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Research Article

PHYTOPLANKTON DYNAMICS IN ANCHAR LAKE, KASHMIR

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ABSTRACT

The present study was carried out for a period of one year. Phytoplankton were studied with respect to their population, growth, species diversity, and composition in the lake. A total of 98 phytoplankton taxa were recorded, out of which 40 belonged to Chlorophyceae, 37 Bacillariophyceae, 14 to Cynophyceae, 5 to Euglenophyceae, and 2 to Dinophyceae. Bacillariophyceae was quantitatively as well as qualitatively the best represented algal class in all the study sites of the lake. The growth and abundance of phytoplankton were closely related to the Physico-chemical features of the lake.

INTRODUCTION

Phytoplankton are microscopic, unattached plants found homogenously mixed throughout the water column. Being dependent on light and nutrients, they populate the euphotic zone of freshwater lakes, ponds etc. The Phytoplanktonic species are present in all the standing water bodies as well as in the middle and lower reaches of rivers. The primary productivity and the day time biogenic oxygenation in the fresh water zones are dependent on these organisms. Of the various aquatic groups, the phytoplanktonic communities respond very quickly to the changes in the environment, because of their short life cycle and thus act as bioindicators of pollution (APHA, 1998).

MATERIAL AND METHODS

Study Area

Anchar lake is a shallow basined valley lake with fulvitile origin (Altitude 1584m above sea level) is situated 14 KMs to the north west of Srinagar city within the geographical coordinates of 34^0 20/----34^0 26/ N latitude and 74^0 28/-----74^0 85/ E longitude. This suburban lake is a mono-basined with its main catchment area comprising of Srinagar city and a number of bordering villages. A network of channels from the cold water river Sind enters the lake on its western shore and serves as the main source of water to the lake. Dal Lake a natural fresh water drainage type of lake enters the Anchar Lake on the southern extremity through a small inflow channel-Nallah Amir Khan. The water to the lake is also supplied by the springs present in the lake basin and along the periphery. Spring precipitation also contributes considerable quantity of water. A number of small channels from agricultural fields also drain into the lake. Also, there is no inflow channel; excess quantities of water leave the lake through an exit in the southern direction.

The lake is undergoing considerable shrinkage mainly due to human activities. Since 1970 the human population residing within the lake catchment has increased from 75 families to 400 families. About 250 hectares of land has been acquired from Anchar village for the construction of Sheri Kashmir Institute of Medical Sciences and still more is being acquired. The land under paddy cultivation is mainly 248 hectares and under orchards about 624 hectares. The human population around the lake is 35,000 and a large number of villagers are engaged in fishing, vegetable cultivation and willow works.

During the recent years, Anchar Lake has become a victim of cultural eutrophicaion which is due to increasing anthropogenic pressure in its catchment area. Increased utilization of lake waters and its resources by locals and disposal of sewage and

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sewerage from the adjoining settlements, soil erosion and encroachment for housing, road building and development of floating gardens for agricultural purposes, besides extensive growth of weeds are greatly responsible not only for deterioration of the lake environment but also for shrinkage of its areas. The runoff from the surrounding agricultural fields and sewage from the bordering human settlements are also drained into the lake. There is continuous and unabated silting due to silt load inflow through a network of channels from the river Sind. On the eastern side of the lake is situated Sheri Kashmir Institute of Medical Sciences complex which drains its effluents into the lake. Towards the western side of the lake the catchment is under cultivation and is mainly used for raising multiple crops.

The lake is heavily infested with macrophytic growth and the littorals constituting the major portion of the lake are especially dominated by tall growing emergents like *Pragmites australis*, *Typha angustata* and *Sparganium erectum*. The heavily polluted sites are dominated by weeds like *Azolla pinnata*, *Salvinia natans* and *Myriophyllum vorticillatum*.

