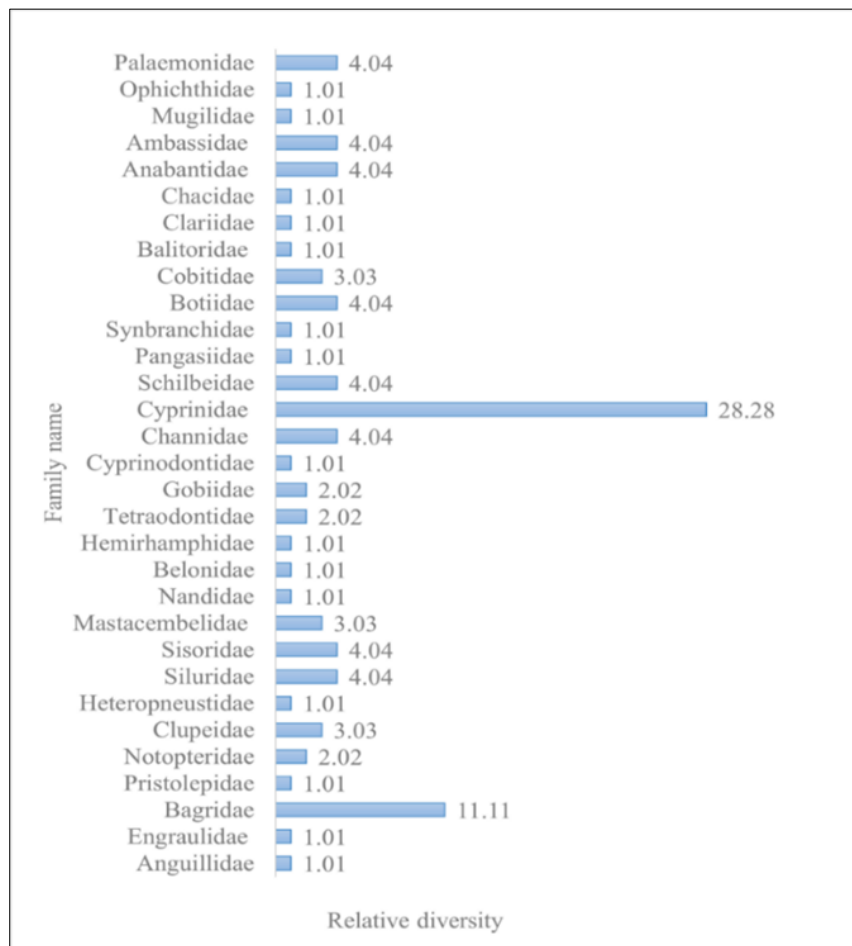
Brief notes were recorded with the features of special interest from the fresh fish and their local names were also noted on the spot with photographs if not possible to preserve samples. After those taxonomic details were followed either in fresh or preserved specimens as convenient and considered for the brief notes of others. Identification was made following the key of Rahman [15], Jhingran and Talwar [16] and Froese and Pauly [17]. For identifying the local status of fish RED LIST OF BANGLADESH, IUCN, 2000 guide-Book was followed and for the present status in Bangladesh [18] and Global status RED LIST OF BANGLADESH (Volume 5: Freshwater Fishes), 2015 was considered [19].

### 3. Results and discussion

In this 21st century, the whole world is facing a remarkable problem of manmade and natural disasters. The water world cannot be escaped from the bad effect of these disasters and all the aquatic organisms fall in the great sufferings. In that case, some Indigenous fish species of Bangladesh have been fallen in an endangered and critically endangered condition, even very few species were Regionally Extinct and become a threat on Biodiversity. Biodiversity status gives the information of the distribution, abundance and threatening of the concerned species. Although Bangladesh has a rich source of fish and fisheries resources but there have very few research are available on the biodiversity status of these species of fish.

Bhuiyan [20] gave an account of 71 freshwater fish species belonging to 45 genera and 25 families from Buriganga river, Dhaka. Nuruzzaman [21] recorded 141 species of fish from Tanguar haor in Sunamganj district. Hossain and Haque [22] was reported 135 species of fishes under 77 genera, 33 families, 14 orders and two classes where 50 species are rare in the Padma river near Rajshahi (Godagari to Charghat). Bhuiyan et al. [23] recorded a total of 73 species of fishes under 44 genera, 22 families, 10 orders and 2 classes and 11 non-fin fishes under the 4 classes from Padma River near Rajshahi district. Mohsin and Haque [24] was reported 56 fish species under 42 genera, 20 families and 9 orders in the Mahananda river at Chapai Nawabganj Sadar upazila. Chowdhury et al. [25] reported 98 fish species in the Naaf river. Nabi et al. [26] recorded 35 species in Bakkhali river estuary of Bangladesh. Mahalder and Mustafa [27] recorded 126 fish species under 39 families in the Sunamganj haor area. Azadi and Alam [28] found a total of 93 species from River Halda. Galib et al. [29] reported 63 species belongs to 41 genera, 23 families and 9 orders where orders Cypriniformes was recorded as the most diversified fish group in terms of both number of species and individuals observed at River Choto Jamuna, Bangladesh. Hossain et al. [30] found 128 species belonging to 35 families under 12 orders from the flood plain area of

greater Noakhali areas. Mohsin et al. [31] studied in Andharmanik river on fish fauna between March 2011 and February 2012 and found 53 number of fish species under 28 families. Islam et al. [32] recorded a total of 114 fish species under 12 orders and 36 families from Payra river. Mohsin and Haque [24] reported 56 fish species in the Mahananda river. Gain et al. [33] mentioned total 95 fish species belonging to 77 genera, 45 families and 14 orders where Perciformes were the most leading fish order constituting 40% of the total of fishes at the Passur river during the study period. Mazumder et al. [34] recorded 54 fish species belonging to 39 genera, 19 families under 6 orders from Hail haor. Saha and Hossain [35] found 40 species of fish including exotic species from Salda beel. Rahman et al. [36] recorded total 80 species of fish under 9 orders and 24 families from Padma distributary of the Ganges river, Northwestern Bangladesh. During the study period total 71 fish species, including prawn under 11 orders and 25 families were recorded from the wetlands of Chhatak, Bangladesh where Cypriniformes (32.38%) was the most dominant order [37]. Roy et al. [38] Considering biodiversity aspects, a total of 63 species were found under 20 families whereas 80 fish species under 29 families found 10 years back. The species availability status was remarked in four categories and obtained as 22 species highly available, 25 species moderately available, 16 species very low in availability and 17 species are not available at Dekhar Haor. A total of 55 fish species found under 10 orders and 20 families were recorded from Titas river [39]. Ali et al. [40] studied in Andharmanik river Sanctuary in Bangladesh and found 93 fish species belonging to 66 genera, 45 families and 14 orders where the highest percentage order was Perciformes (27.65%), followed by Cypriniformes (20.21%), Siluriformes (21.28%) Clupeiformes (7.45%) Mastacembeliformes (4.26%) and Channiformes (4.26%). During the study period at Korotoa river, Ahatun et al. [41] recorded 10 species which belong to 10 genera, 7 families and 5 orders. Cypriniformes was found as the most dominant order considering species variety and abundance, Siluriformes and Perciformes occupied second and third position depend on their abundance and availability. A total of 57 species were mentioned from 8 orders during the study period at Tilai river. Perciformes (17.54%), Siluriformes (22.81%) and Cypriniformes (40.35%) orders exhibited the rich number of fish species at Tilai river [42]. Galib [43] was recorded entire 67 finfish species in which 63 indigenous and 4 exotic fish species are belonged to 46 genera, 24 families and 8 orders in the Brahmaputra River.



