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ARTICLE

Present Status of Aquatic Resource and Its Catch of Mogra River in Bangladesh

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ABSTRACT

Bangladesh is very rich in aquatic fauna with a biodiversity. The present study, conducted during 2015 to 2019, recorded a total number of 131 species (104 fish, 09 prawn, 01 snail, 04 crabs, and 13 turtles) belonging to 26 families were identified from the Mogra River and its flood plain. About ten types of fishing gears, different crafts, hook and line were found operative in the river. Increasing rates of using current jal (16.0-26.40%) and Kapuri jal (11.0-16.70%) were identified as detrimental gears destroying different species. The fish productivity was decreased dramatically from 170.63±10.81mt to 134.75±8.02 mt with a decreasing percentage of 6.26 to 21.03% within five years. Three important aquatic species turtiles (Cyclemys oldhami, Melanocheelys trjuuga and Morenia petersi) became rare and 17 commercially important aquatic species were at the edge of extinction (critically endangered, CR). From the study, 67 species were recorded in the endangered (EN) category, 20 species vulnerable status (VU), 11 species lower risk (LR), 07 species Least concern (LC) and 04 Data deficient (DF). To save the existing aquatic species in the studied riverine ecosystem and ensure better livelihood of the fishes, a team of local management committee, similar to the Hilsa fisheries management technology is needed.

1. Introduction

River ecosystems and biodiversity help in maintaining the ecological balance of the waterbody. There is a necessity of ecological balance for widespread biodiversity and the ecological balance is an indispensable need for human survival [1]. The biodiversity conservation and environmental ethics both are required for sustainable development and survival of aquatic flora and fauna because biodiversity is the foundation of human life [2].

Biodiversity has become a major concern to the fisheries biologists against the backdrop of rapid decline in the natural population of fish and aquatic biota across all the continents of the world. Biodiversity encompasses genetic species, assemblage, ecosystem and land cape levels of biological organization with structural, compositional and functional components [3,4]. Though loss of aquatic species has been occurring rapidly, the aquatic organisms have received comparatively little attention from conservation biologists [5]. A rich diversity of fish species is important to the ecology and sustainable productivity of the flood plains [6]. The resource of aquatic fauna in Bangladesh are

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under severe threat due to over-exploitation and environmental degradation, which includes human interventions through construction of flood control embankments, drainage structures and sluice gates, conversion of inundated land to cropland thereby reducing water area and indiscriminate use of pesticides. Pollution from domestic, industrial and agrochemicals wastes has resulted in extinction of a considerable amount of aquatic biota in some stretches of the open water system [7,8].

The upper region of the Mogra River is connected with Bisnai River and Kangshow River. The riverine flows across the Atpara and Modon Upazilla of Netrokona district from northern to southern Tharail and Itna Upazilla of Kishorgong District, before joining the Surma River. The water flow is continuous in the river. During monsoon, the water flow comes down from the upper region of Kangshow River and water flow does not confine within the banks. As a result, it causes floods in some area of Atpara and Modan Upazilla every year.

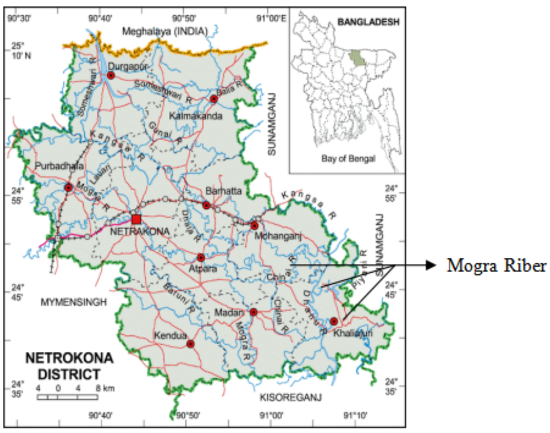

Figure 1. Location of Mogra River in the Netrokona district, Bangladesh.

Once upon a time, Mogra River was an abundance of native wild fishes, shrimp, crabs and reptiles. Due to over-exploitation and various ecological changes of the Mogra River, important fish species, and reptiles disappeared. Now this river is under great stress and its existence is endangered because of the changing aquatic ecosystems. The upper stream of the riverine system is siltated, which reduces the rate of water flow and causes habitat degradation. Like other floodplains, the feeding and breeding grounds of fishes in and around the river have been reducing drastically from various human created obstacles. Indiscriminate destructive fishing practices, soil erosion, siltation, construction of flood control and drainage structures, and agro-chemicals and pesticide have caused havoc to the aquatic biodiversity in Bangladesh.

2. Methodology

Experimental design

Mogra River was studied during 2015-2019 with particular emphasis on soil and water quality, biological productivity and status exploitation of the fishery resources. The river comprises an average length of 20-22 km long course. For the purpose of the study the river course was divided into upper and lower regions based on soil structure, water quality and fishing activities. The river courses of Atpara to Nazirgonj constitute the upper region while the Nazirgonj to Madon constituted the lower region, where in the Mogra River joins with the Surma River.

Study of water quality parameters

The bamboo made meter scale was used to measure water depth. Water temperature (^{o}C) was recorded using a Celsius thermometer and transparency (cm) was measured using a Secchi disc (20 cm diameter). Dissolved oxygen (mg/l) and pH were measured directly using a digital electronic oxygen meter (YSI, Model 58, USA) and an electronic pH meter (Jenway, Model 3020, UK). Alkalinity was determined following the titrimetric method.

Sampling of fish

The investigation was conducted from 2015-2019 and was sampled simultaneously for winter (mid November to mid February), pre monsoon (mid February to April), monsoon (May to August) and post monsoon (September to mid November) for assessment of fish abundance and availability.

Data collection

The study was based on both primary and secondary data, comprehensive literature review and extracts of local knowledge and information. An organized sampling program spread over a reasonably long time is needed to get a true picture of the catch and composition. This study, being a rapid survey, gives only a broad picture of the stock of fishes, prawn, crabs and turtiles that could be obtained through market survey (Brojer Bazar, Nazirgong Bazar, Teligati Bazar, Madon sadar Bazar) and interaction with fishers in the riverside and even in the river and secondary data were collected from the Department of Fisheries (DoF) and the internet. The number of six codes (CR, E, EN, VU, LR, LC and DD) of IUCN was followed to categorize the coservation of status of fishes recorded from the river and to compare the trend among Shannon index value of different years [9].

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Shannon Diversity Index

$$H = \sum_{i=1}^{S} - (P_i * \ln P_i)$$

Where:

H = the Shannon diversity index, P_i = fraction of the entire population made up of species i, S = numbers of species encountered, ∑ = sum from species 1 to species S.

Note: The power to which the base e (e = 2.718281828.) must be raised to obtain a number is called the natural logarithm (ln) of the number.

Analysis of experimental data

The data were analyzed through one way ANOVA using MSTAT followed by Duncan's Multiple Range Test to find out whether any significant difference existed among the different means [10].

