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A SURVEY OF PHYTOPLANKTON DIVERSITY IN BAISHAR BEEL OF NADIA DISTRICT OF WEST BENGAL

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ABSTRACT

An attempt has been made to study the phytoplankton diversity of a freshwater, seasonal oxbow lake, Baishar Beel of Nadia district of West Bengal. This particular beel is located within Chakdaha block of Nadia district and shows a connection between rural and urban areas. A total of 30 phytoplankton species were recorded from the wetland during the study period of March-November, 2012. Phytoplankton composition of the Baishar Beel was fluctuated by seasonal changes and four algal classes namely Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae form the phytoplankton spectrum within the study period. Among this, Chlorophyceae dominates in monsoon and post-monsoon and Cyanophyceae dominates in pre-monsoon season. Various diversity indices (Shannon Wiener diversity index, Margalef species richness index, Pielou evenness index, and Simpson dominance index) were calculated to illustrate the seasonal changes of phytoplankton. The Shannon Wiener diversity index values (2.52, 2.33 and 2.66 for pre-monsoon, monsoon and post-monsoon season respectively) were recorded. Which pinpoint a moderate pollution status of this beel?

Keywords: Phytoplankton diversity, Baishar beel, Nadia, West Bengal.

INTRODUCTION

Wetlands represent a transitional zone between terrestrial uplands and aquatic bodies and characterized by a large number of ecological niches which establishes huge biological diversity. The wetlands of West Bengal have been worked out by several authors during the last century (Mukherjee and Palit, 2001; Mandal *et al*., 2003; Chakraborty *et al*., 2004; Palit *et al.*, 2006; Palit and Mukherjee, 2007; Bala and Mukherjee, 2007; Mandal and Mukherjee, 2007; Bala and Mukherjee, 2011). Floodplain wetlands are locally known as 'Beel'. Phytoplankton acts as primary producer and biological filter of water ecosystem. The purpose of this study was to evaluate the phytoplankton diversity of this beel and its seasonal fluctuation. This type of study in continuation can pin point the successional changes of phytoplankton and the effects of anthropogenic load also.

MATERIAL AND METHODS

Study area and wetland characteristics

Baishar beel is a natural non-perennial oxbow lake, located between 22˚58'48' 'N latitude and 88˚27'53"E longitude of the Chakdaha block division of the Nadia district, West Bengal, India (Figure. 1).It covers a total area of 333.33 acreas of land surface. Although this wetland is a rain fed one but a small part occasionally gets connected with Bhagirathi River. This establishes its open type flood plain wetland nature. The mean depth of this water body is 7 ft.

Sample collection and analysis

Phytoplankton samples were collected between 9 to 10 am. in 500 ml amber color bottle and fixed

with Lugol's iodine solution in 100 : 1 ratios. The supernatant part was pipetted out and the sample being concentrated to5 ml. for analysis. Drop count method (Trivedy and goel, 1984) was followed for numerical representation of phytoplankton and the phytoplankton densities are expressed as organisms per litre.

Physico-chemical parameters such as water-temperature, pH, conductivity, dissolved oxygen, nitrate, phosphates, potassium were analysed by standard method (APHA, 1998). The community structure was analysed by Shannon-Wiener index of diversity (H/), Simpson's dominance index (λ), Margalef's richness index (R) and Pielou's evenness index (E) with the help of Bio-Diversity pro Ver. 2.0 program (McAleece et al. 1997) software. The pollution status of the water body was described by using the relationship proposed by Wilhm and Dorris (1968). For identification we used handbooks (Cox 1996; Desikachary 1959; Hustedt 1930; Komarek and Anagnostidis 1998, 2005; Prescott 1962; Smith 1950; Turner 1982; Wehr and Sheath 2003).

RESULTS AND DISCUSSION

The environmental characteristics (Table. 2) of the Baishar beel differed from one season to another and these influence the phytoplankton diversity and their biological spectrum. A total of 30 species (Table. 1) of phytoplankton of 4 distinct classes, Chlorophyceae (14), Cyanophyceae (9), Bacillariophyceae (5) and Euglenophyceae (2) were recorded from the beel. The post-monsoon season was represented by the maximum number (20) of phytoplankton taxa and the monsoon one with least representation (15). Phytoplankton density was highest in post-monsoon (12633/L) followed by monsoon (10500/L) and pre -monsoon (7266/L). Maximum values of Shannon-Wiener diversity index (H/) value 2.66 ,Simpson's dominance index (λ) value 0.911 and Margalef's richness index (R) value 3.36 observed in post-monsoon season and Pielou's evenness index (E) value reached its maximum 0.693 in pre-monsoon season (Figure.3). The percentage composition of the phytoplankton class (Figure. 2) showed that member of Chlorophyceae dominate in monsoon and post -monsoon and Cyanophyceae dominate in pre-monsoon season. The lowest percentage composition was represented by the member of Euglenophyceae for the pre-monsoon and post-monsoon season and Bacillariophyceae for the monsoon season.

