Research Article

Biodiversity Assessment of Indigenous Fish Species in the Surma River of Sylhet Sadar, Bangladesh

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Authors' Contributions
MAC and MAK performed surveys, data treatments and prepared the manuscript. MTR, SHTS and AR collected the data and reviewed literature. MAH designed and supervised the study, analyzed the data and revised the manuscript.

Abstract | One year long study was executed from August 2016 to July 2017 to identify the present status of fish species diversity of Surma River at Sylhet Sadar, Northeast Bangladesh. A total of 51 fish species belonging to 16 taxonomic families has been identified. The most abundant family was recorded as Cyprinidae covering 36%, while the least abundant family was Gobidae and Plotosidae comprising 1%. A Shannon-Weaver diversity index was fluctuated between 2 to 2.5 with mean value 2.30±0.14, which reveals exposer to light pollution in study area. The peak Pielou's evenness index value was 2.2 in April and the lowest value 1.47 in July with mean value 1.93±0.23. Maximum value of Simpson dominance index is 7.98 in August and minimum value 5.32 in October with mean value 6.99±0.86. The catch per unit effort ranged from 0.15 to 0.48 with an average value of 0.34±0.11.

Introduction

Sylhet is the northeast part of Bangladesh, which endowed with a lot of commercial and diversified freshwater fisheries resource (Das *et al., 2017*). Surma river is the lifeline of Northeast Bangladesh, which travelled a long path from the Manipur state of India (Rahman *et al., 2018*). This river plays a significant role to the fisheries communities as well as other community's livelihood of this area (Joadder, 2008). Bangladesh constitutes the third largest fish biodiversity in Asia, following by China and India, with harboring almost 800 species of fishes (Hussain and Mazid, 2001). The freshwater fisheries resources of Bangladesh thought to be very rich and diverse and considered to accommodate at least 265 species of finfishes (Rahman, 2005). Fish are healthiest, easily digestible and protein rich food item for poor and low income group of people in this geographic location (Khan *et al., 2013*; Hossain *et al., 2015*). They are much sensitive to ecological changes and their diversity in a wide range of tolerance at different level represents the health status of an ecosystem (Pielou, 1996). The current study was aimed at assessing the diversity of indigenous fish species in the Surma river at Sylhet Sadar, Bangladesh. The basic findings of the present study will be very helpful to undertake management and development policies for freshwater resources conservation

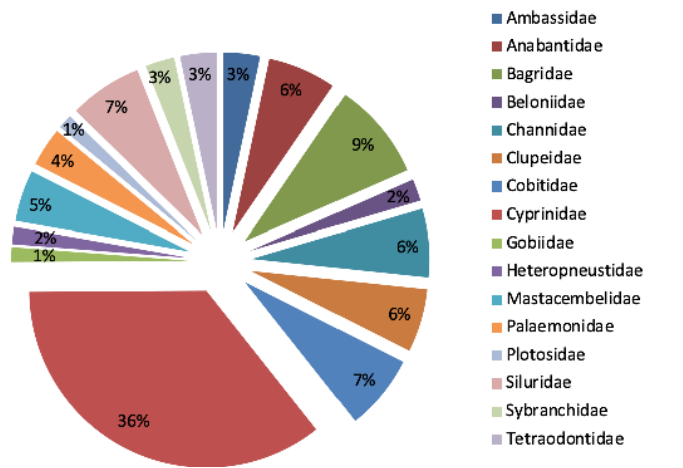**Corresponding Author:** Mohammad Amzad Hossain
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Materials and Methods

Study area

The research was conducted throughsurvey and discussion among resource users in Surma river throughout 9(nine) villages named Chorugaon, Goripur, Gupal, Hydorpur, Pirpur, Shahpur, Shekhpara, Shahebergaon, Tukergaon of Sylhet Sadar under Sylhet district of Bangladesh (Figure 1). Length of study area is 9.65606km (from mouth of Bashia river to mouth of Gualichara).

Figure 1: Overview of the study area in Sylhet Sadar Upzilla, Northeast Bangladesh (map adopted from https://www.thebangladesh.net/upazilas-of-sylhet/sylhet-sadar-upazila.html)

Sampling

During the time of study period, frequent field visits were made twice in a month. Field data were collected from different fishing zones, fish landing centers and fisherman's interview. Primary data were collected from 35 randomly selected fishers through semi-structured questionnaire interviews and different levels of focus discussion group including leaders of fisher community and fish traders.

Diversity analysis tools

This study evaluates the diversity of fish species by Shannon-Weaver index (*H'*) (Shannon and Weaver, 1949), evenness by Pielou's index (*J'*) (Pielou, 1966), dominance by Simpson index (Simpson, 1949) and Catch Per Unit Effort (CPUE).

