Rec. zool. Surv. India, 95 (3-4) 243-259, 1996

HYDROBIOLOGICAL STUDIES ON SOME WATERBODIES ALONG BOMBAY HIGHWAY AND WARANGAL ROAD (HYDERABAD, ANDHRA PRADESH)

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INTRODUCTION

Hyderadad is well known for its numerous waterbodies, ponds and lakes. Considering the role played by these waterbodies in the economy of the State, it was thought to undertake a long-term project on hydrobiology of some waterbodies of this area, which are in use for irrigation, fisheries, recreation, source of drinking water etc. Many workers (Zafar, 1964, Venkateshwarlu, 1967, Munawar, 1970, Rao 1972, Seenaya, 1973) studied hydrobiological aspects of some waterbodies of this area, but very little attention has been given to study the waterbodies of this area in reference to pollution and eutrophication. The present work was carried out for three years from April, 1983 to March, 1986 to collect the data on various abiotic and biotic factors for comparative hydrobiological studies of eight waterbodies of this area in reference to pollution status and eutrophication.

TOPOGRAPHY OF THE WATERBODIES STUDIED

In all eight waterbodies were selected of which four were on Warangal Road *Viz.* Raigir, Bhongir, Bibinagar and Narapally, whereas other four were Miyapur,

Gangaram Village tanks, Patan and Komatkunta situated within 70 Kms from Hyderabad on Bombay Highway.

The Komatkunta and Narapally tanks are temporary and usually get dried up in summer whereas Patan tank is perennial and Gangaram, Miyapur, Raigir, Bhongir, Bibinagar waterbodies were under extensive use for irrigation. The Raigir, Bhongir, Bibinagar tanks are situated in Nalgonda District whereas Patan, Komatkunta in the Medak district.

TABLE : I

Topography of Waterbodies

Name of Waterbody	District	Longitude	Latitude	Distance from Hyderabad
Komatkunta	Medak	78°14′E	17°32′N	42 Kms
Patan	Medak	78°16′E	17°02′E	32 Kms
Gangram	Hyderabad	78°17′E	17°31′N	25 Kms
Miyapur	Hyderabad	78°18′E	17°81′N	24 Kms
Narapally	Hyderabad	78°35′E	17°26′N	16 Kms
Raigir	Nalgonda	78°49′E	17°38′N	56 Kms
Bhongir	Nelgonda	78°41′E	17°31′N	52 Kms
Bibinagar	Nalgonda	78°41′E	17°31′N	46 Kms

MORPHOMETRY, DRAINAGE AND CATCHMENT AREA

Majority of the tanks are oval, suboval, or spherical in shape. The ratio between the smallest and largest tanks is 1 : 1500. The two tank, Narapally and Komatkunta are smaller in size and gets water from the nearby Paddy fields during Monsoon. The tanks namely Bhongir, Raigir, Bibinagar and Miyapur receive water from inlet sources like land run ;off from the surrounding area. The tanks like Bibinagar, Patan, Raigir, Gangaram are under inmense impact of suspended silt from the loose soil of surrounding agricultural fields thus making water turbid.

TABLE : II

Some Morphometric Features of the Waterbodies

Waterbody	I	II	III	IV	V	VI	VII	VIII
Altitude M	1685	1680	1680	1678	1675	1680	1685	1630
Max. depth M	1	5	3	3	3	4	5	1·5

CLIMATIC CONDITIONS

There are four seasons in the study area, cold seasons from December to Mid February. Hot period from Mid February to May, the Monsoon season from June to September and the post monsoon from November to December. The maximum summer temperature varies from 28 to 34°C and the minimum was 12 to 15°C, the annual rainfall was very less during the period understudy is shown below.

MATERIALS AND METHODS

The water and plankton samples were collected from the eight waterbodies once in a month for a period of April, 1983 to March, 1986. Visibility was determined by secchi disc. pH, conductivity, were estimated electrometrically. Alkalinity, chloride, D. O., CO_2, Hardness, Phosphate, Nitrate Nitrogen, Sulfate, Calcium and magnesium were determined as per Standard Methods APHA (1971). The plankton in the water was preserved in 5% formaline and counting of plankton was made with the help of Sedgwick Rafter cell. Identification of aquatic macrophytes and zooplankton were made upto species level whereas identification of algae were made upto genera only.