It has been said that Cyanophycean members by their heat stress tolerating capacities they can withstand the environmental temperature and other conditions of the pre-monsoon season and flourish their maximum limit and other members cannot establish that much in such condition. On the other hand member of Chlorophyceae dominate for the monsoon and post-monsoon season using another specific ecological consideration. The phytoplankton density was also fluctuated due to environmental criteria and in hot and dry situation of pre-monsoon it was lowest and somewhat increased in monsoon. But due to dilution effect of water not so pronounced. The monsoon seasonal condition helps to collect more nutrients from other sources by rain water and these increases the fertility condition of the concerned wetland, which results into maximum density and diversity in post-monsoon. Other factors like competition between and within species are also directly or indirectly influenced under environmental guidance. Wilham and Dorris (1966) have proposed a relationship between species diversity and pollution condition of a water body as, species diversity value > 3 = clean; 1-3 = moderately polluted and < 1 = heavily polluted and this beel shows a moderate level of pollution load. So by this study we can highlight the detail changes of phytoplankton composition in a seasonal frame and also we can correlate these studies in depicting the pollution status of a water body.

CONCLUSION

The present investigation on phytoplankton diversity of the said water body reveals its phytoplankton spectrum within the specific time period. This study not only pinpoints the diversity status but also it depicts the pollution load of the water body using these minute organisms as bio-monitoring tool. As the phytoplankton constitute the basis of the food chain, their study and characterization helps us to understand the details of the nature and type of the members of the subsequent trophic levels. In this study it has been found that the water body exhibits moderate pollution load. Since these water bodies are utilized by local people for various purposes, this is significant because proper conservation methods and use may protect them from further deterioration. It is also necessary for sustainable use of our ecosystem. It is to be noted that such water-bodies are the controlling factor for the neighbouring population of every segment of the ecosystem. So, protective measures are to be taken seriously and not reluctantly.

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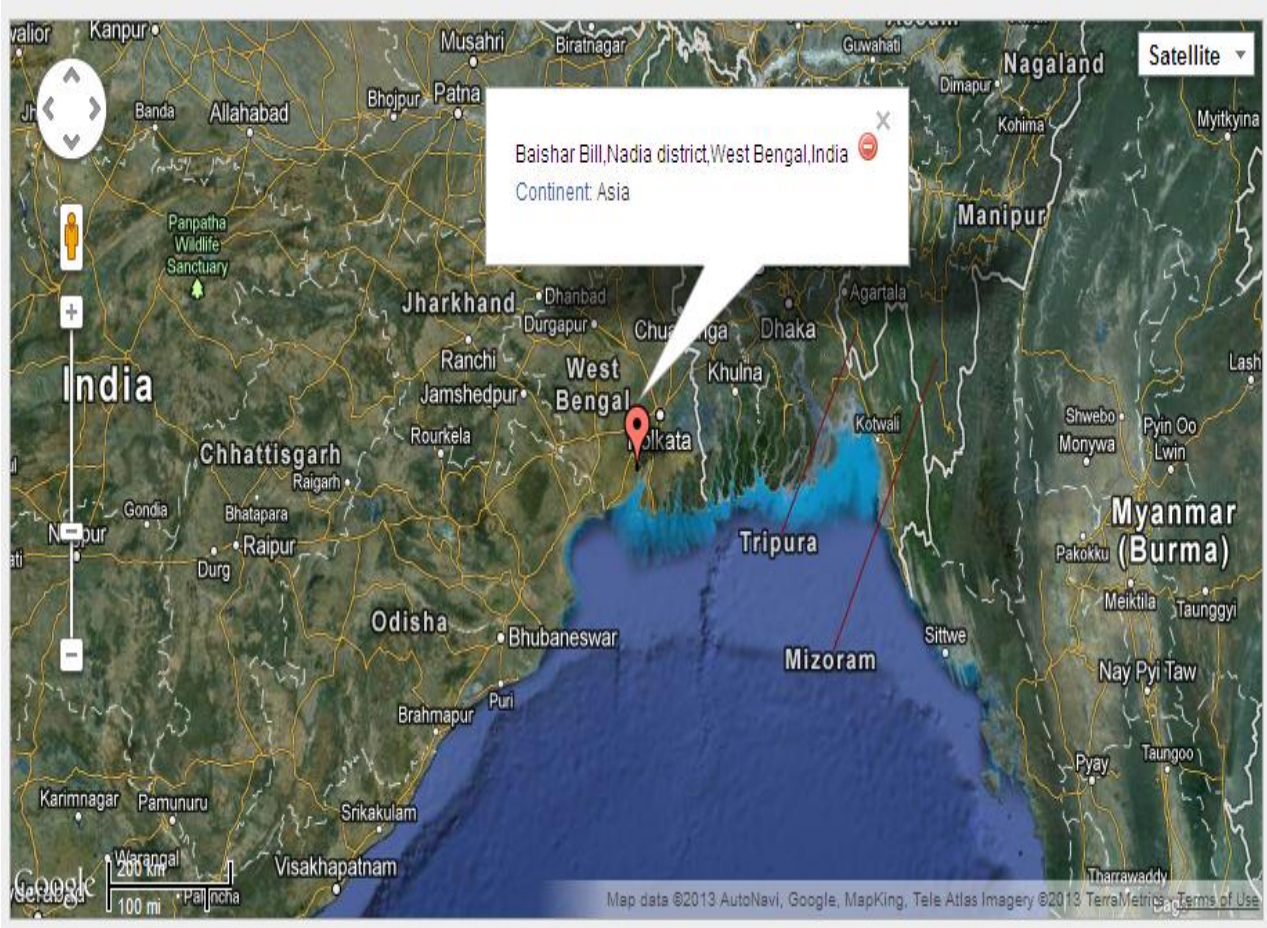