**Figure 3** Relative diversity of fish species under each family

In present study a total of 101 indigenous species of large fish (LF) and Small Indigenous fish (SIS) were found under 63 genera and 31 families (Table 2). Among the indigenous species, highest number of species were recorded in family Cyprinidae with relative diversity 28.28% followed by Bagridae 11.11% and 4.04% were belonging to each family Siluridae, Channidae, Schilbeidae, Botiidae, Ambassidae and Palaemonidae; 3.03% were belonging to each family Clupeidae, Sisoridae, Mastacembelidae and Anabantidae whereas 2.02% were belonging to each family Tetraodontidae, Gobiidae and Notopteridae; 1.01% in each family Anguillidae, Pristolepidae, Heteropneustidae, Nandidae, Belonidae, Hemirhamphidae, Cyprinodontidae, Pangasiidae, Synbranchidae, Cobitidae, Claridae, Chacidae, Mugilidae, and Ophichthidae were recorded (Figure 3).

Iqbal *et al.* [44] studied in Konoskhaihaor, Northeast Bangladesh recorded a total of 37 fish species belonging to 7 orders including prawns were identified where 5 were vulnerable, 7 endangered, 1 critically endangered, 3 exotics, 20 not threatened and 1 not evaluated according to IUCN, Bangladesh, 2000 [18]. According to Red List Species of Bangladesh (Volume 5: Freshwater Fishes) 2015 [19], total number of living fish species is 266, among of them 12 critically endangered (CR), 28 endangered (EN), 14 vulnerable (VU), 66 data deficient and 146 not threatened (NT) species. Where in the present study among the total 101 recorded species, 47 species were considered as least concerned, 10 species as vulnerable, 11 species as endangered, 11 species as critically endangered, 14 species as nearly threatened, 8 species as data deficient (Figure 4) (Table 2).

In some studies researcher recorded fish species and categorized in different groups depend on morphology, morphometrics and meristic characterization. Total 56 species of fish fauna from 21 families including prawn species found available in the study area. Among them 8 species of carps, 12 species of catfishes, 9 species of barb and minnows, 4 species of snakeheads, 4 species of eels, 10 species of perches, 3 species of loaches and other miscellaneous 6 species were found including 3 species of prawns with different level of availability at Soma Nadi Jalmohal of Sunamganj [45]. In another study, Hasan *et al.* [46] found 46 species under 17 families where 15 were found belonged to Cyprinidae family. Among the total species 7 species of carps, 4 species of snakeheads, 4 species of perch. 3 species of eels, 11 species of catfishes, 6 species of barb, 2 species of minnows, 1 species of clupeids and 7 species of other miscellaneous fishes from the haor region in Kishoreganj district. Khan *et al.* [47] was recorded 42 species and divided into 7 common fish groups in which 7 species of carps, 9 species of catfishes, 4 species of snakeheads and perch, 3 species of eels, 3 species of barb, and minnows and 8 miscellaneous species. Among of these the highest value (1.38) of species richness recorded in Catfish and lowest (0.46) was in eels.

