

Fish Biodiversity and Conservation Status in Uthrail Beel of Naogaon District, Bangladesh

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Abstract: Fish abundance and diversity was studied for a period of 5 months from August to December 2018, in the Uthrail beel at Manda Upazila under Naogaon district, Bangladesh. Data were collected fortnightly from two sampling points, one point was 1 km far from another of Pakuria village of Bharso Union, using four fishing gears namely berjal, moijal, fashjal and kholson. A total of 3987 individuals comprising of 28 fish species belonging to 8 orders, 16 families including 2 exotic species (*Cyprinus carpio var. communis*) and *Oreochromis niloticus* (niloticus) were found. Cypriniformes was recorded as dominant order contributing 40.62% and the rest 7 orders Perciformes, Siluriformes, Synbranchiformes, Channiformes, Beloniformes, Tetraodontiformes and Osteoglossiformes contributing 26.31%, 12.4%, 9.77%, 7.59%, 2.90%, 0.22% and 0.10% respectively. *Puntius chola* (chola puti) was the most abundant (30.8%) and *Monopterusuchia* (Kuchia) was the least abundant (0.05%) species. Total six threatened species were recorded (according to IUCN, 2015) of which four (2.90%) are Vulnerable, one (0.4%) as Endangered and one (1.22%) as Critically Endangered. The average value of Shannon -Weiner Diversity Index (H'), Simpson Dominance Index (D) and Margalef Richness Index (d) were calculated as 2.232±0.14, 0.126±0.03 and 2.764±0.29 respectively. The study revealed that fish diversity in Uthrail beel is lesser than other reported beels and rivers in Bangladesh.

Key words: Diversity, fish composition, Uthrail beel, Bangladesh, dominance, richness.

Introduction

Bangladesh is a South East Asian riverine country of 1,47,570 sq. km located in between latitude 20°34' and 26°38' north and longitude 40°01' and 92°41' east. The country is enriched with vast water resources of both freshwater and marine water. Bangladesh is ranked 4th in aquatic biodiversity in Asia, and abound with large varieties of species including 260 of freshwater fish species, 24 species of prawn in inland water bodies, 475 species of marine fishes, 36 species of marine shrimp and 12 species of exotic fishes (Ahmmad *et al.* 2017). At present reduction of fish species abundance from inland open water bodies is a burning issue. IUCN (2015) has reported as many as 253 species of fish, 64 species (25.3%) of which are as threatened. Among these threatened species 9 are assessed as Critically Endangered, 30 species as Endangered and 25 species as Vulnerable. Beel is one of the most important natural habitat for fish comprising 27% of the inland water area (DoF, 2018). Uthrail beel is one of the most important beel situated in Manda Upazila of Naogaon district of Bangladesh. Study on fish biodiversity has been assessed in different beels by researchers like Majumder *et al.* (2017) in Shorupdha beel, Jessore; Rhaman *et al.* (2017) in Chalan beel Natore; Sultana *et al.* (2017) in Bhawal beel, Mymensingh; Joadder

et al. (2016) in Beel Kumari, Rajshahi; Akhtaruzzaman & Alam (2014) in Ichanoi beel, Gaibandha; Ehshan & Bhuiyan (2014) in Roktodaha beel a Flood plain of North - Western Region of Bangladesh; Hussain *et al.* (2013) in Beel Bhatia, Chapai Nawabganj and Imteazzaman and Galib (2013) in Halti beel, Natore. However, information regarding fish diversity of Uthrail beel is unavailable till now. So, a study was conducted to know the status of fish diversity of this beel and to take necessary management techniques to conserve its fish biodiversity by calculating diversity indices and catch composition.

Materials and Methods

Study area: The study was carried out at Uthrail beel in Manda Upzila under Naogaon district, Bangladesh. The beel is surrounded by three villages namely Pakuria, Kalishova and Bharso. The study area lies in between 24°43' and 24°44' North to 88°38' and 88°40' East occupying an area of about 165 acre (Figure 1).

