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Ecology and Biodiversity of *beel* Bhatia in Chapai Nawabganj District, Bangladesh

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Abstract: The investigation was carried out to assess the water quality parameter and biodiversity of *beel* Bhatia under Chapai Nawabganj district from June 2010 to March 2011. During the study period, the mean water depth of the *beel* was found 3.65±1.59m, mean water temperature was 25.43±4.17°C, mean pH was 7.44±0.46, mean DO was 5.42±0.56 mg/l and mean free CO_2 was 6.77±0.95 mg/l. A total of 50 different species of fishes under 18 family of 6 orders were identified. A total of 3 fisheries items under the phylum Arthropoda, 11 genera of phytoplankton under 4 classes and 10 genera of zooplankton under 3 classes were identified. A total of 17 aquatic vegetations were found in the studied *beel*.

Key word: Water quality, Biodiversity, Fish species, Fisheries item

Introduction

The *beels* generally possess high potential for in situ fish production. The vast open water bodies provide natural habitats for various aquatic resources including wild fishes and prawns (Das *et al*., 1990). Approximately 260 species of freshwater fishes, 24 species of prawns, 50 species of reptiles, 24 species of mammals, 475 species of marine fishes and 36 species of shrimps are found in Bangladesh (World Bank, 1991; MAEP, 1996; Rahman, 2005).But the inland open water capture fisheries production started to decline in both quantity and species diversity due to lack of proper management policy. Over fishing, unplanned establishment of Flood Controlled Drainage (FCD), Flood Control Drainage and Irrigation (FCDI) dams have significant effect on declining fish production. More over, fast rate of expiration of agricultural, domestic irrigation, industrial activities and heavy pesticides put on the floodplains during irrigation (Jhingran, 1991). BFRI (2005) surveyed in Bangladesh that, every year about 8000 mt. of pesticides are used in agriculture fields, of these 25% pesticides are being washed into agricultural field that affects on eggs capacity, fertilization and hatching rates of fishes are less 40%, 15% and 25% respectively that free from pesticides (Hossain and Howlader, 1996). As a result about 54 small indigenous species among 260 freshwater species is about to extinct which are found in floodplains and *beels* and these are main nutritional source of poor people (IUCN, 2000). That is why it is important to know the present condition of biodiversity of *beel.* The study was undertaken to find out ecological condition and biodiversity of *beel*. The specific objectives included in the study were to monitor the water quality and to identify fishes and fisheries items of the *beel*.

Materials and Methods

The study was conducted at *beel* Bhatia under Chapai Nawabganj district of Bangladesh for a period of ten months from June, 2010 to March, 2011. Important parameters (water depth, air and water temperature, transparency, dissolved oxygen, free CO_2, pH and plankton of water) were recorded fortnightly from the selected four spots of the *beel* between 9.00 AM to 12.00 PM. Water depth was recorded with a measuring stick. Air and water temperature was recorded by using a mercury thermometer. Measurement of water transparency (cm) was done by a Secchi disc of 20cm diameter. pH was measured by a pH meter. DO (dissolved oxygen) concentration was determined by the Winkler's titration method (APHA, 1992) and Free CO_2 (carbon dioxide) was determined by titration method (Welch, 1948). For the study of plankton 20 liters of water samples from 4 different sites were collected in a plastic bucket and passed through a plankton net of 25 µm and finally concentrated to 40 ml, then the concentrated plankton samples were preserved in plastic vials with 5% formalin for subsequent studies. The qualitative study was done up to generic level under a compound microscope (Olympus BH-2 with phase contrast facilities) according to Bellinger (1992). Aquatic vegetation were identified after Khan and Halim (1987). The fish species were identified directly from the spots after Talwar and Jhingran (1991) and Rahman (2005). Crustaceans species were identified by

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Ahmed *et al*. (2008). The fish diversity of the *beel* was categorized as rare, few, common and very common. Finally, all the data collected were subjected to analyses using the computer software MS Excel.

Results and Discussion

Water quality parameters

Water quality parameters of the *beel* were observed (Table 01) for knowing the productivity of the *beel* Bhatia in respect of sufficient production of plankton, aquatic weeds which effect on fish growth.