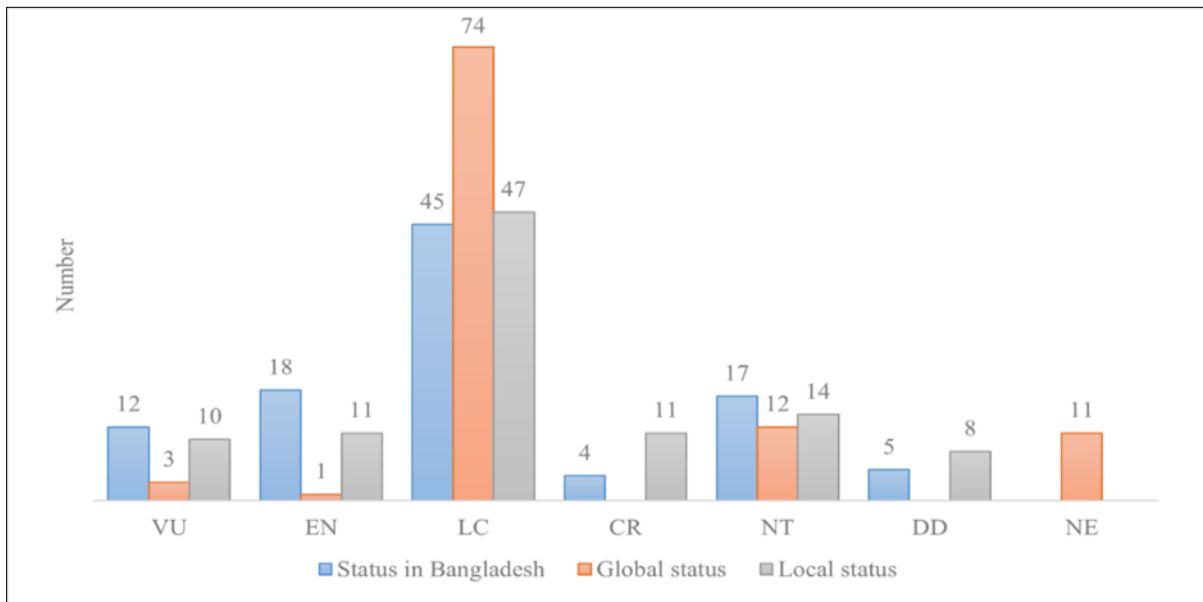


Figure 4 Status of fish according to Red List of Bangladesh, 2015

**Table 2** A check list of indigenous fish species found in the study area

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
Anguillidae (eels)	<i>Anguilla bengalensis</i> (J. E. Gray, 1831)	Indian longfin eel	Bamosh, Banehara, Bao Baim, Boa Baim,	LF	VU	VU	NT	FI0046
Engraulidae (anchovies)	<i>Setipinna phasa</i> (Swainson, 1839)	Gangetic Hairfin Anchovy	Phasa, Phaissa, Phasa Kata	SIS	NT	LC	LC	FI0063
Bagridae (catfishes)	<i>Mystus bleekeri</i> (F. Day, 1877)	Day's mystus	Tengra, Golsha-tengra, Gulsha Tengra	SIS	LC	LC	LC	FI0142
	<i>Mystus cavasius</i> (F. Hamilton, 1822)	Gangetic mystus	Golsha, Kabashi Tengra, Golsha Tengra	SIS	NT	NT	LC	FI0143
	<i>Mystus gulio</i> (F. Hamilton, 1822)	Long whiskers catfish	Nuna Tengra, Guillya, Penchgula	SIS	CR	NT	LC	FI0144
	<i>Mystus tengara</i> (F. Hamilton, 1822)	Tengara mystus	Bajari Tengra, Choto Tengra, GuittaTengra	SIS	LC	LC	LC	FI0145
	<i>Mystus vittatus</i> (Bloch, 1794)	Striped dwarf catfish	Tengra	SIS	LC	LC	LC	FI0146
	<i>Batasio batasio</i> (F. Hamilton, 1822)	Tista batasio	Tengra, Batasi	SIS	CR	NT	LC	FI0013
	<i>Batasio tengana</i> (F. Hamilton, 1822)	Assamese batasio	Tengra	SIS	CR	EN	LC	FI0139
	<i>Sperata aor</i> (F. Hamilton, 1822)	Long whiskered catfish	Air, Ayre, Bhangat	LF	EN	VU	LC	FI0149
	<i>Sperata seenghala</i> (Sykes, 1839)	Giant river catfish	Guji, Guijja, Guijja Ayre,	LF	VU	VU	LC	FI0150
	<i>Hemibagrus menoda</i> (F. Hamilton, 1822)	Menoda catfish	Ghagla, Gang Tengra, Arwari, Kawni	LF	NT	NT	LC	FI0140
<i>Rita rita</i> (F. Hamilton, 1822)	Rita	Rita	LF	NT	EN	LC	FI0148	



Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
Pristolepidae (Cichlids)	<i>Badis badis</i> (F. Hamilton, 1822)	Koi bandi	Naptey koi, Napit koi, Kala koi, Kali koi, Pote koi	SIS	CR	NT	LC	FI0022
Notopteridae (Featherbacks and knifefishes)	<i>Notopterus chitala</i> (F. Hamilton, 1822)	Humped Featherback	Chitl	LF	NT	EN	NT	FI0044
	<i>Notopterus notopterus</i> (Pallas, 1769)	Gray Featherback	Foli, Haila, Kanla	LF	NT	VU	LC	FI0045
Clupeidae (Ray-finned fishes)	<i>Gudusia chapra</i> (F. Hamilton, 1822)	Indian river shad	Chapila, Chaipila, Suiya, Khaira	SIS	VU	VU	LC	FI0062
	<i>Tenualosa ilisha</i> (F. Hamilton, 1822)	Hilsa shad	Ilish, Ilsha	LF	NT	LC	LC	FI0054
	<i>Corica soborna</i> (F. Hamilton, 1822)	Ganges river spral	Kachki, Subarna, Kharika	SIS	NT	LC	LC	FI0050
Heteropneustidae (Air sac catfishes)	<i>Heteropneustes fossilis</i> (Bloch, 1794)	Stinging catfish	Shing, Jiol, Shinghi, Jill Shinghi	SIS	LC	LC	LC	FI0182
Siluridae (Catfishes, Sheathfishes)	<i>Ompok bimaculatus</i> (Bloch, 1794)	Indian butter catfish	Kani Pabda, Boali Pabda	LF	EN	EN	NT	FI0151
	<i>Ompok pabda</i> (F. Hamilton, 1822)	Pabda catfish	Pabda, Madhu pabda, Paibba	SIS	EN	EN	NT	FI0152
	<i>Ompok pabo</i> (F. Hamilton, 1822)	Pabo catfish	Pabda, Kala Pabda	SIS	CR	CR	NT	FI0153
	<i>Wallago attu</i> (Bloch & Schneider, 1801)	Freshwater shark	Boal, Boali, Patari, Boyari, Boayair, Keyali	LF	CR	VU	NT	FI0154
Sisoridae (Sisorid catfishes)	<i>Gagata gagata</i> (F. Hamilton, 1822)	Gangetic gagata	Gang tengra, Jungla, Ghorakata, Hudda	SIS	LC	LC	LC	FI0164

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
	<i>Gagata cenia</i> (F. Hamilton, 1822)	Indian gagata	Jungla, Kauwa, Tengra, Gang tengra, Gang magur, Gun mach	SIS	LC	LC	LC	FI0162
	<i>Bagarius bagarius</i> (F. Hamilton, 1822)	Gangetic goonch	Baghair, Bagh mach	LF	CR	CR	NT	FI016
	<i>Glyptothorax telchitta</i> (Blyth, 1860)	Copper Catfish	Teli, Telchitta	LF	DD	VU	LC	FI0167
Mastacembelidae (Spiny eels)	<i>Macrognathus aculeatus</i> (Bloch, 1786)	Lesser spiny eel/ One-stripe Spinyeel	Tara baim, Golchi, Kota-baim	LF	LC	NT	NE	FI0239
	<i>Mastacembelus pancalus</i> (F. Hamilton, 1822)	Barred spiny eel	Chikra, Gota, Gochi, Turi, Pankal, Chikri	SIS	LC	LC	LC	FI0241
	<i>Mastacembelus armatus</i> (Lacépède, 1800)	Zig-zag eel	Shal baim, Bamni, Chia baim	LF	EN	EN	NE	FI0243
Nandidae (leaffishes)	<i>Nandus nandus</i> (F. Hamilton, 1822)	Mud perch	Bheda, Meni, Roina, Nandui	SIS	NT	NT	LC	FI0208
Belonidae (Needlefishes)	<i>Xenentodon cancila</i> (F. Hamilton, 1822)	Needle fish	Kankila	SIS	LC	LC	NE	FI0244
Hemirhamphidae (Halfbeaks/spipe, fish/spipefish)	<i>Hyporhamphus limbatus</i> (Valenciennes, 1847)	Congaturi halfbeak	Ek Thuita, Ek Thuitta, Ek Thota	SIS	LC	LC	NE	FI0247
Tetraodontidae (Puffer fishes)	<i>Chelonodon patoca</i> (F. Hamilton, 1822)	Green puffer fish	Potka, Tapa	SIS	NT	DD	NE	FI0250
	<i>Tetraodon cutcutia</i> (F. Hamilton, 1822)	Ocellated puffer fish	Tapa, potka, kutkuitta	SIS	LC	LC	LC	FI0249

