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Original Article

Diversity of indigenous fish species in *Konoskhaihaor*, Northeast Bangladesh

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Abstract

The present study was executed to assess the indigenous fish assemblage of *Konoskhaihaor* for 9 months from May 2014 to January 2015. The *Konoskhaihaor* area covers 104.50 acres of land containing 6 small to large beels. In the monsoon the haor remains under water. A total of 37 fish species belonging to 7 orders including prawns were identified. Among the 37 species 5 were vulnerable, 7 endangered, 1 critically endangered, 3 exotic, 20 not threatened and 1 not evaluated according to IUCN, Bangladesh, 2000. The Shannon-Weaver diversity index was found highest (3.12) in June and lowest (2.9) in January. Margalef richness index was found highest (3.02) in July and lowest (2.70) in December. On the other hand, Pielou's evenness index was lowest (0.82) in three successive months i.e., in October, November and January and highest (0.88) in April. The fish species of *Konoskhaihaor* found to be evenly distributed. Simpson dominance index were found to be highest (0.94) in April and lowest (0.91) in January. The diversity indices only evenness index was found to be significant (<0.05) among the months. It revealed from the survey that 8 indigenous species which were previously available but not found for 3 to 12 years in the study area. As 5 vulnerable, 7 endangered and 1 critically endangered fish species were available in the study area that is why it is needed to be conserved these species *in situ* to keep for the use of future generation.

Key words: *Konoskhaihaor,* indigenous fish species, biodiversity, northeast Bangladesh

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INTRODUCTION

Bangladesh is the fourth largest producer of inland fisheries in the world, after China, Myanmar and India (FAO, 2014). According to (DoF, 2014) total fish production in Bangladesh was 34.10 Lakh metric tons. Fish is an excellent source of protein and an important item in the diet of the people of Bangladesh (Pearson and Musummuddin, 1968). Fish muscles are as an easily digestible, rich source of animal protein (Khan *et al.*, 2013, Islam, 2001) and contain low carbohydrates (Lagler *et al.,* 1976).

Fishes are considered as good resources to poor and low income groups in terms of nutrition and economics (Hossain *et al.,* 2015). Extensive use of chemicals, fertilizers and insecticides have been ruining natural breeding and feeding grounds, exploitation of wild brood fishes are major causes of decreasing fish availability (Azher *et al.,* 2007; Ahmed *et. al*., 2004). Among 260 freshwater fish species 56 species are critically endangered, endangered or vulnerable (IUCN, 2000). A haor is a wetland ecosystem with a bowl or saucer shaped shallow depression (Alam, 2004; Bio-ecological Zones of Bangladesh, 2002; Bennett *et al.,* 2007) and constitutes size from a few to several thousand hectares (Bio-ecological Zones of Bangladesh, 2002; Alam and Hossain, 2007).

The *Konoskhaihaor* area of approximately 104.50 acres is located at Dowarabazar upazilla in Sunamgonj district and surrounded by about 7 villages named Tengratila, Ajobpur, Shantipur, Buzhna, Nondigaon, Kadamtoli and Nurpur under the

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Surma union. The *Konoskhaihaor* is connected to Surma river by Khasiamarariver and some other canals. The Surma and Khasiamara river are the main source of water in the haor (Government land office, 2002).

MATERIALS AND METHODS

Study area

The research was accomplished in Dowarabazar upazila, under Sunamganj district, Sylhet, Bangladesh. It is located at 25.0500°N and 91.5667°E. The total area 281.4 km² and bounded by Meghalaya State of India and boarder on the north, and Chattak upazilla on the south and east, Sunamgonj district on the west. Its main rivers are Surma, Jadukata *etc.*

Sampling

Frequent field visits (2-3 times in a month) were made during the time of study period. Data collection program was done at fishing grounds and fish landing centers in respect of the types and amount of indigenous fish species harvested at each field visit and types of fishing gears used to catch them in the *Konoskhaihaor*. During the field survey, different areas of the haor, harvesting spots and few market spots were visited to delineate the veritable population configuration.

Diversity analysis

In the present study, diversity of fish species were evaluated by dint of Shannon-Weaver index (*H'*) (Shannon and Weaver, 1949), species richness by Margalef index (*d*) (Margalef, 1968), evenness by Pielou's index (*J'*) (Pielou, 1966), and dominance by Simpson index.

Shannon-Weaver diversity index (H')

$$H' = - Sum[pi \times \log (pi)]$$

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)

$$C = \sum_{i=1}^{s} (ni/N)^2$$

Where,

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

Statistical analysis

A one way analysis of variance (ANOVA) in SPSS was used to test the significant difference in diversity indices among the months. For ANOVA test SPSS software V15.0 (Statistical Package for Social Sciences) was used. All the multivariate analyses were performed by the software PRIMER V6 (Plymouth Routines Multivariate Ecological Research) (Clark and Warwick, 1994).

