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TROPHIC STATUS OF THE LAKE, KONDAKARLA (ANDHRA PRADESH)

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INTRODUCTION

Studies on the trophic status of some lakes have been carried out earlier by Cheng and Tyler (1976) on Sorella and Crescent lakes of Tasmania, Zutshi (1976) on Mergozo of Italy, Pant *et al.*, (1979) on lakes of Kamaun, Vass (1980) on Kashmir lakes and Khan and Zutahi (1980) on Kashmir Himalayan lake. Similar attempt had been made by the author from the biotic and abiotic factors obtained from the lake during the three seasons of the year, 1997.

MATERIAL AND METHODS

Kondakarla lake is situated at about 50 km south-west of Visakhapatnam in Andhra Pradesh between latitudes 17°35'30" and 17°36'02" N, longitudes 82°59'27" and 83°01'0" E. It covers an area of 6.5 sq. kms. In order to cover the whole topography of the lake, six spots have been selected. Water samples were collected from the lake spots, during three different seasons of the year 1997 and its analysis was done with the help of APHA (1989) and the physico-chemical features were given in the Table-I. Plankton samples were also collected from the lake spots simultaneously and identified the Rotifera and Cladocera species with the aid of standard literature.

RESULTS AND DISCUSSION

Presently Oligotrophic lakes have been defined as low productivity ones and eutrophic lakes with high productivity. Nitrogen and Phosphorus are the nutrients that increase the primary productivity.

TABLE I. : PHYSICO CHEMICAL PARAMETERS OF KONDAKARLA LAKE

Sl. No.	Parameter	Cheemanapalle			Avasomavaram			Rajam			Centre Point			Kond Village			Vadrepalle			Haripalem		
		S	M	W	S	M	W	S	M	W	S	M	W	S	M	W	S	M	W	S	M	W
1.	Temp. (Air) C	32	31	23	32	–	25.5	32	31	26	32	31	26.5	31	31	23	32	31	28	32	31	29
2.	Temp. (Water) C	29	29	22.5	29	–	24	29	29	24	29	31	24	29	29	22	29	30	25	29	30	25
3.	pH	7.5	8.5	7.5	7.2	–	7.5	7.4	8.5	7.5	6.9	8.5	7.5	7.3	8.9	7.0	7.2	8.5	7.0	7.1	8.5	8.0
4.	E. Cond.	840	1340	780	730	–	630	810	860	540	810	860	540	560	960	830	430	1090	510	960	1720	830
5.	Turbidity (NTU)	6	60	8	540	–	6	5	50	8	5	50	8	5	50	8	20	10	8	4	60	8
6.	Dis. Oxygen mg. lr	7.6	8.2	3.2	7.2	–	5.8	7.9	12.2	6.6	7.9	12.2	6.6	2.4	5.6	3.0	2.8	9.2	6.0	3.4	9.8	5.0
7.	Carbonates "	70	90	NIL	35	–	80	45	20	NIL	45	20	NIL	NIL	NIL	NIL	45	60	NIL	NIL	20	NIL
8.	Bicarbonates "	190	185	295	200	–	135	155	255	230	155	255	230	430	290	300	235	210	180	280	315	350
9.	Free CO_2 "	NIL	NIL	NIL	NIL	–	NIL	NIL	NIL	Traces	NIL	NIL	4.8	9.0	6.0	4.0	NIL	NIL	1.6	0.6	NIL	8.0
10.	Chloride "	149	170	110	142	–	80	142	175	75	142	175	75	184	210	70	156	145	55	160	185	70
11.	Total Hardness "	140	80	165	125	–	155	135	210	155	135	210	155	185	430	200	120	280	150	175	295	270
12.	Calcium "	46	17	48	38	–	40	40	34	42	40	34	42	59	92	61	40	52	40	36	50	59
13.	Magnesium "	7	10	12	9	–	15	10	31	13	10	31	13	11	51	13	6	38	13	22	38	32
14.	Nitrate – N	1	2	2	1	–	2	1	1	2	1	1	2	1	4	3	1	3	3	1	5	3
15.	Amm.Nitrogen "	NIL	NIL	NIL	NIL	–	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
16.	Total Nitrogen "	NIL	NIL	NIL	NIL	–	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
17.	Phosphorous "	NIL	15	10	Traces	–	15	NIL	10	NIL	Trace	5	5	NIL	5	10	Traces	40	5	Traces	10	10
18.	Silica "	30	40	25	25	–	20	25	35	25	30	25	20	25	30	25	20	30	20	25	35	25
19.	Sulphates "	10	250	40	10	–	10	10	260	40	15	240	10	70	190	40	10	300	10	25	220	40

