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Studies on Physico-Chemical Conditions and Zooplankton Diversity of Urpod Beel, Goalpara, Assam, India

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Abstract

The present investigation deals with the seasonal variations in physico-chemical conditions and the zooplankton diversity in Urpod Beel, Goalpara, Assam. The survey was undertaken from March, 2014 – February, 2015 and done in four different climatic seasons viz. Pre-monsoon, Monsoon, Post-monsoon and Winter. The study of the physico-chemical properties of the beel water included Water Temperature, Transparency, pH, Free CO_2, Dissolved Oxygen (DO), Total alkalinity, Total hardness, Calcium (Ca), Magnesium (Mg), Chloride (Cl), Bicarbonate, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Sodium (Na) and Potassium (K). A total 29 numbers of zooplankton species were recorded belonging to five different planktonic groups such as Protozoa, Rotifera, Cladocera, Copepoda, and Ostracoda. The study indicated that low temperature, high DO and low concentration of other parameters have considerable influence on the zooplankton diversity. The number of zooplankton species was highest in Cladocera group followed by Rotifera, Protozoa Copepoda and Ostracoda. The group Ostracoda was absent in the winter season.

Keywords: Urpod Beel, Zooplankton Diversity, Physico-Chemical Condition.

Introduction

In an aquatic ecosystem, water quality influences its biotic components and it controls the diversity of aquatic life. Life in aquatic environment is largely governed by physicochemical characteristics and their stability. These characteristics have enabled biota to develop many adaptations that improve sustained productivity and regulate lake metabolism (Sarma *et. al*., 2011). The food chain in an aquatic environment comprises phytoplankton and aquatic vegetation as primary producers, zooplankton as primary consumers, small fishes are secondary consumers and large fishes are tertiary consumers. Zooplanktons are of immense economic importance not only a major link in a food chain between primary producers and carnivores of an aquatic system but also as food directly to fish as well as large animals (Paka and Narsing Rao, 1997).

Plankton population in relation to physico-chemical parameters of water with reference to its periodicity and diversity were done by many workers time to time. Among them some were of Kaushik (1994); Singh (2000); Khare (2005); Sharma (2011); Jain *et.al*., (2013); Laskar and Gupta (2013); Sarma *et.al.* (2013); Kanakiya *et.al*. (2014); Sarma *et.al*. (2015); Hussain *et.al*. (2015); Gogoi *et.al*. (2015) etc.

Objective of the Study

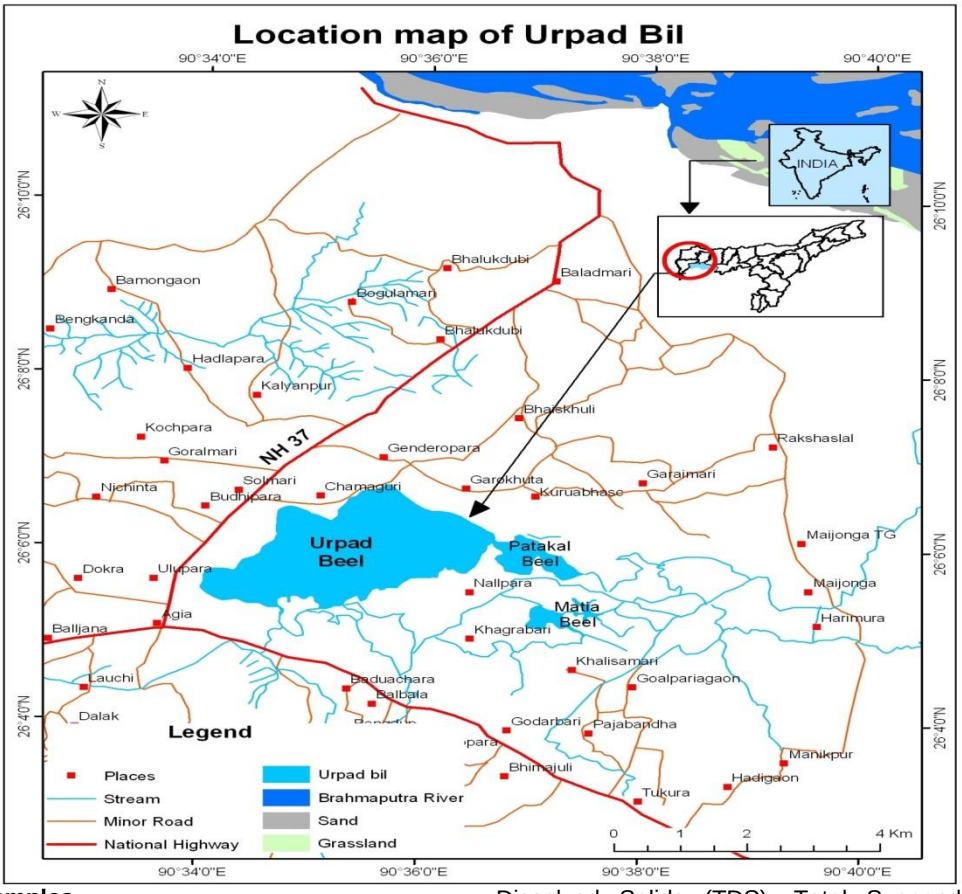
This present investigation was designed to assess some physico-chemical characteristics of Urpod beel water along with its zooplankton diversity and was carried out during March 2014 – February 2015.