Study period: The research was conducted for a period of 5 months from August to December 2018, with a view to achieve information on the status of fish diversity of Uthrail beel.

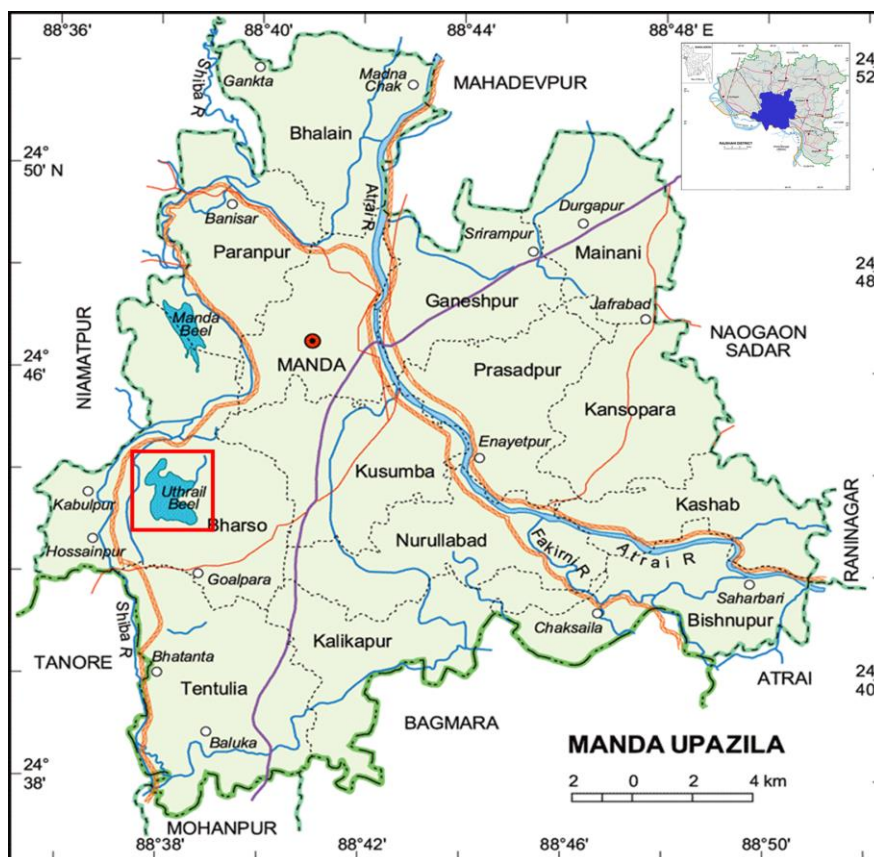


Figure 1: Map of Manda Upazila of Naogaon District showing the study area Uthrail beel

Data collection and identification of fish species:

Data were collected fortnightly from two sampling points (Pakuria and Bharso) using four types of fishing gears comprising 3 types of net (berjal, moijal, fashjal) and 1 type of trap (kholson). The hauling time was 30 min and 10-12 min for berjal and moijal. Data of one haul was considered for analysis. Average catch of two sampling points was presented as mean value of the beel. Fish samples from each fishing gear were counted species wise. After collection, the fish species were identified by assessing their morphometric and meristics characteristics, colour of the fish sample, following Rahman (2005); Talwar and Jinghran (1991) and Red List of Bangladesh (2015). Then, the identified fish species were classified systematically after Nelson (2006).

Analysis of fish diversity and catch composition:

During the investigation, different diversity indices such as Shannon-Weiner diversity index (H), Simpson dominance index (D) and Margalef richness index (d) were calculated to evaluate the status of fish diversity in Uthrail beel using following formulae:

Shannon-Weiner Diversity Index (H)

$$H = - \sum P_i \ln P_i \text{ (Shannon-Weiner, 1949)}$$

Here, H is the diversity index

P_i is the proportion of each species in the sample.