Shannon-Weaver 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)

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)

$$C = \sum_{i=1}^{s} (ni/N)_2$$

Where, n_i = number of individuals in the 'each' species, N = total number of individuals, S = total number of species.

Calculation of catch per unit effort

The CPUE has been calculated by using following formula (Ghosh and Biswas, 2017):

CPUE (g/h or n/h) = (TSGCB or TSGCN) ÷ TSEH

Where total sampling effort hours (TSEH)=SEHPD (sampling effort hours/day/gear) x SGD (sampling gear density), g = gram, n = number, h = hour.

Statistical analysis

After collecting the questionnaire interviewed data, data were analyzed using Microsoft office excels 2007,R Statistics.

Results and Discussions

Finfish species assemblage in Surma River

A total 12 months long study recorded that the presence of 51 fish species under 16 taxonomic families (Figure 2). The most abundant family was Cyprinidae covering 36% and found as dominant all through the year. Others includes Bagridae 9%, Cobitidae 7%, Siliuridae 7%, Channidae 6%, Clupidae 6%, Anabantidae 6%, Mastecembalidae 5%, Palaemonidae 4%, Synbranchidae 3%, Tetraodontidae 3%, Ambasiidae 3%, Heteropneustidae 2%, Belonidae 2%, Gobidae 1% and Plotosidae 1%.

Present study was supportive to the previous findings of Maria *et al.* (2016) while they enlisted 79 fish species in Sylhet Sadar, Bangladesh. Hossain *et al.* (2017) recorded 74 fish species belongs to 22 families in in Kusiara River (Fenchungonj Upazilla), Northeast Bangladesh. A research by Iqbal *et al.* (2015) reported the presence of 37 fish species belonging to 7 orders in Konoskhaihaor, Sylhet, while Warne (2005) reported 107 fish species in freshwater the same *Hakalukihaor*, and Haroon *et al.* (2002) encountered 92 species of fish from Sylhet Mymensingh sub-basins.

Figure 2: Family based fish diversity in Surma River (Sylhet Sadar Upazilla), Northeast Bangladesh.

Diversity indices of fish species

Shannon–Weaver diversity index (H')

Shannon-Weaver diversity index swing in between 2to 2.5 exhibited in (Figure 3). Mean value (2.30±0.14). Lowest mean evenness value is 2.0 (in October) and the highest value 2.5 (in June). There is no significant difference found (P>0.05).
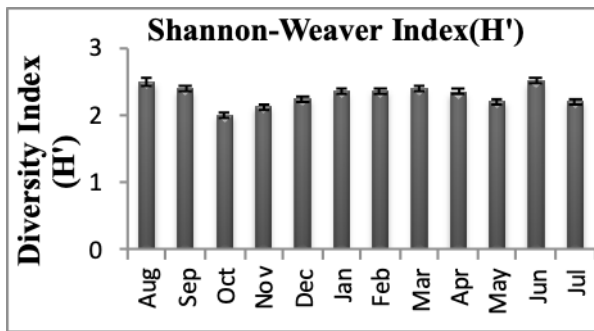

Figure 3: Shannon-Weaver diversity index (H') in Surma River (Sylhet Sadar Upazilla), Bangladesh.

Table 1: Shannon-Weaver index (H') and pollution level given by Biligrami (1988).

Shannon-Weaver diversity index (H')	Pollution level	Values found (Range)
3.0-4.5	Slight	2.0-2.5
2.0-3.0	Light	
1.0-2.0	Moderate	
0.0-1.0	Heavy	

Pielou's evenness index (J')

The highest evenness value is 2.2 (in April) and the lowest value 1.47 (in July) exhibited in (Figure 4). Mean value (1.93±0.23). There is no significant difference found (P>0.05).

Simpson dominance index (c)

Maximum value 7.98 (in August) and minimum value 5.32 (in October) showed in (Figure 5). Mean val-

ue (6.99±0.86). There is no significant difference found (P>0.05).
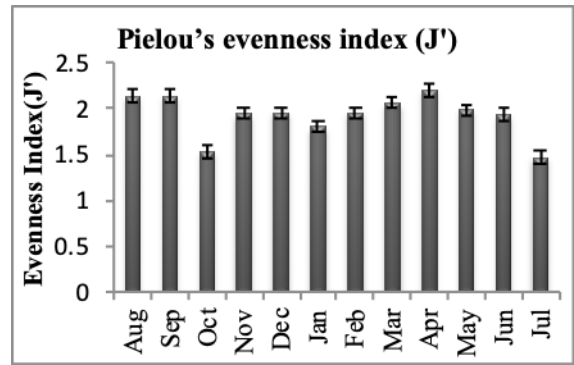
Figure 4: Pielou's evenness index (J') in Surma River (Sylhet Sadar Upazilla), Northeast Bangladesh
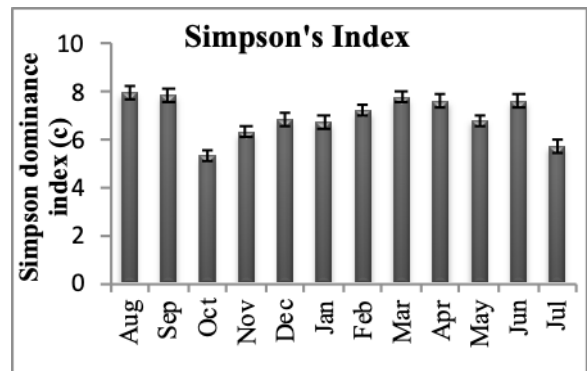
Figure 5: Simpson dominance index (c) in Surma River (Sylhet Sadar Upazilla), Northeast Bangladesh

