Bull. zool. Surv. India, 8 (1-3) : 245-276, 1987

PLANKTON ECOLOGY OF GANDHISAGAR TANK IN NAGPUR, INDIA[1].

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ABSTRACT

Plankton ecology of a perennial tank from Nagpur has been studied. The tank is leased to fishermen for rearing fishes. Water samples and plankton was collected once a week for a period of two years. The physico-chemical factors recorded include temperature, turbidity, pH, free carbon dioxide, carbonate and bicarbonate alkalinity, chloride, total hardness, dissolved oxygen, phosphate and free ammonia.

Plankton samples were collected seperately for qualitative and quantitive analysis. During the course of study 24 species of rotifers, 9 of cladocera and 3 copepod were recorded. Nauplius larvae were recorded both years. The annual % composition of various group is given. The phytoplankton contained major groups namely Myxophyceae, Englenophyceae and Bacillariophyceae. The Myxophceae was the dominant group. The tank is stocked with large number of fish which feed on cladocera and copeopda, hence the rotifers dominated the Zooplankton.

INTRODUCTION

In India limnological work was initiated by Prashad (1916) who studied the seasonal conditions of pond life in Punjab. Pruthi (1933) made some observations in the physico-chemical factors and biota of tank in the Calcutta Indian Museum compound. Sewell (1934) examining Pruthy's collection, gave a record of the fauna during the different months. Further studies on the ecology of a few water bodies from Madras city has been made by Ganapati (1940, 41, 43). Ganapati and Chacko (1951) while working on fish ponds at Madras observed that age and nature of bottom sediments effects the Plankton yield. Das and Srivastava (1956) reported that the quantity of phytoplankton appeared to be inversely proportional to that of Zooplankton. Alikuhni et. al. (1955) worked on the Plankton of nursery pond of Cuttack during the carp fry rearing period. Similar ecological studies of a few water bodies have been appeared from time to time (George 1961,

1. Part of the thesis approved for the Ph. D. Degree of the University of Nagpur, 1977.

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1966 ; Krishnamoorthy and Visweswara 1963, 65 ; Jayangouder 1964, 80 ; Lakshminarayana 1965 ; Michael 1968, 80 ; Vyas and Kumar 1968 ; Munawar 1974 ; Kaul 1977 ; Kaul et. al. 1978 ; Zutshi & Khan 1977 ; Zutshi and Vass 1978 ; Zutshi et. al. 1980 ; Job and Kannan 1980, Harshey et al. 1982, Singh 1982 ; Patil et al. 83 ; Patil and Sen 1983 ; Balkhi et al, 1984 ; Kanungo et al. 1985). Recently Trisal (1985) studied trophic status of Kashmir lak. The present investigation concerning the plankton ecology of the perennial tank from Nagpur was carried out for a period of two years (August 1972 to July 1974).

In the present work the following aspects of plankton ecology have been studied. Physico-chemical conditions of water, temperature, turbidity, pH, dissolved oxygen, free carbondioxide, carbonate and bicarbonate alkalinity, chloride, ammonia, phosphate and total hardness.

The quantitative and qualitative estimation of the Zooplankton and phytoplankton have been carried out. The seasonal fluctuations in the abundance of the various groups of dominant individual species are given. Some physiocochemical factors have been correlated with plankton population.

Topography of Gandhisagar Tank

This is a rectangular tank situated in the heart of the city (fig. 1). The area of the tank is 47.3 acres, and on three sides of the tank there are cement roads and on the fourth side the tank is separated from another small tank with an area of 15.22 acres. The depth of the tank is almost uniform and varies from 6 metres to 10 metres. Three sides of the tank have stone embcnkment with stone steps running upto the water level. The tank is partly polluted by domestic sewage and due to seepage from the adjoining small tank receiving textile mill