RESULTS AND DISCUSSIONS

Fish species assemblage in *Konoskhaihaor*

A total of 37 fish species have been recorded from the study site representing 7 orders.

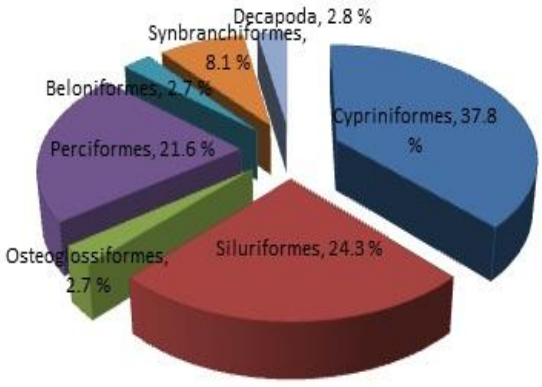

Figure 1: Order-based fish species diversity in *Konoskhalihaor*, Northeast Bangladesh

The dominant order in terms of species was Cypriniformes comprising 37.8% (with 14 species) of all the number of species recorded followed by Siluriformes constituting 24.3% (with 9 species), Perciformes 21.6% (with 8 species) and others contributed the rest (Fig.1). Based on the individuals caught, the most dominant species was *P. tictoc*omprising 18.4% of the total catch followed by *O. cotio* and *P. sarana* (11.8%), *E. danricus* (4.63%), *G. giuris* (3.62%) and so on. Among the observed fishes, 35.14% species were threatened in Bangladesh according to IUCN, Bangladesh (2000).

FISH SPECIES DIVERSITY INDICES

Shannon-Weaver diversity index (H')

The Shannon-Weaver diversity index (*H'*) oscillated from 2.9 (in January) to 3.12 (in June) showed in (Fig. 2) with mean value of (3.0±0.007). No significant difference was observed among the seasons (*F*= 1.907; *P* = 0.228).

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

Shannon-Winner Diversity index(H')	Pollution level	Values found (Range)
3.0-4.5	Slight	2.9-3.12
2.0-3.0	Light	
1.0-2.0	Moderate	
0.0-1.0	Heavy	

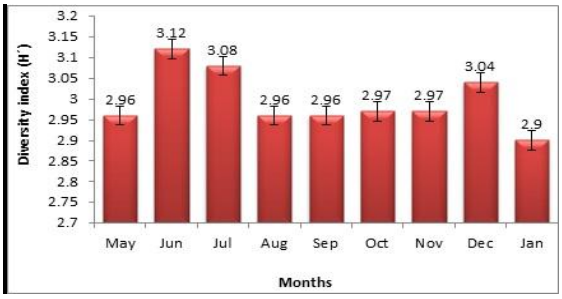

Figure 2: Shannon-wiener diversity index (H') in different months

Margalef richness index (d)

The tiniest Margalef richness index was witnessed in December (2.7) and utmost in July (3.02) presented in (Fig. 3) with mean value of (2.81±0.10). Differences observed among the seasons were non-significant (*F*= 3.27; *P* = 0.110).

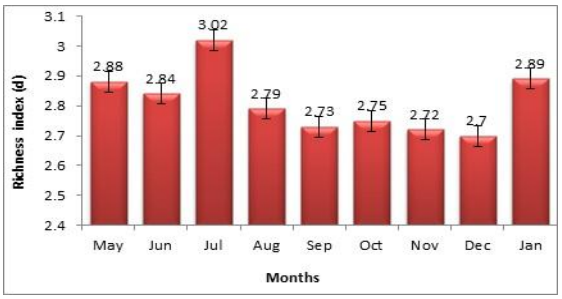

Figure 3: Margalefspecies richness (d) in different months.

Pielou's evenness index (J')

The peak mean evenness value (0.88) was encountered in June and bottommost (0.82) in October, November and January exhibited in (Fig. 4) with mean value of (0.84±0.02). Significant difference was observed among seasons (*F*= 5.88; *P* = 0.039).