3. Results and Discussion

Morphometry and hydrodynamics of experimental river

Generally, there are three main sources of water input into the river ecosystem viz. overspill from the higher river channel, surface flow and regeneration. Water flows were resolved by both rainfall and flooded water from the Meghaloya's hilly range, India. In upper region, this river is connected with Khongsa and Bisnai River. Flooding of the river originated from the Kangshow and Bisnai River. Surface run-off and increased in river height due to inflow of rainwater (flood) from the upper stretch, cause inundation of floodplains. The more water gain or exchange of water took place during southwest monsoon when floodplains were flooded. The early flood phase (April to June) occurred in the early monsoon when the water level in basin was relatively low. The water level in the floodplain rises and falls depending on the water level in adjacent rivers. The deep flood phase (June to September) began when the water level in the river, causing deep flooding in the four unions of Atpara and Madon Upazillas. Floodwater in flood plains began started receding in the post-monsoon season (October to December). The water loss by various means caused shrinkage of the effective water area and lowering of depth in the river which is very similar to the study of Chakraborty et al. [11].

Physical characteristics

Soil texture of the Mogra River bed varied from sandy to loam sand. Soil texture of upper river bed was having 90.80±6.02 sandy, 7.30±2.43 loam sand and 1.9±1.72% clay. The dominance of sand (58.30±5.18) was also recorded in the lower region of the river (Table 1).

Table 1. Physical features of sediment of the Mogra River.

Location	Soil texture of the river bed (%)		
	Sandy	Loam sand	Clay
Upper region	40.20±4.32	43.60±5.03	17.4±3.22
Lower region	38.30±4.18	42.10±4.06	19.60±3.54

The waterw depth of the Mogra River exhibited a decreasing with an average value of 3.55±0.64 3.41±0.55, 3.321±0.584 3.207±0.44 and 3.01±0.41 m during the study period (Figure 2). The highest depth of the river was recorded in the year 2015 and the lowest depth was found in the year 2019 and the equation of the trend line was $y= -0.128x +3.684$ ($R^2 = 0.981$). The alarming trend of decrease in water depth (Figure 2) was majorly due to rapid siltation [11]. The observed values of the value of the physico-chemical parameters of the river water are given in Table 2. The temperature, transparency, pH, dissolve oxygen and alkalinity of water were found to be more or less in the desired range. The variations in mean water temperature of the river were not statistically significant (P>0.05). Water temperature of the river showed an increasing trend in monsoon and post monsoon and decreasing trend in winter which was similar observation of Mathew [12]. Mean Secchi disk transparency differed significantly (P<0.05), during the study period. Higher values were recorded during post monsoon and summer months due to reduced flow and relatively stable conditions of water as observed by others [13]. The pH of the studied river did not differ significantly (P>0.05). Transparency was consistently higher in upper region and in the deeper portion of the river. A significant rise in pH during pre-monsoon and a drop in winter was noted in the river. The mean dissolved oxygen (DO) did not differ significantly (P>0.05). The pH and oxygen values of the river agreed more or less similar with the findings of APHA [14] and Boyd [15]. Water alkalinity levels were recorded medium to high as reported by Clesceri et al. [16]. It differed significantly (P<0.05) with time. Lowest value of alkalinity was recorded in the in the winter during 2015.

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Table 2. Physico-chemical parameters of experimental Mogra River.

Parameters	Years				
	2015	2016	2017	2018	2019
Temperature (°C)	25.74±5.01 (14.04-32.20)	26.17±6.12 (13.73-32.40)	26.48±6.08 (14.11-31.85)	26.88±6.26 (14.00-32.01)	26.14±5.88 (14.15-32.08)
Transparency (cm)	40.04±6.24[d] (30.10-50.16)	50.38±7.02[a] (32.22-58.14)	44.55±6.41[c] (28.15-50.30)	37.19±6.88[e] (27.55-50.25)	47.23±6.74[b] (29.55-55.22)
pH	7.05± 2.04 (6.90-8.86)	7.66±2.22 (6.80-8.88)	8.05±2.03 (6.85-9.07)	7.77±1.88 (6.90-8.88)	8.08±2.01 (6.75-8.90)
Dissolved oxygen (mg/L)	6.95±1.84 (4.18-8.04)	8.84±1.88 (4.55-9.05)	7.70±1.99 (5.44-8.66)	7.22±1.72 (5.41-8.05)	7.09±1.96 (5.04-8.48)
Alkalinity (mg/L)	142.02±10.04[a] (111.22-151.05)	120.66±7.22[e] (110.88-135.02)	126.18±7.05[d] (107.22-138.15)	131.52±8.07[c] (110.40-140.32)	136.38±7.04[b] (111.16-144.55)

Figures with different superscripts in the same row varied significantly (P>0.05).

Figures in the parenthesis indicate the range.

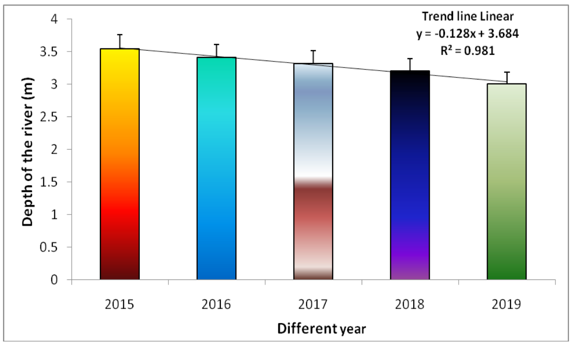

Figure 2. Water depth of the Mogra River between the year 2015 and 2019

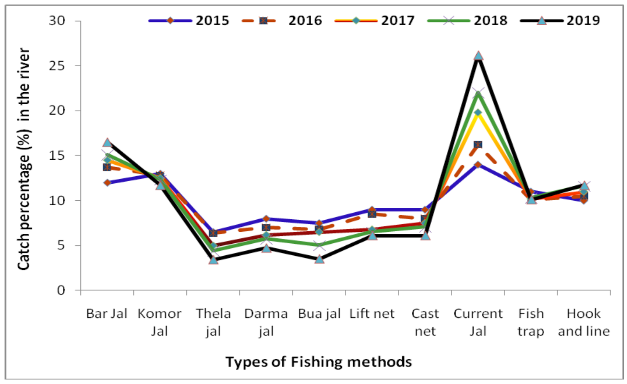

Figure 3. Contribution of different fishing gears during the study period (2015- 2019).

Capture method

The fishers used wooden boats as a major craft. They used seine net (Bar jal and Komor jal), Thela jal, Dharma jal, Bua jal, Lift net, Cast net, Current jal and various types of fish Trap, Hook and Line according to season and availability of different species of fishes. Wide variability in fish traps (vair, dugair, ghuni and pholo etc.) and hook and line (barshi, fulkuichi, Jhupi aikra etc.) were used to capture different groups of aquatic lives.