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
Gobiidae (True gobies)	<i>Glossogobius giuris</i> (F. Hamilton, 1822)	Tank goby	Bele, Baila, Bailly, Bailla, Belia, Bhalia	SIS	LC	LC	LC	FI0001
	<i>Awaous grammepomus</i> (Bleeker, 1849)	Scribbled goby	Shil Baila, Bele	SIS	VU	VU	LC	FI0019
Cyprinodontidae (Pupfish/killifishes)	<i>Aplocheilus panchax</i> (F. Hamilton, 1822)	Blue panchax	Teen chokha, Kanpona, Naharol	SIS	LC	LC	LC	FI0188
Channidae (Snakeheaded )	<i>Channa marulius</i> (F. Hamilton, 1822)	Giant snakehead	Gajar, Gajal, Gajori	LF	LC	EN	LC	FI0005
	<i>Channa striatus</i> (Bloch, 1793)	Snakehead/ murrel	Haul, Sol, Chena	LF	LC	LC	LC	FI0008
	<i>Channa punctatus</i> (Bloch, 1793)	Spotted snake head	Taki, Lata, Lati, Okol, Chaitan, Latha, Gorai, Rakta, Shati, Tahi, Rakhta taki, Veto taki	SIS	LC	LC	LC	FI0007
	<i>Channa orientalis</i> (Bloch & J. G. Schneider, 1801)	Asiatic snakehead	TeloTaki, Gachua, Raga, Cheng, Gaira, Ragua	SIS	LC	LC	LC	FI0006
Cyprinidae (Carps/barbs/ Minnows fishes)	<i>Catla catla</i> (F. Hamilton, 1822)	Catla	Catla, Katol	LF	LC	LC	NE	FI0070
	<i>Labeo angra</i> (F. Hamilton, 1822)	Angra Labeo	Kharsa, Angrot, Kharish	LF	LC	LC	LC	FI0083
	<i>Labeo ariza</i> (Hamilton, 1807)	Ariza Labeo	Lasso, Raik, Bata	SIS	EN	VU	LC	FI0084
	<i>Labeo bata</i> (F. Hamilton, 1822)	Bata	Bata, Bhangon Bata	SIS	LC	LC	LC	FI0085
	<i>Labeo boga</i> (F. Hamilton, 1822)	Boga labeo	Bhangan, Bhangon bata	SIS	CR	CR	LC	FI0086

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
	<i>Labeo calbasu</i> (F. Hamilton, 1822)	Orange fin labeo	Kalibaos, baus, Kalia	LF	LC	LC	LC	FI0088
	<i>Labeo gonius</i> (F. Hamilton, 1822)	Kuria labeo	Gonia, Ghannia, Goni and kurchi	LF	VU	NT	LC	FI0092
	<i>Labeo pangusia</i> (F. Hamilton, 1822)	Pangusia labeo	Ghora maach, Longu, Ghora Muikha	SIS	NT	EN	NT	FI0094
	<i>Labeo rohita</i> (F. Hamilton, 1822)	Rui/Rohu	Rui, Rohit, Ruee	LF	LC	LC	LC	FI0095
	<i>Cirrhinus cirrhosis</i> (Bloch, 1795)	Mrigal	Mrigal, Mirka, Mahal, Malmuch.	LF	NT	NT	VU	FI0072
	<i>Cirrhinus reba</i> (F. Hamilton, 1822)	Reba	Bhanga, Tatkini, Bata, Laccho	SIS	VU	NT	LC	FI0073
	<i>Garra gotyla</i> (J. E. Gray, 1830)	Gotyla, Sucker Head	Ghor Poia	LF	EN	EN	LC	FI0082
	<i>Puntius chola</i> (F. Hamilton, 1822)	Swamp barb	Chola punti	SIS	LC	LC	LC	FI0098
	<i>Puntius sarana</i> (F. Hamilton, 1822)	Olive barb	Sarpunti, Sarnapunti, Saralpunti, Kurti	SIS	EN	NT	LC	FI0104
	<i>Puntius sophore</i> (F. Hamilton, 1822)	Pool barb	Jat punti, Vadi punti	SIS	LC	LC	LC	FI0105
	<i>Puntius ticto</i> (F. Hamilton, 1822)	Two-spot Barb, Firefin Barb, Ticto Barb	Punti, Jat punti, Jathi Punti, tit punti	SIS	LC	VU	LC	FI0107
	<i>Rasbora rasbora</i> (F. Hamilton, 1822)	Gangetic rasbora	Darkina, Leuzza, Darkina	SIS	VU	NT	LC	FI0028
	<i>Salmostoma acinaces</i> (Valenciennes, 1844)	Silver razobelly minnow	Chela	SIS	LC	LC	LC	FI0251
	<i>Salmostoma bacaila</i> (F. Hamilton, 1822)	Large rezorbelly minnow	Chela, Katari	SIS	LC	LC	LC	FI0030

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
	<i>Salmostoma phulo</i> (F. Hamilton, 1822)	Finescale resorb belly minnow	Fulchela, Phulo Chela, Prem Chela	SIS	LC	NT	LC	FI0031
	<i>Amblypharyngodon Mola</i> (F. Hamilton, 1822)	Mola carplet	Mola, Molongi, Moya, Moilla	SIS	LC	LC	LC	FI0015
	<i>Esomus danricus</i> (F. Hamilton, 1822)	Flying barb	Darkina, Darkinda, Dadhika, Chukkuni, Bore chela.	SIS	LC	LC	LC	FI0025
	<i>Tor putitora</i> (F. Hamilton, 1822)	Mohashol	Mohashol, Mohsheer	LF	EN	EN	NT	FI0112
	<i>Tor tor</i> (F. Hamilton, 1822)	Mahseer	Mohashol, Mahsheer	LF	CR	CR	NT	FI0113
	<i>Neolissochilus hexagonolepis</i> (Mc Clelland, 1839)	Copper mahseer	Unknown	LF	NT	EN	NT	FI0114
	<i>Osteobrama cotio</i> (F. Hamilton, 1822)	Cotio, Hafua	Dhela, Mou Mach, Bolungo Melanda, Gunta, Keti, Mauwa	SIS	NT	NT	LC	FI0026
	<i>Barilius bendelisis</i> (F. Hamilton, 1807)	Hiralu, Koksa	Tila, Chedra, Koksa	SIS	EN	EN	LC	FI0067
	<i>Danio rerio</i> (F. Hamilton, 1822)	Zebra danio	Anju, Ful Darkina	SIS	CR	NT	LC	FI0076
Schilbeidae (Schilbid catfishes)	<i>Ailia coila</i> (F. Hamilton, 1822)	Gangetic ailia	Kajuli, Bashpata	SIS	LC	LC	NT	FI0155
	<i>Ailia punctata</i> (Day, 1872)	Jamuna ailia	Kajuli, Bashpata	SIS	LC	LC	NE	FI0156
	<i>Clupisoma garua</i> (F. Hamilton, 1822)	Garu bacha	Ghaura, Gharua, Gagra, Garua Bacha, Guarchcha	SIS	VU	EN	NE	FI0157