Figure-1: Satellite image of the location of the Baishar Bill.

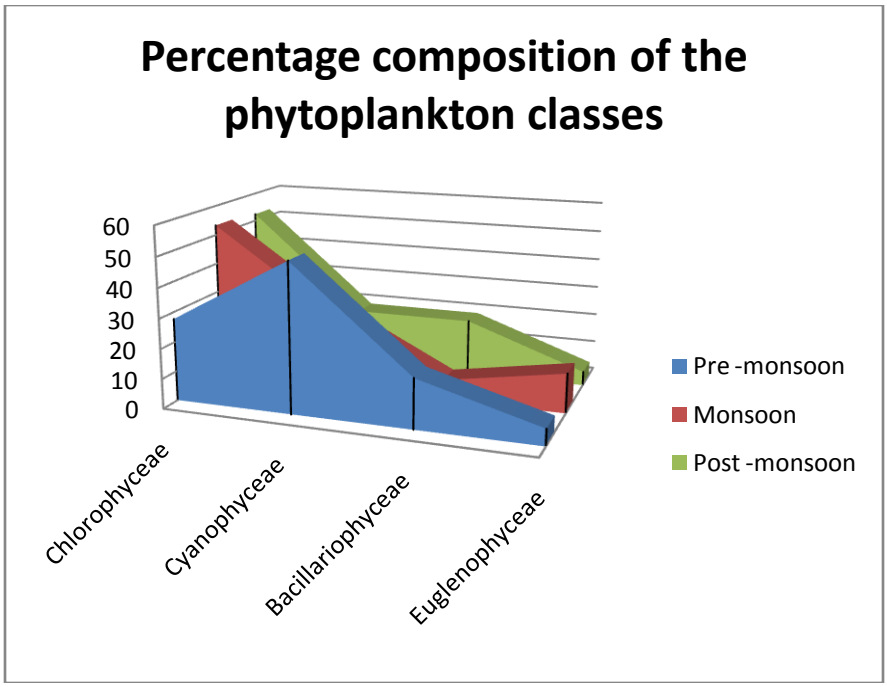

Figure-2: Percentage composition of the phytoplankton classes.