Figure 3 shows a remarkable yearly increase in fishing effort by using illegal fishing gear like gill net (Current jal) and Bar jal (kaperi jal) in the total catch. The percentage of catch from Current jal were 14.00%, 16.20%, 19.80%, 22.00% and 26.20%; and Bar jal (kaperi jal) 12.00%, 13.70%, 14.50%,15.10% and 16.50%; and Hook and line 10.00, 10.50, 11.00, 11.60 and 11.70% in the year 2015, 2016, 2017, 2018 and 2019, respectively. Significant difference in catch (P<0.05) by Current jal and Bar jal (kaperi jal) and Hook and line were identified. The contribution of catch by Komor jal were 13.00%, 12.80%, 12.50%, 12.30% and 11.70% in the years 2015, 2016, 2017, 2018 and 2019, respectively.

Use of different fishing gears also differed significantly (P<0.05). Haroon et al. [17] reported eighteen types of fishing gears from the Sylhet sub-basin and thirteen types from Mymensingh sub-basin which is very similar to this study. The catch using Thela jal, Dharma jal, Bua jal, Lift net, Cast net, fish Trap and Hook and line were found decreasing and differed significantly (P<0.05). A decreasing trend in the catch of the river and its flood plains were recorded and the findings were similar to that of Chakraborty et al., and Sugunan and Bhattacharjya [11,18].

Fish catch and composition

An organized sampling program was run for a long time to get a real picture of the catch and composition of the river. The present investigation gave a broad picture of the stock of fishes and other aquatic lives obtained through market survey, landing center and interaction with fishers in the river. From the fishing activity in the Mogra River, occurrence of 104 species of fish, 09 species of prawn, 01 species of snail and 04 species of crabs, and 13 species of turtles belonging to a total 26 families were recorded. Fishing activity run throughout the year. During monsoon and post monsoon, fishers used Lift net, Current jal, Cast net, Traps, and line and Hooks to catch fishes. Fishermen also operated kata fishing by seine net (Bar jal and Komor jal) in winter and spring. The catch is consisted of knife fish, major carp and minor carp, small fish, cat fish and small cat fish, eels, prawn, crabs and reptiles (Table 3 and Figure 4). The assessment of yearly total catch from the river was around 170.63±10.81 mt, 159.93±9.80 mt 150.98±10.66 mt, 143.16±9.80 ton and 134.75±8.02 mt during 2015, 2016, 2017, 2018 and 2019, respectivly (Figure 5). The catch trend line was exponential type and the equation was $y= 180.3e^{-0.05x}$ ($R^2= 0.999$).

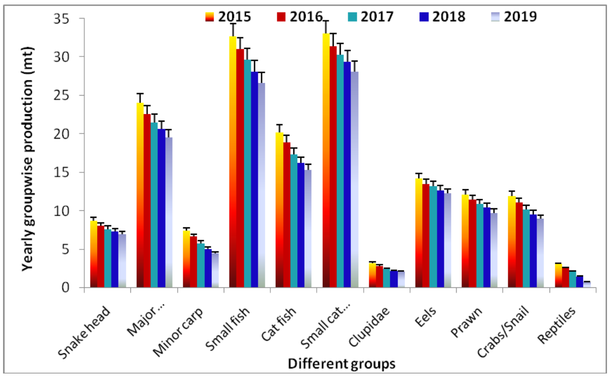

Figure 4. The production of different groups of aquatic lives in the Mogra River in the year 2015 to 2019.

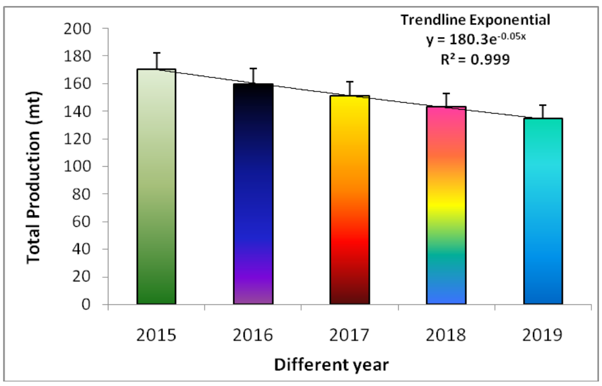

Figure 5. Decreasing trend in the total production of aquatic lives in the Mogra River during 2015 to 2019.

The fish catch showed a decrease percentage at the rate of 6.26%, 11.52%, 16.10% and 21.03% of catch in the years 2015-2016, 2016-2017, 2017-2018 and 2018-2019, with respect to the catch of 2015 (Figure 6) and which exhibited a linear trend line and the equation was $y= 4.889x + 1.5.5$ ($R^2 = 0.999$). A decrease trend in production from the river was clearly pronounced within the study period of five years which was similar to the study of Chakraborty and Mirza [19,20] and Moyle and Leidy [21]. Although the production of all the recorded groups decreased during the study, it was pronounced more for reptiles.

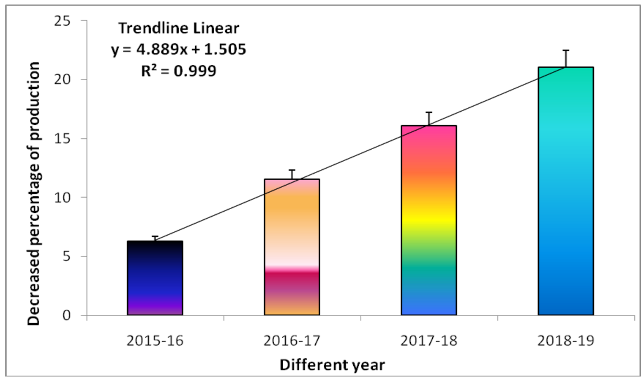

Figure 6. Decreasing percentage of total production of aquatic lives in the Mogra River during 2015 to 2019.

Table 3 and Figure 7 exhibited the conservation status of the 131 aquatic wild animals of the Mogra River and identified as E- 04 (3%), CR-17 (12%), EN-67 (51%), VU-20 (15%), LR-11 (9%), LC-7 (9%) and DD-06 (4%), respectively.

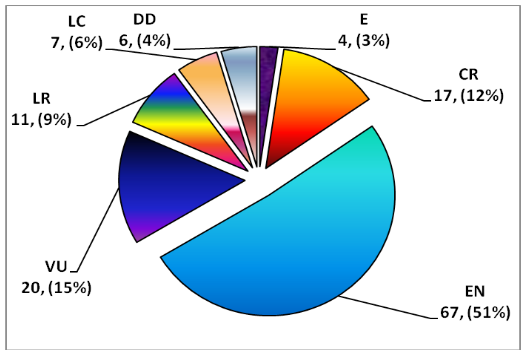

Figure 7. Conservation status of the recorded aquatic species in the Mogra River.

Status code: E- Extinct, CR- Critically Endangered, EN- Endangered, VU- Vulnerable, LR- Lower risk, LC- Not threatened DD=Data deficient (As per IUCN [22]).

