The status of the fish diversity of the Turag River, Dhaka, Bangladesh

Sharmin Islam Sathi and Md. Kamrujjaman

DOI: https://doi.org/10.22271/fish.2022.v10.i6a.2747

Abstract
A research study was carried out to assess fish diversity of the Turag River, Dhaka, Bangladesh over a period of January to December 2017. Fish sample was collected from four sampling spots of the Turag River round the year. During this period, a total of 35 fish species under 28 genera, 20 families and 8 orders were recorded. Among the recorded fishes, finfish and shellfish were 97.14% and 2.85% respectively. The dominant order was cypriniformes and family was cyprinidae comprising 34.28% and 28.57% respectively. The abundant, common, moderate and rare species were 3 (8.57%), 5 (14.29%), 8 (22.86%) and 19 (54.29%) in number respectively. Regarding the national status of recorded fishes, threatened, near threatened, least concern and not evaluated species were 22.85%, 11.42%, 62.85% and 2.85% respectively. Again, among the threatened species, 2 species (25%) and 6 species (75%) were recorded as endangered and vulnerable respectively.

Keywords: Fish diversity, abundance, diversity parameter, Turag River

Introduction
River water becomes polluted in many ways and as a consequence diversity of fishes in most of the rivers of our country decreases day by day. High quantities of industrial wastes, petroleum products from ships, launches, cargoes, boats, untreated sewage etc. regularly get dumped into the Buriganga, Turag, Balu and Shitalakshya Rivers, which are already severely polluted (Khan et al., 2007) [1]. Fish diversity of a waterbody represents the fish faunal status and their abundance and river conserves comparatively varieties of fish species which supports commercial fishery. On the other hand, freshwater fishes are one of the most threatened taxonomic groups, because of their high sensitivity to the quantitative and qualitative alteration of aquatic habitats (Laffaille, et al., 2005; Sarkar et al. 2008) [2, 3]. As a consequence, they are often used as bio indicator for the examination of water quality, river network connectivity or flow regime (Chovance et al., 2003) [4]. Gupta et al., 2009 said that their size, community composition and structure often reflect nutrient status of a water body [5]. Fish health may therefore reflect and give a good indication of the status of specific aquatic ecosystem. So, it is inevitable to assess the fish diversity of the respective habitat to know their present status and how their habitat was destroyed as well. The study was done to carry out the assessment about the present status of fish diversity in the Turag River.

Materials and Methods
Study area and period
Four sampling sites were selected to get the available data of fish diversity of the Turag River from January to December 2017. The sampling sites were Gabtoli bridge (23°47′ 3.44″ N, 90°20′8.34″ E), Tamanna park (23°49′ 5.56″ N, 90°20′8.34″ E), Birulia bridge (23°51′ 4.64″ N, 90°20′2.31″ E) and Ashulia bridge (23°53′ 34.61″ N, 90°21′36.43″ E) on the said river (Fig.1).
Sampling procedure
For that research, four sampling sites were selected for getting almost complete record about the available fish species. From each of these sampling sites, fishes were harvested by local fishermen using different types of nets namely, gill nets, seine, cast nets, lift net (dharma jal) and dragnets. Survey was usually done between 7.00 am to 5.00 pm. Data were collected from the direct observation of repeated visits to four sampling sites, personal interview of the fishermen, Focus Group Discussion (FGD). Collected data were cross-checked with the interview of the Upazila Fisheries Officer (UFO). As soon as a new fish species was found, it was collected and immediately photographs were taken prior to preservation in 8-10% formalin containing plastic pots. Fishes were immediately brought to the laboratory for identification. Identifications were done based on keys used by Bhuiyan (1964), Talwar and Jhingaran (1991), Shafi and Quddus (2001) and Rahman (2005), Siddiqui et al. (2007) and IUCN (2015) [6, 7, 8, 9, 10, 11]. The relative abundance of the fish was classified into four categories namely abundant (76-100% of total catch), Common (51-75% of the total catch), moderate (26-50% of the total catch) and rare (1-25% of the total catch) according to Paunikar et al. (2012) [12]. On the other hand, national status of fish was determined according to IUCN Bangladesh (2015) [11].