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
	<i>Eutropiichthys vacha</i> (F. Hamilton, 1822)	Bacha	Bacha, Garua Bacha	SIS	NT	LC	LC	FI0010
Pangasiidae (Shark catfishes)	<i>Pangasius pangasius</i> (F. Hamilton, 1822)	Yellowtail catfish	Pangas, Pangwash	LF	EN	EN	LC	FI0158
Synbranchidae (Swamp-eels)	<i>Monopterus cuchia</i> (F. Hamilton, 1822)	Cuchia	Kuchia, Cuchia, Kuiccha	LF	VU	VU	VU	FI0196
Botiidae (Loaches)	<i>Botia Dario</i> (F. Hamilton, 1822)	Bengal loach	Rani Mach, Bou Mach	SIS	EN	EN	LC	FI0127
	<i>Botia dayi</i> (Hora, 1932)	Hora loach	Rani, Betangi	SIS	DD	EN	NE	FI0128
	<i>Botia lohachata</i> (Chaudhuri, 1912)	Reticulate loach	Rani, Putul, Beti	SIS	DD	EN	NE	FI0129
	<i>Botia rostrata</i> (Günther, 1868)	Loach	Rani Mach	SIS	VU	DD	VU	FI0130
Cobitidae (True loaches)	<i>Lepidocephalichthys guntea</i> (F. Hamilton, 1822)	Guntea loach	Gutum, puiya	SIS	LC	LC	LC	FI0133
	<i>Lepidocephalichthys irrorate</i> (Hora, 1921)	Loktak Loach	Puiya	SIS	DD	VU	LC	FI0134
	<i>Somileptus gongota</i> (F. Hamilton, 1822)	Gongota Loach	Ghora Gutum, Ghora Poia, Pahari Gutum	SIS	NO	NT	LC	FI0138
Balitoridae (Hillstream/river loaches)	<i>Acanthocobitis botia</i> (Hamilton, 1822)	Zipper Loach, Sand Loach, Mottled Loach	Bilturi, Balichata	SIS	DD	LC	LC	FI0119
Clariidae (Airbreathing catfishes)	<i>Clarias batrachus</i> (Linnaeus, 1758)	Walking catfish	Magur, Mosqur, Mojgor, Jiol	SIS	LC	LC	LC	FI0181
Chacidae (squarehead/frogmouth /angler catfishes)	<i>Chaca chaca</i> (F. Hamilton, 1822)	Squarehead catfish	Chaka, Gangainna, Chaka Veka	SIS	CR	EN	LC	FI0183

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
Anabantidae (Climbing perches)	<i>Colisa fasciatus</i> (Bloch & J.G. Schneider, 1801)	Banded/Rainbow gourami	Khalisa, Khaila	SIS	LC	LC	LC	FI0233
	<i>Trichogaster lalius</i> (F. Hamilton, 1822)	Dwarf gourami, Red gourami	Baicha, Lal Khailsha, Ranga khailsha	SIS	LC	LC	LC	FI0235
	<i>Trichogaster chuna</i> (F. Hamilton, 1822)	Honey Gourami, Sunset Gourami	Chuna khaiisha, Baicha, Baichi, Boicha.	SIS	LC	LC	LC	FI0237
	<i>Anabas testudineas</i> (Bloch, 1792)	Climbing perch	Koi	SIS	LC	LC	LC	FI0231
Ambassidae (Glass perches)	<i>Chanda nama</i> (F. Hamilton, 1822)	Perchlet	Nama Chanda, Lomba Chanda	SIS	LC	LC	LC	FI0200
	<i>Pseudambassis baculis</i> (F. Hamilton, 1822)	Himalayan Glassy Perchlet, Indian Glassy Fish.	Kata Chanda, Phopa Chanda	SIS	LC	NT	LC	FI0201
	<i>Pseudambassis lala</i> (F. Hamilton, 1822)	High fin glassy perchlet	Lal chanda, Ranga chanda, Chandu	SIS	LC	LC	NE	FI0202
	<i>Pseudambassis ranga</i> (F. Hamilton, 1822)	Indian glassy fish	Gol chanda, Chanda, Chandu, Tek chanda	SIS	LC	LC	LC	FI0203
Mugilidae (Mulletts or grey mullets)	<i>Rhinomugil corsula</i> (F. Hamilton, 1822)	Corsula, Kakunda, Corsula Mullet	Khorsula, Bata, Khalla	SIS	LC	LC	LC	FI0213
Ophichthidae (Snake eels)	<i>Pisodonophis boro</i> (F. Hamilton, 1822)	Rice paddy eel/ snake eel	Bamosh, Kharu, Hijra, Kecho Baim, Nol Baim	SIS	LC	LC	LC	FI0047
Palaemonidae (Shrimps/prawns)	<i>Macrobrachium lamarrei</i> (Edwards, 1837)	Kuncho river prawn	Kuncho Chingri, Gura Chingri, Thenga Icha	SIS	LC	LC	LC	CR0058
	<i>Macrobrachium lanchesteri</i> (De Man, 1911)	Rice land prawn	Dhanua Chingri	SIS	DD	DD	LC	CR0059

Family name	Scientific name	English name	Bengali Name	Type of fish	Local status	Status in Bangladesh	Global status	Species ID
	<i>Exopalaemon styliferus</i> (Edwards, 1837)	Roshma prawn	Gara Icha, Ghora Chingri	SIS	DD	DD	NE	CR0060
	<i>Exopalaemon modestus</i> (C. Heller, 1862)	Siberian prawn	Gura Chingri	SIS	DD	DD	LC	CR0061

LF = Large fish, SIS = Small Indigenous Species, NE = not evaluated, DD = data deficient, LC = least concern, NT = nearly threatened, VU = vulnerable, EN = endangered, CR = critically endangered.

