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RESEARCH ARTICLE

Seasonal Variation of Phytoplankton Diversity in Anchepalya Lake, Bengaluru Urban, India

M. Raghavendra[1], N. Nandini[2], M. VijayKumar[1], and K. Bheemappa[1]

1. Research scholars, Department of Environmental Science, Bangalore University, Bengaluru.

2. Professor, Department of Environmental Science, Bangalore University, Bengaluru.

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Corresponding Author

M.Raghavendra, Department of Environmental Science, Bangalore University,
Bangalore – 560056,
Karnataka, India.
E-mail: raghu.envi@gmail.com

Abstract

Seasonal dynamics of Phytoplankton populations were studied in Anchepalya Lake for a period of one year from March 2013 to February 2014 covering three seasons. Phytoplankton sampling, collection, quantitative and qualitative population was performed using APHA (2005) Standard methods. The counting of plankton was done by using Sedgwick Rafter counting cell and phytoplankton were identified by using the identification manual on limnology by Adoni (1985). A total of 88 genera of phytoplanktons were recorded. The diversity of Phytoplankton number is of increase as in the order of Chlorophyceae >Bacillariophyceae > Cyanophyceae > Eugleanophyceae. The present study revealed that the lake water is polluted with the direct entry of sewage and effluent discharge.

INTRODUCTION

Phytoplankton forms the base of the aquatic food chains and is important indicators of the productivity of aquatic environments. Phytoplankton productivity and composition are influenced by the spatial and temporal dynamics of environmental factors. The relationship between the physicochemical parameters and plankton production of water bodies are of great importance in management strategies of aquatic ecosystems.

Phytoplankton is the primary producers and good indicators of the trophic status of aquatic ecosystems (Whitton and Potts, 2000). They convert solar energy to chemical energy and release oxygen to the water body and the surrounding terrestrial environment through photosynthesis. Half of the world's oxygen is produced via phytoplankton photosynthesis (Roach, 2004).

Material and Methods

The present work has been conducted on Anchepalya Lake, located in the Northern part of Bangalore having an area of 16.08 acres and lies within geographical coordinates 13°03’07”N and 77°28'46"E. The Lake receives water through surface runoff during monsoon from surrounding upland and has a regular inlet of sewage canal.

The standard methods of APHA (American Public Health Association) 2005 were used in collection, counting and identification of planktons.

Collection of Plankton samples was carried out using a mesh net number 25 and size 20 µm. 50 liters of water were measured in a graduated bucket and filtered through the net and concentrated in a 100 mL bottle. The samples were labeled with the date, time, name of the Lake and the volume measured and pasted on the containers. Plankton is preserved by using 4% formalin. The sample allowed to settle for 24-48 hours and was further concentrated to approximately 30 mL by decanting. The Sedgwick Rafter counting cell is used to count the plankton. The Sedgwick Rafter cell is approximately 50 mm long, 20 mm wide and 1 mm deep. The total volume of the cell is 1 mL. A Trinocular compound microscope is used to count the plankton with different eyepieces such as 10X and 40X. Formula to convert unit/mL of plankton into unit/liter is

$$n = \frac{(a \times 1000)\, c}{l}$$

Where,
n = Number of plankton / liter of water.
a = Average no. of plankton in one small counting chamber of S-R cell.
c = mL of plankton concentrate.
l = Volume of original water filtered in liter.

Result and Discussion

Plankton has long been used as indicators of water quality. Because of their short life spans, plankton responds quickly to environmental changes. They flourish both in highly eutrophic waters while a few others are very sensitive to organic or chemical wastes.