Materials and Methods

Description of Study Site

Urpod beel is a natural lake situated at Agia in Goalpara district of Assam, located approximately 25° 33' to 26° 12' N latitude and 90° 7' to 91° 5' E longitude respectively. It is one of the largest beel in lower Assam with an area of 649.38 ha with a depth of 1.0 m – 5.3 m and has been incorporated in the Asian wetland Directory Scot, 1988 (Kalita, 2008). The Urpod beel is connected to the Brahmaputra through two of its tributaries the Jinziram and Jinari. In monsoon period the beel received rain water from the nearby plains and the hilly areas through a network of stream and in this period the beel size is increased by about 20% of the actual size. The beel is surrounded by 10 villages and the some villagers earned their

livelihood by fishing in the beel. After 1980's due to the rapidly encroaching of the surrounding areas of the beel by the villagers, the drastic shrinkage of the water body of the beel is resulted (Boruah *et.al.*, 2008),



Collection of Samples

Water samples were collected from the surface level of water body in different climatic seasons - Pre-monsoon (March-May); Monsoon (June–August); Post-monsoon (September-November) and Winter (December - February) from five different collection spots of Urpod beel. Atleast five samples were collected from each collection site for each analysis.

Water Analysis

The water samples were collected between 7 to 10 am in sterilized plastic bottles and water was analyzed for a number of physico-chemical characteristics employing standard method (APHA, 2012). The parameters included Water Temperature, Transparency, pH, Free CO_2, Dissolved Oxygen (DO), Total alkalinity, Total hardness, Calcium (Ca), Magnesium (Mg), Chloride (Cl), Bicarbonate, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Sodium (Na) and Potassium (K).

Zooplankton Analysis

For study of zooplankton, the samples were collected by filtering a volume of 50 liter surface water through plankton net made up of bolting silk cloth heaving mash size 25 micrometers (Ahmed *et al*., 2011). The collected samples were preserved in 4% formalin in 100 ml sterilized bottles and were used for studying zooplankton diversity. The best sampling time for zooplankton is before 9 am and no samplings were done during evening period. Zooplanktons were observed and identified under research binocular microscope by using standard key and literature (Needham and Needham, 1986; Battish, 1992).

Results

The result of seasonal analysis of physico-chemical parameters of the beel water are represented in tabular form (Table 1).