S – Summer M – Monsoon W – Winter

Eutrophic water bodies have got characteristic features like : (i) shallow and broad littoral zone, (ii) greater ratio of epilimnion and hypolimnion, (iii) green to yellow or brownish green water, (iv) limited transparency, (v) depleted oxygen in summer hypolimnion, (vi) presence of algal blooms, (vii) biomass of profundal benthos is great particularly chironomid larvae and (viii) low species diversity and high density of algae dominated particularly cyanobacteria.

Oligotrophic water bodies have got (i) deep steeped bank, (ii) epilimnion volume is smaller than hypolimnion, (iii) water is blue or green in colour, (iv) poor plant nutrients and calcium, (v) oxygen is abundance in all levels, (vi) littoral plants are limited and poor phytoplankton, (vii) lack of algal blooms, (viii) low quality of profundal benthos and (ix) salmonids (ex : trout), and coregonids (white fish) dominant, (x) high species diversity and low density algae, dominated particularly by chlorophyceae.

The sources of nutrients in urban areas are domestic sewage, industrial wastes and storm, drainage, whereas in rural areas the sources of nutrients are those from agriculture, forest managements and rural dwellings. Out of which agricultural sources is the chief one. In general, rural dwellings dispose off their sewage into septic tanks that is likely to cause pollution. Since Kondakarla lake is situated in the rural areas, the main sources of the pollution are agriculture run off and rural dwellings. Since villages like Rajam, Cheemanapalle are also partly covered with forest areas in proper forest management is also a minor source of pollution. At the bank spot at Chemanapalle village. A lot of washermen washing the clothes were seen and the detergents that are being used for washing the clothes from which phosphates passes into the water body, leads to deteriorate the water quality. The Vadrepalle and Kondakarla villages have got more population and hence the rural dwelling into the lake may cause pollution. The surroundings of the villages—Kondakarla, Haripalem, Vadrepalle and Cheemanapalle and Ava somavaram are covered by sugarcane and paddy fields and the nutrients from these fields are also leading to deterioration of water quality.The effluents that are released into the water body from sugar factory at Thummapala through Sarada river are also responsible for this phenomena.

Kondakarla lake was found as a water body with shallow broad littoral zone. Its epilimnion volume is relatively small. Littoral plants are limited, without much water blooms, but were seen brownish water blooms in the centre point during summer. Benthic organisms are medium and chironomid larvae are lacking.

As far as the physico-chemical parameters are concerned, low values of turbidity were found in the lake. The lowest values of this factor were found in summer and winter seasons, whereas its highest were in monsoon season. But its exceptional highest value (540) was noticed in summer. The surface water temperature varied from 22.5 to 31°C.

The lowest value of dissolved oxygen (0.8 mg/lit.) was recorded in the winter season. The quantity of dissolved oxygen depends upon the time and depth of sampling. The lower values can

be seen in the morning and increases in mid day and declines in the evening hours. The reason could be attributed to photosynthetic activity.

The pH has shown alkaline tendency of the lake water. The concentration of free CO_2 was substantially low in the lake specifically in winter in general, but exceptionally highest value (9.0) was found in summer. The reason for winter maxima could be attributed to low photosynthetic activity in the season.

Vollenweider (1968), Zutshi (1976) and Cheng and Tyler (1976). Pant *et al.*, (1979) have attributed different trophic classifications to different water bodies. The physico-chemical factors such as high turbidity, higher concentration of nitrate, nitrogen, low dissolved oxygen high alkalinity, low free CO_2 values have placed the lake as mesotrophic status.

The observations on zooplankton composition of the water body, indicates more rotatorian diversity followed by Cladocera, Copepoda and Ostracoda. Since long time, the rotifers have been used as bio-indicators of water quality because of their species diversity and cosmopolitan distribution.

Among the rotatorians, presence of *Brachionus falcatus, B. forficula, B. quadridentatus, Tetramastix opiliensis* are the indicator species for clean water; *B. angularis, B. calyciflorus, Keratella tropica, Filinia longiseta, F. terminalis* and *Polyarthra multiappendiculata* are for polluted waters and *Epiphanes macrorus* for heavily polluted waters. A relative abundance of cladocerans especially the members of the family Chydoridae indicates eutrophic conditions (Khan and Seshagiri Rao, 1981). According to Mahajan (1981) *Diaphanosoma, Simocephalus* and *Ceriodaphnia* are indicators for eutrophication.