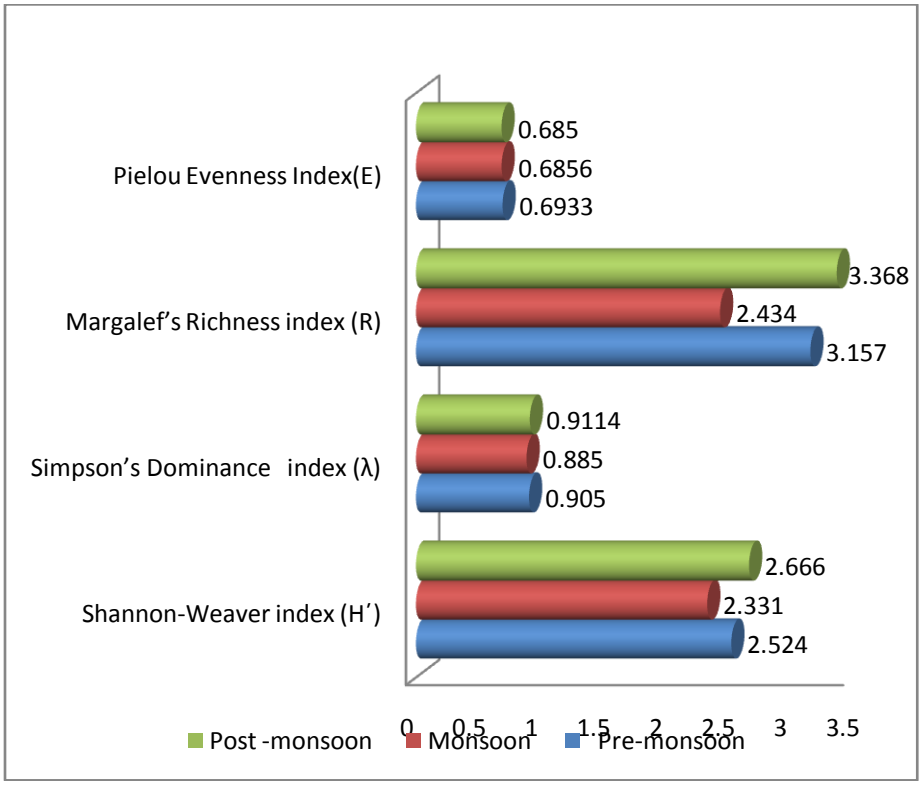

Figure-3: Fluctuation in various diversity indices during the study period.

Table-1: Phytoplankton taxa in the study site under seasonal time frame.
(+ = present, - = absent)

Serial no.	Material	Pre-monsoon	Monsoon	Post-monsoon
1	*Tetraedron hemisphaericum* Skuja	+	+	+
2	*Oocystis lacustris* Chodat	-	+	+
3	*Ankistrodesmus falcatus* (Corda) Ralfs	+	-	+
4	*Pediastrum angulosum* Ehrenberg ex Meneghini	-	+	+
5	*Coelastrum microporum* Nägeli	-	+	+
6	*Kirchneriella elegans* Playfair	-	-	+
7	*Selenastrum minutum* (Nägeli) Collins	+	-	+
8	*Sorastrum spinulosum* Nägeli	+	+	+
9	*Cosmarium angulatum* (Perty) Rabenhorst	-	+	+
10	*Closterium parvulum* Nägeli	+	-	-
11	*Volvox globator* Linnaeus	-	+	-
12	*Scenedesmus obliquus* (Turpin) Kützing	-	+	+
13	*Pandorina morum* (O.F.Müller) Bory de Saint-Vincent	-	-	+
14	*Mougeotia viridis* (Kützing) Wittrock	-	-	+
15	*Lyngbya capitata* (Desikachary) Anagnostidis	+	+	+
16	*Gloeotrichia echinulata* (J.E.Smith) P.Richcte	+	-	-
17	*Microcystis biformis* (A.Braun) Rabenhorst	+	+	-
18	*Oscillatoria formosa* (Bory) Gomont	+	+	+
19	*Spirulina subsalsa* (Oersted) Gomont	+	-	-
20	*Cylindrospermum stagnale* (Kützing) Bornet & Flahault	+	-	+
21	*Aphanocapsa montana* Cramer	+	-	+
22	*Merismopedia glauca* (Ehrenberg) Kützing	+	-	-
23	*Aulosira fritschii* Bharadwaja	+	+	-
24	*Eunotia grunowi var. uplandica* (Berg) Clave- Euler	+	+	-
25	*Pinnularia major* (Kützing) Rabenhorst	+	-	+
26	*Suriella capronii* Brebisson ex F. Kitton	-	-	+
27	*Meridion circulare* (Greville) C.Agardh	-	-	+
28	*Nitzschia acicullariformis* Manguin	+	-	+
29	*Eugulena viridis* Ehrenberg	+	+	-
30	*Lepocinclis acus* (O.F.Müller) Marin & Melkonian	-	+	+

Table-2: Season wise water quality parameters and amount of phytoplankton density.

Season	Water temperature(˚C)	p^H	Conductivity (µs/cm)	Dissolved Oxygen (mg/L)	Nitrates (mg/L)	Phosphates (mg/L)	Potassium (mg/L)	Phytoplankton Density/Litre
Pre-monsoon	32	6.75	243	6.95	1.83	0.363	15	7266
Monsoon	26	7	260	7.51	1.35	0.313	13	10500
Post-monsoon	23	7.55	251	7.32	1.16	0.242	19	12633