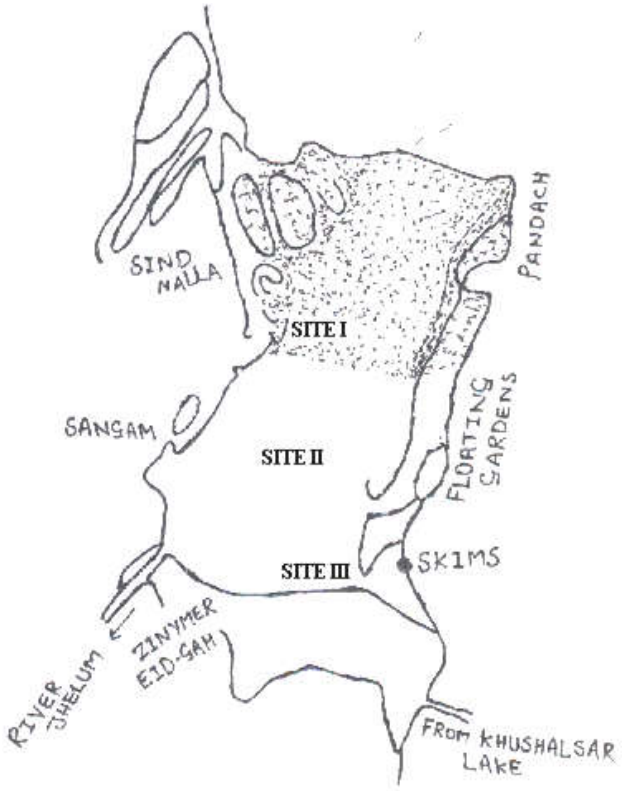

Fig. 1 Map of Anchar Lake Showing Study Sites

Selection of Study Sites

Three sampling sites were selected in the lake differing in various environmental variables like depth, vegetation, and human interferences. Site 1: Close to in let of water into the lake, Site 2: In the deepest central part of the lake virtually free from macrophytes and Site 3: Near the floating gardens and SKIMS complex.

Collection of Samples

Water sampling was carried out monthly for a period of one year starting from January to December. For the quantitative estimation of phytoplankton, five liters of water were sieved through plankton net having 60 meshes/cm. The content was collected in the plankton tube, attached to lower end of the plankton net, were transferred to separate polyethylene tubes and preserved in 4% formalin. The quantitative estimation of phytoplankton was done under microscope, with the help of Sedgwick Rafter cell of 1 ml capacity. The unicellular algae were counted as individuals whereas in filamentous forms, each filament was taken as unit. Similarly in colonial forms counting unit was the colony (Jamppanen, 1976).The phytoplankton density was expressed as units per liter.

Identification of the phytoplankton species was done with the help of standard taxonomic works of (Fritsch, 1935), (Desikachary, 1959), (Prescot, 1970), (Palmer. 1980), (Edmondson, 1992), (Cox, 1996).

RESULTS AND DISCUSSION

A total of 98 phytoplankton species belonging to five major groups were recorded in the lake namely, Bacillariophyceae, Chlorophyceae, Cynophyceae, Euglenophyceae, and Dinophyceae.

Table 1 Average abundance of phytoplankton species at various sites of Anchar Lake