\*Status considered using by IUCN Red List Guidebook, 2000 [18]

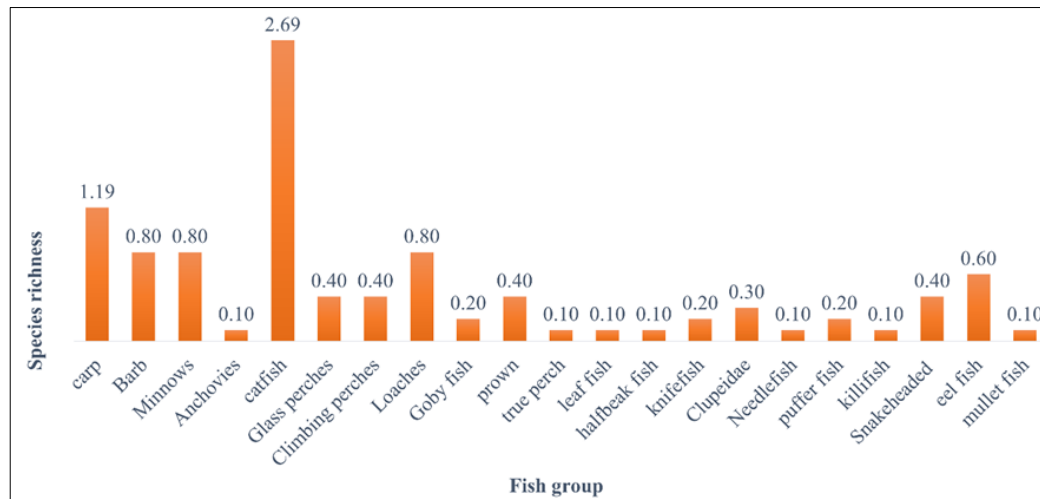
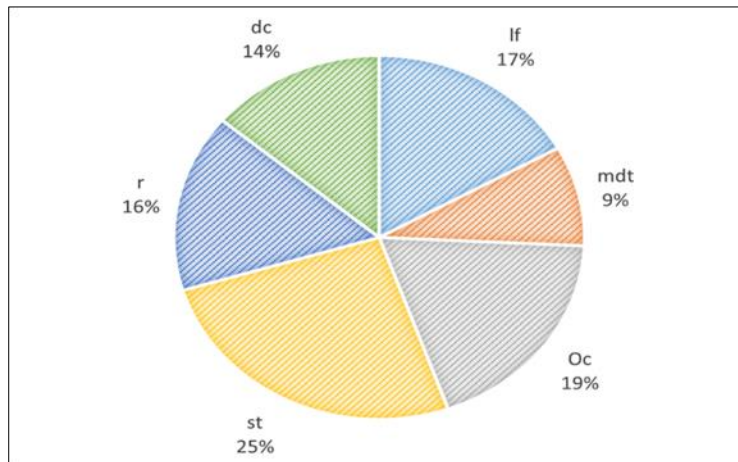


Figure 5 Species richness in a particular group of fish species



In present study, highest number 27 (2.69%) fish species were found in catfish group followed by 12 (1.19%) species of carp, 8 (0.80%) species of bard, 8 (0.80%) species of minnows, 6 (0.60%) species of eel fish, 8 (0.80%) species of loaches, 4 (.40%) species of prawn, 4 (0.40%) species of snake-headed or airbreathing fish, 4 (0.40%) species of glass perches, 3 (0.30%) species of each climbing perches and clupeid, 2 (0.20%) species of each goby fish, knifefish and puffer fish and rest of the group true perch, leaf fish, halfbeak fish, Needlefish, mullet fish, anchovies and killifish has 1 (0.10%) species (Figure 5).



**Figure 6** Present status of availability in study area (lf=less frequent, st=stable, mdt=moderate, r=rare, oc=occasional, dc=decrease)

In this study 25% fish species were found as stable, 16% were considered as rare fish species and rest of the fish species were considered as less frequent (17%), moderate (9%), occasional (19%) and decrease (14%) (Figure 6) (Appendix A).

### 3.1. Exotic fish species

Nowadays exotic fish culture has become popular for their market value and fashionable one though our aquatic resources were full of fishes. Rahman [48] recorded 18 number of exotic fishes where Iqbal *et al.* [44] reported 3 exotics fish species and Hossain *et al.* [49] mentioned 11 species of exotic fishes in their study. Mahalder and Mustafa [27] recorded 12 Exotic fish from Sunamganj haor area. These exotic fishes were introduced in our country without considering the biodiversity point of view, to increase aquaculture production and for aesthetic needs. Bangladesh is over flooded country specially Kurigram district flooded every year for heavy rain and, even most of the time India release their over flooded water which create miserable condition of this district. This is one of the reasons for what sometime exotic fishes are escaped from the aquaculture ponds and farms to open water (floodplain, rice field, river, beel, haor etc.) and compete with the indigenous ones for ecological niche, shelter, and food. In this study, 17 exotic species of fish were collected from fishermen captured from different beels, water reservoir, small portion of riverside and fish marketplace. Among the 17 exotic species 3 species in Gambezi group accordingly 6 species in Carp, 1 species in Barb, 2 species in Cichlid, 1 species in Air-breathing catfish, 3 species in Catfish and 1 species in Piranha group (Table 3).

**Table 3** Recorded of Exotic fish species during the study period

Species	Local name	Common name	Source (Year)
<b>Group: Gambezi (Family: Cyprinidae)</b>			
<i>Carassius auratus</i>	-	Goldfish	Pakistan (1953)
<i>Poecilia reticulata</i>	Guppy	Guppy, Rainbow fish	Thailand (1957)
<i>Gambusia affinis</i>	-	Mosquito fish	India