WATER TRANSPARENCY

In majority of these tanks water was turbid due to silting from the nearby agriculture land and urthen bundh. The secchi disc reading was 2 m in Miyapur and lowest reading was 0·5 m in Komatkunta. The transparency of Bibinagar tank was less due to planktonic population besides silting process. All the water bodies under

study were not very deep and most of them dried up due to summer and use of water for irrigation.

CHEMICAL FEATURES OF THE WATERBODIES

pH of all the waterbodies was always above 7 with notable variation in all the water systems. Specific conductivity was the lowest in Bhongir and Miyapur. The water of these reservoirs is moderately hard. Since the total hardness was always abov 100 to 150 mg (except Komatkunta) and in some waterbodies it was above 150 mg. The highest chloride content was recorded (185 mg/L) in Patan Cheru. The total alkalinity value was maximum in Bibinagar while the total phosphate, values were relatively more in Bibinagar tank and Patan tank (table III).

The human settlement nearby area of Patan tank has affected the water quality of this tank although previously this tank was used for *Trapa* and fish culture by local people. At present this aquatic system is gradually deteriorating and the thick mat of *Trapa* plants, has been completely vanished likewise other waterbodies Gangaram, Miyapur, Bibinagar are under immense pollution impacts and there is urgent need to protect and save them from death. Further it is necessary to protect these waterbodies from the natural process of filling. The catchment area should be properly planted to prevent soil erosion.

DISCUSSION

During the first year of study it was observed that good aquatic floating vegetation florishes well in Patan tank followed by Gangaram and Miyapur tank. The list of species recorded from all the waterbodies are given in Table VI, In all 17 Macrophytes have been reported, out of which the Patan tank showed all the plants. The Marshy amphibious plant was dominant in Patan tank besides *Trapa bispinosa.* Among submerged plants *Ceratophyllum demersum* was the most common in Miyapur tank besides *Hydrilla verticillata.* The distribution of *Trapa* plant was quite predominant in first year of study but gradually the thick mat vanished by the end of study period due to increasing pollution by sewage and effluents from the nearby factories. The distribution of macrophytes in other waterbodies was sparse and irregular. In all 20 species of rotifers, 10 species of cladocera and 4 species of Copepods were recorded in all (table IV) the water bodies. Bibinagar tank and Patan tank represent maximum number of species whereas lowest number was reeorded in Narapally and Komatkunta. The phytoplankton

TABLE : III

Annual average range of various Physico-chemical Parameters

Lake	Temp. Water °C	pH	CO_2 mg/L	CO_3 mg/L	HCO_3 mg/L	D.O. mg/L	Hard-ness mg/L	Ca mg/L	Mg mg/L	Chlo-ride mg/L	Total PO_4 mg/L	Sulp. hate mg/L	NO_3 N mg/L	Sp. onductivity μ Ohm/Cm
I	20-29	7·3-8·5	0-20	0-24	50-90	5·6-8·0	60-86	40-52	24-36	10-25	0·01-0·25	1·8-4·5	0·18-2·6	10^3X.675 X1.0-1·5
II	19-32	7·2-8·8	0-22	18-64	160-286	7·2-8·4	100-150	40-80	28-60	70-185	3·60-4·00	1·8-1·95	10·70-12·50	10^3X.675 X 1·0-2·5
III	20-30	8·0-9·3	0-0	12-26	36-170	5·8-6·2	114-240	84-120	36-100	128-140	0·01-0·27	7·2-15·5	1·5-7·68	10^3X.6·75 X 1·8-2·0
1V	20-30	7·3-8·8	0-0	4-38	52-184	4·6-5·0	142-180	126-140	30-50	20-102	0·02-0·136	3·2-5·6	1·05-5·51	10^3X.675 X 1·0-1·2
V	20-30	8·0-8·2	0-34	0-0	70-160	3·2-4·4	120-185	85-135	40-60	31-110	0·03-0·20	6·9-14·0	0·0-0·87	10^3X.675 X 1·2-1·5
VI	21-28	8·0-8·5	0-24	0-36	80-110	6·1-7·2	180-224	124-165	20-45	50-92	0·02-0·22	7·2-15·5	0·0-0·58	10^3X.675 X 1·0-1·3
VII	19-28	8·2-9·7	0-35	34-80	170-370	5·1-9·7	180-220	65-145	50-60	64-160	0·30-2·45	8·2-10·0	0·58-0·65	10^3X.675 X 1·0-2·0
VIII	10-30	7-8·8	0-0	24-60	70-95	7·8-8·1	180-240	120 200	60-80	80-150	0·40-0·80	2·8-7·2	2·6-8·2	10^3X.675 X 1·7-2·5