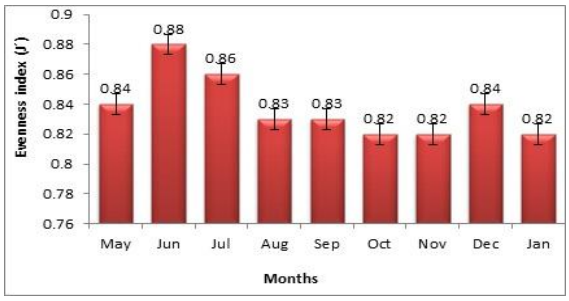

Figure 4: Pielou's evenness index (J') in different months

Simpson dominance index (c)

The uppermost mean dominance value (0.94) was observed in June and lowest (0.91) in January revealed in (Fig. 5) with mean value of (0.92±0.009). Seasonal variations were negligible throughout the study period (*F*1.50; *P* = 0.296).

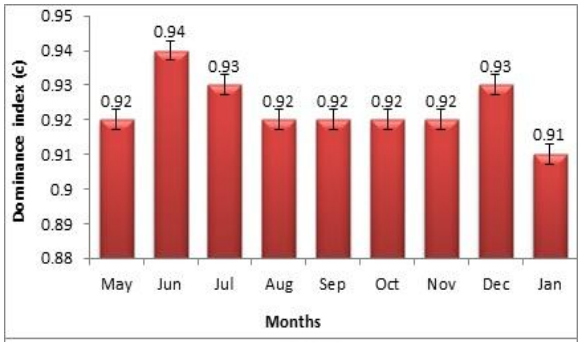

Figure 5: Simpson dominance index (c) in different months.

Fish species diversity richness of the *Konoskhaihaor*was very low except evenness and dominance. Belaluzzaman (1995) recorded 'H' as 1.017534-4.6494 from the *Bakkhali* river estuary, Cox's Bazar which support the present statement. The minimum Margalef's species richness value (5.536) was observed during summer while the maximum value (6.4) was found during winter which does not support the present findings. Islam (2005) recorded the Margalef's index ranging from 0.110 to 0.444 during the monsoon period in the Buriganga river estuary, which was less than the present study. Margalef's Index (Max) is dependent on sample size (Nair *et al.,* 1989).

The Margalef's Index may deviate from actual diversity value to some extent because it does not confound the evenness and species richness value properly (Nair *et al.,* 1989). This may occur as a result of reduced water depth due to lack of rainfall, which disturbed fishermen to employ their fishing gears more effectively. Biligrami (1988) recommended better condition of water body for fish diversity when Shannon-Weaver diversity index ranged from 3.0-4.5. But in the present study diversity index was ranged from 2.90-3.12. That's mean the water body is light to slightly polluted. This may be due to domestic discharge, poor water quality and different insecticides and pesticides from the adjacent lands. So it is felt that, the condition of the water body is not good and needs to make rules and regulations for better management of the water body.

Availability of threatened fishes in Konoskhaihaor

Fishermen of *Konoskhaihoar* mainly harvest fish throughout the year except February to April and rest three months fishing remain stop due to diminution of water level and the haor converted in the agricultural land.

Table II: Status and percentage of fish species found in the study area.

Status	No. of species	Percentages (%)
Vulnerable	5	13.51
Endangered	7	18.92
Critically Endangered	1	2.7
Exotic	3	8.11
Not Threatened	20	54.06
Not Evaluated	1	2.7
Total	**37**	100

A total of 13 threatened fish species including 5 vulnerable, 7 endangered and 1 critically endangered was recorded during the investigation period. Among the total encountered species, 13.5% were vulnerable, 18.9% endangered and 2.7% critically endangered (Table II).

Biodiversity status of vulnerable fish species

Among vulnerable fish species in study area Tit punti (*P. ticto*) contributing highest percentage 18.4% (on the basis of total individuals encountered in the study area), Lambachanda (*C. nama*) 3.53%, Tara baim (*M. aculeatus*) 2.26% Foli (*N. notopterus*) 0.7% and Ayre (*S. aor*) 0.03% of the total biomass, showed in Fig.6.

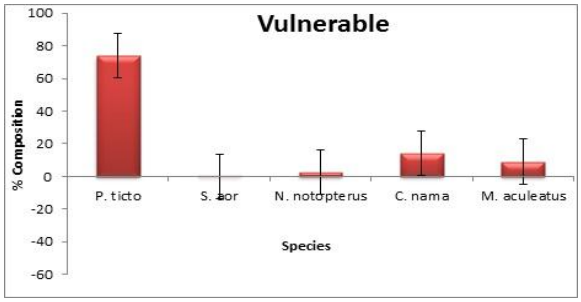

Figure 6: Vulnerable fish species composition of*Konoskhaihaor*, Northeast Bangladesh

Biodiversity status of endangered fish species

Among endangered catfish species in study area Dhela (*O. cotio*) contributing highest percentage 11.8% (on the basis of total individuals encountered in the study area) followed by Darkina (*E. danricus*) 4.63%, Gonia (*L. gonius*) 3.09%, Rani (*B. dario*) 2.38%, Gozar (*C.marulius*) 1.61%, Shalbaim (*M.armatus*) 1.41% and Bata (*L. bata*) 0.07% of the total biomass found in the study area showed in Fig. 7.