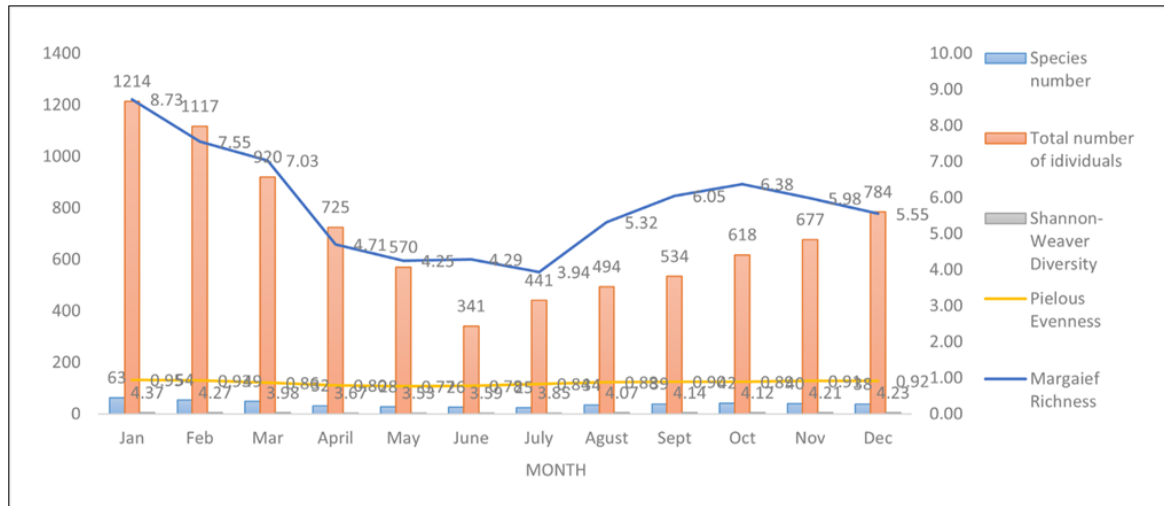
Species	Local name	Common name	Source (Year)
<b>Group: Carp (Family: Cyprinidae)</b>			
<i>Cyprinus carpio var communis</i>	Japani rui	Common carp	India, Nepal (1960)
<i>Cyprinus carpio var specularis</i>	Minar carp	Mirror carp	India, Nepal (1979)
<i>Cyprinus carpio var nudus</i>	-	Leather carp	India, Nepal
<i>Ctenopharyngodon idella</i>	Grass carp	Grass carp	Hong Kong (1966)
<i>Hypophthalmichthys molitrix</i>	Silver carp	Silver carp	Hong Kong (1969)
<i>Aristichthys nobilis</i>	Briged, Bighead	Bighead carp	Thailand (1974)
<b>Group: Barb (Family: Cyprinidae)</b>			
<i>Barbonymus gonionotus</i>	Punti , Sarpunti	Minnows barb	Thailand (1977)
<b>Group: Cichlid (Family: Cichlidae)</b>			
<i>Oreochromis mossambicus</i>	Tilapia	Mozambique tilapia	Thailand (1954)
<i>Oreochromis niloticus</i>	Nilotica	Nile tilapia	Nepal (1981)
<b>Group: Air-breathing catfish (Family: Clariidae)</b>			
<i>Clarias gariepinus</i>	African magur	North African catfish	Thailand (1990)
<b>Group: Catfish (Family: Pangasiidae)</b>			
<i>Pangasius hypophthalmus</i>	Thai or Bideshi pangas	Sutchi catfish	Thailand (1990)
<i>Pangasius gigus</i>	Boro pangas	Giant pangas	Thailand
<i>Hypostomus plecostomus</i>	-	Sucker mouth catfish	Hong Kong
<b>Group: Piranha (Family: Serrasalminidae)</b>			
<i>Pygocentrus nattereri</i>	Piranha	Red piranha	Singapore (2003)

Sources: modified, Rahman, 2005 [48]

### 3.2. Different types of fish diversity indices

The Shannon-Weaver diversity index (H) typically ranges from 1.5 to 3.5 and rarely reaches 4.5. A high value of H represents a diverse and evenly distributed community, while lower values represent a less diverse community [50]. The range of Margalef richness index is unbounded and shows a perfect linear relationship with species richness [51]. Pielou's evenness (e) is the number of individuals of each species in an area and ranges from zero to one, with zero representing no evenness and one representing complete evenness [11]. Fluctuation diversity, number of genera and Shannon-Weaver diversity of fish community have shown similar trend when the diversity index and species richness index co-relate with the number of species as well as number of individuals in each species and contribute equally [52]

In some scientific article researcher reported that the result of Shannon-Weaver diversity (H), Pielou's evenness and Margalef's richness of different areas with different values for different factors. Galib et al. [29] reported the lower value of Shannon-Weaver diversity index (H) (3.717) during April to August as the higher level of water, which makes fishing very difficult and the highest values (3.78, 3.78 and 3.81) in Winter seasons for their preferable fishing conditions and environmentally sustainable. The highest values of the S-W diversity index (3.40) were recorded in post monsoon months as for preferable environmental conditions and lower values (0.99) were recorded in monsoon months and in winter months as for adverse condition indicates the environmental stress [53]. Alam et al. [54] mention the highest S-W diversity value 3.71 in January, Pielou's evenness 0.94 in June and Margalef's richness 7.95 in January. In this present study, the Shannon-Weaver diversity (H), Pielou's evenness (e) and Margalef's richness (D) index of the selected waterbodies during the study period ranged from 3.53 (May) to 4.37 (January), 0.77 (May) to 0.95 (January) and 3.94 (July) to 8.73 (January), respectively. Here, the highest S-W diversity index value (4.37) found in winter season. And lowest values found in pre-monsoon and monsoon seasons for the adverse conditions and environmental stress (Figure 7).



**Figure 7** Total number of species and total number of individuals with different indices (Shannon-Weaver diversity (H), Pielous's evenness (e) and Margalef's richness (D)). (study period: 2015-2019)

In this study, different fish diversity also observed in five river sites (Phulkumar, Dudhkumar, Dharla, Tista and Brahmaputra) considering the seasonal variation. The highest fish diversity (H) recorded in Winter season in five river sites followed by 3.01 in Phulkumar, 3.73 in Dudhkumar, 3.87 in Dharla, 3.67 in Tista and 3.79 in Brahmaputra. In the recent century, riverine ecosystems faced alarming threats due to the loss of fish diversity through different anthropological and natural causes [18]. To maintain the ecological and socioeconomic equilibrium, conservation of fish diversity is very essential [55]. In this concern suitable precautions need to be taken to reduce the environmental threats.