S.No	Phytoplankton	Site I		Site II		Site III	
		S	B	S	B	S	B
A)	**Class: Bacillariphyceae**						
1	*Anchnanthese minutissima*	1+	-	-	-	2+	2+
2	*Achnanthese sp*	2+	+	4+	2+	4+	2+
2	*Amphora bitumida*	--	--	2+	+	2+	--
4	*A.ovalis*	2+	+	2+	+	2+	--
5	*A. exiqua*	+	--	2+	+	2+	--
6	*A. proteus*	+	+	2+	2+	+	+
7	*Cocconeis placentula*	4+	2+	2+	4+	4+	2+
8	*Cymbella ventricosa*	2+	2+	4+	4+	4+	2+
9	*Cymatoplura solea*	2+	+	2+	4+	4+	2+
10	*Cyclotella sp*	2+	2+	2+	4+	2+	2+
11	*Diatoma elongatum*	--	--	2+	2+	2+	2+
12	*Epithemia pectinalis*	--	--	+	--	+	--
12	*Eunothia sp*	4+	2+	4+	4+	4+	2+
14	*Fragillaria arcus*	+	--	+	+	+	2+
15	*F. capuncina*	+	--	+	--	+	--
16	*F. crotunensis*	--	--	2+	--	+	+
17	*F. gracilus*	--	--	2+	+	--	--
18	*Gomphoneis herculeana*	2+	+	+	2+	+	2+
19	*Gymnodium sp*	+	-	+	-	+	-
20	*G. acuminatum*	+	-	2+	+	2+	-
21	*G. acicularis*	2+	+	4+	2+	4+	+
22	*G. olivaceum*	+	-	+	-	2+	+
22	*G. constrictrum*	2+	+	4+	-	2+	-
24	*G. germinatum*	+	-	+	-	+	-
25	*Hantzschia sp*	2+	+	2+	4+	2+	+
26	*Melosira sp*	+	-	+	-	2+	-
27	*Navicla apicularis*	4+	4+	4+	2+	4+	4+
28	*N. inspidata*	2+	+	2+	2+	4+	4+
29	*N. radiosa*	4+	2+	4+	2+	4+	4+
30	*Nitzschia sigma*	2+	2+	2+	2+	2+	4+
31	*N. towutensis*	+	-	+	-	+	-
32	*Pinnulania sp*	2+	-	2+	+	2+	-
32	*Rhizoselenic sp*	+	+	2+	-	+	+
34	*Phopalodia gibba*	2+	-	+	+	2+	+
35	*Surinella ovalis*	2+	2+	4+	2+	4+	4+
36	*Synedra ulna*	4+	2+	4+	2+	4+	2+
37	*Stauronesis obtuse*	4+	2+	2+	+	4+	4+
		22	19	26	26	25	22
B)	**Class: Chlorophyceae**						
1	*Actinastrum spiralis*	+	-	2+	-	+	-
2	*Chlorella sp*	+	+	+	+	2+	2+
3	*Chlorodella ciliate*	+	+	+	+	2+	+
4	*Closterium moniliforma*	2+	2+	2+	+	2+	+
5	*Closterium sp*	2+	+	2+	4+	4+	2+
6	*Coelostrum microporum*	+	-	+	2+	+	-

7	*C. sphaericum*	+	-	+	-	+	-
8	*Cosmarium sp*	+	+	4+	4+	+	2+
9	*Crucigenia crucifera*	2+	+	2+	2+	2+	2+
10	*C. fenestrate*	4+	2+	2+	-	2+	2+
11	*C. tetrapedia*	-	-	+	-	-	-
12	*Dictyaspharium sp*	-	-	+	-	-	-
12	*Euastrum spinolosum*	-	-	+	+	2+	-
14	*Gonatozygon sp*	+	-	-	-	2+	+
15	*Gonium pectoral*	+	+	2+	+	2+	2+
16	*Nochneriella obese*	-	-	+	-	+	-
17	*Microastrias pinnatifida*	-	-	-	-	+	-
18	*Oedogonium sp*	-	-	+	2+	2+	+
19	*Pandorina sp*	+	+	2+	2+	2+	4+
20	*Pediastrum duplex*	2+	+	2+	2+	2+	4+
21	*P.tetras*	+	-	+	-	+	-
22	*Pleurotaeria sp*	-	-	+	-	-	-
22	*Scenedismus acuminatus*	2+	+	2+	+	4+	2+
24	*S. armatum*	+	+	2+	2+	2+	2+
25	*S. arcuatus*	2+	+	2+	+	4+	2+
26	*S. hijugata*	+	+	-	+	2+	2+
27	*S. dimorphus*	-	-	2+	2+	-	4+
28	*S. quadricauda*	-	+	2+	-	-	2+
29	*Scenedasmus sp*	-	-	2+	-	-	-
30	*Sphaerozosma sp.*	-	-	+	+	-	+
31	*Spondylosium planum*	-	-	2+	-	+	+
32	*Staurastrum fercigerum*	+	-	+	+	+	-
33	*Staurodesmus aspidatus*	+	+	+	-	+	+
34	*Tetradon minimum*	+	+	-	+	+	+
35	*T. mutica*	2+	-	-	-	+	-
36	*Tetrastrum sp*	+	+	2+	+	4+	2+
37	*Tracubaria sp*	+	+	2+	+	+	2+
38	*Triploceras sp*						
39	*Volvox sp*	-	-	+	-	-	+
40	*Xanthidium sp*	-	-	+	-	-	-
		24	19	25	22	20	22
C	**Class. Cyanophyceae**						
1	*Anabaenbopsis sp*	+	-	+	-	-	-
2	*Anabaena sp*	+	-	2+	+	2+	+
3	*Aphanocapsa sp*	+	-	2+	+	2+	+
4	*Aphanopusa sp*	+	+	+	+	+	+
5	*Arthrospira sp*	-	-	-	-	+	+
6	*Coelosphaerium sp.*	2+	2+	2+	2+	+	-
7	*Merismopedia elagens*	4+	4+	4+	2+	4+	4+
8	*M.puntata*	2+	2+	4+	2+	4+	4+
9	*Microcystis aeroginosa*	2+	+	4+	+	4+	+
10	*Nostoc sp.*	-	-	2+	-	+	-
11	*Oscillatoria sp.*	4+	4+	4+	2+	4+	4+
12	*Rivularia sp.*	4+	2+	2+	+	2+	4+
12	*Spirulina sp.*	+	-	+	4+	2+	2+
14	*Coccochloris stigma*	-	+	2+	+	+	+
D	***Class. Euglenophyceae***						
1	*Euglena sp.*	4+	4+	2+	2+	4+	4+
2	*E. acus*	2+	4+	4+	4+	4+	2+
3	*Phacus sp.*	2+	4+	4+	4+	2+	4+
4	*Astasia klebsii*	+	+	+	+	+	+
5	*Chlorogonium sp.*	+	+	+	+	+	+
E	***Class: Dinophyceae***						
1	*Ceratium hirudinella*	2+	-	+	-	4+	4+
2	*Peridinium sp.*	2+	-	+	-	4+	4+