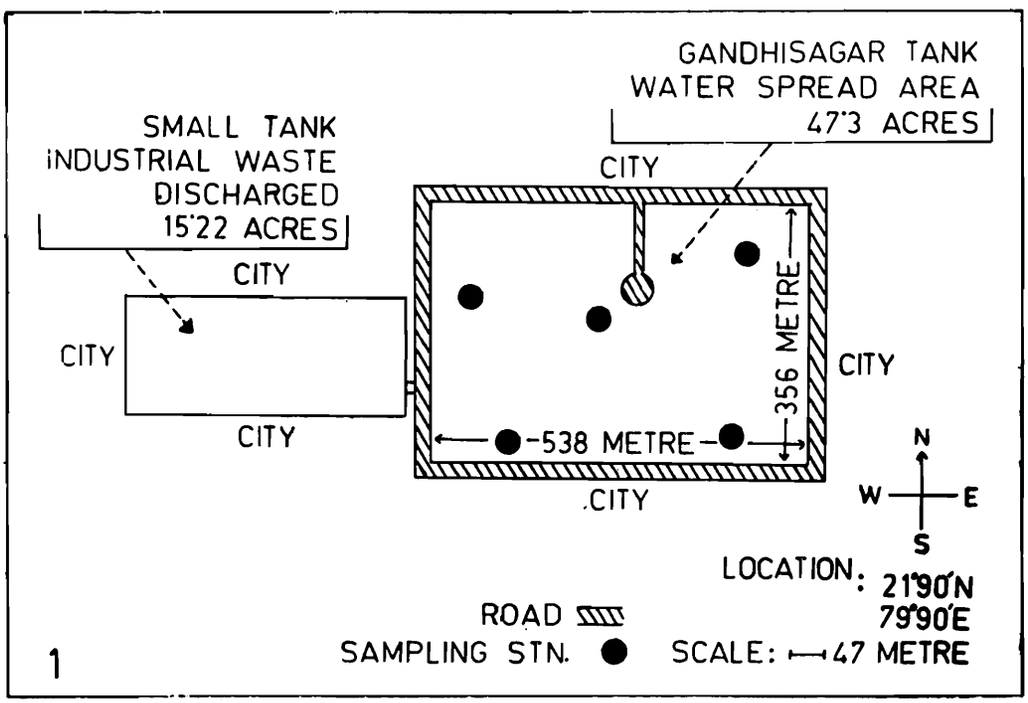


Fig. 1. Map of Gandhisagar tank showing location of sampling stations.

effluent. There is plenty of faecal pollution and on the sides along the road between the two tanks cattle are washed. Domestic garbage is also thrown into the tank. A small island is also present on one side of the tank which is approachable by a road. This tank is under the control of Nagpur Municipal Corporation and is leased to fisherman's Society for pisciculture. The location and number of sampling stations are given in the Map (fig. 1). In all five sampling stations have been selected for the present study.

Vegetation : There are very few hydrophytes and they are restricted to the marginal zone of the tank. As the tank is used for pisciculture, the aquatic hydrophytes have been removed from the tank.

MATERIAL AND METHODS

Water samples and plankton from the tank were collected once a week between 9.30 a.m. and 11.30 a.m. Water samples were collected by dipping a wide mouth bottle just below the surface of the water at a slightly inclined angle to avoid bubbling of air and were immediately brought to the laboratory for chemical analysis, which was generally completed within two to three hours.

Water analysis : For the estimation of dissolved oxyzen water samples were taken in three hundred ml narrow mouth bottle having a glass stopper and the oxygen was fixed in the field according to modified Winkler method. The physical factors recorded include, temperature, turbidity and pH. The temperature of the water was noted in the field by an ordinary centigrade therometer and pH was recorded by pH metre. Turbidity was determined by a turbidometer. The reading for rainfall were taken from the data of Metrological Department. Chemical factors such as dissolved oxygen, free carbon dioxide, bicarbonate and carbonate alkalinity, chloride, free amonia, phosphate and total hardness due to calcium and magnessium, estimated as per methods given in the "Standard methods for the examination of water and waste water" (American Public Health Acsociation, 13th Edition 1971). Free Carbon dioxide was determined by fitrating with N/44 NaOh using phenolphthalein indicator. Carbonate and bicarbonate alkalinity was determined by titration with N/50 sulphuric acid using phenolphthalein and Methyl orange indicators respectively. Chloride was estimated by Mohr's method and hardness by E D T A titration method. Free Ammonia was estimated by direct Nesslerisation and phosphate was determined by Stannous chloride method. The physico-chemical data represented in the tables is the average of weekly collections per month.

