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Seasonal variation in Phytoplankton community structure of Muktapur lake: North Bihar

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ABSTRACT

Investigations were carried out on phytoplankton community structure of Muktapur lake in relation to physico-chemical parameters. Studies were done per month for two years from January 2014 to January 2016. Our findings show that Muktapur lake water has sufficient account of phytoplankton community. Community structure among phytoplankton, Chlorophyceae (green algae) with 64.62%, Cyanophyceae (blue green algae) with 31.64%, Bacillariophyceae (diatoms) with 2.97% and Euglenophyceae (euglena) with 0.77% were recorded during whole of the investigation.

Keywords: *Water Pollution, Phytoplanktons, Muktapur Lake, Inorganic Nutrients.*

INTRODUCTION

Planktons are any organism that live in the war column and are incapable of swimming against a current. Phytoplankton ('phyto' = plant; 'planktos' = made to wander) are single celled marine algae, some of which are capable of movement through the use of flagella while others drift with currents. These microscopic plants range in size from 1/ 1000 of a millimeter to 2 millimeters and float or swim in the upper 100 m of the ocean, where they are dependent on sunlight for photosynthesis. In addition to light and oxygen (O_2), they require basic simple inorganic chemical nutrients, such as phosphate (PO_4) and nitrate (NO_3). They also require carbon in the form of carbon dioxide (CO_2). Some phytoplankton, the diatoms, also require a form of silicon (silicate, SiO_4) because they have a "glass-like" shell.

Lakes are important attribute of the earth's landscape by shifting of river courses which are not only the source of precious water, but provide valuable habitats to different flora and fauna. Muktapur lake is one the largest ox-bow lakes of Samastipur district with a water spread are of 60 hectares. It is an important lake in the north Bihar. It is located at Muktapur about 6 km north of Samastipur Railway Station. There is a possibility of origin of this ox-bow lake by shifting of the Burhi Gandak River. The principal features of the lake are U-shaped. Its depth varies between 2.5m-6m, mean depth 1 m. One of the arms of the lake is largely dominated by Murrels and Cat-fishes. Locally this oxbow lake is known as Muktapur Maun.

MATERIALS AND METHODS

In order to determine the ecological condition of Muktapur lake, a survey was conducted at 8 selected sites *i.e.*, Site-1-Puranighat Site-2-Pipalghat, Site-3- Poolghat, Site-4-Asnanghat, Site-5-Musepurghat, Site-6-Majar ghat, Site-7-Mandir ghat, and Site-8, Dhobi ghat. These sites were choosen keeping in mind pollution point of view. The distance between two sites was 25-200m (Table 1).

Table 1
Selected sites on the bank of Muktapur lake

Site no.	Site's Name	Direction of Lake Part	Latitude (N-Coordinate)	Longitude (E-Coordinate)	Altitude (Elevation)
1	Puranighat	SW to NE	25°53'32.44" N	85°46'57.90" E	172 ft
2	Pipalghat	SW to NE	25°53'32.93" N	85°46'58.19" E	170 ft
3	Pool ghat	SW to NE	25°53'32.86" N	85°46'58.20" E	169 ft
4	Asnan ghat	E to W	25°53'41.06" N	85°47'00.51" E	171 ft
5	Musepurghat	NE to SW	25°53'41.61" N	85°47'00.52" E	169 ft
6	Majar ghat	E to W	25°53'42.00" N	85°47'00.59" E	170 ft
7	Mandir ghat	N to S	25°53'42.80" N	85°47'00.74" E	168 ft
8	Dhobi ghat	N to S	25°53'42.31" N	85°47'00.60" E	168 ft

Where: W-West, E-East, N-North, S-South

Collection and Preservation

Phytoplankton samples were collected by hauling 100 liters of water through a plankton net(blotting silk no.22) with the help of a water sampler of knowing volume. The sampler thus collected were preserved by adding lugal's solution. Peryphytic algae were collected by scraping submerge stones sticks piling macrophytes and other available substrates. These were also preserved by adding lugal's solution. 0.3 ml of Lugal's solution (It consists of 10g iodine and 20g potassium iodine dissolved in 200ml of distilled water and 20g of glacial acetic acid) was added to 100 ml sample and the preserved samples were kept in the dark.