Table1: Seasonal Distribution of Bacillariophycae No/mL

	Species	Summer	Monsoon	Winter
1	*Achnanthes inflata*	2	3	2
2	*Amphora coffeaeformis*	2	0	0
3	*Amphora veneta*	3	2	2
4	*Cyclotella meneghiniana*	4	2	3
5	*Caloneis bacillum*	2	2	0
6	*Cymbella cymbiformis*	2	2	0
7	*Cymbella gracilis*	8	4	2
8	*Diatoms*	3	2	2
9	*Fragilaria intermedia*	6	3	4
10	*Fragilaria crotonensis*	5	2	3
11	*Fragilaria pinnata*	6	2	4
12	*Gomphonema sphaerophorum*	6	2	4
13	*Gomphonema. acuminatum*	3	2	0
14	*Gyrosigma acuminatum*	2	1	1
15	*Hantzschia amphioxys*	3	1	2
16	*Hantzschia virgata*	1	1	1
17	*Melosira granulata*	2	1	1
18	*Navicula cincta*	6	2	4
19	*Navicula cuspidata*	5	3	4
20	*Navicula protracta*	6	2	2
21	*Navicula pupula*	2	1	2
22	*Nitzschia obtusa*	2	1	2
23	*Nitzschia palea*	1	2	1
24	*Pinnularia Intermedia*	4	2	3
25	*Synedra tabulata*	2	1	2
26	*Synedra ulna*	1	2	1
27	*Tabellaria flocculosa*	2	1	0
	Total	91	49	52

Table 2: Seasonal Distribution of Chlorophyceae No/mL

	Species	Summer	Monsoon	Winter
1	*Actinastrum gracillimum*	3	2	1
2	*Ankistrodesmus falcatus*	2	0	1
3	*Ankistrodesmus spiralis*	5	2	3
4	*Chlorella vulgaris*	6	3	4
5	*Closterium acerosum*	3	0	2
6	*Closterium moniliferum*	2	1	1
7	*Coelastrum microsporum*	3	1	2
8	*Coleochaete orbicularis*	1	0	2
9	*Cosmarium depressum*	2	0	0
10	*Cosmarium granatum*	1	1	1
11	*Cosmarium reniforme*	1	0	0
12	*Cosmarium moniliforme*	6	3	4
13	*Crucigenia quadrata*	3	2	1
14	*Crucigenia tetrapedia*	1	0	1
15	*Eudorina elegans*	3	1	2
16	*Gonium pectorale*	3	1	3
17	*Kirchneriella lunaris*	2	0	1
18	*Micrasterias foliacea*	3	1	2
19	*Micrasterias rotata Ralfs*	2	0	2
20	*Micrasterias thomasiana*	2	2	1
21	*Oedogonium gracilius*	0	3	0
22	*Oedogonium princeps*	2	3	2
23	*Pandorina. morum*	3	4	1
24	*Pediastrum biradiatum*	0	2	1
25	*Pediastrum duplex*	0	2	1
26	*Pediastrum simplex*	2	8	3
27	*Pediastrum tetras*	2	3	1
28	*Scendesmus dimorphus*	4	6	2
29	*Scendesmus quadricauda*	3	5	2
30	*Spirogyra rivularis*	4	6	2
31	*Spirogyra distenta*	2	1	1
32	*Spirogyra gracilis*	3	1	2
33	*Tetraedron sp.*	1	0	2
34	*Tetradesmus sp.*	2	0	0
35	*Ulothrix cylindricum*	1	1	1
36	*Ulothrix variabilis*	1	0	0
37	*Volvox aureus*	6	3	4
38	*Zygnema pectinatum*	3	2	1
	Total	**93**	**70**	**60**

Table 3: Seasonal Distribution of Cynophyceae No/mL

	Species	Summer	Monsoon	Winter
1	*Anabaena azollae*	1	2	3
2	*Anabaena variabilis*	1	3	3
3	*Aphanocapsa biformis*	0	1	2
4	*Arthrospira platensis*	1	2	3
5	*Chroococcus dispersus*	0	2	2
6	*Cylindrospermum stagnale*	2	1	2
7	*Lyngbya birgei*	3	0	0
8	*Lyngbya ceylanica*	3	2	2
9	*Merismopedia convoluta*	4	1	3
10	*Merismopedia elegans*	2	1	0
11	*Merismopedia punctata*	2	1	0
12	*Microcystis aeruginosa*	8	3	2
13	*Nostoc sphaericum*	3	1	2
14	*Oscillatoria obtusa*	6	2	4
15	*Oscillatoria curviceps*	5	2	3
16	*Oscillatoria princeps*	6	2	4
17	*Phormidium tenue*	3	4	6
18	*Spirulina major*	2	1	3
19	*Spirulina subsalsa*	0	1	1
	Total	**52**	**32**	**45**