Simpson Dominance Index (D)

$$D = \sum \frac{n_i(n_i - 1)}{N(N - 1)} \text{ (Simpson, 1949)}$$

Here, D is the dominance index

n is the total number of individuals of each species

N is the total number of fish of all species

Margalef Richness Index (d)

$$d = \frac{S - 1}{\ln N} \text{ Margalef, (1968)}$$

Here, d is the richness index

S is the total number of individuals for each species

N is the total number of individuals.

(%) Catch composition

$$\frac{n}{N} \times 100$$

Here, n is the total number of individuals of each species

N is the sum of all fish individuals caught in the study period.

Data analysis: Calculation and graphical presentation of different biodiversity indices were performed using Microsoft Excel- 2010.

Results and Discussion

Fish Species Diversity Indices

Diversity index is a mathematical measure of species diversity in a given community which provides information about community composition and also takes the relative abundance of different species into account. It also provides important information about rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologist trying to understand the community structure.

Shannon- Weiner Diversity Index (H)

The Shannon-Weiner diversity index (H) is an information statistical index which means it assumes all species are represented in a sample and that they are randomly sampled. The typical value of H generally lies in between 1.5 to 3.5 in most ecological studies and the index is rarely greater than 4. Here, the higher the value, the greater the diversity (Table 1).

Table -1: Fish species diversity indices of Uthrail beel during the study period.

Months	Value		
	Shannon-Weiner Divinity (H)	Simpson dominance index (D)	Margalet richness index (d)
August	2.05	0.16	2.27
September	2.17	0.15	2.92
October	2.19	0.12	2.74
November	2.42	0.10	2.92
December	2.33	0.10	2.97
Average	2.232 ±0.145	0.126 ±0.028	2.764 ±0.289

The mean value of Shannon- Weiner diversity index (H) was found 2.23±0.14. The lowest value 2.05 was recorded in August and

highest value 2.42 was recorded in November. So, the fish diversity was highest in November. No significant differences were found between the months.

Shannon-Weiner diversity index (H) was reported 2.31±0.69 in Surma river Sylhet (Ahammad *et al.* 2017); 0.45 to 2.3 in Shiba river (Khanom *et al.* 2016); 1.06 to 1.51 in Talma river (Rahman *et al.* 2015); 3.22 in Roktodaha beel (Ehshan and Bhuiyan, 2014) and 3.427 to 3.818 in Choto Jamuna river (Galib *et al.* 2013)

The documented value of Shannon- Weiner diversity index (H) was 2.05 to 2.42 which was lower than the value of Choto Jamuna river, Upper Halda river, Surma river, Roktodaha beel but higher than Shiba and Talma rivers. So, it can be said that fish diversity of Uthrail beel is richer than the Shiba and the Talma rivers.

Simpson Dominance Index (D)

Simpson dominance index (D) was introduced by Edward H. Simpson in 1949 to measure the degree of concentration when individual is classified into types. The index represents the probability that two individuals randomly selected from a community will belong to different species. The value of this index ranges between 0 to 1. Here, the bigger the value of (D), the lower the diversity.

The maximum value of Simpson dominance index was recorded as 0.16 and minimum value was 0.10 which were recorded in August, and in November and December respectively, with a mean value of 0.13±0.03. No significant differences found between the value in different months (Table 1).

Simpson dominance index (D) was reported to range from 0.05 to 0.06 in Upper Halda river (Alam *et al.* 2013) and 0.32 to 0.89 in Dhaleshawri river (Islam and Yasmin 2018)

The observed values of the present study of Simpson dominance index (0.10 to 0.16) was lower than the values of Dhaleshawri river but higher than Upper Halda river. So fish species diversity in the studied beel is more than the Dhaleshawri river but less than the Upper Halda river.

Margalef Richness Index (d)

The Margalef Index measures species richness and it is highly sensitive to sample size though it tries to compensate for sampling effects. It depends on the variation of species rather than number of individuals. Margalef Richness Index has no limited value and used to make comparison among the sites.