Identification

Identification of the phytoplankton were mainly based on works of Prescott and Scott(1942) and Dhargalkar and Ingole (2004): Phytoplankton Identification Manual (First Edition : March 2004, National Institute of Oceanography, Dona Paula, Goa - 403 004)

Community structure

The preserved phytoplankton samples were concentrated prior to counting. These samples were centrifuged at 1500rpm for 20 minutes. The supernatant was removed by decanting and the phytoplankton samples were collected in 10ml final volume. The counting of phytoplankton was doe with the help of a haemacytometer. The haemacytometer was charged with vigorously shaken concentrated sample. The phytoplankton were allowed to settle for 5 minutes and then counted in the central chamber of the haemacytometer. 10 replicates were taken for each sample and the density of the phytoplankton was calculated as follows (Adoni *et al.*, 1985).

$$\text{phytoplanktons, units/l} = \frac{\text{No of phytoplankton in the central chamber x 104}}{\text{concentration factor}} \times 1000$$

Where, Concentration factor= Volume of water concentrated/Volume of water made after concentration

RESULTS AND DISCUSSION

Our study shows that Muktapur Lake water has sufficient account of phytoplankton community. Community structure among phytoplankton Chlorophyceae (Green Algae) with 64.62%, Cyanophyceae (Blue Green Algae) with 31.64%, Bacillariophyceae (Diatoms) with 2.97% and Euglenophyceae (Euglena) with 0.77% were recorded during whole of the investigation as mentioned in Fig. 1.

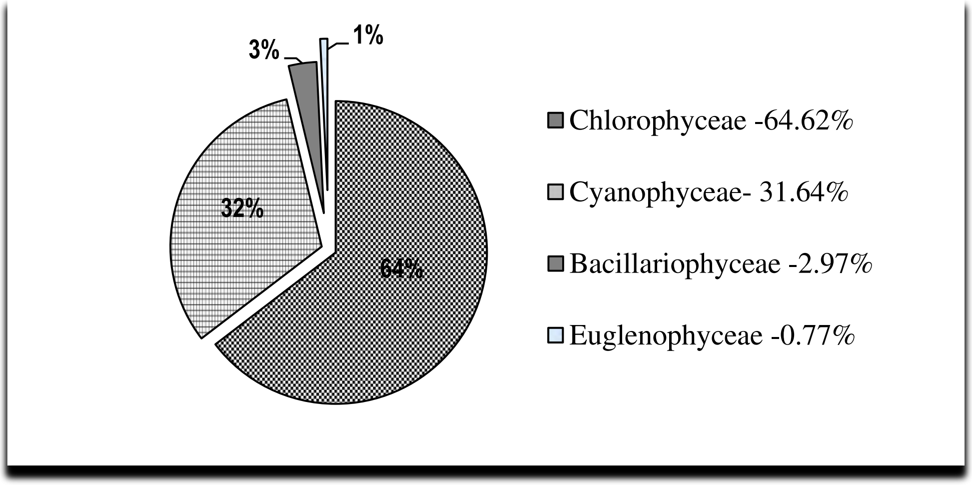

Fig.1. % abundance of phytoplankton

The annual mean average of phytoplankton in lake was found as 1991.25±1029.83 with annual range of fluctuation with Chlorophyceae contributing 1286.67±578.86, Cyanobacteria 630.00±478.37, diatoms59.17±35.79 and Euglena 15.42±14.69(Table 2 and Fig. 2-5). The maximum density of Chlorophyceae was recorded in March and minimum density in June probably due to high temperature in the summer. The result is same type in the case of Cyanophyceae. However, Singh (1992) observed minimum phytoplankton density in the month of September and maximum density in the month of July. Chlophyceae in the month of May recognizing that structural complexity is a meaningful property of natural communities, ecologist are making instead use of its quantitative expression which summarize the density of species in communities(Ahmad and Prasad 2006). The qualitative and quantitative studies of phytoplankton have been utilized to assess the quality of water (Adoni *et al.*, 1985 and Chaturvedi *et al.*, 1999). Phytoplanktons are the primary producers forming the first trophic level in the food chain (Shekhar *et al.*, 2008).