The total catch in different years differed significantly (P<0.05). Commercial important Pata Kachim, *Cyclemys oldhami,* Kali Kachhap, *Melanocheelys trjuuga* and Bengal Eyed Turtile, *Morenia petersi* were rarely found in the years 2015 to 2017 in the river. However these species were not recorded during 2019. *Channa marulius, Puntius sarana, Barilius tileo, Sicamugil casoasia, Rohtee cotio*, *Bagarius yarrellii, Mystus seenghala, Bagarius yarrellii, Chaca chaca, Rama chandramara, Sisor rabdophorus, Pseudolaguvia muricata, Pseudolaguvia inornata* and reptiles (*Indotestudo elongata, Batagur baska, Geoclemys hamiltonii* and *Pangshura tecta* (17 species) were reported as critically endangered and facing an extremely high risk of extinction in the river system (Table 3). According to IUCN [23], in Bangladesh, about 56 freshwater fish species are critically or somewhat endangered. Due to Over

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Table 3. Status and distribution of Mogra River of northern Bangladesh.

SL No	Group/ Family	Local name	Scientific name	Production (mt)					Status
				Someswari River					
				2015	2016	2017	2018	2019	
Snake headed									
1	Notopteridae	Chitol	*Notopterus chitala*	0.70 ±0.09	0.65 ±0.05	0.59 ±0.05	0.54 ±0.03	0.50 ±0.02	EN
2	Notopteridae	Foli	*Notopterus notopterus*	0.50 ±0.04	0.44 ±0.03	0.37 ±0.02	0.33 ±0.01	0.30 ±0.01	EN
3	Belonidae	Kakila	*Xenentodon cancila*	1.90 ±0.44	1.70 ±0.40	1.55 ±0.41	1.38 ±1.10	1.26 ±0.07	LR
4	Channidae	Gojar	*Channa marulius*	0.60 ±0.20	0.53 ±0.09	0.50 ±0.07	0.48 ±0.05	0.44 ±0.03	CR
5	Channidae	Soal	*Channa striata*	1.03 ±0.51	1.00 ±0.10	0.97 ±0.08	0.98 ±0.09	0.92 ±0.06	EN
6	Channidae	Gachua	*Channa gachua*	1.88 ±0.50	1.70 ±0.50	1.68 ±0.44	1.66 ±0.42	1.62 ±0.41	CR
7	Channidae	Taki	*Channa punctata*	2.08 ±0.60	2.00 ±0.55	1.98 ±0.50	1.95 ±0.44	1.90 ±0.42	LR
SubTotal				**8.89 ±0.69**	**8.02 ±0.68**	**7.64 ±0.64**	**7.32 ±0.63**	**6.94 ±0.62**	
Major carps									
1	Cyprinidae	Catla	*Catla catla*	1.98 ±0.80	1.84 ±0.65	1.80 ±0.60	1.73 ±0.54	1.65 ±0.50	EN
2	Cyprinidae	Rui	*Labeo rohita*	3.01 ±0.30	2.88 ±0.30	2.81 ±0.30	2.71 ±0.27	2.60 ±0.21	EN
3	Cyprinidae	Mrigal	*Cirrhinus mrigala*	3.04 ±0.26	3.0 ±0.24	2.97 ±0.22	2.90 ±0.21	2.78 ±0.20	EN
4	Cyprinidae	Kalbaus	*Labeo calbasu*	2.3 ±0.19	2.25 ±0.18	2.21 ±0.17	2.16 ±0.10	2.07 ±0.10	EN
5	Cyprinidae	Ghonia	*Labeo gonius*	2.80 ±0.17	2.50 ±0.16	2.30 ±0.14	2.20 ±0.11	1.97 ±0.10	EN
6	Cyprinidae	Reba	*Cirrhinus reba*	1.80 ±0.11	1.60 ±0.10	1.40 ±0.09	1.20 ±0.08	1.10 ±0.06	EN
7	Cyprinidae	Common carp	*Cyprinus carpio*	5.50 ±1.84	5.20 ±1.70	5.00 ±1.22	4.80 ±1.10	4.50 ±1.00	VU
8	Cyprinidae	*Grass carp*	*Ctenopharyngodon idella*	3.60 ±1.24	3.30 ±1.11	3.00 ±1.01	2.95 ±1.00	2.88 ±0.98	VU
Sub-Total				**24.03±1.17**	**22.57±1.12**	**21.49±1.09**	**20.65 ±1.08**	**19.55 ±1.03**	
Minor carp									
1	Cyprinidae	Along	*Bengala elanga*	1.20 ±0.07	1.10 ±0.06	0.94 ±0.04	0.82 ±0.03	0.69 ±0.01	VU
2	Cyprinidae	Bhangna bata	*Labeo bata*	1.10 ±0.06	1.00 ±0.05	0.80 ±0.05	0.65 ±0.04	0.50 ±0.02	EN
3	Cyprinidae	Ghora muikha	*Labeo pangusia*	1.82 ±0.05	1.80 ±0.05	1.70 ±0.04	1.60 ±0.03	1.50 ±0.03	EN
4	Cyprinidae	Jarua/Utti	*Chagunius chagunio*	0.87 ±0.06	0.70 ±0.05	0.62 ±0.03	0.48 ±0.03	0.38 ±0.01	EN
5	Cyprinidae	Puda	*Puntius sarana*	0.58 ±0.04	0.45 ±0.03	0.22 ±0.02	0.12 ±0.01	0.01 ±0.01	CR
6	Cyprinidae	Tila koksa	*Barilius tileo*	1.01 ±0.08	0.90 ±0.05	0.88 ±0.04	0.84 ±0.03	.81 ±0.01	EN
7	Cyprinidae	Bhol	*Raimass bola*	0.86 ±0.05	0.72 ±0.04	0.64 ±0.04	0.55 ±003	0.54 ±0.01	EN
Sub-Total				**7.74 ±0.39**	**6.67 ±0.43**	**5.80 ±0.45**	**5.06 ±0.47**	**4.43 ±0.46**	
Small fish									
1	Cyprinidae	Mola	*Amblypharyngodon mola*	1.88 ±0.07	1.77 ±0.06	1.64 ±0.05	1.53 ±0.05	1.45 ±0.03	EN