Diversity parameter
In the present study Shannon-winner diversity index (H), Margalef species richness (d), Pielou's evenness index (J') and Simpson dominance index (c) were evaluated by the following formula:

Shannon-Winner diversity index (H')

\[ H' = \sum [pi x \log (pi)] \]

Where

\( H' \) = Shannon-Weaver index,

\( pi = ni/N \),

\( Ni = \) No. of individuals of a species,

\( N = \) Total number of individuals

Margalef species richness (d)

\[ d = (S-1)/\log (N) \]

Where,

\( S = \) Total species,

\( N = \) Total individuals

Pielou's evenness index (J')

\[ (J') = \frac{H (s)}{H (max)} \]

Where,

\( H (s) = \) The Shannon-Weaver information function,

\( H (max.) = \) The theoretical maximum value for H(s) if all species in the sample were equally abundant,

Simpson dominance index (c)

\[ D = \left( \frac{n}{N} \right)^2 \]

Where,

\( N = \) the total number of organisms of a particular species,

\( N = \) the total number of organisms of all species

Result and Discussion
To fulfill the objectives of the present study, fish diversity of the Turag River was carried out at four sampling spots in three seasons (monsoon, post-monsoon and pre-monsoon) of the said river. During the study period, a total of 35 fish species under 28 genera, 20 families and 8 orders were recorded (Table 1). Among the recorded species, finfish and shellfish were 97.14% and 2.85% respectively. The dominant order was cypriniformes comprising 34.28%. The other orders were Osteoglossiformes (2.85%), Clupiformes (5.71%), Channiformes (2.85%), Siluriformes (5.71%), Pimelodiformes (1.14%) and Characiformes (17.43%).
(22.85%), Perciformes (25.71%), Beloniformes (2.85%) and Decapoda (28.5%). (Table 1 and Fig. 2). On the other hand, there were 20 families recorded as Notopteriidae (2.86%), Clupiidae (2.86%), Clupeidae (2.86%), Engraulidae (2.86%), Channidae (2.86%), Cyprinidae (28.5%), Cobitidae (5.71%), Bagriidae (11.43%), Siluridae (2.86%), Heteropneustidae (2.86%), Pangasiidae (2.86%), Schilbeidae (2.86%), Ambassidae (8.57%), Nandidae (2.86%), Cichlidae (2.86%), Gobiidae (2.86%), Anabantoidei (2.86%), Osphronemidae (2.86%), Mastacembelidae (2.86%), Belonidae (2.86%) and Palaemonidae (2.86%). (Table 1 and Fig.3). The most dominant order and family were Cypriniformes (34.28%) and Cyprinidae (28.5%) respectively.

