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INVESTIGATION OF LAKE SAROOR NAGAR WITH REFERENCE TO WATER POLLUTION

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Phycological and Physico-chemical parameters have been taken into consideration in order to evaluate the degree of water pollution. The pollution of lake is evident with the presence of cyanobacterial blooms and also due to certain diatoms like *Nitzschia palea*, N. *obtusa*, *Gomphonema parvulum* which are indicators of pollution. Though the hydro-chemical parameters pH, chlorides, hardness and total solids have exceeded the permissible tolerance limits which indicates the anthropogenic impact of wastes on the water body.

Keywords : Indice; Bloom; Pollution.

Introduction

The water pollution is caused due to the introduction of physical, chemical and biological impurities in the water body. They will create turbidity, hardness and alkalinity, bad taste and odour problems. Algal blooms are of frequent occurrence in Indian waters. Plants serve as indicators of water quality and their distribution in time and space may be used for detecting the characteristics of water (Whitton, 1979). It is well recognised that species identification would prove valuable in pollution monitoring. The present study was designed to assess the status of water body.

Materials and Methods

The lake 'Saroor Nagar' is situated in Ranga Reddy district of Andhra Pradesh. Surface water samples were collected at monthly intervals for a period of two years. Water samples were analysed for certain physico-chemical and phycological parameters as per standard methods suggested by Wilcox and Hatcher (1950) and APHA (1985). Multiple Regress Analysis (MRA) has been employed to know the relative importance of various physico-chemical factors on the growth and development of different groups of algae. Quantitative and frequency measurements have been made by the drop method of

Pearsall *et al.* (1946) and Venkateswarlu (1969).

Results and Discussion

The results of seasonal and year wise average values of physico-chemical parameters are given in table - 1. The pH was high with an average value of 8.9 indicating highly alkaline nature of water body. Bicarbonates, chlorides, organic matter, hardness, PO_4 and total solids are high with an average values of 4?3.5, 38?.7, 9.4, 370.8, 0.89 and 989.9 ppm respectively. Nitrates and Iron are in low concentrations whereas D O. and silicates are in moderate concentrations.

Factors affecting the distribution of algae : Four groups of algae viz. Cyanophyceae, Bacillariophyceas, Chlorophyceae and Euglenophyceae were encountered but euglenoids are very scantily represented (Fig. 1). Multiple Regression Analysis (MRA) reveals that all the physico-chemical factors like temperature, CO_3, HCO_3, D. O., O.M., T.H., Ca, Mg, PO_4, NO_3, SiO_2 and dissolved solids together explain 8?% of variation for the distribution of cyanobacteria. Among them, a total of 6 factors viz., temperature, CO_3 total hardness, Mg, SiO_2 and dissolved solids are the minimum factors essential to account for the maximum variation significantly (Fig. 2).

Cyanophyceae was represented by the species of *Microcystis* and *Oscillatoria* blooms during summer seasons. Diatoms are represented by the species of *Synedra ulna*, *S. tabulata*, *Gomphonema parvulum*, *G. montanum*, *Navicula cryptophala*, *Cyclotella meneghiniana*, *Rhopalodia gibberula*, *Nitzschia palea*, *N. hungarica*, *N. obtusa* etc.

MRA revealed that all the physico-chemical factors are influencing 57% of diatom variance. Among them, except pH, total hardness and calcium, others are less important as is evident from the negligible drop of R^2 value in Step down Regression Analysis (SRA) which could contribute only 2-3% for the diatom variance (Fig. 3). Diatoms prefer carbon in the form of carbonates which contributed 6% of algale variance.

As compared with volvocales and zygnematales (desmids) chlorococcalian flora of the lake has shown a better representation among the chlorophyceae. This group is represented by the species of *Chlorella*, *Tetraedron*, *Scenedesmus*, *Selenastrum*, *Oocystis*, *Pediastrum*, *Coelastrum*, *Crucigenia*, *Tetraspora* etc.