Komatkunta, II. Patan, III. Gangaram, IV Miryapur, V. Raigir, VI. Bhongir, VII. Bibinagar, VIII. Narapally.

consisted of Myxophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae of which Myxophyceae was reported by 5 genera and the distribution of other genera is given in Table V.

TABLE : IV

Distribution of Zooplankton Species

	I	II	III	IV	V	VI	VII	VIII
ROTIFERA								
Rotaria rotaria (Pallas)	–	–	–	–	–	–	–	+
Philodina sp.	–	–	–	–	–	–	+	+
Polyarthra vulgaris (Carlin)	+	+	–	–	–	+	+	+
Filinia longiseta (Ehrenberg)	+	++	++	–	+	–	++	+
Filinia terminalies (Plate)	+	+	–	–	+	–	–	–
Keratella Cochlearis (Gosse)	–	+	–	–	–	–	+	–
K. tropica (Apstein)	+	–	++	–	–	–	++	–
Asplanchna intermedia (Hudson)	–	+	–	–	–	+	+	–
Anuraeopsis fissa (Gosse)	+	+	–	–	–	+	+	–
Trichocerca cylindrica (Imhoff)	–	+	–	–	–	–	++	–
Brachionus angularis (Gosse)	–	+	+	–	+	+	+	–
B. calyciflorus(Pallas)	+	+	++	–	+	+	+	–
B. caudatus Barrois & Daday	–	–	–	++	–	+	++	+
B. forficula wierjeski	–	+	–	+	–	–	–	+

	I	II	III	IV	V	VI	VII	VII
B. quadridentatus (Hermann)	–	+	+	–	+	–	+	–
B. falcatus Iacharias	–	–	–	–	+	–	+	–
B. rubens Muller	+	+	–	+	–	–	+	–
Epiphanes macrourus Barrois & Daday	–	+	–	–	–	—	+	–
Lecane bulla Gosse	–	–	+	–	+	–	–	+
Monostyla Sp.								
CLADOCERA								
Diaphanosoma sarsi Richard	+	+	–	–	+	+ +	–	+
Ceriodaphnia cornuta Richard	–	+	+	–	–	+ +	–	–
Scapholeberis kingi Sars	–	+	+	–	–	–	+	–
Moina micrura (Jurine)	–	–	–	–	+	–	+	+
Simocephalus vetulus Schodlor	+	+	–	+	–	–	+	–
Pleuroxus aduncbus	–	–	–	–	–	+	–	–
Macrothrix spinsoa King (E...)	–	–	–	+	+	+	+	–
Chydorus reticulatus	+	+	–	+ +	+ +	–	+	+
Chydorus sphaericus Muller	+	–	+	+	+	+	+	–
Alona rectangula Sars	–	+	–	+	–	+	+	–
COPEPODS								
Mesocyclops hyalinus Rehberg	+	+	+	–	+	+	+	–
Cyclops sp.	–	–	–	+	–	+	–	–
Diaptomus sp.	+	+	+	+	+	+	+	+

\+ = Present
\+ + = Abundant
– = Absent

As such the tanks like Narapally and Komatkunta are temporary tanks and usually gets dried up in summer thus affecting annual life cycle whereas the tanks like Gangaram, Miyapur, Raigir, Bhongir. Bibinagar are under immense impact of irrigation. Consequently, the water level gets reduced or sometimes completely dried up in summer. The annual rainfall was very less which also directly affects the water level besides evaporation. The Patan tank is perennial and under impact of sewage and industrial pollution.