| Order          | Family             | Scientific name                          | English name            | Local name | Relative abundance | National status |
|----------------|--------------------|------------------------------------------|-------------------------|------------|--------------------|-----------------|
| Finfish        |                    |                                          |                         |            |                    |                 |
| Osteoglossiformes | Notopteriidae     | Notopterus notopterus                     | Grey Featherback        | Foli, Fholui | +                  | VU              |
| Perciformes    | Clupeidae          | Fenulaosa ilisha                         | River Shad, Hilsa Shad  | Ilish, Ilish | +                  | LC              |
|                | Engraulidae        | Gudius alta                              | Indian river shad       | Chapila     | +                  | VU              |
| Cypriniformes  | Channidae          | Chanha puncirata                         | Spotted Snakehead       | Taki, Lata, Lati | + + +              | LC              |
|                | Cyprinidae         | Amblypharyngodon mola                     | Molacarpet              | Mola, Moa   | ++                 |                |
|                |                    | Catla carla                              | Catla, Catla            | +           |                    |                 |
|                |                    | Labeo calbasu                            | Black Rohu, Kalbasu     | Kalibaus, Baus | +                  | LC              |
|                |                    | Labeo rothi                              | Rohu, Rohu Carp         | Rui, Rohit  | +                  |                |
|                |                    | Labeo bata                               | Bata, Labeo             | Bata        | +                  |                |
|                |                    | Cirrhinus reba                           | Reba                    | Tatkini,    | +                  | NT              |
|                |                    | Puntius sarana                           | Olive Berb              | SarPunti    | ++                 | NT              |
|                |                    | Puntius sophore                          | Spotfin Swamp Barb       | Punti, VadiPunti | + + +              | LC              |
|                |                    | Puntius ticto                            | Ticto Barb              | Tit Punti   | +++                | VU              |
|                |                    | Esomus danricus                          | Common Rusbark           | Darkina     | +                  | LC              |
| Cobitidae      |                    | Lepidodephalichthys guntea              | Guntea Loach            | Gutm       | +                  | LC              |
|                |                    | Lepidodephalichthys irrorata            | Lokeria Loach           | Puiya      | +                  | VU              |
| Siluriformes   | Bagriidae          | Mystus cavius                            | Gangetic Mystus         | Golsha      | ++                  | NT              |
|                |                    | Mystus tengara                           | Tengra Mystus           | GhuitaTenga | +                  |                |
|                |                    | Mystus vittatus                          | Stripped Dwarf Catfish   | Tengra      | +++                 |                |
|                |                    | Sperata aor                              | Long Whiskered           | Ayre        | +                  | VU              |
| Heteropneustida | Siluridae          | Wallago attu                            | Boal                    | Boal, Boali | +                  | LC              |
|                |                    | Heteropneustes fossili                  | Striking Catfish         | Shing, Jio  | +++                 |                |
| Pangasiidae    |                    | Pangasius pangasius                     | Pungas                  | Pungas      | +                  | EN              |
| Schilbeidae    |                    | Clupisoma garua                         | GaruaBacha              | Ghaura      | +                  | EN              |
| Ambassidae     |                    | Pseudambassiasi lala                    | Highfin Glassy Perchlet  | LalChanda   | +                  | LC              |
|                |                    | Pseudambassiasi ranga                    | Round Perchlet           | Golchanda   | +                  |                |
|                |                    | Chanda nana                              | Long Perchlet           | Lombchanda  | +                  |                |
| Nandidae       |                    | Nandus nadus                            | Mottled Nandus           | Bheda, Meni | +                  | NT              |
| Cichlidae      |                    | Oreochromis mossambicus                  | Tilapia                 | Tilapia     | +                  | NE              |
| Gobiidae       |                    | Glossogobius giuris                      | Tank Goby               | Bele, Bailla | +++                 | LC              |
| Anabantidae    |                    | Anabas testudinatus                      | The Climbing Perch       | Koi, Kai    | +                  | LC              |
| Osphronemidae  |                    | Colisa fasciata                         | Striped Gourami          | Khaliasha, cheli | +++                |                |
| Mastacembelida |                    | Macrognathus pculus                     | Striped Spinyeel         | GuchiBaim   | +++                 | LC              |
| Beloniforms    | Belonidae          | Xenentodon cancila                      | Freshwater Garfish       | Kakila      | +                  | LC              |
| Shellfish      |                    |                                          |                         |                     |                    |                 |

| Decapoda       | Palaemonidae       | Macrobrachium rude                       | Hairy river prawn       | Kuchachingri | +                  | LC              |

*+=exotic fish; +++=very common, ++=common, +=rare; LC=least concern, NT=near threatened, VU=vulnerable, EN=endangered, NE=not evaluated

Obviously, it seems very poor condition compared to other rivers in Bangladesh and might be due to the worst water quality of river which did not support the diversified fish species. And Bhuiyan (2016) and Hossain et al. (2012) reported of 71 species of freshwater fishes (65 indigenous and 6 exotic species) and 53 species of finfishes respectively from the same river which were more than the present study and some other rivers of Bangladesh [13, 14] (Bhuiyan et al., 2008; Rahman et al., 2012) [15, 16]. But presence of similar number of fish species was also reported in Mahananda River (Mohsin and Haque, 2009) [17], Kamrujjaman and Nabi (2015) [18] found a total of 48 fish species in the Bangshi River which was more or less similar to the present findings. However, Ahmed and Akter (2008) found 35 species of fish in the Titas River which coincides with the present study [19]. Diversity of fish of the present study indicated the poor status of fish diversity both qualitatively and quantitatively. On the other hand, Bhuiyan (2016) recorded 9 orders and 25 families in the Turag River which were somewhat higher than the present study [13]. Kamrujjaman and Nabi (2015) observed 18 families and 8 orders in the Bangshi River which were more or less similar to the present findings [18]. Present status of fish diversity in the Turag River was obviously for the habitat destruction due to continuous discharge of untreated industrial effluents from surrounding industries as well as municipal discharge from Dhaka city.