Simple Correlation Analysis (SCA) reveals that pH, CO_3, HCO_3, D.O., total and dissolved solids all are significant individually at both 5% and 1% level. However, MRA also revealed that all the physico-chemical factors together account for 90% of variation in algale number. Among them a total of five factors viz., pH., temperature, could influence the growth to the extent of 58% (Fig. 4). Volvocales are represented by *Phacotus lenticularis* and desmids are represented by *Closterium* and *Cosmarium*.

In this lake the Ionic composition is in the order of $HCO_3 > Cl > CO_3 > Mg > Ca$.

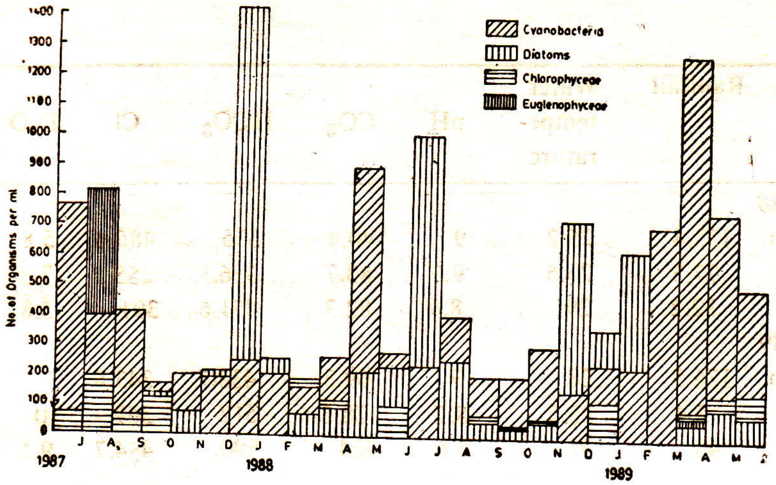

Fig. 1 Total phytopankton in Saroor Nagar lake.

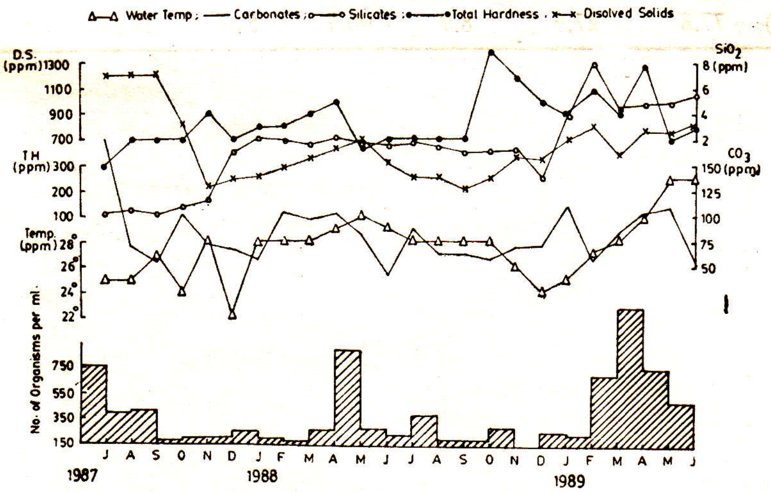

Fig. 2 Affect of various physico-chemical factors on the growth of Cyanobacteria in Saroor Nagar lake.

Table 1 : Saroor Nagar Lake : Physico-chemical factors (concentration expressed as ppn)

Season	Ranifall	Water tempe-rature	pH	CO_3	HCO_3	Cl	D.O	O.M.
1987–1988								
Monsoon	133.4	25.2	9	140.4	535	485.4	5 8	2.6
Winter	77.3	26.5	9.1	83.7	336.3	255.1	7.3	5.1
Summer	32.2	29	8.9	82.3	451.6	391	5.8	6.2
1988–1989								
Monsoon	176.5	28	9	69.3	433.7	343.8	7.4	14.7
Winter	3.4	25.5	8.7	78.3	512	369	10	14.7
Summer	45	31	8.6	904	690	454.7	9.1	13.3
I Year) Average)	80.9	26.9	9	102.1	475.1	377.1	63	4.6
II Year) Average)	74.8	28.1	8.7	79.3	545.2	388.7	8.8	14.2
Two years) Average)	77.8	27.5	8.9	90.7	510.1	382.7	7.5	9.4