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Table 1
The Results of Physico-Chemical Analysis of Urpod Beel Water

S. No.	Parameters	Pre-monsoon (Mean Value)		Monsoon (Mean Value)		Post-monsoon (Mean Value)		Winter (Mean Value)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	Water Temp (°C)	20.8	0.1225	28.3	0.1817	25.3	0.1663	19.5	0.1673
2	Transparency (cm)	43.8	0.1225	56.7	0.2881	45.2	0.2302	41.2	0.1581
3	pH	7.2	0.1871	6.9	0.0837	6.6	0.2074	6.5	0.2388
4	DO (mg./l)	6.7	0.2916	8.1	0.1949	10.2	0.1673	8.6	0.1517
5	Free CO_2 (mg./l)	6.6	0.2739	6.7	0.2916	6.9	0.1304	6.8	0.1225
6	Total Alkalinity (mg./l)	40.2	0.2549	30.0	0.1483	32.0	0.2449	32.2	0.817
7	Total Hardness (mg./l)	37.6	0.3240	34.5	0.2074	26.3	0.2074	29.3	0.2074
8	Calcium (Ca) (mg./l)	23.0	0.0447	22.0	0.7871	19.0	0.1414	19.0	0.1342
9	Magnesium (Mg) (mg./l)	18.0	0.1304	16.0	0.1095	13.0	0.1483	16.0	0.1643
10	Chloride (Cl) (mg./l)	11.0	0.0548	9.6	0.1140	8.3	0.5811	8.3	0.1517
11	Bicarbonate (mg./l)	36.0	0.1788	29.0	0.1095	31.0	0.0707	31.0	0.0836
12	Total Dissolved Solids(mg/l)	22.0	0.1871	18.0	0.1483	13.0	0.0894	15.0	0.1483
13	Total Suspended Solids (mg/l)	64.0	0.1581	72.0	0.1871	69.0	0.483	65.0	0.1483
14	Sodium (Na) (mg./l)	0.63	0.0158	0.67	0.0152	0.70	0.0071	0.70	0.0114
15	Potassium (K) (mg./l)	1.35	0.0070	1.39	0.0071	1.43	0.0192	1.47	0.0148

The physico-chemical analysis of water revels that the water temperature of the beel water was varied between 19.5˚C (Monsoon) and 25.3˚C (Winter). The p^H level was ranged from 6.5 (Winter) to 7.2 (Pre-monsoon). Total alkalinity of water was higher in pre-monsoon season 40.2 mg/l and in other season it shows slight variation which was ranged between 30.0 to 30.2 mg/l. Total hardness of beel water was in higher range during the Pre-monsoon season (37.6mg/l) and lower range was observed during Post-monsoon season (26.3 mg/l). The Dissolved oxygen of beel water was fluctuated between the ranges of 6.7 (Pre-monsoon) to 10.2 mg/l (Post-monsoon). The transparency of beel water varied from 41.2 (Winter) to 56.7 cm (Monsoon). Free Co_2 showed a slight variation of which ranged from 6.6 (Pre-monsoon) to 6.9 mg/l (Post-monsoon). The Chloride content varied from 8.3 (Post-monsoon) to 11.0 mg/l (Pre-monsoon). The nutrient contents like Ca, Mg, Na and K showed a variation from 19.0 (Post-monsoon) to 23.0 mg/l (Pre-monsoon), 13.0 (Post-monsoon) to 18.0 mg/l (Pre-monsoon), 0.63(Pre-monsoon) to 0.70 mg/l (Winter) and 1.35 (Pre-monsoon) to 1.47 mg/l (Winter) respectively.

The zooplanktons that were recorded from the study period were listed in table and figure (Table 2 & Fig.1). There were 29 species representing five classes of zooplankton namely Protozoa (6 species), Rotifera (8 species), Cladocera (9 species), Ostracoda (2 species) and Copepoda (4 species). The availability of zooplankton community follows the following sequences:

Table 2
Seasonal Variations in Zooplankton Population of Urpod beel (March, 2014–Feb. 2015)