~ 36 ~
Fig 2: A graphical presentation of the percentage of recorded orders of fish species found in the studied area during the study periods.

Fig 3: A graphical presentation of the percentage of families of fish species found in the studied area during the study periods.

Relative abundance of recorded fish
Among the recorded 35 species, 3 species (8.57%) were abundant. Those were *Puntius sophore*, *Heteropneustes fossilis* and *Macronogathus panchalus*. On the other hand, the common, moderate and rare number of species were 5 (14.29%), 8 (22.86%) and 19 (54.29%) respectively (Table 1). Kamrujjaman and Nabi (2015) reported that a maximum of 29 species were rare, whereas, only 3 were very common and 16 were common in the Bangshi River. These findings were more or less similar to the present study. Ali* et al.* (2014) also stated availability of 10 species throughout the year, 12 species throughout the year in small quantities but, 7 species throughout the year in large quantities. However, rare and very rare species were recorded as 8 and 15 species respectively in the Chitra River.

National status of recorded fish
According to IUCN (2015), among the recorded 35 species of fish, threatened, near threatened, least concern and not evaluated species were 22.85%, 11.42%, 62.85% and 2.85% respectively (Fig. 4). Again, among the threatened species, 2 species (25%) and 6 species (75%) were endangered and vulnerable respectively. But, no critically endangered species were recorded during the study periods (Fig. 5). This observation was not a good indication of the current status of this river which suggested immediate conservation strategy to protect the species diversity. Bhouiyan* et al.* (2016) reported of 5 critically endangered, 9 endangered and 12 vulnerable species among the 65 species of recorded fish in the Turag River according to IUCN (2000). Kamrujjaman and Nabi (2015) founded 25 (52.08%) species were threatened out of the recorded 48 species in the Bongshi River. Among the threatened fish species vulnerable, endangered, critically endangered species were 05 (20%), 09 (36%) and 11 (44%), respectively. Pramanik* et al.* (2017) reported of 20% threatened fish species in the Meghna River in which 11 species (10.28%) were found as Vulnerable (VU), 8 species (7.48%) as Endangered (EN) and 2 species (2%) as Critically Endangered (CR) according to IUCN (2015). The percentage of threatened fish more or less supported the present findings.
Diversity, richness, evenness and dominance index

In the present study, Shannon-Winner diversity index (H’) indicated the highest (2.49) and lowest (0.53) value was in the month of June and of December respectively. H’ value of fish diversity is 5-4 indicating very good quality, 4-3 good quality, 3-2 moderate quality, 2-1 poor quality and very poor quality <1 (Mishra et al., 2010). So, present findings revealed that fish diversity remained moderate in quality only in the month of June (2.49) and July (2.04), in poor quality between January to May and August to October (Fig. 6). However, it became of a very poor quality in November (0.69) and December (0.53). Most of the fish species were available in the monsoon compared to other seasons as the river water volume increased during the monsoon and water quality of the river was suitable to fish. But, in other seasons especially in dry seasons, water volume became reduced and water turned peach black in colour in some area and destructed the fish habitat. These phenomena were not common to the other normal rivers of Bangladesh. Hossain (2012) found Shannon diversity index values high in December (3.14) and low in April (2.78) [22]. According to the study of Galib et al. (2013), Shanon Winner diversity index was ranged from 3.427 (June) to 3.818 (December) in the Choto Jamuna River. These results were completely reverse of the present findings [23]. However, Ruma et al. (2017) stated maximum (3.517) H’ value in July and minimum (3.011) in March which was more or less similar with the present investigations [24].
In the present study, the Margalef richness index (d) ranged from 0.83 (in December) to 3.6 (in June) which indicated the river had healthy to poor-quality food chains (Fig. 7). Healthy food chain retained from June to August. But, rest of the months this value decreased and was worst from November to December. Rahman (2017) described that Margalef’s index (d) was 5.13 for species available in the Agunmukha River that was higher from the present study. Hossain (2012) found highest Margalef richness value 6.75 during March whereas, lowest value 6.10 during November [22]. According to Galib (2013), Margalef richness index ranged from 6.973 (June) to 8.932 (November) in Choto Jamuna River [23]. These results were not similar to the present study. However, Ruma et al. (2017) reported maximum richness from July to September and minimum in March which more or less supported the present observation [24].