T.H.	Ca	Mg	PO_4	NO_3	SiO_2	F.e	T.S.	D.S.	S.S.
117	36.3	10.9	0.65	0.6	1.5	0.22	784.8	482.2	302.5
352.1	52.6	43.9	0.95	0.21	3	0.07	642.2	459.5	241.7
394.2	55.8	62.1	0.95	0.19	3.1	0.05	906.1	594	312.1
371.7	43.1	64.3	0.58	0.32	3.7	0.25	1575.4	1004.7	570.7
460.8	68.3	70.4	1.1	0.39	5.5	0.06	991.5	669.5	321.8
554.4	79.1	86.7	1.1	0.26	4.2	0.04	1016	737	304.2
287.7	48.2	40.6	0.85	0.33	2.53	0.11	777.7	511.9	285.4
452.3	63.5	73.8	0.92	0.32	4.46	0.11	1194.3	803.7	3[illegible]8.9
370.8	55.4	57.2	0.89	0.33	3.4	0.11	986	657.8	342.1

The dominance of HCO_3 indicates that the hardness of water is temporary. Organic matter was high in the lake. Stewart (1963) and Fogg and Nalwejko (1964) have shown that the contribution to the organic content of water through the liberation of extracellular substances by phytoplankton is considerable. In the present investigation, continuous blooms of Cyanobacteria were observed viz., *Microcystis aeruginosa* and *Oscillatoria limosa* during summer seasons, which have contributed for the high concentration of organic matter. In the estimate of Wetzel *et al.*, (1972) about 82% of organic matter in a lake is contributed by the phytoplankton. In the lake, though D.O , Ca and Mg are within the stipulated ranges, pH and total hardness are exceeding the tolerance limits of ISI, WHO and Rawal's quality criteria. Further, chlorides are also beyond the permissible limits of WHO and Rawal's data (Table-2). Total solids are also exceeding the tolerance limits and the light green colour of water imparted by these blooms also creates aesthetic pollution.

The polluted nature of water is evident from the luxuriant growths of *M. aeruginosa* (bloom), *Oscillatoria limosa* (bloom) and the presence of *Nitzschia palea*, *N. obtusa*, *Synedra ulna*, *Cyclotella meneghiniana* coupled with the paucity of desmids indicating that the lake is polluted with organic matter, chlorides and hardness. Palmer (1980) termed the above mentioned species as pollution indicators. According to Sawyer (1947), *Microcystis aeruginosa* is the best single indicator of organic pollution. *M. aerugionsa* and *Oscillatoria* are involved in water pollution. This is in accordance with Prescott (1969).

The present lake is found to be rich in HCO_3, Ca and PO_4 which indicates eutrophic nature of water body. In the present study, it is purely cultural, which is due to anthropogenic activities. Almost universally, the relative enrichment has a direct consequence of cultural advances made by growing human populations but discharging locally as sewage also contributing the net changes in catchment lake equilibria and this is true for the present lake. In addition, somewhat higher concentration of PO_4 might be due to modern detergents based on polyhosphates. Inevitably such changes disturb existing individual catchment lake equilibria accelerating the trophic abvance to a greater or lesser extent and bring about anthropogenic eutrophication. According to Patrick (1965) eutrophic waters are characterized by the blooms of *Microcystis*, *Oscillatoria* etc. which are also experienced in the present lake.