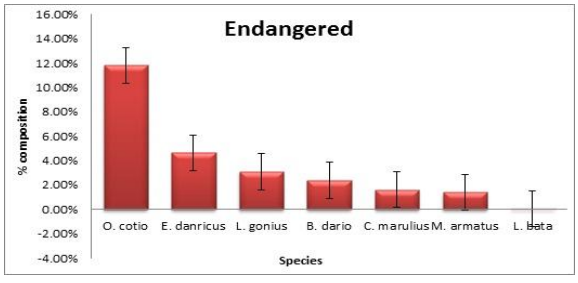

Figure 7: Endangered fish species composition of *Konoskhaihaor*, Northeast Bangladesh

Biodiversity status of critically endangered fish species

Only one critically endangered fish species Sarpunti (*P. sarana*) which comprised 11.8% of the total biomass was recorded from the study area during the entire study period.

Biodiversity status of exotic fish species

Three exotic fish species namely Carpio (*C. carpio*) comprising 2.22% followed by Tilapia (*O. mossambicus*) 1.4% and Grass carp (*C. idella*) 0.07% of the total biomass was recorded from the study area during the entire study period (Fig. 8).

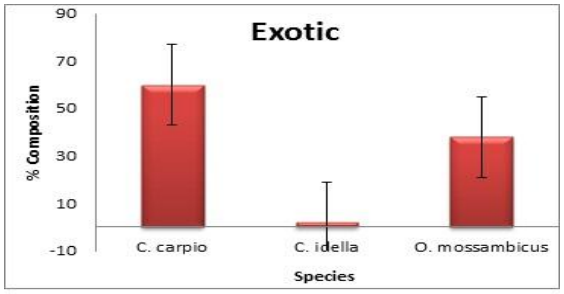

Figure 8: Exotic fish species composition of *Konoskhaihaor,* Northeast Bangladesh

The non-available and less availability of some fish species indicates the alarming decline of the fish diversity in the study area. Among the exotic species Grass carp (*C. idella*), Tilapia *(O. mossambicus)* and Common carp (*C. carpio*) were highly available and most probably due to escape from adjacent culture areas during heavy flood and another source is enhanced fisheries government intervention. These species can pose serious threat to native fish species (Mukherjee *et al.,* 2002) and need quick regional legislation in order to avoid potential negative impacts on native fish species. Similar conclusions were also made by several researchers (Rixon *et al.*, 2005; Imteazzaman and Galib, 2013). However, the study area seemed to have less contamination by the exotic species than some other water bodies of Bangladesh as 9, 8, and 5 non-native fish species have been recorded in *Chalanbeel, Haltibeel* and *Book bharaba*or, respectively (Galib *et. al.,* 2009; Imteazzaman and Galib, 2013; Mohsin and Haque, 2009). Alom *et al.* (2012) observed a total of 141 species under 35 families in *Tanguarhaor*. Among them *C. barca*, *L. boggut, L. nandina* are considered as extinct, 16 species critically endangered and 26 endangered. Warne (2005) encountered total of 107 different fish species, among them 32 species are nationally threatened from Hakalukihaor. About 16 species are endangered, 12 vulnerable and 4 are critically endangered based on (IUCN, 2000). The present findings are not in agreement with the observation of (Warne, 2005 and Alom *et al.,* 2012). Haroon *et al.* (2002) identified a total of 92 species of fish and prawn from Sylhet-Mymensingh sub-basins. Joadder (2008) found a total of 76 fish species belonging to 76 genera, 26 families and 1 species of prawn from the Kumaribeel, under Rajshahi district. The present findings are less in number compared to the above mentioned findings.

CONCLUSION

Monthly variations occurred in total abundance and diversity of the fish species assemblage of the *Konoskhaihaor.* Tit punti (*P. ticto*) was found as most dominant fish species in the *Konoskhaihaor* contributing 18.4% of the total biomass. Fish catching percentage also indicates the minimum relative abundance of species in the river. As only 37 species are identified from the study area, so the proper steps should have to take for the protection and conservation of these valuable fisheries resources. Restriction on fishing prior to breeding season, controlled discharge of domestic wastes, banning the use of illegal fishing gears in fishing, establishment of fish sanctuary etc. can done for protection of fisheries biodiversity.

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