On the other hand, the values of Evenness (E) usually ranged from 0 to 1 (Rahman et al., 2015 and Krebs, 1999) where the closer to 1, the more even the populations of fish that form the community [25, 26]. In present study, the evenness value found almost closer to 1 (0.71 to 0.91) during January to October which indicated very few or no dominating species in the Turag River (Fig. 8). However, in the month of November to December indicated the dominating species in the said river. Hossain (2012) described highest evenness value as 0.686 in November and lowest as 0.350 in April [22]. Galib (2013) found evenness index ranged from 0.891 (July) to 0.936 (December) in the choto Jamuna River which were not supported by the present findings [23]. However, Ruma et al. (2017) stated maximum (0.752) in March and minimum (0.616) in September which was more or less similar to the present findings [24].
Again, dominance index (D) value ranged from 0 to 1. 0, represents no dominance/complete diversity and 1, represents complete dominance/no diversity (Rahman et al., 2015). In the Turag River it was shown that the river had very few dominated fish species thus with higher diversified fish community structure in April to August (Fig. 9) [16]. However, it remained moderate from January to March and September to October. But there was no diversity in November to December. Hossain (2012) found highest monthly dominance diversity index value was 0.102 during March and lowest value was 0.062 during December [12]. Ruma et al. (2017) reported ranged between 0.043 and 0.048 [24]. These finding were not supported by the present study.

**Conclusion**

Bangladesh being an economically rising country, life and river are closely interrelated for their fishery, agriculture, navigation and even sanitation development. Present study revealed that the fish diversity of the Turag River was not the up to the mark. This river is currently experiencing severe water pollution due to discharge of untreated industrial effluents from the surrounding industries, municipal discharge and various anthropogenic activities which destroying the fish habitat. It was evident from the present study that the fish is the worst victim in this said river. Study and conservation of fish diversity is essential to maintain ecological or nutritional and socio-economic equilibrium. Therefore, proper management and maintenance of river is important not just because of their crucial role in maintaining ecological balance but to increase fisheries production as well as to provide livelihood for the fishermen who are dependent on the Turag River.

**References**

1. Khan MAI, Hossain AM, Huda ME, Islam MS, Elahi SF. Physico-chemical and biological aspects of monsoon
waters of Ashulia for economic and aesthetic applications: preliminary studies. Bangladesh Journal of Science and Industry Res. 2007;42(4):377- 396.

2. Laffaille PA, Acou J, Guilouet, Legult A. Temporal change in European eel, Anguilla anguilla, stock in a small catchment after installation of fish passes. Fisheries Management and Ecology. 2005:12:123-129.

3. Sarkar UK, Pathak AK, Lakra WS. Conservation of freshwater fish resources of India: new approaches, assessment and challenges. Biodiversity and Conservation. 2008;17:2495-2511.

4. Chovanec A, Hoffer R, Schiemer F. Fish as bioindicators. In: Market BA, Breure AM, Zechmeiser HG (eds) Bioindicators and biomonitors; c2003. p. 639-679.

5. Gupta A, Rai DK, Pandey RS, Sharma B. Analysis of some heavy metals in the riverine water, sediments and fish from river Ganges at Allahabad. Environ Monito Assess. 2009;157:449-458.

6. Bhuiyan AL. Fishes of Dacca. Asiatic society of Pakistan, Dacca: c1964. p. 148.

7. Talwar PK, Jhingaran A. Inland fishes of India and adjacent countries, vol. I & II, Oxford and IBH Publishing Co. New Delhi; c1991. p. 1158115-6.