The meagre representation of volvocales could have been due to the continuous blooms of *Microcystis*, which was antagonistic to volvocales in the present lake. This is also supported by Seenayya (1968). The present lake has also supported lower percentage of desmids which might be due to high total solid contents and high pH. Gonzalves and Joshi (1946) have observed a similar phenomenon. According to Strom (1924) and Froehne (1939) acidic waters support rich desmid flora

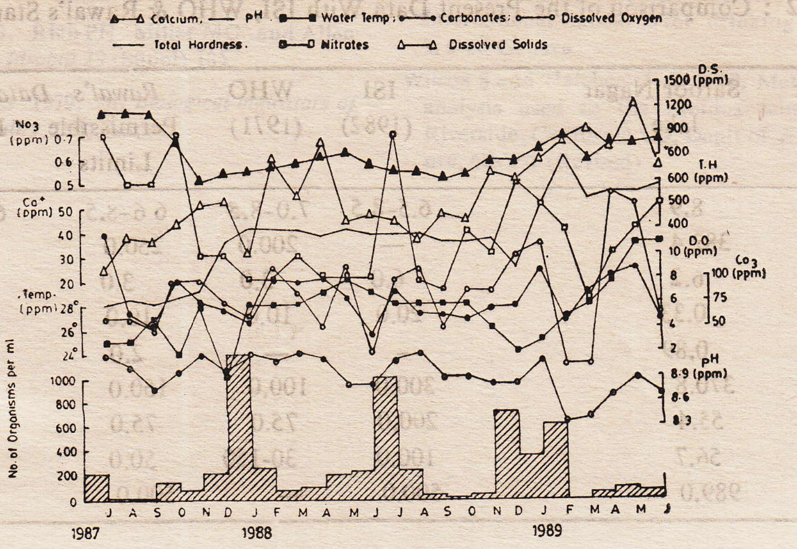

Fig. 3 Factors affecting the distribution of Bacillariophyceae in (diatoms) Saroor Nagar lake.

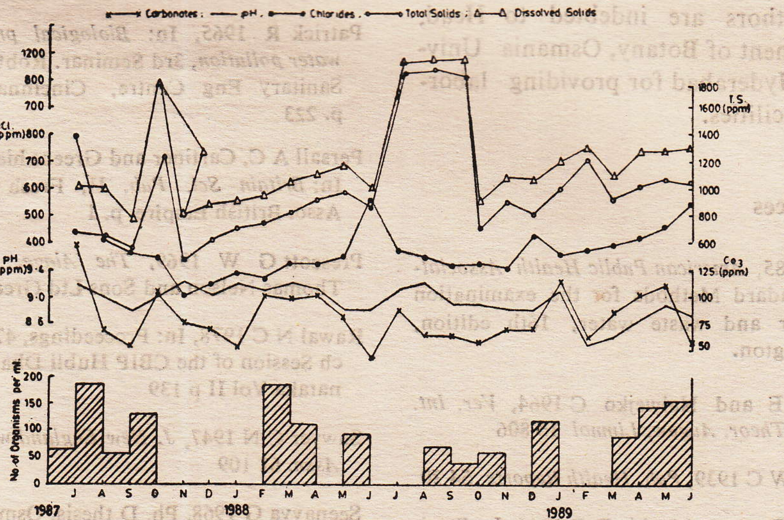

Fig. 4 Effect of various physico-chemical factors on the growth of Chlorophyceae in Saroor Nagar lake.

Table 2 : Comparison of the Present Data With ISI, WHO & Rawal's Standards

Factor	Saroor Nagar lake	ISI (1982)	WHO (1971)	*Rawal's Data (1978)* Permissible Limits	Excessive Limits
pH	8.9	6.5–8.5	7.0–8.5	6 6–8.5	6.5–8.5
Cl	382.4	—	200.0	250.0	606.0
DO	6.2	6.0	3.0	3.0	—
NO_3	0.33	20.0	10.0	10.0	—
PO_4	0.89	—	—	2.0	5.0
T.H	370.8	300.0	100.0	150.0	500.0
Ca	55.4	200.0	75.0	75.0	200.0
Mg	56.7	100.0	30-150	50.0	50.150
T.S	989.0	500.0	—	500.0	1500.0

which also extends support to the present data.

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