2	Cyprinidae	Barna Baril/ Koksa	*Barilius barna*	1.20 ±0.05	1.00 ±0.04	1.10 ±0.04	0.96 ±0.02	0.90 ±0.03	EN
3	Cyprinidae	Baril	*Barilius bendelisis*	0.66 ±0.03	0.59 ±0.01	0.55 ±0.01	0.50 ±001	0.46 ±0.01	EN
4	Cyprinidae	Koksa	*Barilius shacra*	0.55 ±0.02	0.52 ±0.02	0.49 ±0.02	0.45 ±0.01	0.41 ±0.01	EN
5	Cyprinidae	Koksa	*Barilius tileo*	0.88 ±0.03	0.87 ±0.03	0.84 ±0.03	0.80 ±0.01	0.78 ±0.0	CR
6	Cyprinidae	Aspidopara/ Morar	*Aspidoparia morar*	0.66 ±0.04	0.62 ±0.04	0.60 ±0.03	0.58 ±0.02	0.55 ±0.01	EN
7	Cyprinidae	Chepchela	*Chela cachius*	0.80 ±0.05	0.75 ±0.04	0.66 ±0.03	0.62 ±0.03	0.58 ±0.02	EN
8	Cyprinidae	Kashkhaira	*Chela laubuca*	0.90 ±0.06	0.88 ±0.04	0.84 ±0.04	0.81 ±0.03	0.78 ±0.03	EN
9	Mugillidae	Kachi Kholya	*Sicamugil casoasia*	0.66 ±0.02	0.60 ±0.01	0.58 ±0.01	0.55 ±001	0.52 ±0.01	CR
10	Cyprinidae	Baspata	*Danio devario*	0.55 ±0.03	0.52 ±0.03	0.48 ±0.03	0.45 ±0.02	0.43 ±0.01	EN
11	Cyprinidae	Dhela	Rohtee *cotio*	0.50 ±0.03	0.40 ±0.02	0.32 ±0.02	0.22 ±0.01	0.12 ±0.0	CR
12	Cyprinidae	Chola punti	*Puntius chola*	0.66 ±0.04	0.63 ±0.04	0.62 ±0.03	0.61 ±0.02	0.60 ±0.02	EN
13	Cyprinidae	Taka punti	*Puntius conchonius*	0.70 ±0.05	0.68 ±0.05	0.64 ±0.04	0.60 ±0.03	0.58 ±0.02	EN
14	Cyprinidae	Phutani punti	*Puntius phutunio*	0.80 ±0.05	0.78 ±0.05	0.75 ±0.02	0.72 ±0.02	0.68 ±0.01	EN
15	Cyprinidae	Jatpunti Punti	*Puntius Sophore*	0.44 ±0.03	0.42 ±0.03	0.40 ±0.02	0.37 ±0.02	0.34 ±0.01	EN
16	Cyprinidae	Teri punti	*Puntius terio*	0.70 ±0.04	0.67 ±0.04	0.65 ±0.03	0.63 ±0.02	0.60 ±0.02	EN
17	Cyprinidae	Tit Punti	*Puntius ticto*	0.83 ±0.05	0.80 ±0.05	0.77 ±0.04	0.74 ±0.03	0.70 ±0.02	VU
18	Cyprinidae	Fulchela	*Salmostoma phulo*	0.78 ±0.04	0.75 ±0.04	0.73 ±0.03	0.70 ±0.02	0.68 ±0.02	EN
19	Cyprinidae	Darkina	*Esomus danricus*	0.50 ±0.03	0.48 ±0.02	0.45 ±0.02	0.42 ±0.02	0.12 ±0.01	VU
20	Cyprinidae	Kanpona	*Oryzias melastigma*	1.00 ±0.03	0.98 ±0.03	0.95 ±0.03	0.92 ±0.02	0.88 ±0.01	VU
21	Clupeidae	Kachki	*Corica soborna*	0.40 ±0.03	0.38 ±0.02	0.36 ±0.02	0.28 ±0.02	0.23 ±0.01	DD
22	Cobitidae	Balitora	*Psilorhynchus balitora*	0.40 ±0.02	0.40 ±0.02	0.37 ±0.02	0.35 ±0.01	0.33 ±0.01	EN
23	Cobitidae	Balitora	*Psilorhynchus rahmani*	0.37 ±0.02	0.36 ±0.01	0.22 ±0.01	0.09 ±001	0.08 ±0.01	LC
24	Cobitidae	River stone carp/ Titari	*Psilorhynchus sucatio*	0.70 ±0.07	0.66 ±0.06	0.64 ±0.04	0.63 ±0.05	0.60 ±0.03	EN
25	Cobitidae	Bilturi /Bali chata	*Acanthocobitis botia*	0.50 ±0.03	0.47 ±0.03	0.44 ±0.02	0.42 ±0.02	0.38 ±0.01	EN
26	Cobitidae	River loach/ Balichata	*Acanthocobitis zonalternans*	0.70 ±0.05	0.68 ±0.04	0.64 ±0.03	0.60 ±0.02	0.56 ±0.03	VU
27	Cobitidae	Koirka	*Nemacheilus corica*	0.60 ±0.04	0.58 ±0.03	0.56 ±0.02	0.53 ±0.01	0.50 ±0.2	LR
28	Cobitidae	Creek loach	*Schistura beavani*	0.40 ±0.03	0.38 ±0.04	0.36 ±0.03	0.35 ±0.02	0.32 ±0.02	VU
29	Cobitidae	Corica Loach/ Korika	*Schistura corica*	0.70 ±0.05	0.66 ±0.05	0.63 ±0.05	0.60 ±0.04	0.57 ±0.04	LR
30	Cobitidae	Savon khorka	*Schistura savona*	0.66 ±0.04	0.62 ±0.03	0.60 ±0.03	0.57 ±0.02	0.55 ±0.02	LR
31	Cobitidae	Dari	*Schistura scaturigina*	0.40 ±0.03	0.38 ±0.02	0.36 ±0.02	0.35 ±0.02	0.32 ±0.01	EN

