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Diversification in phytoplankton population of Shelar Lake

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Abstract
Thane district consists of many fresh water bodies. One of them is Shelar lake, situated in the rural area of it. Three stations having environmentally different conditions such as cow shed near one station and oil runoff from nearby highway into another station were selected for the study. Phytoplankton study was carried out in a lake for a period of one year i.e. from October 2010 to September 2011.Total 19 genera were recorded belonging to chlorophyceae, cyanophyceae and bacillariophyceae. Extensive growth of phytoplankton, caused by increased amount of nutrients is a common problem in lakes. The lake shows slight eutrophication in the pre monsoon period which reduces the clarity of water and has depletion of oxygen content. It was observed during the study that some of the members of chlorophyceae, bacillariophyceae and cyanophyceae show their appearance only during premonsoon. Phytoplankton responds rapidly to the condition changes. Conditional changes result in the formation of high compositional diversity. Phytoplankton like *Navicula, Nostoc*, *Microcystis*, make their appearance in large quantity during premonsoon indicating the lake is polluted. Phytoplankton belonging to Chlorophyceae group shows domination on cyanophyceae and bacillariophyceae group.

Keywords: Phytoplankton, Shelar, premonsoon, fresh water

1. Introduction
Phytoplanktons are small organisms that drift on water currents. They are microscopic aquatic plants, occurring as unicellular, colonial or filamentous forms, without any resistance to currents, and are free floated or suspended in open/pelagic waters. Phytoplankton communities are widely spread from aquatic to terrestrial lands. Plankton forms the first ring of food chain in aquatic environment affecting the efficiency of this environment. Phytoplankton composition is a tropic indication of the water mass. In addition, phytoplankton species are used as an indicator for determining the nutrient level which is the basis for preparing and monitoring the strategies of the lake management in the lakes. Plankton is the major primary producers in many aquatic systems and is important food source for other organisms [3].
The abundance of phytoplankton in aquatic ecosystems is primarily controlled by the availability of the nutrients nitrogen and phosphorus in the water column and in sediments, although light and temperature also plays an important roles in determining the distribution and abundance of these organisms. In tropical lakes conspicuous temporal fluctuation in rainfall, runoff and vertical mixing imply some annual variation patterns which are reflected on species composition and abundance of phytoplankton [10]. The first and foremost visible symptoms of nutrient enrichment are the prolific growth of algal communities which produce blooms.
The Shelar Lake is a fresh water body situated in the rural area of Thane district near Bhiwandi. Geographically it lies between $18^0$42'and $20^0$20' North latitude and $72^0$45'and $73^0$45' East longitude. At one end the lake have entry of national highway run off during rainy season while at the other end entry of agricultural runoff make the water polluted. Presence of cow shed at the edge of Lake made the water rich in nitrogenous waste. Phytoplankton responds very quickly to environmental changes because of their very short life cycle and hence their standing crop and species composition are likely to indicate the exact quality of a water body in which they are found. The distribution, composition and succession of plankton give valuable clue for determining the environmental conditions, which determine their abundance is fundamental to any scientific utilization of water resources. The present study has been undertaken for the first time on the Shelar lake to study the effect of climatic change on the phytoplankton composition.

2. Materials and Methods

The study was conducted during October 2010 to September 2011 on Shelar lake, Bhiwandi. The standard methods suggested by APHA are used for plankton collection and identification. Plankton samples were collected once in every month between 8am to 10 am from all the three sites selected for study at a depth of 20 cm below the surface [5]. Plankton samples were collected by net made up of silk cloth having mesh size approximately 120 µm [1]. The plankton concentrate used to accumulate in the specimen jar of one-liter capacity fitted at the tail end of the net were collected and preserved in 5% formalin solution on the spot. One-liter sample was centrifuge at 15000rpm for 15 minutes. The supernatant was discarded and total 100 ml sample is collected for study. Qualitative and quantitative observations were made in the laboratory. The plankton identification was done with the aid of plankton identification key and monographs [2, 6, 9].

3. Results and Discussion

The environmental characteristic of the lake differ season to season. In the present investigation algal groups belonging to Cyanophyceae, Chlorophyceae and Bacillariophyceae were recorded. As shown in table 1, over all 19 genera were recorded out of which 9 genera belonging to Chlorophyceae,6 genera belonging to Cyanophyceae and 4 genera belongs to Bacillariophyceae. The genera belonging to chlorophyceae are, *Spirogyra sp*, *Zygnema sp, Oedogonium sp, Pediastrum sp, and Chlorella sp* which shows moderate appearance while *Desmidium sp, Scenedesmus sp, Ankistrodesmus sp Gloeotrichia sp* shows rare appearance. Among Cyanophyceae Spirullina sp, *Nostoc sp, Microcysts sp* and *Anabaena sp* were dominated while *Merismopedia sp* and *Oscillatoria sp* shows rare appearance. Members of bacillariophyceae were *Navicula sp* and *Diatoms shows* dominance in appearance while *Niotzchia sp* and *Melosira sp* appeared rarely. The percent group density of chlorophyceae was more at all the three stations rather than Cyanophyceae and bacillariophyceae.