The mean transparency valus in the Patan, Bibinagar, Narapally and Komatkunta, was low. The low secchi values are due to suspended particles from the erosion of the surrounding area and urthen bundh in Narapally and Komatkunta, whereas in Patan and Bibinagar it is due to density of plankton (Hickel, 1973). Thus these tanks an be judged at the stage of cultural eutrophication on the basis of index of eutrophication (Yoshimura, 1933). The depth of the water in any waterbody does not exceeds above 5 meters. According to Crumrine and Beeton (1965) for developing stable summer stratifiication depth should exceed 8 meters. The pressent study corroborate this view.

The pH in Patan and Bibinagar reservoirs were high coinciding with heavy bloom of phytoplankton (Moitra and Bhattacharya 1965 and Jana 1973). High pH indicates higher productivity (Davis, 1955 ; Bhatnagar, 1984). The present study support this view for the waterbodies like Patan and Bibinagar.

Direct relationship between carbonate and pH was observed as has been shown by (Rao, 1955). Comparative study of pH range of all the waterbodies reveal that all the waterbodies are favourable for aquatic life (Das, 1978 ; Robert *et al.* 1940). As such the pH has shown only minor seasonal variations (George, 1966). Free carbon dioxide was not detected except in Komatkunta, Bhongir and Raigir. The absence of CO_2 in the other waterbodies may he due to its utilization by higher plants, evaporation and agitation (Welch, 1952, & Jayangouder, 1980).

Carbonate was absent in Raigir. The carbonate values in the tanks viz. Bhongir, Komatkunta were not detected on many occasion this may be explained on the basis of the amount of equilibrium CO_2 in water which inhibits coversion of bicarbonate into carbonate as stated by Ruttner (1953) and Munawar (1970), Harshey *et al.* (1982). Bicarbonate content were high in Bibinagar while lowest bicarbonate alkalinity was seen in Komatkunta. Alikunhi *et al.* (1955) pointed out that alkalinity of highly productive waters must be above 100 PPM. Taking into account the 100 PPM as seperation point for highly productive and low productive waterbody, the reservoirs Patan, Bibinagar could be grouped as productive.

Freiser and Fernando (1966) opine that when total alkalinity is high, the bicarbonate system prevails and pH is generally on alkaline side. The present study support this

view. Haarrel and Dorris (1968) pointed out relationship between high alkalinity with high productivity. In the present study the alkalinity of Patan and Bibinagar were high and the tanks are more productive in fauna and fiora as compared to other tanks. Das (1978), Patil *et al.* (1983) concluded that high alkalinity indicate pollution. In the present study it holds good in case of tanks like Patan and Bibingar which are considerebly polluted. The former due to sewage and industrial effluents while the later is due to domestic waste and sewage.

D. O. content in all the waterbodies was always above 5·1 mg/L except in Miyapur and Raigir where it was less than 5 mg/L on many occassions. Low oxygen may be due to evaporation at high temperatures and oxydation of organic matter, (Munawar, 1970, Patil *et al.* 1985). It seems that the above tanks except Miyapur and Raigir, are favourable to maintain fish fauna. (Ellis *et al.* 1946, Dimick & Merryfield 1947). Ganapati (1962) stated that higher D. O. during winter can be due to photosynthetic activities at upper level. Total hardness of water was always above 100 mg/L except in Komatkunta. Thus the tanks studied showed water hardness between slightly hard (100-150) and moderately hard (150-250 PPM) (Taylor, 1958 and Jayangouder, 1980). The most dominant cation in these water are calcium and the ratio was 2 : 1 in some cases. The maximum chloride content was found in Bibinager and Patan and the lowest in Komatkunta. The chloride content was maximun in summer months and it might be due to reduced water level and evaporation at high temperature.