Water depth: Water depth ranged from 1.29±0.02m (in March, 2011) to 5.91±0.17m (August, 2010) with a mean of 3.65m (Table 1) which is similar of Chanda *beel* as reported by Ehshan *et al*. (1996). Leaching and evaporation of water were supposed to be the important reasons for fluctuation in the water depth. Dewan and Mazid (1994) reported that the fluctuation of water level had a close relationship with the rainfall. The relationship is seemed to be similar for the present study.

Air and water temperature: The air temperature varied from 15.75±1.68°C (January, 2011) to 36±0.65°C (August, 2010) and the water temperature varied from 14.8+0.42 (January, 2011) to 29.33+1.5°C (July, 2010) while the mean air and water temperature was 26.73±1.33°C and 25.43±4.17°C respectively which is strongly agreed with Ehshan *et al.* (1996). It indicates that air temperature was higher than water temperature. Rahman *et al*. (2006) recorded water temperature from 26.33±0.47°C to 29.50±0.40°C in Rajdhara *beel* of Netrokona district. Alam *et al.* (2007) recorded minimum surface water temperature 16°C during winter and maximum 33°C in summer of Posna *beel*, Tangail.

Water transparency: The mean water transparency was found (20.95±7.52 cm) in the study period. However, highest (32.17±2.50 cm) and lowest (13.5±2.5cm) water transparency was recorded in July, 2010 and in January, 2011 respectively. Rahman *et al*. (2006) recorded water transparency from 89.0±6.48cm (July) to 62±2.49cm (September) in Rajdhara *beel.* The higher transparency might be due to increased volume of clear unpolluted water with lower plankton density in the month of July. But in the studied *beel* a minimum water transparency indicates the higher plankton density throughout the year.

pH: The mean pH value of *beel* Bhatia was 7.44±0.46 whereas highest pH was 7.85±0.22 (September, 2010) and lowest was 7.23±0.16 (July, 2010) (Table 1) during the study period. Hossain *et al*. (1997) obtained pH values from 6.53 to 7.12 in BSKB *beel*, Saha and Hossain (2002) recorded the pH 7.18 (May) to 8.45 (April) in Saldu *beel* and Rahman *et al*. (2006) recorded pH of 7.55±0.40 (October) to 8.03±0.07 (June) in Rajdhara *beel*.

Dissolved oxygen (DO): The highest DO level (6.7±0.08 mg/l) was recorded in the month of October, 2010 and the lowest was recorded (4.98±0.23 mg/l) in the month of March, 2011 (Table 1) Rahman *et al*. (2006) recorded lowest DO value (8.26±1.1mg/l) in July and highest (9.65±0.20mg/l) in June in Rajdhara *beel*. The mean value of DO of 8.92±6.91 mg/l indicated that *beel* water was almost suitable for aquatic life (Ellis *et al*., 1946).

Table 1. Monthly variation in physico-chemical parameters of the *Beel* Bhatia from June 2010 to March 2011

Months	Water depth (m)	Air temperature(°C)	Water temperature(°C)	Transparency (cm)	pH	DO (mg/l)	Free CO_2 (mg/l)
Jun	4.21±0.12	32.5±1.7	29.05±0.30	31.67±6.29	7.55±0.21	5.15±0.18	5.78±0.07
Jul	5.73±0.10	33.00±1.83	**29.33±1.5****	**32.17±2.75****	**7.23±0.16***	5.29±0.12	5.77±0.07
Aug	**5.91±0.17****	**36±0.65****	29.3±0.57	30±3.90	7.75±0.30	5.4±0.05	**5.67±0.20***
Sep	4.69±0.1	34.93±1.20	29.05±0.43	22±3.60	**7.85±0.22****	6.18±0.25	7±1.0
Oct	4.03±0.11	29.90±0.55	28.17±2.0	17.83±4.77	7.83±0.18	**6.7±0.08****	6.81±0.63
Nov	3.67±0.12	23.87±0.60	23.47±0.99	16.5±0.87	7.71±0.05	5.15±0.01	**8.13±0.25****
Dec	3.01±0.12	19.92±1.24	19.59±0.70	15.91±2.32	7.57±0.10	5±0.25	7.77±0.33
Jan	2.37±0.07	**15.75±1.68***	**14.8±0.42***	**13.5±2.5***	7.25±0.13	5.33±0.19	6.48±0.33
Feb	1.61±0.15	23.55±3.40	22.06±0.29	14.49±1.80	7.27±0.14	5.11±0.20	6.29±0.33
Mar	**1.29±0.02***	26.13±1.57	25.53±1.25	15.16±3.77	7.41±0.3	**4.98±0.23***	8.08±0.12
Mean ± SD	3.65±1.59	26.73±1.33	25.43±4.17	20.95±7.52	7.44±0.46	5.42±0.56	6.77±0.95