Plankton analysis : Weekly collection of plankton samples were made with the help of conical plankton net of Nylon-satin cloth of 200 mesh per square centimeter to which a rim lesss test tube was attached at the bottom. Plankton samples were collected for qualitative analysis by towing the net through surface layer of water. For quantitative analysis live organisms were examined. Plankton samples were obtained by filtering 20 litres of water through the net for quantitative estimation. The plankton concentrates were preserved in 5% formalin. The quantitative estimation of Zooplankton was done with the help of a Sedgwick Rafter cell under binocular microscope with magni-

fication of 100 x and the number of the various zooplankers was counted. Phytoplankton was enumerated by "drop method" under high magnification of 440 x (Pearsall et al, 1946). On an average three counts were made for each sample and the mean concentration were calculated for the zoo and phytoplanktonic forms. From this data the total count/litre was calculated and the various plankters were considered as units of organisms/Litre of water.

Observations

A. PHYSICAL AND CHEMICAL FACTORS

The data giving two years variation in Physico-chemical factors of water are given in Tables I to II.

Rainfall–

The data on total rainfall in cm. obtained from the Mateorological Department is given below :

It will be seen that during the first year of study (Aug. 1972 to July 1973) the total rainfall recorded was 38.00 cm. and during the second year (Aug. 1973 to July 1974) 38.87 cm. Though the total rainfall recorded during the two year period of investigation was nearly the same, their monthly record differs. Rainfall was recorded throughout the year except in the month of March, 1973. In the second year there was a long dry spell form Nov. 1973 to Feb. 1974 and April 1974.

Temperature : The temperature fluctuations (fiig. 1) during the two year course of investigation (August 1972 to July 1974) were not very much and was 9.2°C,

The maximum temperature was recorded in the month of June 1973 and 1973 and a gradual rise in temperature was neticed from January to June and again a small rise in August 1973 and a gradual decrease in temperature from August to December or January. In Jnne 1973 and June 1974 the maximum temperature were recorded and it was 28.2°C and 23.6°C respectively. The minimum temperature recorded was in January 1974 and it was 19°C.

Turbidity : The turbidity of water (fig. 3) in this tank was not very high and the turbidity range was 28.7 to 146 mg/litre. The

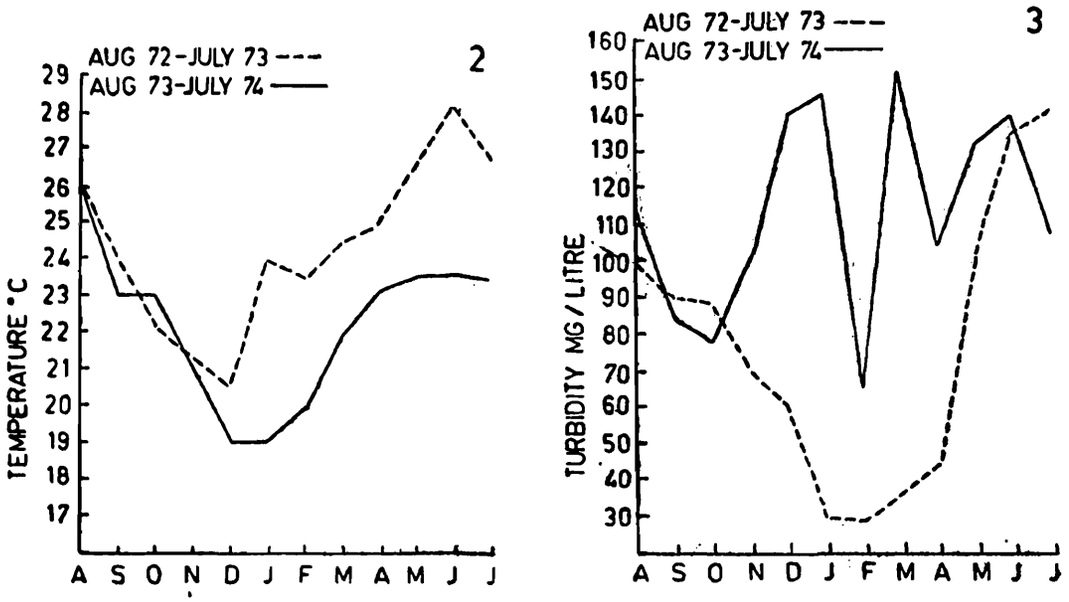
Month and year	Total rainfall CM.	Month and year	Total rainfall CM.
Aug. 1972	6.20	Aug. 1973	6.15
Sep. 1972	1.40	Sept. 1973	6.02
October 1972	4.64	Oct.	7.63
Nov. 1972	0.95	Nov. 1973	0.0
Dec. 1972	1.50	Dec. 1973	0.0
Jan. 1973	5.50	Jan. 1974	0.0
Feb. 1973	0.50	Feb. 19 4	0.0
Mar. 1973	0.0	March 1974	0.50
April 1973	1.0	April 1974	0.0
May 1973	0.25	May 1974	2.30
June 1973	2.65	June 1974	8.45
July 1973	14.71	July 1974	7.15