Table 4: Seasonal Distribution of Euglenophyceae No/mL

	Species	Summer	Monsoon	Winter
1	*Euglena acus*	3	1	3
2	*Euglena elastica*	2	0	1
3	*Phacus indicus*	3	1	2
4	*Phacus longicauda*	2	0	2
	Total	10	2	8
	Total Phytoplankton Count / mL	**244**	**153**	**167**
	Total Phytoplankton Count / L	**73200**	**45900**	**50100**

Phytoplankton:

In the present study the qualitative and quantitative analysis of phytoplankton in Anchepalya Lake water were carried out seasonally and the density of phytoplankton were identified. Figure 1 elucidates about the Phytoplanktons observed in four major groups, namely Chlorophyceae (Green algae), Cyanophyceae (Blue green algae), Bacillariophyceae (Diatoms) and Eugleanophyceae.

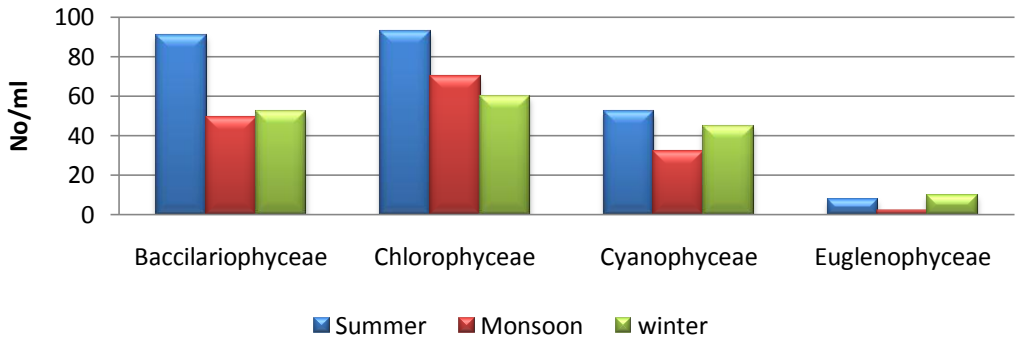

Figure 1: Seasonal variation of phytoplankton in Anchepalya Lake

Bacillariophyceae: The diatom cell is also called as frustules and the classification of diatoms is based on the pattern of ornamentation on the wall of the frustules. In the present study in Anchepalya Lake a total of 27 species of bacillariophyceae (Table:1) was recorded throughout the study. The total number of Bacillariophyceae varied from 49 to 91 No/mL in the lake. Seasonal fluctuation of diatoms registered maximum in summer and minimum during monsoon and winter season. Pahwa and Mehrotra (1966) also observed similar trend in the water body.
Chlorophyceae: They either form a greenish scum on the surface of quiet or stagnant or grow firmly attached to the submerged rock, pieces of wood and other objects in the water. 38 species of Chlorophyceae family were recorded. The total number species of Chlorophyceae varied from 60 to 93 No/mL in the Lake (Table: 2). During the study green algae were recorded maximum counts in summer season followed by monsoon and winter.
Cyanophyceae: The species of cyanophyceae occur abundantly in freshwater habitats along with other groups of algae. 19 species of Cyanophyceae family were recorded. The species of Cyanophyceae varied from 32 to 52 No/mL during the study period (Table: 3). The highest count was recorded in summer season and least in winter season.
Euglenophyceae: Euglenophyceae are relatively large and diverse, few species are truly planktonic, and almost all are unicellular. The Euglenophyceae species ranged from 2 to 10 No/mL. The minimum number of Euglenophyceae was recorded during monsoon and maximum during winter (Table: 4). Pendse et.al., (2002) observed the maximum euglenophyceae population during monsoon period when the water shows sufficient amount of dissolved oxygen and good amount of nutrients.