The evaluated mean value of Margalef Richness Index (d) was 2.76 ± 0.29 . The maximum value was 2.97 and minimum value was 2.27 which were documented in December and August respectively (Table 1)

Margalef Richness Index (d) was documented as 4.79 to 7.43 in Dhaleshawri river (Islam and Yasmin 2018); 6.60 to 7.91 in Upper Halda river (Alam *et al.* 2013); 3.86 ± 0.31 in Surma river (Ahammad *et al.* 2017); 5.11 to 7.41 in Talma river (Rahman *et al.* 2015) and 6.954 in Choto Jamuna river (Galib *et al.* 2013)

The recorded value of Margalef Richness Index (d) was 2.76 ± 0.29 which was lower than all other mentioned rivers. So, fish species richness is less in Uthrail beel than the mentioned rivers.

Catch composition

In the studied beel a total of 3,897 fish individuals comprising of 28 fish species belonging to 8 orders, 16 families were recorded including 2 exotic species viz., *Cyprinus carpio var. communis* (common carp) and *Oreochromis niloticus* (nilotica) (Table 2).

Among these 8 orders, Cypriniformes was evaluated as dominant order (40.62%) and the rest 7 orders Perciformes, Siluriformes, Synbranchiformes, Channiformes, Beloniformes, Tetraodontiformes and Osteoglossiformes represented 26.31%, 12.4%, 9.77%, 7.59%, 2.90%, 0.22% and 0.10% respectively. Again order Cypriniformes comprises with 8 species followed by Perciformes (7), Siluriformes (4), Synbranchiformes (4), Channiformes (2), Beloniformes (1), Tetraodontiformes (1) and Osteoglossiformes (1). *Puntius chola* (chola puti) was the most abundant (30.8%) whereas *Monopterusuchia* (Kuchia) was the least abundant (0.05%) species.

Majumder *et al.* (2017) reported a total of 52 fish species belonging to 9 orders and 19 families from Shorupdha beel; Rahman *et al.* (2017) recorded total 66 species belonging to 08 orders and 23 families in Chalan beel; Sultana *et al.* (2017) found total 56 species comprising 10 orders and 23 families in Bhawal beel; Joadder *et al.* (2016) recorded a total of 52 species under 7 Orders and 20 families in Beel Kumari in Rajshahi District; Imteazzaman and Galib (2013) recorded a total of 63 species belonging to 8 orders and 20 families in Halti Beel; Hussain (2013) recorded 50 different fish species under 6 orders and 18 families in Beel Bhatia, Chapai Nawabganj; Hossain *et al.* (2009) listed total 114 species belonging 29 families in Chalan

beel; Chakraborty and Mirza (2007) found total 70 species comprising 18 families in Gharia Beel and Akhtaruzzaman and Alam (2004) recorded a total of 62 fish species under 10 orders and 23 families in Ichanoi Beel. The above mentioned results revealed that the species diversity in the studied beel is lower than others beels.

IUCN conservation status

During the study period, a total of 28 fish species of beel Uthrail was found of which six species (4.52%) were documented as Threatened species comprising four (2.90%) as Vulnerable, one as (0.4%) as Endangered and one (1.22%) as Critically Endangered. IUCN Red List (2015) based analysis of the existing fish species exhibit highest occurrences under the Least Concern (91.27%) was followed by Near Threatened (4.21%), Vulnerable (2.90%), Critically Endangered (1.23%), Endangered (0.4%) and Data Deficient (0.025%) (Table 2).

The order based status of threatened species in the study area indicated highest occurrences under Cypriniformes 1 (2.68%) followed by Siluriformes 2 (1.3%), Synbranchiformes 2 (0.45%), Osteoglossiformes 1 (0.1%) and the rest 4 orders Perciformes, Channiformes, Beloniformes and Tetraodontiformes has no contribution in threatened species.