* = Minimum; ** = Maximum

Free CO_2: During the study period, highest and lowest value of free CO_2 of water was recorded as 8.13±0.25 mg/l (November, 2010) and 5.67±0.20 mg/l (August, 2010) respectively. Mean value of free CO_2 was 6.77±0.95 mg/l. Alam *et al.* (2007) recorded free CO_2 (5-13 mg/l) in Posna *beel*. The value of free CO_2 less than 12 mg/l in suitable for fish growth (DoF, 1998).

Plankton: During the study period 11 genera of phytoplankton under 4 classes viz. Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae; and 10 genera of zooplankton under 3 classes viz. Rotifera, Cladocera and Copepoda were identified (Table 2). Razzaque *et al.* (1995) identified 87 genera of phytoplankton and 29 genera of zooplankton in Halti *beel*. Rahman *et al.,* (2006) a total number of 25 genera of phytoplankton and 11 genera of zooplankton were identified in Rajdhara *beel.*

Table 2. Identified genera of plankton prevailing in the *beel* Bhatia

Plankton type	Class	Genus	Total
Phytoplankton	Bacillariophyceae	*Diatom* *Navicula* *Nitzschia*	03
	Cyanophyceae	*Anabaena* *Nostoc* *Oscillatoria*	03
	Chlorophyceae	*Spirogyra* *Volvox* *Ulothrix* *Oedogonium*	04
	Euglenophyceae	*Euglena*	01
Zooplankton	Cladocera	*Daphnia* sp. *Diaphanosoma* sp. *Moina* sp. *Bosmina* sp	04
	Copepoda	*Cyclops* *Diaptomus* *Mesocyclops*	03
	Rotifera	*Asplanchna* *Brachionus* *Keratella*	03
Grand total			**21**

Biodiversity of *beel* Bhatia

Aquatic vegetation: A total of 17 aquatic vegetation (8 species of floating hydrophytes, 3 species of submerged hydrophytes, 2 species of rooted emergent hydrophytes and 4 species of mesophytic plant) were found in the study area (Table 3). Islam *et al*. (2010) reported 58 species of different vegetations were observed in *beel* Koshba at Naogaon district, Bangladesh.

Table 3. List of hydrophytes prevailing in the *beel* Bhatia along with their ecological niche

Hydrophytes			
Floating hydrophytes	**Submerged hydrophytes**	**Rooted emergent hydrophytes**	**Mesophytic plants**
Utricularia sp. *Eichornia crassipes* *Pistia stratiotes* *Lemna perpusilla* *Spirodella polyrhiza* *Wollffia arrhiza* *Hydrilla* sp. *Najas* sp.	*Nymphaea* sp. *Nuphar* sp. *Potamogeton crispus*	*Aeschynomene indica* *Limnanthemum* sp.	*Enhydra fluctuans* *Ipomoea aquatica* *Commelina* sp. *Alternathera philoxeroider*
Total = 08	**03**	**02**	**04**