At station *A Gloeotrichia* sp was absent throughout the pre monsoon period while *Chlorella sp* and *Ankistrodesmus sp* shows its absence during monsoon and post monsoon respectively. Numerically large number of Bacillariophyceae members were recorded during premonsoon. From Cyanophyceae group *Nostoc* sp was absent during premonsoon and its presence in other season shows numerically low value. The biological processes are so complex that no single ecological factor can be identified to be responsible for the growth and production of plankton community. Environmental heterogenecity increases the number of species and diversity in aquatic system [4].

Group % density of chlorophyceae is more during monsoon at all the three stations. The bacillariophyceae and cyanophyceae members are found to be more during premonsoon and postmonsoon period. Marked seasonal variations were recorded by Nisar Shaikh [7].

Table 1: Variation in phytoplankton population at Shelar lake

Phytoplankton	Station A			Station B			Station C		
	PRM	MO	PSM	PRM	MO	PSM	PRM	MO	PSM
Chlorophyceae									
Spirogyra sp	20	17	25	16	19	16	16	19	17
Zynema sp	13	19	16	14	11	19	12	15	16
Oedogonium sp	13	19	20	18	14	21	20	17	18
Pediastrum sp	17	15	19	0	19	18	13	11	15
Scenedesmus sp	12	13	14	9	21	0	15	20	13
Desmidium sp	23	13	9	17	17	19	11	18	19
Gloeotrichia sp	0	12	7	12	10	11	13	0	11
Ankistrodesmus sp	8	6	0	7	0	11	12	14	16
Chlorella sp	20	0	10	15	12	17	15	20	8
Group % Density	38.71	40.66	35.98	34.29	49.88	49.65	34.12	40.32	40.89
Bacillariophyceae									
Niotzschia sp	15	0	25	16	0	18	16	0	0
Navicula sp	19	14	11	25	25	27	22	14	14
Melosira sp	22	17	8	21	0	17	11	10	17
Diatom sp	23	22	21	15	16	19	19	12	10
Group % Density	27.08	30.25	26	28.27	24.33	20.92	31.94	27.60	23.27
Cyanophyceae									
Anabaena sp	14	19	18	19	18	14	15	9	15
Nostoc sp	0	9	16	15	11	18	19	20	12
Merismopedia sp	20	20	22	15	0	25	13	10	0
Spirullina sp	13	12	27	19	16	0	19	15	15
Microcysts sp	20	14	14	21	16	14	22	14	14
Oscillatoria sp	17	0	20	19	0	11	16	16	19
Group % Density	34.18	28	37.24	37.0	25.76	29.41	33.92	30.05	35.82
Total No. of Phytoplankton	208	137	205	221	128	181	230	136	155

PRM-Premonsoon, MO-Monsoon, PSM- Postmonsoon

Appearance and massive growth of phytoplankton in water bodies depend not only on factors such as light and temperature but also on the nutrient load, which affect species composition. In the present study, greater abundance of phytoplankton was recorded in premonsoon and post monsoon. There is decrease in plankton production during monsoon. These results imply that changes in land use or climate that affect these local environmental factors are likely to have major impacts on large-scale biodiversity patterns of freshwater phytoplankton.

4. Conclusion

The Lake receives sufficient monsoon rainfall and associated run off in monsoon results in enhanced concentration of suspended sediments, inorganic substances and dissolved organic matter which in turn impacts the volume of species diversity of phytoplankton in the lake. The qualitative texture of phytoplankton community observed in Shelar Lake indicated a sequence of Chlorophyceae > Cyanophyceae > Bacillariophyceae. The Chlorophyceae group, which is the most successful competitor in waters, is well exposed to penetration of sunlight. The quantitative texture also follows similar sequence. Density of phytoplankton was found higher during premonsoon at all stations and was quite higher at Station C may be due to nutrients and temperature as rightly said by Subhabrata Ghosh [8]. Present investigation indicates that climatic changes are expressed in the phytoplankton community fluctuation. Presence of more cyanophceae and bacillariophyceae members reveals presence of organic pollutants during premonsoon in comparison with monsoon.

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