Rahman *et al.* (2017) recorded 18 (27%) threatened species out of 66 species, including Vulnerable 8 (12%), Endangered 8 (12%) and Critically Endangered 2 (3%) in Chalan beel; Sultana *et al.* (2017) recorded 13 threatened species out of 56 species in Bhawal Beel including 1 Critically Endangered, 5 as Endangered and 7 as Vulnerable; Galib *et al.* (2013) recorded 41.27% species as Threatened, including 15.87% Vulnerable, 15.87% Endangered and 9.52% as Critically Endangered in Choto Jamuna river; Imteazzaman & Galib (2013) recorded 3 Critically Endangered, 11 Endangered and 8 Vulnerable fish species from Halti Beel where total species was 63; and Chakraborty & Nur (2009) recorded 39 species as Endangered and 19 species as Vulnerable from Medha beel in the Northern region of Bangladesh.

The fish diversity in Uthrail beel did not find to be satisfactory compared to most of the mentioned beels and rivers in Bangladesh. Fisheries resources in the beel are under threat due to fishing by dewatering, catching of fry and brood fish, absence of fish sanctuary

Table-2: Catch composition and conservation status of different fish species identified in Uthrail beel.

Order	Family	Scientific name	Local name	English name	IUCN Red status (BD)		Total Catch	% Catch Composition		
					2015	2000		Individual	Family	Order
Cypriniformes	Cyprinidae	<i>Arnlypharyngodon mola</i>	Mola	Mola carplet	LC	NO	111	5.57	37.44	40.62
		<i>Puntius chola</i>	Cholapunti	Swamp barb	LC	NO	614	30.8		
		<i>Esomus danricus</i>	Darkina	Flying barb	LC	DD	20	1.0		
		<i>Salmostoma bacaila</i>	Chela	Large lazorbelly minnow	LC	NO	10	0.47		
		<i>Catla catla</i>	Katal	Catla	LC	NO	1	0.05		
		<i>Cyprinus carpio var. communis</i>	Common carp	European carp	-	-	1	0.025		
	<i>Labeo rohita</i>	Rui	Rohu	LC	NO	1	0.025			
	Cobitidae	<i>Lepidocephalichthys annadalei</i>	Gutum	Annadale loach	VU	NO	53	2.68	2.68	
Channiformes	Channidae	<i>Channa punctatus</i>	Taki	Spotted snakehead	LC	NO	145	7.30	7.59	7.59
		<i>Channa striatus</i>	Shoul	Stripped snakehead	LC	NO	6	0.3		
Siluriformes	Bagridae	<i>Mystus vittatus</i>	Tengra	Striped Dwarf cat fish	LC	NO	97	4.88	4.88	12.4
	Siluridae	<i>Sperata aor</i>	Ayre	Long whiskered catfish	VU	VU	2	0.075	1.3	
		<i>Ompok pabo</i>	Kala pabda	Pabo catfish	CR	EN	25	1.23		
	Heteropneustidae	<i>Heteropneustes fossilis</i>	Shing	Liver catfish	LC	NO	124	6.22	6.21	
Beloniformes	Belonidae	<i>Xenentodon cancila</i>	Kakila	Freshwater Garfish	LC	NO	58	2.90	2.90	2.90
Synbranchiformes	Mastaeembelidae	<i>Macrognathus pancalus</i>	Guchi	Barred Spiny eel	LC	NO	102	5.14	9.72	9.77
		<i>Macrognathus aculeatus</i>	Tara Baim	One-stripe spiny eel	NT	VU	83	4.18		
		<i>Mastaeembelus armatus</i>	Sal Baim	Tire track spiny eel	EN	EN	8	0.4		
	Synbranchidae	<i>Monopterusuchia</i>	Kuchia	Swamp eel	VU	VU	1	0.05	0.05	
Perciformes	Ambassidae	<i>Chanda nama</i>	Namachanda	Asian Glass fish	LC	VU	215	10.78	13.41	26.31
		<i>Pseudambassis lala</i>	LalChanda	Indian Glassy fish	LC	VU	52	2.63		
	Anabantidae	<i>Anabas testudineus</i>	Koi	Climbing perche	LC	NO	12	0.58	0.57	
	Osphronemidae	<i>Pseudosphromenus cupanus</i>	Koi bandi	Spiketail paradise fish	LC	EN	6	0.3	6.66	
		<i>Trichogaster fasciata</i>	khalisa	Banded Gourami	LC	NO	127	6.37		
		Cichlidae	<i>Oreochromis niloticus</i>	Nilotica	Nilotica	DD	NE	1	0.025	
	Gobiidae	<i>Glossogobius giuris</i>	Bele	Tank goby	LC	NO	112	5.64	5.64	
Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>	Foli	Grey Featherback	VU	VU	2	0.1	0.10	0.10
Tetraodontiformes	Tetraodontidae	<i>Tetraodon cutcutia</i>	Potka	Pufferfish	LC	NO	5	0.18	0.17	0.22

