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MONTHLY VARIATIONS OF PHYTOPLANKTON IN FRESH WATER BODY, FUTERA ANTHROPOGENIC POND OF DAMOH DISTRICT (M.P.), INDIA

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***Abstract*—** The phytoplankton forms a very important component of aquatic vegetation, occurring in all kinds of water bodies and consequently enjoying a worldwide distribution. All types of growth forms emergent, submerged, free-floating and floating leaved aquatic environment indicates the quantity and quality of nutritive organisms present in the organism present in the medium. These nutritive organisms are aquatic plant and animals as food. These nutritive organisms are produced by mineral nutrients in solution in the water by means of the sun, heat and light. The green vegetation is able to transform the inorganic matter and carbonic acid in solution in the water into organic matter which forms vegetable tissue.

In the present study, four major group of phytoplankton have been identified, Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae and only the "net plankton" community have been analysed qualitatively and quantitatively; their seasonal variations have also been studied and the data obtained have been analysed statistically to estimate the significance of the impact of physico-chemical parameters on the phytoplankton community. Effort has also been made to evaluate the correlation between physico-chemical parameters and the "net phytoplankton" community. Monthly variation in the number of phytoplankton with the communities occupying higher trophic levels, were recorded in Futera pond, Damoh, M.P. The phytoplankton population of Futera pond was studied for a period of 12 months from June 2011-May 2012. The highest value of total phytoplankton in Futera pond was recorded 824.8±22.74 org/l in the month of August 2011, while the lowest value of total phytoplankton was recorded 348.4±10.01 org/l in the month of January 2012. The fluctuation in the number of phytoplankton was discussed in relation to the physico-chemical and other environmental condition of the pond. Dominance of Bacillariophyceae and Chlorophyceae indicate the eutrophic status of pond.

Keywords: Futera pond, phytoplankton, Eutrophic status.

I. INTRODUCTION

The word plankton originates from the Greek word for "wandering." It refers to the astonishingly diverse group of plants and animals that spend some or all of their life cycle drifting in the water of oceans or freshwater lakes. Although many of these organisms are capable of locomotion, they are generally unable to move independently of currents and waves. This lack of strong swimming ability separates plankton from nekton, which includes organisms that can control their movement in the water (such as fish). Some planktonic organisms can be quite large (up to a meter or more), however, plankton are generally smaller than nekton, and most are best viewed with the aid of a microscope.

The phytoplankton forms a very important component of aquatic vegetation, occurring in all kinds of water bodies and consequently enjoying a worldwide distribution. All types of growth forms emergent, submerged, free-floating and floating leaved aquatic environment indicates the quantity and quality of nutritive organisms present in the organism present in the medium. These nutritive organisms are aquatic plant and animals as food. These nutritive organisms are produced by mineral nutrients in solution in the water by means of the sun, heat and light. The green vegetation is able to transform the inorganic matter and carbonic acid in solution in the water into organic matter which forms vegetable tissue.

Although, there are a number of major groups of phytoplankton, those relevant to the present study are Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae.

The plankton which play a role of converting into food, suitable for fish and aquatic animals have acquired importance in fishery research. The planktons can also play an important role in indicating the presence or absence of certain species of fishes on in determining the population densities. Phytoplankton plays major role in the food web of an aquatic ecosystem and forms an intermediate link between primary and tertiary production. Study of plankton diversity and their ecology greatly contribute to an understanding of the basic nature and general economy of an aquatic habitat. Phytoplanktons are capable of concentrating large quantities of heavy metals from water bodies. These metals may be passed on and concentrated at higher trophic levels through the food chain. Thus it is necessary to understand whether the mortality is due to bio- magnifications of heavy metals or pollutants. The fishery potential is fully related to the presence of plankton (Dubey *et.al* 2006). Nutrients mainly nitrogen and phosphorus act as bio-stimulants causing eutrophication or enhancement of the growth of zooplankton and phytoplankton. This can lead to luxuriant

growth of unusual plankton blooms, that may or may not be toxic, but which on decay use up oxygen from the water which also cause deoxygenation. Phytoplanktons are representing the microscopic algal communities at primary level, whereas zooplankton at secondary level. They react quickly to limnological change of aquatic environment. They can be listed and used as pollution indicators (Telkhade et.al. 2008). Uncontrolled domestic wastewater discharge into the pond has resulted in the eutrophication of the pond as evidenced by substantial algal blooms, dissolved oxygen depletion in the subsurface waters, large fish kill and malodour generation. These conditions continued unabated and give rise to monoculture of water hyacinth (*Eichhornia crassipes*) which covered almost the entire pond area.