TABLE : V

Distribution of Phytoplankton

	I	II	III	IV	V	VI	VII	VIII
Chlorophyceae								
Ankistrodesmus	–	+	+	++	–	++	+	+
Botryococcus	–	–	–	+	–	++	++	–
Closteriosis	–	–	–	–	++	+	++	–
Coelastrum	–	–	+	–	++	–	–	–
Pediastrum	+	+	–	–	–	+	++	–
Scenedesmus	+	+	–	+	+	+	+	+
Selanastrum	+	+	–	++	–	–	–	+
Tetradesmus	+	–	–	+	–	–	++	–
Olosterium	+	++	–	–	–	++	–	+

	I	II	III	IV	V	VI	VII	VIII
Cosmarium	—	++	—	+	—	—	++	++
Staurastrum	+	—	—	+	+	—	—	+
Cyanophyceae								
Anabaena	—	—	+	—	+	—	++	—
Microcystis	+	++	—	—	—	++	++	—
Oscillatoria	—	+	—	+	+	+	+	+
Spirulina	—	—	—	+	+	+	+	—
Merismopedia	+	+	—	+	—	+	++	—
Bacillariophyceae								
Cyclotella	+	+	—	+	+	—	++	+
Melosira	+	+	—	—	+	—	+	—
Naviculla	+	++	+	+	—	+	++	+
Nitzschia	—	+	+	+	+	—	+	—
Synedra	+	+	+	—	++	++	+	+
Cymbella	—	+	+	—	+	—	—	+
Fragillaria	—	—	+	—	—	+	++	+
Euglenophyceae								
Euglena	—	+	—	—	—	—	++	+
Phacus	+	+	—	+	—	—	+	—

\+ = Present
++ = Abundant
— = Absent

The maximum chloride content in both tanks Patan and Bibinagar indicates pollution of animal origin (Keenwood 1923, Ganapati 1962).

Vollenweider and Frei (1953) relate increase in specific conductivity to the state of enrichment. Same holds good in the present study. Specific conductivity values were quite high in Patan, Bibinagar and Narapally but were in favourable range Ellis (1937). Zutshi *et al.* (1980) stated; that generally the water with higher transparency

TABLE VI

Distribution of some Macropytes

	I	II	III	IV	V	VI	VII	VIII
Azolla pinnata	D	P	P	—	P	P	—	—
Ceratohyllum demersum	P	D	P	D	—	P	D	P
Chara sp.	—	P	P	P	P	P	P	—
Eichhornia crassipes	P	D	P	—	—	—	—	—
Hydrilla verticillata	P	P	—P	—P	—	P	—	P
Hygroryza aristara	—	P	—	—	—	—	—	—
Ipomea aquatica	—	P	P	—	—	P	P	—
Jussiaea repens	—	P	P	—	—	—	—	—
Leamna minor	D	P	P	P	P	P	P	P
Najas minor	P	P	P	P	—	—	—	—
Nelumbo nucifera	—P	D	D	P	—	—	—	—
Nymphoides indicum	—	P	—	—	—	—	—	—
Ottelia olismoides	P	P	P	—	—	P	—	—
Pistia	—	P	—	—	—	P	P	P
Potamogeton perfoliatus	—	P	—	—	—	—	P	—
Trapa bispinosa	—	D	P	—	—	—	P	—
Vallisnaria spiralis	—	P	P	P	—	—	—	—

D = Dominant

P = Present

— = Absent

develops high density of submerged plants and in turbid water floating forms dominates. The present study support this view. *Ceratophyllum demersum* was dominant in Patan and Bibinagar tanks which indicate beginning of cultural eutrophication. Similar conclusion was also made by Zutshi *et. al.* (1980). The plant *Nelumbo nucifera* was dominant in Gangoram village tank in the first year of study.