From the rotatorian and cladoceran fauna found from Kondakarla lake during the period of investigation *Brachionus calyciflorus* dominated among rotatorians and *Ceriodaphnia cornuta* in Cladocerans. The presence of *B. falcatus, B. forficula, B. quadridentatus* indicating the cleanliness of water. But the presence of *B. calyciflorus and Filinia longiseta* and *F. terminalis* among Rotifera and Genera *Diaphanosoma, Simocephalus* and *Ceriodaphnia* is indicating eutrophication. Hence the author is placing the water body as Mesotrophic and getting eutrophicated. As per the information procured from the villagers, the lake water was being used for drinking. But after the floods in the year 1990, the lake water has become polluted due to influx of heavy load of domestic sewage from the surrounding villagers, effluents from Thummapala sugar factory and agricultural wastes into the water body made the water body polluted and could not be used for drinking purpose at present.

Medium values of bicarbonates and calcium are found in the lake. Even though the phosphate contents were not found in some spots, these values are also found medium that shows mesotrophic nature of the system. Due to anthropogenic activities, the lake is purely cultural. The relative

Table II. : Physico chemical features (ranges) of Kondakarla lake water

Sl. No.	Parameter	Range	Drinking water Standards as per WHO (1971)		ISI Standards (1982)	Rawal's Data (1978)	
			Highest Desirable	Maximum permissible		Permissible	Excessive limits
I	II	III	IV	V	VI	VII	VIII
1.	pH	7.0–8.9	7.0–8.5	6.5–9.2	6.5–8.5	6.6–8.5	6.5–8.5
2.	Electric Conductivity (Microsiemens/cm)	480–1640	–	–	–	–	–
3.	Turbidity (N.T.U.)	4–60	5.0	2.5	–	–	–
4.	Dis. Oxygen (mg/lit.)	0.8–12.2 (except. 16.2)	–	3.0	6.0	3.0	–
5.	Carbonates (mg/lit.)	0–90	–	–	–	–	–
6.	Bicarbonates (mg/lit.)	120–430	–	–	–	–	–
7.	Free CO_2 (mg/lit)	0–9.0					
8.	Chloride (mg/lit.)	45–185	200	600	–	250	600
9.	Total Hardness (mg/lit.)	80–295 (Except. 430)	100	500	300	150	500
10.	Calcium (mg/lit.)	17–92	–	–	200	75	200
11.	Magnesium (mg/lit.)	6–51	30	150	100	50	150
12.	Nitrate (mg/lit.)	1–4	45	45	20	10	–
13.	Amm. Nitrogen (mg/lit.)	NIL	–	–	–	–	–
14.	Total Nitrogen (mg/lit.)	NIL	–	–	–	–	–
15.	Phosphorus (mg/lit.)	0–15	–	–	–	2.0	5.0
16.	Silica (mg/lit.)	20–40	–	–	–	–	–
17.	Sulphate (mg/lit.)	10–300	200	400	–	–	–

enrichment has a direct impact of cultural activities made by growing human population surrounding the lake basin, discharging the sewage into the water body, the effluents that are being let into river from Thummapala sugar factory and the detergents that are being used for washing activities. These three activities are disturbing the catchment lake equilibrium and leading to increase the trophic nature of the water body up to certain extent.

Pejler (1957) has described rotatorian species *viz.*, *Brachionus* sp. *Keratella cochlearis, K. quadrata, Anuraeopsis fissa, Trichocerca birostria, T. capucina, T. cylindrica, T. porcellus, T. pusilla, Polyarthura euryptera,* and *Filinia longiseta* from mesotrphic lakes.

SUMMARY

This paper communicates the trophic status of Kondakarla lake, Visakha district, Andhra Pradesh, from the studies on its biotic and abiotic factors during the three seasons of the year 1997. Totally 19 parameters have been studied from the water samples collected from seven spots of the water body, in three seasons. The water was found alkaline with pH ranging between 7.0 and 8.9, bicarbonate alkalinity from 120–430 mg/litre, Nitrates between 1 and 5 mg/litre and phosphorus from 0 to 5 mg/litre. The results indicate that the water is useful for irrigation and aquacultural purposes. The author has placed the water body, as a mesotrophic one.

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