Green algae accounted 39% of the phytoplankton diversity which is represented by 37 species this is followed by diatoms represented by 27 species (34%), others were blue green algae 19 species (23%) and 4 species of euglenoids (4%) (Figure: 2).

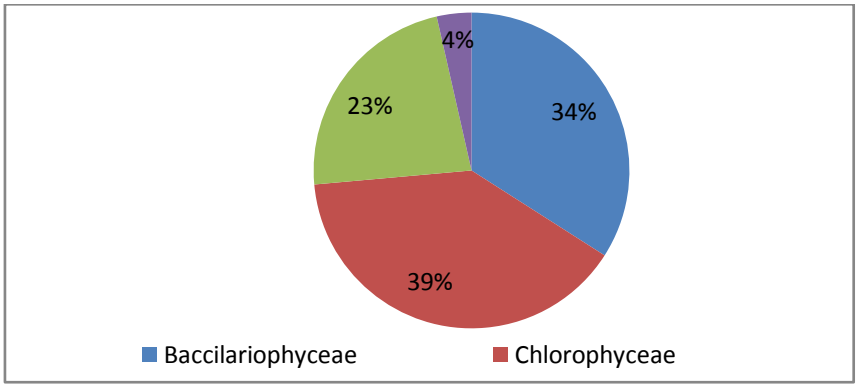

Figure 2: Composition of Phytoplanktons in Anvhepalya Lake

In the present investigation, the phytoplankton fluctuates seasonally and its productivity was found to be high during summer, the basic process of phytoplankton production was dependent upon temperature. Similar findings were reported by Shrinivasan et.al., (1979), Sukumaran and Das (2002) the phytoplankton fluctuates monthly and its productivity high during summer and low in monsoon the basic process of phytoplankton production was dependent upon temperature, turbidity and nutrients.

The abundance of phytoplankton was lowest during monsoon season, when the water column was remarkably stratified to a large extent because of heavy rainfall and decreased temperature cool conditions. Chlorophyceae was found to be dominated through the study period and the presence of species like *Navicula spp.*, *Oscillatoria spp.*, *Chlorella spp.*, *Microcystis spp.*, *Spirulina spp.*, *Anabaena spp.*, and *Closterium spp.*, represents as an indicators of sewage pollution in the Anchepalya Lake.

The present research study shows that the plankton diversity was low during monsoon season whereas there was an increase in the plankton diversity during summer season. Chlorophyceae were observed as dominant group. The result of Phytoplankton diversity shows that the water quality of Anchepalya Lake is polluted due to account of anthropogenic activities such as domestic waste disposal in the form of sewage and solid wastes.

References

Adoni, A.D. (1985). Work book on limnology. Pratibha Publishers, Sagar, pp. 1126.

APHA, (2005). Standard Methods for the examination of water and wastewater. Washington DC. 20th Edition.

Pahwa, D.V. and Mehrotra, S.N. (1966). Observation of fluctuation in the abundance of plankton in relation to certain hydrological condition of river Ganga. Proc. Nat. Acad. Sci. India. B, 36(2): 157-189.

Pendse, D.C., YogeshShastri and Barhate. (2002). Hydrobiological study of percolation tank of village Dasane.Ecol. Env. And Cons. *6*(1):93-97.

Roach, J. (2004). Source of half Earth's oxygen gets little credit. National Geographic News, National Geographic Society Press.

Sreenivasan, V., Sampath and Paramasivam M.(1979). Limnological survey of Cauvery river system with particular reference to pollution indicator, MAB Final Report:92.

Sukumaran, P.K. and Das A.K. (2002). Plankton abundance in relation to physico-chemicals features in a peninsular manmade lake. Environ. Ecol., 20(4):873-879.

Whitton, B.A. and Potts. M. (2000). The ecology of Cyanobacteria: Their Diversity in Time and Space. Kluwer Academic Publishers, Dordrecht, The Netherlands: 668.