The present investigation has been undertaken to assess the monthly variations in the occurrence of phytoplanktons of Futera pond, Damoh district (M.P.) during June, 2011 to May' 2012, whose banks have been developed into an attractive tourist spot of the city.

II. STUDY AREA

The present study has been carried out on Futera pond of Damoh district in Madhya Pradesh. The topographical situation of Futera pond is 23°5' N longitude and 79°26' E latitude in central India and situated in Futera ward No.5 besides the railway line from Bina to Katni in Damoh district. The area of Futera pond is about 36.923 hectares and depth is 4.50 meter. The depth of pond is variable from season to season. The water storage capacity of Futera pond is about 48 MCFT (Fig. No.1). The pond is anthropogenic and pond water is used for domestic purpose, irrigation, aquaculture etc. The surrounding area of pond is semi urban and semi agricultural. The need to define quality of water has development with the increasing demand of water, which is suitable for specific uses and confirms to desired quality.

Fig. 1 Satellite map of Futera Pond Damoh Dist. (M.P.).

III. MATERIAL AND METHODS

Samples were collected monthly from five different sampling stations namely A, B, C, D, and E for one year (June 2011 to May 2012). The samples were collected at 11 am -1pm during second week of each month. Under qualitative analysis of planktonic communities the identification was done; as for as possible to species level. Sample was collected for planktonic population net in each month. Microphotography, camera Lucida diagrams etc. were the main tools for this taxonomy study of the planktonic species. For the quantitative studies of plankton twenty liter water was filtered through a piece of silk bolting cloth from each station and the collection samples were preserved in 4% formalin. Plankton counting was done with the help of Sedgwick Rafter cell. The average number of planktonic forms per liter was calculated by the following formula:

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$$\text{Organism/liter} = \frac{C \times 1000m3m3}{L \times D \times W \times S}$$

Where, C = Number of planktonic organisms counted in all strips
L= Length of strip
D= Depth of a strip
W= Width of a strip
S= Numbers of strips counted

IV. RESULTS AND DISCUSSION

The values of total number of phytoplankton have been noted to varied with an increasing trend from January up to August and becoming maximum in the month of August due to rain brings more phytoplankton from the water bodies of upper reaches to the sites under investigation. Then a decline is recorded from September onwards up to December. The phytoplankton populations belonged to 4 groups of algae, cyanophyta, chlorophyta, euglenophyta and bacillariophyta. In general, blue green algae were observed as a dominant group over other kinds of algae, in Futera pond. 51 species of phytoplankton have been identified. These include filamentous, colonials as well as unicellular forms. Bacillariophyta has the largest number of species (23), while chlorophyta was represented by 13 species.

The autotrophic phytoplankton comprising the major portion in ponds and lakes acts as a basic food material in the food chain of aquatic situations. The low level of phytoplankton may be due to grazing by zooplanktons and fishes. The investigation is also in accordance with Sharma and Capoor (2010).

The observation also shows close conformity with the findings of Mary Kensa (2011) who carried out a study on the diversity of phytoplankton in relation to physico-chemical parameters in two perennial ponds of Kulasekharam area, Kanyakumari district, Tamil Nadu. They identified forty eight species belonging to Bacillariophyceae, Euglenophyceae, Cyanophyceae, Chlorophyceae and Dinophyceae. High value of physico-chemical parameters and low phytoplankton diversity were recorded in the Undichalkulam, whereas low value of physico-chemical parameters and high phytoplankton diversity were recorded in Eraddaikulam. Among these forty eight species, Chlorella vulgaris, Cladophora

glomerata and Peridinum aciculiferum were recorded throughout the year.