#### 4. Appendix-A

SN	Scientific name	Availability	Phulkumar	Dudhkumar	Dharla	Tista	Bhramaputra
1	<i>Anguilla bengalensis</i>	lf	√	√	√	√	√
2	<i>Setipinna phasa</i>	lf		√	√	√	√
3	<i>Mystus vittatus</i>	st	√	√	√	√	√
4	<i>Mystus tengara</i>	st	√	√	√	√	√
5	<i>Mystus cavasius</i>	lf		√	√	√	√
6	<i>Mystus bleekeri</i>	mdt		√	√	√	√
7	<i>Batasio batasio</i>	oc	√	√	√	√	√
8	<i>Batasio tengana</i>	r				√	
9	<i>Sperata aor</i>	mdt		√	√	√	√
10	<i>Mystus gulio</i>	r		√			√
11	<i>Sperata seenghala</i>	dc			√		√
12	<i>Hemibagrus menoda</i>	dc		√	√	√	
13	<i>Rita rita</i>	dc		√	√		√
14	<i>Badis badis</i>	oc	√	√	√	√	√
15	<i>Notopterus chitala</i>	oc		√	√	√	√
16	<i>Notopterus notopterus</i>	oc	√	√	√	√	√
17	<i>Gudusia chapra</i>	oc					√
18	<i>Tenualosa ilisha</i>	lf					√
19	<i>Corica soborna</i>	dc					√
20	<i>Heteropneustes fossilis</i>	dc	√	√	√		√

21	<i>Ompok bimaculatus</i>	lf			√		√
22	<i>Ompok pabda</i>	lf	√	√	√	√	√
23	<i>Ompok pabo</i>	r		√	√		
24	<i>Wallago attu</i>	r	√	√	√	√	√
25	<i>Gagata gagata</i>	st			√		
26	<i>Gagata cenia</i>	st	√	√	√	√	√
27	<i>Bagarius bagarius</i>	r			√		√
28	<i>Glyptothorax telchitta</i>	dc			√	√	√
29	<i>Mastacem belus armatus</i>	lf			√	√	√
30	<i>Macrornathus aculeatus</i>	mdt	√	√	√	√	√
31	<i>Mastacembelus pancalus</i>	st	√	√	√	√	√
32	<i>Nandus nandus</i>	dc		√	√		
33	<i>Xenentodon cancila</i>	mdt	√	√	√	√	√
34	<i>Hyporhamphus limbatus</i>	st	√	√	√	√	√
35	<i>Chelonodon patoca</i>	dc	√	√	√	√	√
36	<i>Tetraodon cutcutia</i>	lf	√	√	√	√	√
37	<i>Glossogobius giuris</i>	lf		√	√		√
38	<i>Awaous grammepomus</i>	oc		√		√	
39	<i>Aplocheilus panchax</i>	oc			√	√	
40	<i>Channa marulius</i>	dc		√	√		
41	<i>Channa striatus</i>	st	√	√	√	√	√
42	<i>Channa punctatus</i>	st	√	√	√	√	√
43	<i>Channa orientalis</i>	st		√	√		
44	<i>Labeo rohita</i>	st	√	√	√	√	√
45	<i>Catla catla</i>	dc		√	√	√	√
46	<i>Labeo angra</i>	st			√		√
47	<i>Cirrhinus cirrhosus</i>	st	√	√	√	√	√
48	<i>Cirrhinus reba</i>	mdt		√	√		√
49	<i>Labeo gonius</i>	oc		√	√		
50	<i>Labeo calbasu</i>	st		√	√		
51	<i>Labeo bata</i>	st		√	√		
52	<i>Labeo boga</i>	oc	√	√	√		
53	<i>Garra gotyla</i>	dc		√		√	
54	<i>Labeo ariza</i>	lf			√		
55	<i>Labeo pangusia</i>	oc			√	√	
56	<i>Puntius sarana</i>	r		√	√	√	√
57	<i>Puntius sophore</i>	dc	√	√	√	√	√
58	<i>Puntius ticto</i>	dc		√	√		√
59	<i>Puntius chola</i>	st	√	√	√	√	√
60	<i>Rasbora rasbora</i>	lf		√		√	
61	<i>Salmostoma acinaces</i>	st		√		√	
62	<i>Salmostoma bacaila</i>	oc		√			
63	<i>Salmostoma phulo</i>	oc		√			
64	<i>Amblypharyngodon Mola</i>	st	√	√	√	√	√

65	<i>Esomus danricus</i>	st		√			√
66	<i>Tor tor</i>	r		√			
67	<i>Tor putitora</i>	r		√			
68	<i>Neolissochilus hexagonolepis</i>	lf				√	
69	<i>Osteobrama cotio</i>	oc	√	√	√	√	√
70	<i>Barilius bendelisis</i>	oc			√		
71	<i>Danio rerio</i>	r				√	
72	<i>Ailia coila</i>	st	√	√	√	√	√
73	<i>Ailia punctata</i>	lf		√	√		
74	<i>Clupisoma garua</i>	lf			√	√	√
75	<i>Eutropiichthys vacha</i>	lf		√	√	√	√
76	<i>Pangasius pangasius</i>	dc		√	√		√
77	<i>Monopterusuchia</i>	mdt	√	√	√		√
78	<i>Botia Dario</i>	mdt		√	√	√	√
79	<i>Botia dayi</i>	oc					
80	<i>Botia lohachata</i>	oc			√	√	√
81	<i>Botia rostrata</i>	oc					
82	<i>Lepidocephalichthys guntea</i>	st	√	√	√	√	√
83	<i>Lepidocephalichthys irrorate</i>	r	√	√	√	√	√
84	<i>Somileptus gongota</i>	oc			√	√	√
85	<i>Acanthocobitis botia</i>	lf		√	√	√	√
86	<i>Clarias batrachus</i>	oc	√		√		√
87	<i>Chaca chaca</i>	r					√
88	<i>Colisa fasciatus</i>	st	√	√	√	√	√
89	<i>Trichogaster lalius</i>	st	√	√	√	√	√
90	<i>Trichogaster chuna</i>	st		√	√	√	√
91	<i>Anabas testudineas</i>	st	√	√	√	√	√
92	<i>Chanda nama</i>	st	√	√	√	√	√
93	<i>Pseudambassis ranga</i>	mdt	√	√	√	√	√
94	<i>Pseudambassis lala</i>	mdt	√	√	√	√	√
95	<i>Pseudambassis baculis</i>	st	√	√	√	√	√
96	<i>Rhinomugil corsula</i>	lf		√	√	√	√
97	<i>Pisodonophis boro</i>	r				√	
98	<i>Macrobrachium lamarrei</i>	r		√			
99	<i>Exopalaemon styliferus</i>	r		√			√
100	<i>Macrobrachium lanchesteri</i>	r					√
101	<i>Exopalaemon modestus</i>	r		√			
Total number of fish species in different rivers			37	75	77	61	70
*lf=less frequency, st=stable, mdt=moderate, r=rare, oc=occasional, dc=decrease							

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## 5. Conclusion

The present study focused on the variety of fish and their richness in the study area. This study represents a general features of fish biodiversity status of the study area where there has no previous record under the Kurigram district. Further research will be needed to know the total features of fish biodiversity in Kurigram District, Bangladesh.

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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