TABLE—I Physico-chemical characteristic of water, August 1972 to July 1973.

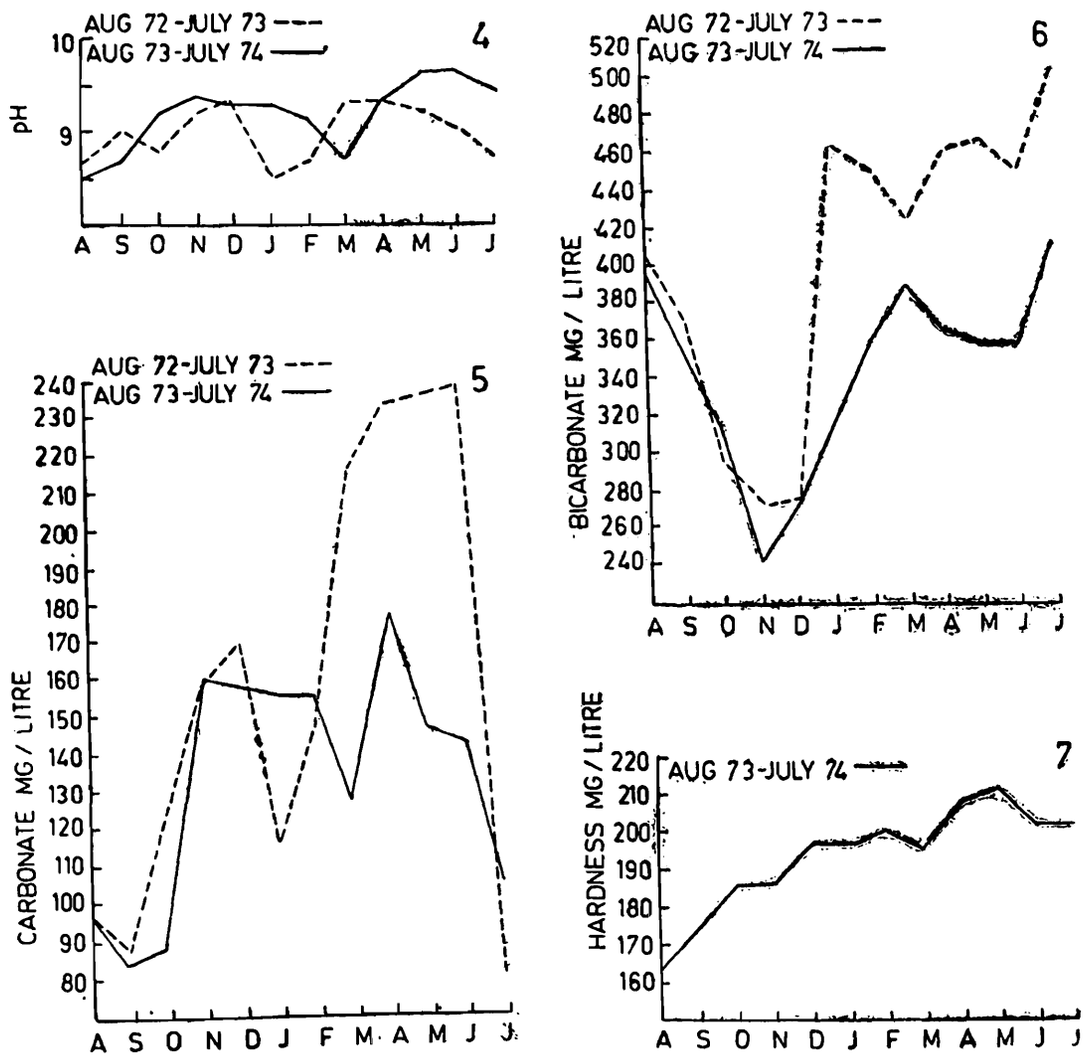
Month and Year		Temperature (°C)	Turbidity mg/Litre	pH	Free Cardon dioxide mg/ Litre	Carbonate as $CaCo_3$ mg/ Litre	Bicarbonate as $CaCo_3$ mg/ Litre	Chloride as Cl. mg/ Litre	Disolved Oxygen mg/ Litre
August	1972	26.2	99.0	8.7	Nil	96	405	129.5	9.2
Sept.	1972	24.2	90.00	9.0	Nil	88	372	125.4	9.94
Oct.	1972	22.2	88.0	8.8	Nil	124	296	120.9	8.8
Nov.	1972	21.4	70.0	9.2	Nil	158	273	124.3	9.78
Dec.	1972	20.5	61.0	9.35	Nil	170	277	158.0	10.2
Jan.	1973	24.0	30.5	8.5	Nil	116	464	201.0	7.8
Feb.	1973	23.5	28.7	8.7	Nil	150	451	202.0	7.2
March	1973	24.5	37.0	9.3	Nil	216	453	215,0	6.9
April	1973	25.0	45.0	9.3	Nil	232	461	219.0	7.4
May	1973	26.7	102.0	9.2	Nil	234	466	219.0	9.0
June	1973	28.2	135,9	9.0	Nil	236	449	200.0	8.2
July	1973	26.8	141.0	8.7	Nil	82	506	122.0	8.6

TABLE—II Physico-chemical charactaristics of Water, August 1973 to July 1974.