Catch per unit effort (CPUE)

The month of November showed the minimum value of 0.15 and the month of June showed the maximum value of 0.48 as shown in Figure 6. Average mean value of CPUE is 0.34±0.11.
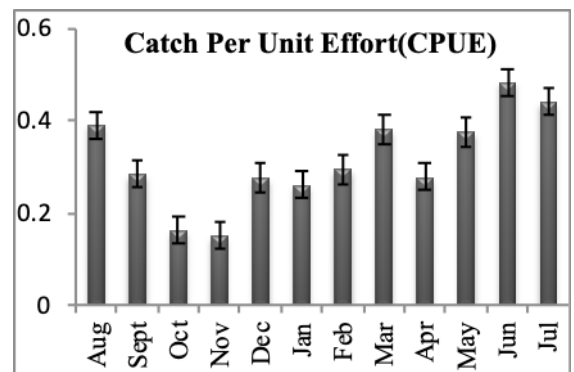

Figure 6: Catch Per Unit Effort (CPUE) in Surma River (Sylhet Sadar Upazilla), Bangladesh

Biodiversity indices represent the diversity of community through an assigning numerical value (Magurran, 1988). The fluctuations in hydrological and meteorological parameters are the primary factor for variation in fisheries communities (Young and Potter, 2003). Biodiversity index of an ecosystem are influenced by season, nutrients, species

coexistence (Huh and Kitting, 1985), atmospheric and environmental features (Keskin and Unsal, 1998), migrations, mortality and recruitment ration (Ryer and Orth, 1987). Fishes are now being widely using as sentinel organism to characterize the health status of aquatic ecosystem (Vijaylaxmi *et al.*, 2010). Iqbal *et al.* (2015) estimated H´ value for Hakalukihoar between 1.8 to 3.40, while Hossain *et al.* (2017) founded H´ value between 2.07 to 2.41 in case of Kusiara river of Northeast Bangladesh. Following the Biligrami (1988) recommendation, better condition of water body for fish diversity assigned at Shannon-Weaver diversity index ranged from 3.0-4.5. Present research reveals the H value ranged as 2.0-2.5, which prove the study area is slightly polluted. The Simpson's dominance index (C)had been oscillated between 2.78-7.23 for Kusiara river (Hossain *et al.*, 2017), while between 0.064 to 0.0133 on Bishkhali river, Bangladesh (Rahman *et al.*, 2016).The Pielou's evenness was fluctuated between 0.79- 0.9 for Surma River (Iqbal *et al.*, 2015), 0.99-1.15 for Kusiara river (Hossain *et al.*, 2017) and 0.36-0.76 for Halda river, Bangladesh (Jannatul *et al.*, 2015). In this study, the highest Pielou's evenness was reported as 2.2 (in April) and the lowest value 1.47 (in July).The catch per unit effort CPUE in the Surma river found higher in the Monsoon Season (July to September) and lower in the Post-Monsoon Season (October to November). The value of CPUE is varied according to the season, water depth and type of gear used. Ghosh *et al.* (2017) showed that CPUE become lower during monsoon and post-monsoon seasons in oxbow lake in eastern India.Clinical wastage, domestic discharge, turbidity, sewage, waste runoff, poor water quality and extensive chemical usages in aquaculture are the major causes of diversity degradation in wild environment (Faruk *et al.*, 2005; Uddin *et al.*, 2017). Intensive harvesting, habitat destruction, alternation of reduced water flow, increasing anthropogenic activities on wetlands are considered as major threats for aquatic species diversity (Chaklader *et al.*, 2014; Hossain *et al.*, 2015).

Conclusion

Declined trend on abundance of fish species is being alarming due to overfishing, siltation, industrial water discharge, use of illegal fishing gear, lack of sanctuary management, wastage of municipals. Moreover, political and capitalist influence is unworthy for the fisheries resources as well as threatening to the local small-scale fisherman of the study area. So, sanctuary establishment and management, restriction on use of illegal fishing gear and overfishing, waste management can be very much supportive measures to the protection and conservation for the biodiversity of endangered fish species in the Surma river.

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