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32	Cobitidae	Bengal loach / Bou mach	*Botia dario*	0.60 ±0.05	0.55 ±0.04	0.53 ±0.04	0.51 ±0.02	0.48 ±0.02	VU
33	Cobitidae	Hora loach	*Botia dayi*	0.60 ±0.05	0.58 ±0.04	0.56 ±0.03	0.53 ±0.03	0.50 ±0.01	EN
34	Cobitidae	Loach/ Puiya	*Lepidocephalichthys goalparensis*	0.90 ±0.05	0.88 ±0.04	0.85 ±0.02	0.83 ±0.02	0.81 ±0.02	EN
35	Cobitidae	Goalpara loach	*Neoeucirrhichthys maydelli*	0.55 ±0.04	0.52 ±0.04	0.50 ±0.03	0.48 ±0.02	0.45 ±0.01	EN
36	Cobitidae	Gonga loach/ Poia/ Ghar poia	*Somileptes gongota*	0.60 ±0.05	0.58 ±0.05	0.55 ±0.04	0.53 ±0.03	0.50 ±0.02	VU
37	Cobitidae	Rani	*Botia lohachata*	0.44 ±0.04	0.41 ±0.04	0.38 ±0.03	0.36 ±0.03	0.33 ±0.01	LR
38	Cobitidae	Rani	*Lepidocephalichthys annandalei*	0.55 ±0.03	0.53 ±0.03	0.52 ±0.02	0.50 ±0.02	0.47 ±0.02	EN
39	Cobitidae	Balichata	*Nemachilus botia*	0.77 ±0.04	0.74 ±0.04	0.73 ±0.02	0.71 ±0.03	0.68 ±0.03	EN
40	Centropomidae	Chanda	*Chanda nama*	1.50 ±0.08	1.47 ±0.05	1.44 ±0.04	1.36 ±004	1.28 ±0.03	LC
41	Centropomidae	Chanda	*Pseudambasis bacuculis*	1.20 ±0.08	1.16 ±0.06	1.15 ±0.05	1.13 ±0.04	1.08 ±0.04	EN
42	Centropomidae	Ranga chanda	*Pseudambasis ranga*	0.80 ±0.05	0.74 ±0.04	0.70 ±0.03	0.68 ±0.03	0.66 ±0.02	LC
43	Gobiidae	Baila	*Glossogobus giuris*	1.20 ±0.07	1.10 ±0.06	1.00 ±0.05	0.98 ±0.04	0.94 ±0.04	DD
44.	Tetradontidae	Potka	*Tetradon cutcutia*	1.50 ±0.08	1.44 ±0.07	1.44 ±0.06	1.36 ±0.04	1.32 ±0.04	EN
Sub-Total				**32.72 ±0.32**	**29.53±0.29**	**29.63±0.30**	**28.14 ±0.29**	**26.63 ±0.28**	
Cat fish									
1	Bagridae	Ayre	*Mystus aor*	2.20 ±0.12	2.10 ±0.11	2.00 ±0.10	1.98 ±0.10	1.90 ±0.09	EN
2	Bagridae	Guizza	*Mystus seenghala*	3.00 ±0.20	2.89 ±0.17	2.75 ±0.14	2.66 ±0.11	2.55 ±0.11	CR
3	Schilbeidae	Shilong	*Silonia silondia*	1.00 ±0.09	0.97 ±0.08	0.93 ±0.09	0.90 ±0.07	0.88 ±0.08	EN
4	Siluridae	Boal	*Wallago attu*	5.03 ±1.84	4.90 ±1.71	4.70 ±1.81	4.40 ±1.70	41.00 ±1.40	LR
5	Bagridae	Baghair	*Bagarius yarrellii*	2.08 ±0.80	1.66 ±0.70	1.20 ±0.7	1.11 ±0.68	1.00 ±0.65	CR
6	Chacidae	Cheka	*Chaca chaca*	1.50 ±0.10	1.30 ±0.09	1.00 ±0.08	0.96 ±0.08	0.90 ±0.05	CR
7	Bagridae	Gangmagur	*Mystus menoda*	2.85 ±0.90	2.55 ±0.80	2.33 ±0.78	2.00 ±0.74	1.88 ±0.60	EN
8	Bagridae	Rita	*Rita rita*	2.55 ±0.81	2.50 ±0.70	2.44 ±0.70	2.20 ±0.60	2.09 ±0.50	EN
Sub total				**20.21±1.21**	**18.87±1.22**	**17.35±1.24**	**16.21 ±1.15**	**15.30 ±1.08**	
Small cat fish									
1	Bagridae	Gulsa	*Mystus cavasius*	2.20 ±0.12	2.10 ±0.11	2.08 ±0.08	2.03 ±0.07	1.90 ±0.06	EN
2	Bagridae	Tengra	*Mystus vitttus*	2.70 ±0.11	2.60 ±0.11	2.50 ±0.10	2.45 ±0.10	2.40 ±0.08	EN
3	Bagridae	Bujuri	*Mystus tengra*	2.70 ±0.11	2.66 ±0.11	2.60 ±0.08	2.55 ±0.07	2.51 ±0.06	VU
4	Bagridae	Gura Tengra/ Futki bujuri	*Rama chandramara*	0.70 ±0.06	0.60 ±0.04	0.50 ±0.03	0.48 ±0.03	0.39 ±.0.02	CR
5	Bagridae	Menoda catfish /Arwari	*Hemibagrus menoda*	0.80 ±0.07	0.77 ±0.05	0.75 ±0.05	0.73 ±0.04	0.70 ±0.02	EN
6	Bagridae	Kerala mystus	*Mystus armatus*	0.90 ±0.04	0.85 ±0.04	0.80 ±0.03	0.75 ±0.03	0.70 ±.0.02	EN

7	Bagridae	Day's mystus/ Tengra	*Mystus bleekeri*	0.75 ±0.07	0.74 ±0.05	0.72 ±0.05	0.70 ±0.04	0.68 ±0.02	EN
8	Schilbeidae	Kajuli	*Ailia coila*	0.90 ±0.08	0.86 ±0.07	0.84 ±0.06	0.81 ±0.05	0.79 ±0.04	EN
9	Siluridae	Kani Pabda	*Ompok bimaculatus*	1.58 ±0.08	1.50 ±0.07	1.48 ±0.06	1.41 ±0.06	1.37 ±0.05	EN
10	Siluridae	Madhu Pabda	*Ompok pabda*	1.77 ±0.09	1.60 ±0.08	1.55 ±0.07	1.52 ±0.06	1.48 ±0.05	VU
11	Siluridae	*Ompok pabda*	*Ompok pabo*	1.20 ±0.06	1.17 ±0.05	1.14 ±0.06	1.10 ±0.04	1.00 ±0.04	EN
12	Schilbeidae	Gharua	*Clupisoma garua*	1.07 ±0.08	0.96 ±0.06	0.94 ±0.07	0.88 ±0.07	0.80 ±0.05	EN
13	Schilbeidae	Muri Bacha	*Clupisoma murias*	1.40 ±0.05	1.30 ±0.05	1.26 ±0.05	1.20 0.04	1.14 ±0.03	EN
14	Schilbeidae	Batasi	*Pseudeutropius atherinoides*	1.00 ±0.05	0.97 ±0.05	0.95 ±0.03	0.92 ±0.02	0.90 ±.0.02	VU
15	Schilbeidae	Bacha	*Eutropiichthys vacha*	0.90 ±0.04	0.88 ±0.05	0.85 ±0.04	0.83 ±0.04	0.80 ±0.02	EN
16	Sisoridae	Kutakanti	*Hara hara*	0.60 ±0.04	0.55 ±0.04	0.49 ±0.04	0.45 ±0.04	0.44 ±0.04	LR
17	Sisoridae	Kutakanti	*Hara jerdoni*	1.10 ±0.07	1.04 ±0.06	1.00 ±0.06	0.99 ±0.05	0.96 ±0.04	EN
18	Sisoridae	Gang tengra	*Nangra nangra*	0.90 ±0.04	0.88 ±0.03	0.85 ±0.04	0.82 0.04	0.79 ±0.03	VU
19	Sisoridae	Chenua	*Sisor rabdophorus*	0.35 ±0.02	0.30 ±0.02	0.25 ±0.03	0.16 ±0.02	0.08 ±.0.02	CR
20	Sisoridae	Conta catfish/ Kuta kanti	*Conta conta*	1.24 ±0.07	1.20 ±0.06	1.15 ±0.05	1.11 ±0.04	1.05 ±0.02	DD
21	Sisoridae	Kutakanti	*Erethistes pusillus*	1.00 ±0.02	0.97 ±0.02	0.93 ±0.01	0.12 ±0.01	0.10 ±.0.01	VU
22	Sisoridae	Kani Tengra	*Pseudolaguvia muricata*	0.55 ±0.04	0.50 ±0.03	0.46 ±0.04	0.43 ±0.03	0.34 ±0.02	CR
23	Sisoridae	Chanua	*Pseudolaguvia inornata*	1.44 ±0.09	1.33 ±0.08	1.32 ±0.06	1.32 ±0.05	1.29 ±0.05	CR
24	Clariidae	Cat fish/ Magur	*Clarias batrachus*	0.50 ±0.03	0.47 ±0.03	0.45 ±0.03	0.43 ±0.02	0.40 ±.0.02	VU
25	Heteropneustidae	Stinging catfish/ Shingi	*Heteropneustes fossilis*	1.44 ±0.07	1.38 ±0.05	1.32 ±0.05	1.30 ±0.04	1.26 ±0.02	LC
26	Chacidae	Cheka	*Chaca chaca*	1.70 ±0.10	1.60 ±0.09	1.15 ±0.08	1.47 ±0.05	1.33 ±.0.05	LR
27	Olyridae	Gagora catfish / Gobi	*Arius gagora*	1.48 ±0.07	1.40 ±0.06	1.35 ±0.05	1.32 ±0.04	1.27 ±0.02	EN
Sub-total				**33.03±0.60**	**31.45±0.58**	**30.31±0.57**	**29.41 ±0.57**	**28.09 ±0.56**	
Clupidae									
1	Clupidae	Chapila	*Gadusia chapra*	1.80 ±0.08	1.50 ±0.07	1.12 ±0.06	1.00 ±0.05	1.00 ±0.04	EN
2	Clupidae	Hilsa	*Tenualosa ilisha*	0.98 ±0.08	0.95 ±0.06	0.90 ±0.04	0.85 ±0.02	0.82 ±0.01	EN
3	Clupidae	Gizzard shad/ Chapila	*Gonialosa manmina*	0.44 ±0.08	0.38 ±0.06	0.34 ±0.04	0.31 ±0.02	0.28 ±0.01	EN
Subtotal				**3.22 ±0.68**	**2.83 ±0.56**	**2.44 ±0.44**	**2.16 ±0.36**	**2.10 ±0.38**	
Eels									
1	Mastacembeli-dae	Baim	*Mastacembalus armatus*	3.44 ±0.14	3.35 ±0.11	3.33 ±0.09	3.24 ±0.08	3.12 ±0.07	VU
2	Synbranchidae	Kuicha	*Monopterus cuchia*	3.09 ±0.10	2.98 ±0.10	2.91 ±0.09	2.80 ±0.08	2.27 ±0.08	EN
3	Mastacembelidae	Lesser spiny eel/ Tara baim	*Macrognathus aculeatus*	2.90 ±0.13	2.83 ±0.12	2.76 ±0.10	2.63 ±0.10	2.54 ±0.09	EN