Table 4. Diversity status of fish and fisheries items of *beel* Bhatia

	Order	Family	Local name	Scientific name	Abundance	Seasonal availability
Fish items	Cypriniformes	Cyprinidae	Catla	*Catla catla*	Rare	Few
			Silver carp	*Hypophthalmichthys molitrix*	Rare	Rainy
			Japani rui	*Cyprinus carpio* var. *communis*	Rare	Rainy
			Mirror carp	*Cyprinus carpio* var. *specularis*	Rare	Rainy
			Mrigel	*Cirrhinus mrigala*	Common	Rainy
			Raikor	*Cirrhinus reba*	Common	Rainy
			Bighead carp	*Aristichthys nobilis*	Rare	Rainy
			Thai sarputi	*Puntius gonionotus*	Few	Rainy
			Bata	*Labeo bata*	Very common	Whole
			Sarputi	*Puntius sarana*	Very Common	Round the year
			Punti	*Puntius sophore*	Very Common	Whole
			Titputi	*Puntius ticto*	Common	Whole
			Rui	*Labeo rohita*	Common	Whole
			Mola	*Amblypharyngodon mola*	Common	Whole
			Darka	*Esomus danricus*	Very common	Whole
			Chela	*Salmostoma bacaila*	Common	Whole
			Chela	*Chela phulo*	Common	Whole
			Chela	*Chela laubuca*	Rare	Whole
		Cobitidae	Rani	*Botia dario*	Rare	Whole
			Gutum poia	*Lepidocephalus guntea*	Common	Whole
		Cichlidae	Tilapia	*Oreochromis mossambicus*	Rare	Few
			Nilotica	*Oreochromis niloticus*	Rare	Few
		Channidae	Taki	*Channa punctatus*	Very common	Whole
			Shol	*Channa striatus*	Few	Whole
	Perciformes	Mastacembelidae	Tara baim	*Macrognathus aculeatus*	Common	Whole
			Sal baim	*Mastacembelus armatus*	Common	Whole
			Guchi baim	*Mastacembelus pancalus*	Common	Whole
		Anabantidae	Koi	*Anabas testudineus*	Few	Whole
			Khalisha	*Colisa fasciatus*	Common	Whole
			Lal khalisha	*Colisa lalius*	Common	Whole
			Boicha khalisha	*Colisa labiosa*	Very common	Whole
		Centropomidae	Chanda	*Chanda nama*	Very common	Whole
			Chanda	*Chanda ranga*	Very common	Whole
		Gobidae	Bele	*Glossogobus giuris*	Very common	Whole
		Mugilidae	Korsula	*Rhinomugil corsula*	Few	Whole
		Clariidae	Magur	*Clarius batrachus*	Few	Autumn-Winter
		Heteropneustidae	Shing	*Heteropneustes fossilis*	Few	Whole
		Siluridae	Pabda	*Ompok pabda*	Few	Whole
			Kani pabda	*Ompok bimaculatus*	Few	Whole
		Schilbeidae	Boal	*Wallago attu*	Common	Whole
			Batasi	*Pseudeutropius atherinoides*	Very common	Rainy
		Bagridae	Ayre	*Mystus aor*	Rare	Whole
			Golsha tengra	*Mystus cavasius*	Very common	Whole
			Tengra	*Mystus tengara*	Very common	Whole
			Tengra	*Mystus vittatus*	Common	Whole
	Cypriniodontiformes	Belonidae	Kakila	*Xenentodon cancila*	Common	Whole
	Osteoglossiformes	Notopteridae	Foli	*Notopterus notopterus*	Common	Whole
			Chital	*Notopterus chitala*	Rare	Whole
	Clupeiformes	Clupeidae	Chapila	*Gudusia chapra*	Few	Whole
	Synbranchiformes	Synbranchidae	Kuchia	*Monopterus cuchia*	Very common	Whole
	Phylum	**Class**	**Local name**	**Scientific name**	**Abundance**	**Seasonal availability**
Fisheries items	Arthropoda	Crustacea	Gura chingri	*M. lamarrei*	Very common	Whole
			Beel chingri	*M. dayanum*	Common	Whole
			Kakra	*Cancer pagurus*	Very common	Whole

Fish species: During the study period, a total of 50 different species of fishes are recorded under 18 family and 6 orders. The highest number of fish species under the order Cypriniformes was found highest but species diversity of the family namely Cyprinodontidae, Centropomidae etc. were found very few during the study period. Most of the fishes were commercially important (Table 04). Doha (1973) published a list of 106 species from Mymensingh and Tangail district. Islam and Hossain (1983) recorded 110 species of fishes from the river Padma near Rajshahi. Flowra *et al.* (2009) recorded 75 fish species under 9 orders dominated by cypriniformes (28 species) and siluriformes (23 species) in Dahia *beel* under Natore district, Bangladesh. Hussain *et al.* (2013) recorded 59 different species of fishes under 21 families of 7 orders in Ghukshi *beel* at Naogaon district, Bangladesh.

Fisheries items: 3 species of fisheries items under the classes crustacea (Phylum-Arthropoda) were identified (Table 4) which were related to Islam *et al*. (2010) who recorded 9 species of fisheries items from *beel* Koshba at Nagaon district.

From the above study it was found that water quality parameters of the studied *beel* is in suitable range for fisheries production

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