Twenty species of Rotifers were recorded from all the water bodies. The tanks which have showed dominance of Rotifers are Patan and Bibinagar and majority of the rotifers were cosmopolitan. No specific pattern was observed throughout the period of study for the peak of rotifers. The rotifer population was poor than cladoceran population. This might be bue to forage activities of these large crustaceans. Pennington (1948) concluded that in the presence of cladocera (large crustacean) rotifers population was reduced. Green (1972) and Chengalath *et. al.* (1974) have shown common occurrence of *Brachionus* and the ebsence or non absence of boreal genus *Notholca*, to be characteristics of many tropicalwaters. The same holds good in the present study. Komatkunta, Bhongir, Raigir and Narapally tanks have very limited fauna of rotifers thus indicating low fertility. The cladoceran fauna was better presented in Patan, Bibinagar, Bhongir, Raigir in the absence of predator like fish fauna (Harbacek *et. al.* 1961). The cladoceran studied did not show any fixed pattern of abundance and the reduced number of cladocera in the reservoir may be related to vegetation (Shireman and Martin, 1978).

Availability of food affect fertility of of females (Comitta and Anderson, 1959 ; Edmondson, 1965)indirectly affecting birth rate and mortality of zooplankton. It seems reasonable to consider that food is important factors which control zooplankton abundance (Swar and Fernando, 1980.) Copepods were represented by *Cyclops* and *Diaptomus* copepodids and Nauplius showing various peaks in different months of tne year.

Seasonal variations in the population of phytoplankton was seen. The phytoplankton consisted of Myxophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae. Considering the Myxophyceae as indicator of trophic status of the waterbody, the tanks Patan and Bibinagar can be judged as eutrophic waterbodies (Welch, 1952). Whereas the tanks like Narapally, Gangaram, Miyapur, Bhongir, Raigir are Mesotrophic since all these waterbodies showed dominance of chlorophyceae.

The phytoplankton was dominant over zooplankton. Temperature does not seem to be important for seasonal periodicity of phytoplankton (Jana 1973, Chari 1980, 1985). The phytoplankton was in peaks when the pH was high (Jana 1963 ; Moitra and Bhattacharya, 1965). Green algae were found when the phosphate content was low (Komorovasky, 1953), this is in contrast to the study of Chari (1980) and welch (1952) Diatoms populations was poor in some waterbodies. Pearsall (1932) opines that diatoms occured when PO_4, NO^3 and silicate are rich, it seems to be so in the case of tanks like Patan and Bibinagar.

The total phytoplankton was found to be low on many occassions and it might be due to bottom rich deposit which is continuously drawn out for argricultural

purposes in some irrigational reservoirs like Bibinagar, Bhongir, Raigir, Miyapur and Gangaram.

SUMMARY

Eight water bodies were studied for 3 years from 1982-1985 of which four were on Warangal Road, *viz*, Raigir, Bongir, Bibinagar and Narapalli whereas other four were Miyapur, Gangaram village tanks. Patan and Komatkunta situated within 70 kms. away from Hyderabad on Bombay Highway. Physico-chemical factors like temperature, turbidity, pH. dissolved oxygen, Free Co_2, total alkalinity, Chloride, total hardness have been studied. Some of these factors have been correlated and discussed. Rotifers, cladocerans, Copepods, were recorded during the period of study. The annual persentage composition of different groups of zooplankton were recorded. 20 species of rotifers, 10 species of cladocera and 4 species of copepods were recorded from waterbodies under study. The phytoplankton consist of Myxophyceae, Chlorophyceae, Euglenophyceae and Bacillariophyceae.

ACKNOWLEDGEMENT

We are thankful to the Director, Zoological Survey of India, Calcutta for necessary approval for this work and to Dr. A. N. T. Joseph, Ex Joint Director, Madras, and Dr. K. V. Rama Rao, Officer-in-Charge of FBS/ZSI, Hyderabad and Dr. G. M. Yazdani, Ex Joint Director, WRS/ZSI, Pune for facilities.

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