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4	Mastacembelidae	One-stripe spiny eel	*Macrognathus aral*	2.20 ±0.12	2.00 ±0.11	1.95 ±0.09	1.91 ±0.08	1.86 ±0.07	LR
5	Mastacembelidae	Barred spiny eel/ Pankal baim	*Macrognathus pancalus*	2.55 ±0.13	2.30 ±0.12	2.22 ±0.12	2.12 ±0.11	2.04 ±0.10	EN
Subtotal				**14.18 ±0.48**	**13.44 ±0.54**	**13.17 ±0.55**	**12.70 ±0.53**	**12.26 ±0.51**	
Prawn									
1	Palaemonidae	Golda Isa	*Machrobrachiu rosenbergii*	1.83 ±0.07	1.77 ±0.06	1.68 ±0.05	1.60 ±0.05	1.47 ±0.04	EN
2	Palaemonidae	Gura Isa	*Machrobrachium biramanicus*	2.50 ±0.18	2.42 ±0.16	2.35 ±0.15	2.28 ±0.14	2.20 ±0.15	DD
3	Palaemonidae	Gul Isa	*Machrobrachium malcolmsnii*	1.61 ±0.09	1.44 ±0.05	1.32 ±0.05	1.25 ±0.04	1.18 ±0.04	VU
4	Palaemonidae	Dimua icha	Macrobrachium villosimanus	1.90 ±0.20	1.80 ±0.11	1.71 ±0.10	1.64 ±0.09	1.57 ±0.10	LC
5	Palaemonidae	Gura icha or kuncho chingri	Macrobrachium lamarrei	0.88 ±0.22	0.79 ±0.16	0.80 ±0.15	0.77 ±0.14	0.75 ±0.16	LR
6	Palaemonidae	Kaira icha or beel chingri.	Macrobrachium dayanum	0.71 ±0.06	0.66 ±0.03	0.60 ±0.03	0.60 ±0.02	0.54 ±0.02	LR
7	Palaemonidae	Chikna chingri.	Macrobrachium idella	0.92 ±0.02	0.88 ±0.02	0.82 ±0.01	0.77 ±0.01	0.59 ±0.01	DD
8	Palaemonidae	Icha	Macrobrachium kempi	0.87 ±0.08	0.82 ±0.07	0.78 ±0.04	0.75 ±0.04	0.72 ±0.02	VU
9	Palaemonidae	chingri	Macrobrachium superbum	0.90 ±0.06	0.84 ±0.04	0.86 ±0.03	0.80 ±0.02	0.73 ±0.02	LC
Sub-total:				**11.12 ±0.63**	**11.42 ±0.62**	**10.92 ±0.60**	**10.46 ±0.57**	**7.75 ±0.56**	
Crabs/Snail									
1	Potamidae	Kakra	*Sartoriana spinigera*	2.77 ±0.80	2.73 ±0.61	2.54 ±0.53	2.46 ±0.48	240 ±0.40	DD
2	Grapsidae	Common Kakra	*Lobothelphusa wood-masoni*	2.60 ±0.06	2.40 ±0.08	2.33 ±0.05	2.10 ±0.08	1.88 ±0.04	LR
3	Grapsidae	Kakra	*Acanthopotamon martensi*	2.48 ±0.08	2.33 ±0.07	2.12 ±0.06	2.00 ±0.04	1.90 ±0.03	VU
4	Parathelphusidae	Kakra	*Pyxidognathus fluviatilis*	1.08 ±0.03	0.92 ±0.03	0.88 ±0.02	0.82 ±0.02	0.78 ±0.01	LC
5	Parathelphusidae	Kakra	*Austrotelphusa transversa*	1.88 ±0.04	1.72 ±0.05	1.44 ±0.04	1.34 ±0.03	1.22 ±0.01	EN
6	Unionidae	Bivalve	*Lamellidens marginalis*	1.12 ±0.04	1.00 ±0.03	0.90 ±0.02	0.85 ±0.02	0.79 ±0.01	VU
Sub-total:				**11.93 ±0.75**	**11.10 ±0.76**	**10.21 ±0.72**	**9.57 ±0.70**	**8.97 ±0.67**	
Reptiles									
1	Testudinidae	Elongated Tortoise/ Kachhap	*Indotestudo elongata*	0.29 ±0.03	0.22 ±0.02	0.19 ±0.02	0.13 ±0.01	0.09 ±0.01	CR
2	Testudinidae	Asian Giant Tortoise/ Chila Kachhap	*Manouria emys*	0.35 ±0.04	0.32 ±0.03	0.21 ±0.02	0.18 ±0.02	0.11 ±0.01	EN
3	Geoemydidae	River Terrapin /Bodo Kaitta	*Batagur baska*	0.16 ±0.02	0.13 ±0.01	0.09 ±0.01	0.05 ±0.01	0.01 ±0.00	CR
4	Geoemydidae	Painted Roofed Turtile/Dhoor Kachim	*Batagur dongoka*	0.18 ±0.02	0.14 ±0.02	0.11 ±0.01	0.08 ±0.01	0.03 ±0.07	EN
5	Geoemydidae	Oldham,s Leaf Turtile/ Pata Kachim	*Cyclemys oldhami*	0.26 ±0.02	0.20 ±0.02	0.14 ±0.01	010 ±0.01	0.00 ±0.00	E
6	Geoemydidae	SpottedTurtile/ Kala Kachim	*Geoclemys hamiltonii*	0.19 ±0.03	0.14 ±0.02	0.12 ±0.01	0.10 ±0.01	0.07 ±0.01	CR
7	Geoemydidae	Brahminy River Turtile/Kali Kaitta	*Hardella thurjii*	0.30 ±0.11	0.24 ±0.05	0.18 ±0.06	0.13 ±0.02	0.07 ±0.01	EN
8	Geoemydidae	Shila Kachhap	*Melanocheelys tricarinata*	0.30 ±0.02	0.26 ±0.01	0.19 ±0.01	0.15 ±0.01	0.08 ±0.00	EN