Month and Year		Tempera-ture (°C)	Turbidity mg/Litre	pH	Free Carbon dioxide mg/Litre	Carbonate as $CaCo_3$ mg/Litre	Bicarbo-nate as $CaCo_3$ mg/Litre	Total hard-ness as $CaCo_3$ mg/Litre	Chloride as Cl mg/Litre	Dissolved Oxygen mg/Litre	Phos-phate mg/Litre	Free Ammo-nia mg/ Litre
August	1973	26.0	114.0	8.5	Nil	95	397	164	126.0	9.6	4.5	1.0
Sept.	1973	23.0	80.0	8.7	Nil	84	355	180	113.0	8.8	4.5	0.2
Oct.	1973	23.0	78.0	9.2	Nil	88	315	186	112.0	8.9	4.9	0.2
Nov.	1973	21.0	102.0	9.4	Nil	160	242	186	124.5	10.0	4.0	0.2
Dec.	1973	19.0	139.0	9.3	Nil	158	272	196	125.5	12.3	9.0	0.2
Jan.	1974	19.0	146.0	9.3	Nil	156	314	196	129.5	10.8	9.05	0.4
Feb.	1974	20.0	65.0	9.1	Nil	156	355	200	170.0	10.2	11.0	0.75
Mar.	1974	22.0	102.0	8.7	Nil	128	388	195	155.0	9.6	11.0	0.04
April	1974	23.2	104.0	9.31	Nil	178	365	207	138.5	11.8	6.82	1.05
May	1974	23.6	132.0	9.6	Nil	148	358	211	123.0	6.6	4.23	0.2
June	1974	23.6	140.0	9.62	Nil	144	357	202	123.5	6.7	3.80	0.7
July	1974	23.5	108.0	9.4	Nil	106	413	202	142.0	7,55	2.1	0.8



Figs. 2 & 3. Seasonal fluctuations in temperature and turbidity.