Group	Name of Species	Season			
		Pre-Mon	Mon	Post-Mon	Winter
PROTOZOA	1. *Arcella discoides* Ehrenberg,1843	-	+	+	+
	2. *A. vulgaris* Ehrenberg,1830	+	+	+	+
	3. *Difflugia oblonga* Ehrenberg,1838	+	-	+	-
	4. *D. corona* Wallich1864	+	+	+	+
	5. *Centropyxis minuta* Deflandre,1929	+	-	+	+
	6. *Pyxicola affinis* Kent1882	-	-	+	+
ROTIFERA	7. *Brachionus calyciflorus* Pallas,1766	-	-	-	+
	8. *B. falcatus* Zacharias,1898	-	+	+	+
	9. *Keratella tropica* Apstein,1907	-	-	+	+
	10. *Lecane lunaris* O.F.Muller,1776	+	+	+	+
	11. *Horaella brehmi* Donner,1949	+	+	+	+
	12. *Testudinella patina* Hermann,1783	+	+	+	+
	13. *Trichocera longiseta* (Schrank,1802)	+	+	+	+
	14. *T. Procellus* Gosse,1851	+	+	+	+
COPEPODA	15. *Mesocyclops leuckarti* (Claus,1857)	-	-	+	+
	16. Cyclopoid nauplii	+	+	+	+
	17. C. copepoidite	+	-	+	+
	18. *Microcyclops varicans* Sars	-	-	+	-
CLADO	19. *Acroperus harpae* (Baird,1834)	+	+	+	+
	20. *Camptocercus rectirostris* Schoedler,1862	-	+	+	+

CERA	21. *Chydorus sphaericus* (O.F.Muller,1776)	+	+	+	+
	22. *Macrothrix spinosa* King,1853	+	+	+	+
	23. *M. triseralis*(Brady,1886)	+	+	+	+
	24. *Alona globolusa* (Daday,1898)	+	+	+	+
	25. *A. Rectangula* Sars,1862	-	-	+	+
	26. *M.odiosa* (Gurney,1907)	-	-	-	+
	27. *Bosmina longirostris* (O.F. Muller)	+	+	+	+
OSTRACODA	28. *Centrocypris sp.*	+	+	+	-
	29. *Heterocypris sp.*	-	+	+	-

Abbreviations: Mon = Monsoon ; += present, - = absent

Rotifera : Winter > post-monsoon > monsoon > pre-monsoon
Protozoa : Post-monsoon > winter > pre-monsoon > monsoon
Cladocera : Winter > post-monsoon > monsoon > pre-monsoon
Copepoda : Post-monsoon > winter > pre-monsoon > monsoon
Ostracoda : Post-monsoon > monsoon> pre-monsoon

The total Zooplankton population showed a variation according to season. Maximum numbers of zooplankton species were observed during Post-monsoon season and minimum numbers were observed during Monsoon season.