8. Shafi M, Quddus MMA. Bangladesher matshaw sampad (Bangla). Kabir Publications, Dhaka; c2001. p. 485.

9. Rahman AKA. Freshwater fishes of Bangladesh. 2nd edn., The Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, Dhaka; c2005. p. 485.

10. Siddik M, Chaklade M, Hani M, Islam M, Sharker M. Stock Identification of Critically Endangered Olive Barb, Puntius sarana (Hamilton, 1822) with Emphasis on Management Implications. J. Aqua. Res. Dev. 2016;7:411.

11. IUCN Bangladesh. Red List of Bangladesh Volume 5: Freshwater Fishes. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh; c2015.p. xvi+360.

12. Pramanik MH, Hasan MM, Biswas S, Hossain A, Biswas TK. Fish biodiversity and their present conservation status in the Meghna River of Bangladesh. International Journal of Fisheries and Aquatic Studie. 2017;5(1):446-455.

13. Bhouriyan NA, Baki MA, Sarkar A, Hossain MA. Inventory of Ichyofaunal Diversity, Fishing Gear and Craft in the Turag River, Dhaka, Bangladesh. Fisheries and Aquaculture Journal. 2016;7(2):1-6.

14. Hossain MD, Rahman MM, Chandra JB, Shammi M, Uddin MK. Present Status of Water Quality of The Bangshi River, Savar, Dhaka, Bangladesh. Bangladesh Journal of Environmental Research. 2012;10:17-30.

15. Bhuiyan SS, Joadder MAR, Bhuiyan AS. Occurrence of fishes and non-fish species of the River Padma near Rajshahi, Bangladesh. Univ. J. Zool. Rajshahi Univ. 2008;27:99-100.

16. Rahman AKML, Islam M, Hossain MZ, Ahsan MA. Study of the seasonal variations in Turag river water quality parameters. African Journal of Pure and Applied Chemenistry. 2012;6(10):144-148.

17. Mohshin ABM, Haque E. Diversity of Fishes of Mahananda river at Chapai Nawabgonj district. Res. J. Bio. Sci. 2009;4(7):828-831.

18. Kamrujjaman M, Nabi MR. Ichthyodiversity of the Bangshi River, Savar, Dhaka. Jahangirnagar University J. Biol. Sci. 2015;4(1):19-25.

19. Ahmed MDS, Akther H. Brush and Vegetation Park Fishery in the River Titus, Brahmanbaria, Bangladesh. South Pacific Studies. 2008;29(1):63-71.

20. Ali M, Hossain B, Minar M, Rahman M, Sharmeem, Islam S. Socio-Economic Aspects of the Fishermen of Lohalia River, Bangladesh. Middle-East Journal of Scientific Research. 2014;19(2):191-195.

21. Pramanik MH, Hasan MM, Biswas S, Hossain A, Biswas TK. Fish biodiversity and their present conservation status in the Meghna River of Bangladesh. International Journal of Fisheries and Aquatic Studies. 2017;5(1):446-455.

22. Hossain MS. Fish diversity and habitat relationship with environmental variables at Meghna river estuary, Bangladesh. Egyptian Journal of Aquatic Research. 2012;38:213-226.

23. Galib SM, Naser SMA, Mohsin ABM, Chaki N, Fahad MFH. Fish diversity of the river Choto Jamuna, Bangladesh: Present status and conservation needs. International Journal of Biodiversity and Conservation. 2013;5(6):389-395.

24. Ruma M, Hossain MM, Rahman MB, Nahar A, Siddik MAB. Fish Community Structure of Sandha River: A Link Analysis towards Fisheries Management and Conservation. J. Bio. & End. Sp. 2017;5(3):192-198.

25. Rahman MB, Hoque MS, Hasan MM. Selectivity of fishing gears and its effects on fisheries diversity of Rabnabad Channel of Patuakhali District in Bangladesh. Academic Research International. 2015;6:184-196.

26. Krebs CJ. Ecological Methodology, 2nd Edn. Addison Wesley Longman. University of British Columbia, Vancouver; c1999. p. 10-11.