Figs. 4, 5, 6 and 7. Seasonal fluctuations in pH, Carbonate, bicarbonate and hardness.

turbidity values were generally low from January to April and high values were recorded from May to August. The high values of turbidity were due to the drying up of the tank in summer and later due to the onset of monsoon.

pH.

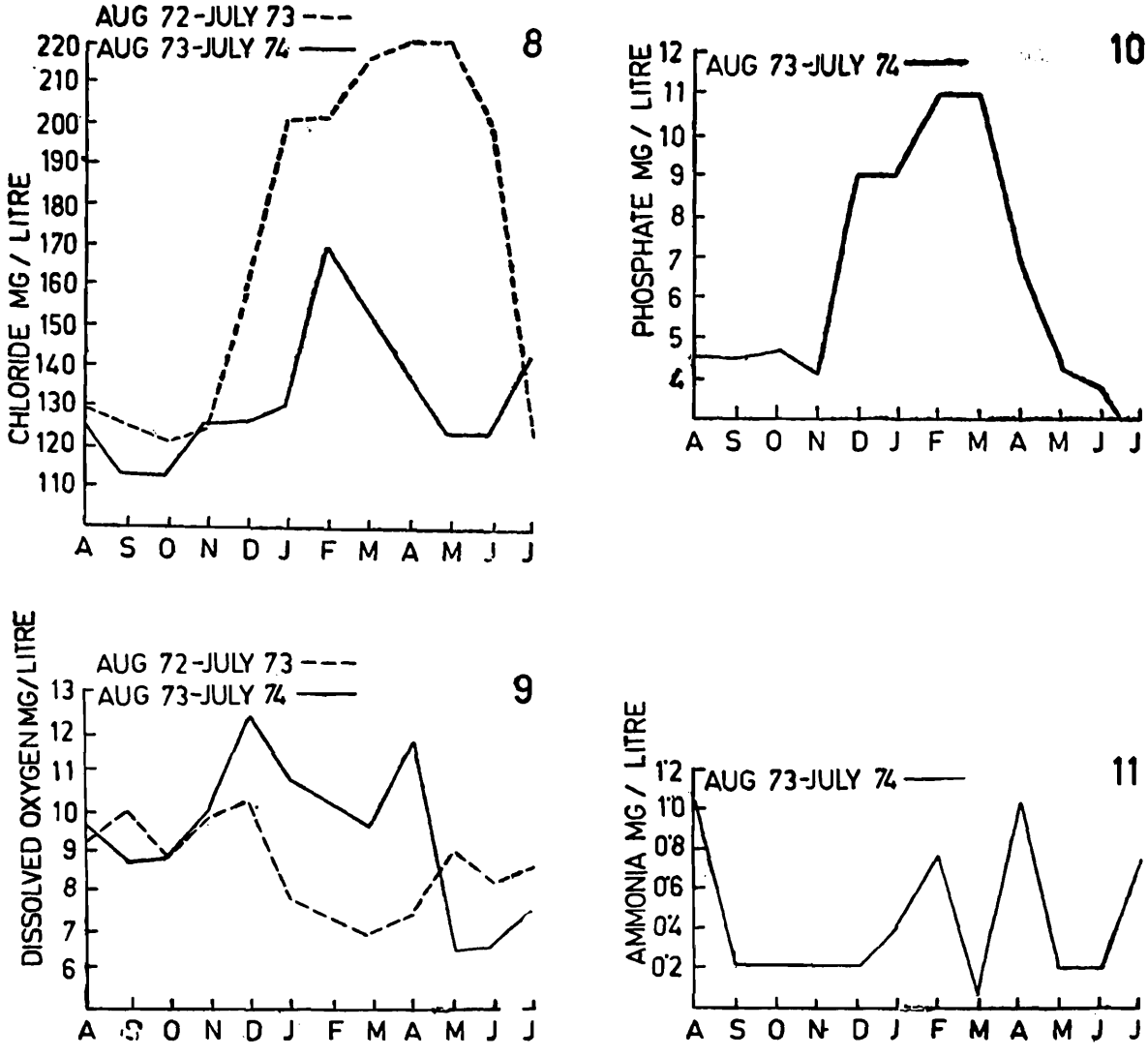
The water in the tank was always alkaline and the pH range was between 8.5 to 9.6. The minimum value was noticed in January and August 1973 and the maximum in June 1974 (fig. 4)