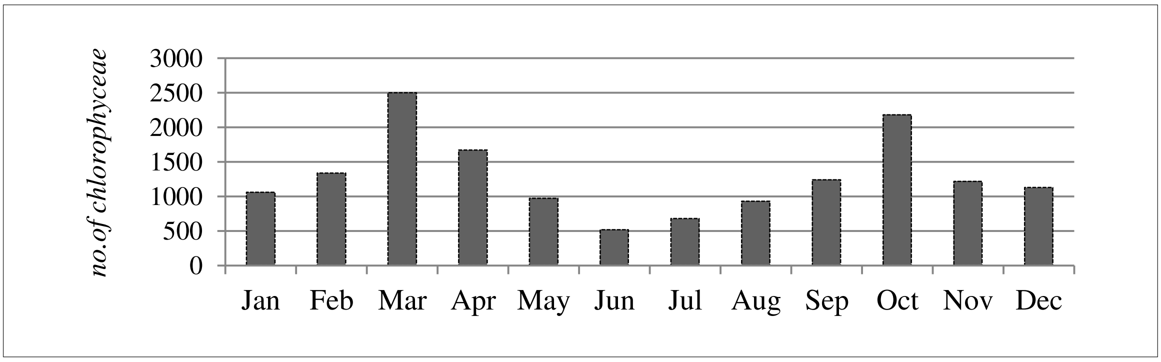

Fig.2. Chlorophyceae abundance per month

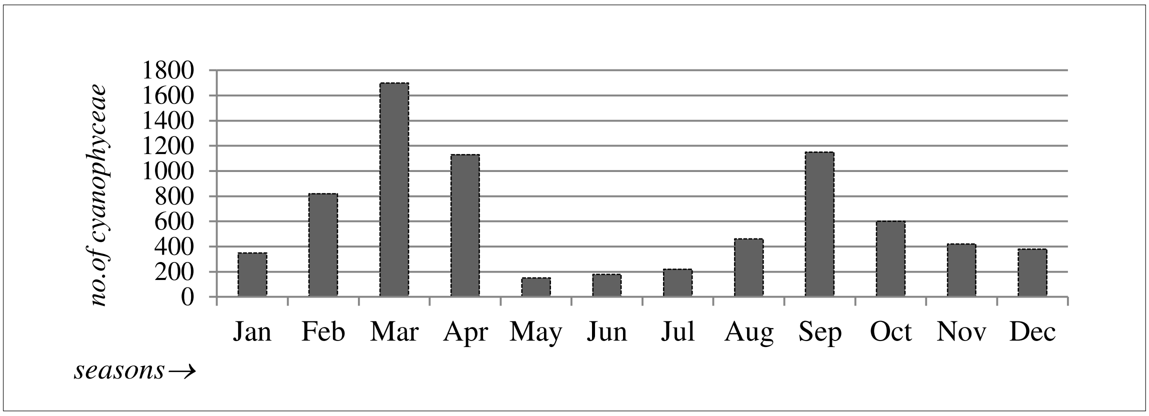

Fig.3. Cyanophyceae abundance per month

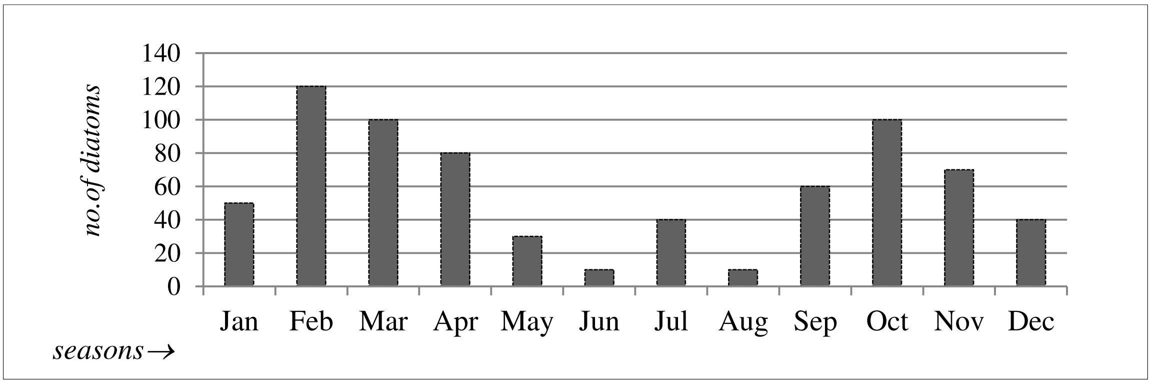

Fig.4. Bacillariophyceae (diatoms) abundance per month

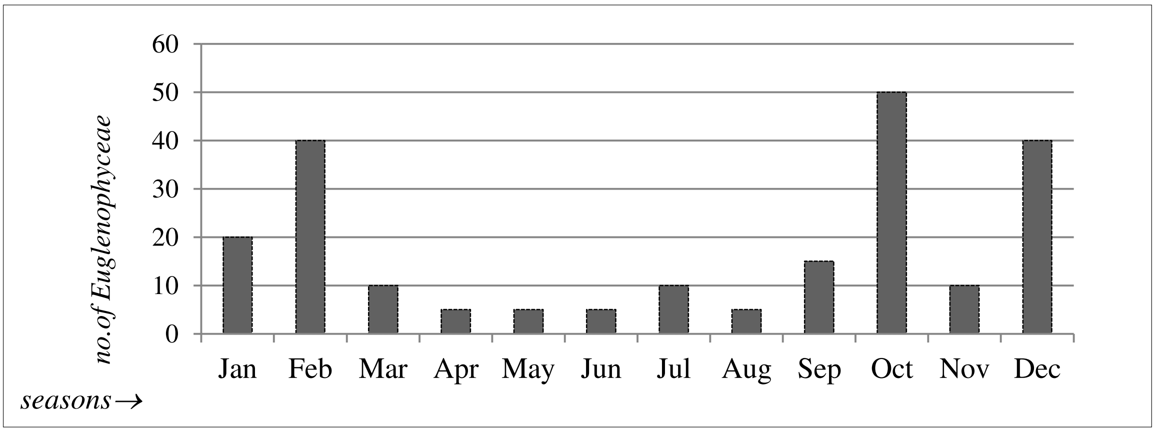

Fig.5. Bacillariophyceae(diatoms) abundance per month

Diversity of planktonic organisms is quite high in fertile standing water bodies. Phytoplankton diversity responds rapidly to changes in the aquatic environment particularly in relation to silica and other nutrients (Eggs and Aksnes, 1992 and Chellappa *et al.,* 2008). Several phytoplankton species have served as a bioindicators (Vareethiah and Haniffa, 1998, Bianchi *et al.*, 2003, Tiwari and Chauhan, 2006 and Shekhar *et al.*, 2008) and it is a well suited tool for understanding water pollution studies (Ahmad, 2006). High density of phytoplankton species diversity and physico-chemical parameters exhibited during study period except the month of September and October 2000. This may be due to physico-chemical factors greatly influenced by phytoplankton population. On the other hand, during rainy season cloudy weather, low