9	Geoemydidae	Snail Eating Turtile/ Kali Kachhap	*Melanocheelys trjuuga*	0.40 ±0.02	0.35 ±0.02	0.30 ±0.01	0.10 ±0.00	0.00 ±0.00	E
10	Geoemydidae	Bengal Eyed Turtile	*Morenia petersi*	0.08 ±0.01	0.06 ±0.01	0.05 ±0.01	0.04 ±0.00	0.0 ±0.00	E
11	Geoemydidae	Indian Turtile/ Kori Kaitta	*Pangshura tecta*	0.13 ±0.02	0.10 ±0.01	0.10 ±0.01	0.09 ±0.01	0.07 ±0.01	CR
12	Geoemydidae	Tent Turtile/ Majhari Kaitta	*Pangshura tentoria*	0.07 ±0.01	0.06 ±0.01	0.06 ±0.00	0.05 ±0.01	0.04 ±0.00	EN
13	Trionychidae	Ganges Turtile/ Khalua Kachim	*Aspideretes gangeticus*	0.35 ±0.03	0.32 ±0.02	0.30 ±0.03	0.28 ±0.02	0.16 ±0.01	VU
Sub-total				**3.06 ±0.11**	**2.54 ±0.10**	**2.04 ±0.08**	**1.48 ±0.06**	**0.73 ±0.05**	
			Total	**170.63 ±8.81**	**159.93 ±7.40**	**150.98 ±6.66**	**143.16 ±5.87**	**134.75 ±5.02**	

exploitation and various ecological changes in natural aquatic ecosystem of river and its floodplains, commercially important aquatic lives are in the verge of extinction which is in agreement with the findings of Sarker [24].

The total catch data of the river exhibited a constant sharp decrease during 2015 and 2019. Some of the important native species were noted to be losing their presence. The capture of fishes, crab and reptiles in the river was recorded highest in 2015-16, but decreased considerably in 2017-2018 and the similar situation continued in 2018-2019. Small catfishes and small fishes are dominant groups caught from the river. The observation was similar to the findings of Chakraborty and Mirza [20], Chakraborty [25] and Chakraborty et al. [26,11]. As a result, commercially important three aquatic lives of river were recorded to be disappearing during this short 5 years experimental period.

A decreasing trend in catch of the river was clearly recorded within five years which was similar to the report of Chakraborty and Mirza [19] and Moyle and Leidy [21]. A total of thirteen species of fresh water turtles were found in the Mogra River and its floodplain. Khan [27] reported that *Pangshura tecta* are mainly distributed between the stretches of the Ganges River and the Brahmaputra River. Bengal Eyed turtle, *Morenia petersi* was found in the rivers and its flood plains wetland. Das [28] mentioned its occurrence in Assam of India. *Morenia petersi* was regularly caught by fishermen and expert tribal hunters. Unfortunately, three important species of turtles became rare in their existence as per the catch data, within five years study period.

The population of bivalve, *Lamellidens marginalis* as found in the river and its flood plains has also been decreasing which is considered with the observation of Ali [29] and Chakraborty [25]. During the study period, fresh water pearl bearing mussels (Bivalve, *Lamellidens marginalis*) were identified in the river. Shells of bivalve were utilized by rural people for production of lime which was utilized in aquaculture and agriculture land, and consumed with betel leaves and nuts.

The wildlife comprises amphibians (*Bufo melanostictus*, *Rana tigerina*, *Rana limnocharis*, *Rana cyanophyctis* and *Salamandra salamandra* etc.) aves (whistling duck, great crested grebe, great cormorant, red crested pochard, water cock, swamphen, great black headed gull, gray-headed fish eagle, curlew, spotted redshank etc.) and mammals (musk shrew, fishing cat, small Indian jackal, flying fox etc.) were previously reported by Chakraborty et al. [26].

The study clearly indicates that the aquatic lives of the river were subjected to over exploitation resulting in gradual decline in their catch. The stock of aquatic animals is reducing due to pollution and destructive fishing practices [30,31,11]. Indiscriminate killing of fish occurred due to the use of pesticides in improper doses[6], use of forbidden chemicals, and aerial spray of chemicals as used in paddy field which was very much similar to the observation of Chakraborty [31] and Mazid [32]. Intervention to control floods, adoption of new agricultural technologies and construction of road networks altered the ecology of rivers and its flood plains significantly which supported the views of Khan [33] and Ali [29]. Decreased stock of the wild brood fishes in their breeding ground also resulted in a reduction of biodiversity as noted by Nishat [34], Zaman [35] and Chakraborty [36].

4. Conclusions

To save the stock of aquatic species in the river, a team of local management committee like Hilsa fisheries management technology is needed to develop a working frame-work. The deeper area of the river must be declared as a sanctuary to protect the aquatic lives, stricken enforcement of fish Act-1950 in the river, ensured stopping unplanned construction of flood control embankments, drainage system and sluice gates, conversion of inundated land to cropland (reducing water area); and controlling use of pesticides and agrochemicals in the floodplains of the river can save the ecosystems. The sustained produc-

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tion level from the river will also ensure livelihood of the fishers.

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