Free carbon dioxidc :

Free carbon dioxide was not observed during the period of investigation.

Carbonate alkalinity : The reading of the carbonate alkalinity (fig. 4) showed wide fluctuations and the maximum amount of carbonate alkalinity of 232 to 236 mg/litre was recorded in the month of April, May and June 1973 and the minimum of 82 to 96 mg/litre in July, August and September.

Bicarbonate alkalinity : The range of bicarbonate alkalinity was between 242 to 506



Figs. 8, 9, 10 and 11. Seasonal fluctuations in chloride, dissolved oxygen, phosphate and ammonia.

mg/litre. It was found that the bicarbonate alkalinity was at its minium in November 1973 and maxium in May or July 1973 (Fig. 5).

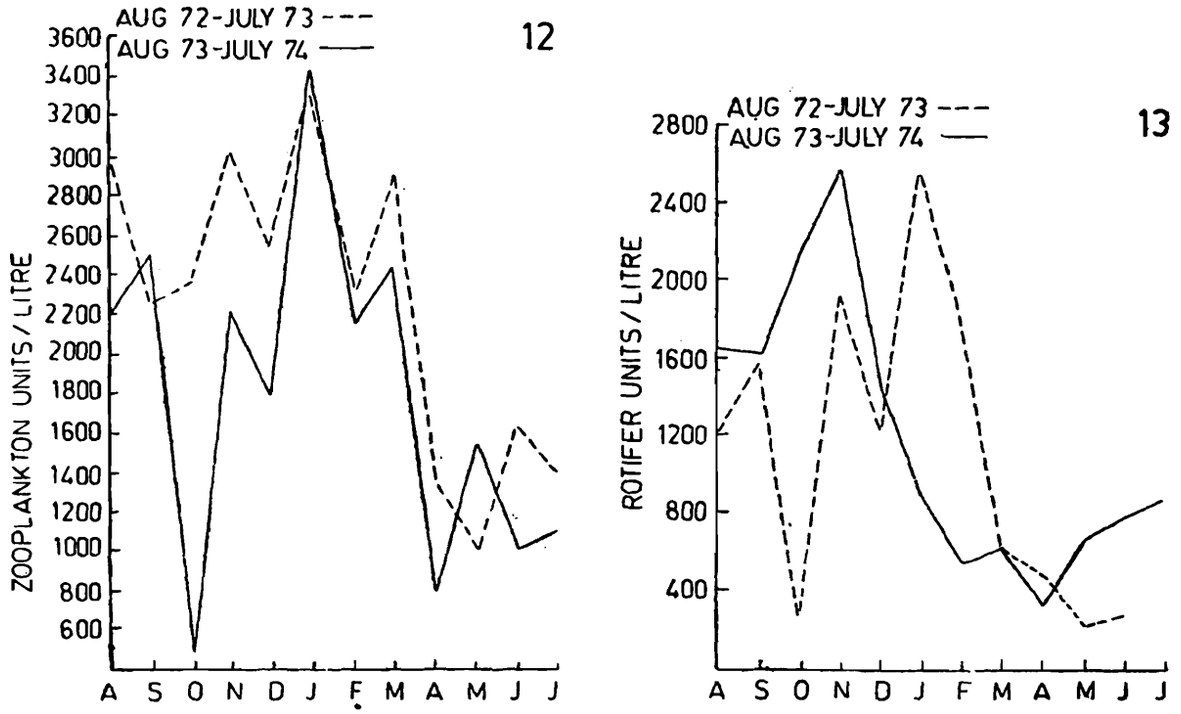
Total Hardness : It was noticed that the total hardness of water was generelly high and the range was between 164 to 211 mg/litre A gradual rise in total hardness was observed in this tank. from August 1973 to June 1974 (fig. 7)