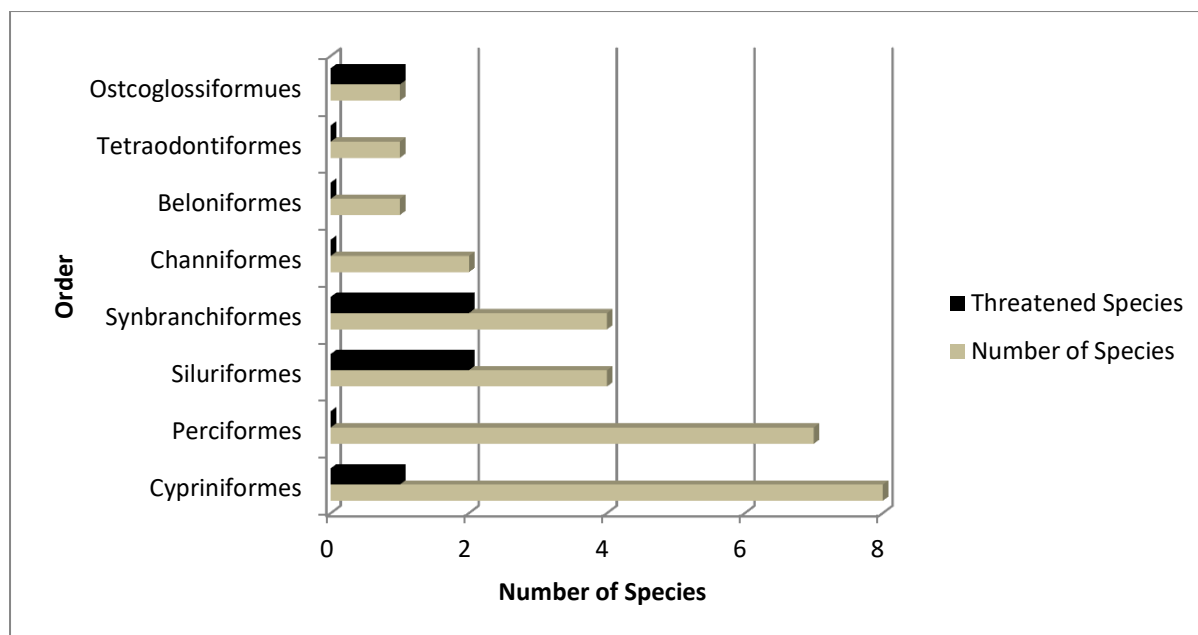


Figure 2: Number of threatened fish species under different orders evaluated during the study period.

proper beel management policy, use of insecticides and pesticides and natural causes like drought. The present findings indicate that there was no significant differences among the value of diversity index in different months of the study period, because Uthrail beel is almost a confined water body having no proper connection with the other beels and rivers. As a result, there is a little chance for fish species to being entered in the studied beel.

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