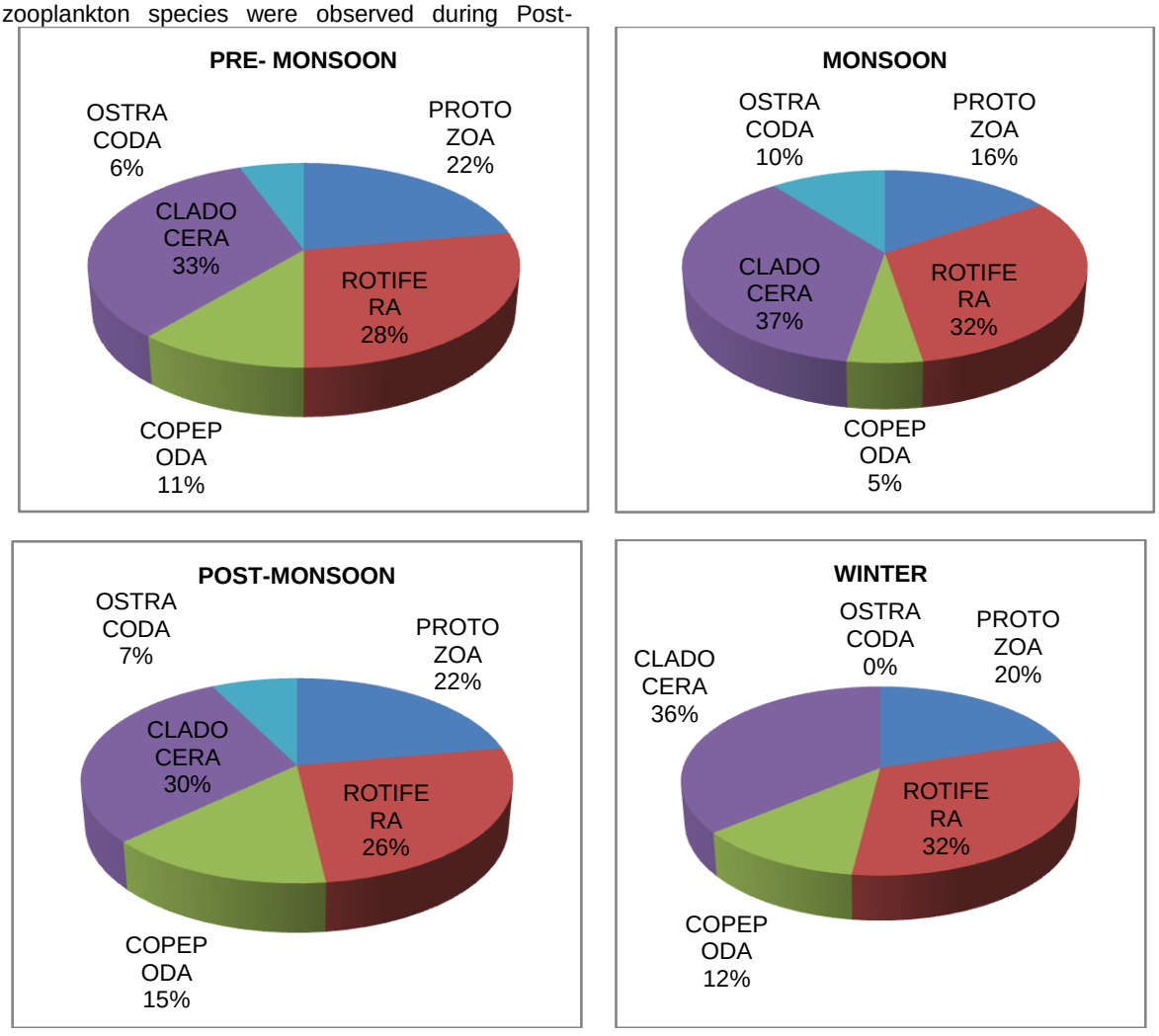

Fig1:- Composition of Different Groups of Zooplankton of Urpod beel, Goalpara, at Different Seasons

Discussion

In this investigation water temperature is higher in monsoon, lower in winter and medium in rainy season (Table I) . The present investigation is similar with the findings of Rao *et al*. (1996). They reported that temperature is the most important factor for zooplanktonic growth and variation.

The maximum tolerable limit of chloride is 17 mg/l and the value of this factor was found in ranged between 8.3 to 11.0 mg/l in the lake water, this finding is in conformity with Chandrasekhar and Rao (2010). The tolerance limit of P^H is said to be 6.0 to 8.5, which was in our findings in ranged from 6.5 to 7.2 with its mean value 6.8 showing the water is slightly acidic in

nature. Dissolved oxygen shows well oxygenated water in the lake, alkalinity and hardness indicate soft water nature in the beel water and this investigation was in conformity with the findings of Sarma and Sarma (2008).

Here the population of Rotifers and Cladocera were found higher in winter season. Similar findings were also observed by Sinha and Sinha (1993). Sarma and Sarma (2008) observed Rotifera as highest zooplankton species richness group from flood plain lakes of Assam but in contrary to that present investigation observed Cladocera as highest zooplankton species richness group.

Low chloride level in the beel shows the less anthropogenic influence in the lake water which increases the amount of Dissolve oxygen. The high DO content and the abundance of zooplankton of Urpod beel indicates the prospect of pisciculture in the beel as a possible mode of lively hood of the fishing people.

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