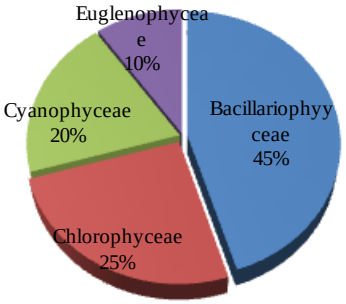
Sunita Kumari et al (2007) reported that the local and regional climatic variations has a great influence on plankton's species composition, diversity and density variation in freshwater pond ecosystem along with dispersal and grazing pressure. Ali et al (2005) suggested that diversity of plankton life were used as a measure of water quality of a brackish water aquaculture pond. While making a study on monthly variations in biological and Physico-chemical parameters of brackish water fish Pond, muzaffargarh, Pakistan they reported that Phytoplanktons were abundant as compared to zooplanktons.

Phytoplankton density:

The highest value of total phytoplankton density in Futera pond was recorded 824.8±22.74 org/l in the month of August 2011, while the lowest value of total phytoplankton was recorded 348.4±10.01 org/l in the month of January 2012. The phytoplankton species identified in this study were composed of Bacillariophyceae (45.10%), Chlorophyceae (25.49%), Cyanophyceae (19.61%) and Euglenophyceae (09.80%). In the frequency occurrence of phytoplankton, the most dominant group was that of Bacillariophyta. Highest percentage was recorded in February. The population of this group remained high throughout the year, with very little variation in Futera pond. The second dominant community was that of Chlorophyta with optimum percentage in June and October. Cyanophyta and Euglenophyta occupied a very small portion in the phytoplankton community with maximum percentage in January.

Hastler (1947) observed that the constant addition of even low levels of nitrogen and phosphorus to an aquatic environment could greatly stimulate algal growth and high level of total nitrogen was followed with the growth of Chlorophycean, Eugleninean and Cyanophycean forms. Prescott, (1948) discussed the importance of temperature in the growth and periodicity of blue green algae. Zafar (1964) reported that phosphates were observed in traces during winter season, and Cyanophyceae were in peak when the phosphate content is very low or even undetectable. Nazneen (1974) found that maximum bloom of phytoplankton occurred during summer due to high growth of Myxophyceae, while in Bacillariophyceae growth was greater than Chlorophyceae. A decrease in the abundance of total phytoplankton observed in May and in November was attributed to the disappearance of *Microcystis aeruginosa*.

Graph No.1. The number of genera belonging to different families



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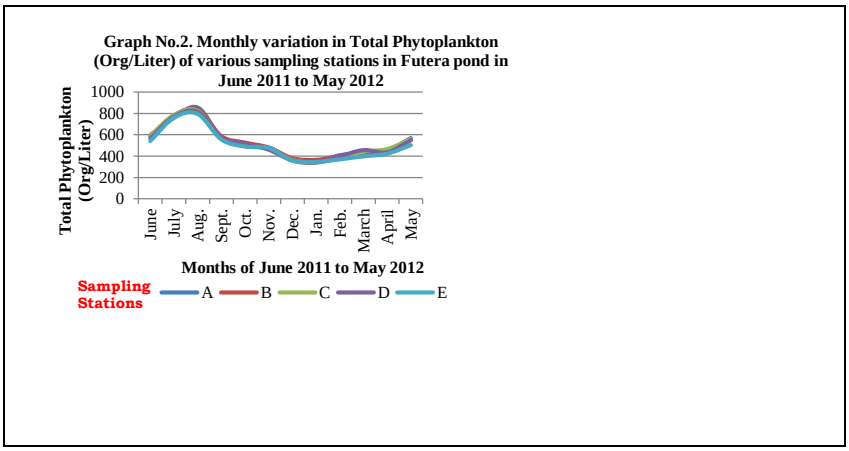

Table No.1. Phytoplankton Genera encountered at different sampling stations of Futera pond, Damoh district (M.P.).