Where,
- = not seen
+ = Rare = < 100
2 + = Frequent = 101 – 500
3+ = Subdominant = 501 - 1000
4 + = > 1000

Bacillariophyceae: This group was quantitatively as well as qualitatively the dominant algal class in all the study sites of the lake. According to (Hutchinson, 1967) diatoms are the most important members of fresh water plankton, being present in significant numbers. A comparison of diatom population in different areas of the lake revealed that the group was least dominant in polluted sites of the lake and highest population was recorded in macrophytic belt where epiphytic diatoms had greater chance of mixing with plankton community, the pattern of periodicity was probably observed due to the mixing of periphytic organisms under the influence of wave action. This factor can influence the periodicity of diatoms. The present study revealed that out of various diatom taxa, only six played a significant role in diatom biomass, and all these were recorded throughout the year and rest of the taxa were having very small population in one or the other month. The species occurring throughout the year included: *Cymbella cistula, Fragilaria capucina, Navicula subtillisma, Pinnularia nobilis, Eunotia minor and Synedra ulna.*

Chlorophyceae: The chlorophyceae was the second best algal class representing after bacillariophyceae.The notable taxa include, *Chlorella sp, Chlorococum sp, Cosmarium sp, Cladora sp, Closterium sp, Cladophora sp, Spirogyra sp, Volvox sp, Ulothrix sp*. The comparatively higher transparency and temperature associated with low water level seems to be conducive for the dominance of freshwater filamentous forms of green algae and overall maximum phytoplankton density. These findings are in consonance with the earlier findings of (Kaul, 1978) and (Pandit, 1998).

Cynophyceae: The next dominant group is cynophyceae.This group is associated with nutrient rich waters and is represented by 14 taxa in the lake. Nitrates, phosphates and organic matter have reported to be the most significant influencing factors for the bloom of blue green algae. The abundance of blue green algae in fresh water lakes has been related with the process of eutrophication (Hutchinson, 1975). *Microcystis* was the most dominant taxon, recorded throughout the year.

Euglenophyceae: This group was represented by 5 taxa and contributed a significant part of the phytoplankton biomass near floating gardens and SKIMS and the *Euglena sp,* and *Phacus sp*, were the most dominant and abundant taxa at site 3.

Dinophyceae

The most remarkable feature of phytoplankton of Anchar Lake is the thin population of Dinophyceae and is attributed to the higher values of phosphorus and nutrient rich waters. The same was also reported by (Rhode, 1948) and (McMurry and Olive, 1975).

CONCLUSION

The present nutrient status and phytoplankton populations justify the placement of Anchar Lake in the advanced stage of eutrophication.

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