transparency and heavy flood caused the decline of phytoplankton density and physico-chemical parameters. Dhargalkar and Ingole (2004) also recorded high population during summer and suggested that this might be due to physical rather than chemical conditions in which the water temperature and transparency had a direct relationship with phytoplankton population.

Table 2
Population density/Month of different group of phytoplankton

Month	Chlorophyceae	Cyanophyceae	Bacillariophyceae	Euglenophyceae	Total
	Green algae	Blue green algae	Diatoms	Euglena	
Jan	1060	350	50	20	1480
Feb	1340	820	120	40	2320
Mar	2500	1700	100	10	4310
Apr	1670	1130	80	5	2885
May	970	150	30	5	1155
Jun	520	180	10	5	715
Jul	680	220	40	10	950
Aug	930	460	10	5	1405
Sep	1240	1150	60	15	2465
Oct	2180	600	100	50	2930
Nov	1220	420	70	10	1720
Dec	1130	380	40	10	1560
Total	15440	7560	710	185	23895
Mean	1286.67	630.00	59.17	15.42	1991.25
S.D.±	578.86	478.37	35.79	14.69	1029.83

CONCLUSION

On the basis of aforesaid discussion it may be concluded that the lake has sufficient quality and quantity of phytoplankton. This will create a good situation for fish.

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