S.No.	PHYTOPLANKTON GENERA	Sampling Stations				
		A	B	C	D	E
	BACILLARIOPHYCEAE					
1.	*Amphora sp.*	+	-	+	+	+
2.	*Amphora ovalis*	+	+	+	+	+
3.	*Asterionella Formosa*	+	+	+	-	+
4.	*Cymbella cistula*	+	+	-	+	+
5.	*Cyclotella sps*	+	+	+	-	+
6.	*Cymbella naviculiformis*	+	+	+	+	+
7.	*Cymbella cysta*	+	+	+	+	+
8.	*Fragillaria sp.*	+	-	+	+	+
9.	*Fragillaria intermedia*	+	+	+	+	+
10.	*Frustulia sp.*	+	+	+	+	+
11.	*Gamphonema gracile*	+	+	-	+	+
12.	*Melosira granulate*	+	+	+	-	+
13.	*Meridion circulare*	+	-	+	+	+
14.	*Navicula mutica*	+	+	+	+	+
15.	*Navicula indica*	+	-	+	+	+
16.	*Nitzschia sp.*	+	+	+	+	+
17.	*Nitzschia vermicularis*	+	-	+	+	+

S.No.	PHYTOPLANKTON GENERA	Sampling Stations				
		A	B	C	D	E
18.	*Pinnularia braunni*	+	+	+	+	+
19.	*Stauronesis sp.*	+	+	+	+	+
20.	*Synedra ascus*	+	+	+	+	+
21.	*Synedra ulna*	+	+	+	+	-
22.	*Surirella sp.*	+	-	+	+	+
23.	*Tabellaria sp.*	+	+	+	+	+
CHLOROPHYCEAE						
24.	*Actinastrum hantzschii*	+	+	+	+	+
25.	*Cladophora fracta*	+	+	-	+	+
26.	*Chlorella sps.*	+	+	+	+	+
27.	*Cosmarium sp.*	+	+	+	+	+
28.	*Eudorina sp.*	+	+	+	-	+
29.	*Oedogonium sps.*	+	-	+	+	+
30.	*Pediastrum simplex*	+	+	+	+	+
31.	*Scenedessmus sps.*	-	+	+	-	+
32.	*Selenastrum gracile*	+	+	-	+	+
33.	*Spirogyra sps.*	+	+	+	-	+
34.	*Ulothrix zonata*	+	+	+	+	+
35	*Volvox globater*	+	+	+	+	+
36	*Zygnema majus*	+	+	+	+	+
CYANOPHYCEAE						
37.	*Anabaena oryzae*	+	-	+	+	+
38.	*Anabaena spiroides*	+	+	-	+	+
39.	*Chroococcus sp*	+	+	+	-	+
40.	*Gloeocapsa sp*	+	+	+	+	+
41.	*Lyngbya sp.*	+	+	+	+	+
42.	*Microcystis sp.*	+	+	+	+	+
43.	*Merismospedia sps*	-	+	+	+	+
44.	*Nostoc sps*	+	-	+	+	+
45.	*Oscillatoria sp.*	+	+	+	+	+

S.No.	PHYTOPLANKTON GENERA	Sampling Stations				
		A	B	C	D	E
46.	*Spirulina sp.*	+	-	+	+	+
EUGLENOPHYCEAE						
47.	*Euglena viridis*	+	+	+	+	-
48.	*Euglena acus*	+	-	+	+	+
49.	*Phacus curvicauda*	+	+	+	+	+
50.	*Phacus orbicularius*	+	+	-	+	+
51.	*Phacus longicauda*	+	+	+	+	+
Total		**49**	**40**	**45**	**44**	**49**

V. CONCLUSION

Therefore it can be concluded through this study that the age old Futera pond with social and cultural importance is degrading at an alarming rate and eutrophic status. In the past two decades the pond has shown drastic changes regarding the productivity. The rapid increase of human activities and assemblage of livestock are creating pollution in the pond water and needs immediate measure. At this critical juncture the local representatives, Government and Non- Government bodies, the educated bodies, the village heads and the reputed figures of the society should come forward and formulate conservational model for the sustainability of this beautiful water body.

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