Chloride : High chloride content (fig. 8) was noticed in this tank and it was always more than 112 mg/litre and the maximum was 219/litre. A gradual increase in the chloride values from November or December 1972 onwards was observed and the maximum being in May 1973.

Dissolved oxygen : Dissolved oxygen (fig. 9) was generally above 6 mg/litre and the D.O. values ranged between 6.6 to 12.3 mg/litre in this tank. The maximum D.O. values was observed in December or January. From December or January onwards dissolved oxyen decreased progressively till March and again there was a gradual increase with few fluctuation till the highest value was reached in December or January.

Phosphate : Inorganic phosphate content (fig. 10) was generally high and the maximum value of 11 mg/litre was observed in February and March 1974 and the minimum of 2.1 mg/litre in July 1974.

Free ammonia : It was observed that the maximum ammonia content was recorded in April 1974 and the range was between 0.04 to 1.05 mg/litre (fig. 11).



Figs. 12 & 13. Seasonal variations in the total zooplankton and Rotifer population.

B. ZOOPLANKTON

The zooplankton of the tank was composed of rotifers, cladocerans, copepods and crustacean larvae. The different planktonic forms recorded (Table III) and their quantitative variations are given in tables (IV, V). During the course of study for a period of two years 24 species of rotifers, 9 Cladocerans and 3 copepods were recorded. Nauplius larvae were present in the tank practically throughout the period of investigation.

The maximum zooplankton population (Fig. 12) was recorded in the tank. It showed a pulse in January 1973 and 1974 and the maximum number of units/litre were 3441. The percentage distribution of the major group of zooplankters is shown below.

TABLE-III : List of Zooplankton species present in the tank.

Name of the Genera and species.

Rotaria rotaria (Pallas)
Philodina sp.
Floscularia sp.
Sinantherina sp.
Conochilus unicornis Rousselet
Collotheca sp.
Synchaeta pectinata Ehrenberg
Polyarthra vulgaris Carlln
Filinia longiseta (Errenberg)
Filinia terminalis (Plate)
Keratella cochlearis (Gosse)
Keratella tropica (Apstein)
Asplanchna intermedia (Hudson)
Trichocerca sp.
Trichocerca cylindrica Imhof
Branchionus angularis (Gosse)
Branchionus caudatus Barrois and Daday
Branchionus forficula Wierzejski
Branchionus quadridentata Hermann
Branchionus urccolaris O. F. Muller
Epiphanes macrourus (Barrois & Daday)
Lecane sp.
Monostyla sp.
CLADOCERA
Diaphanosoma sarsi Richard
Daphnia dubia Hirrick
Daphnia carinata King
Simocephalus vetulus Schdler
Scapholeberis Kingi Sars
Moina brachiata Jurine
Moina dubia de Guerne et Richard
Macrothrix spinosa King
Chydorus sphacricus (O. F. Muller
COPEPODA
Cyclops sp.
Mesocyclops hyalinus (Rehberg)
Diaptomus sp.
Nauplius larvae

Table showing percentage distribution of Zooplankters during 1972-73 and 1973-74.

Period of investigation	1972-73	1973-74
Annual average units/litre of total Zooplankton	2273	1718
Percentage composition of		
(a) Rotifera	51.60%	60.3%
(b) Cladocera	2.10%	1.90%
(c) Copepoda	5.90%	6.60%
(d) Nauplius larvae	40.40%	31.20%

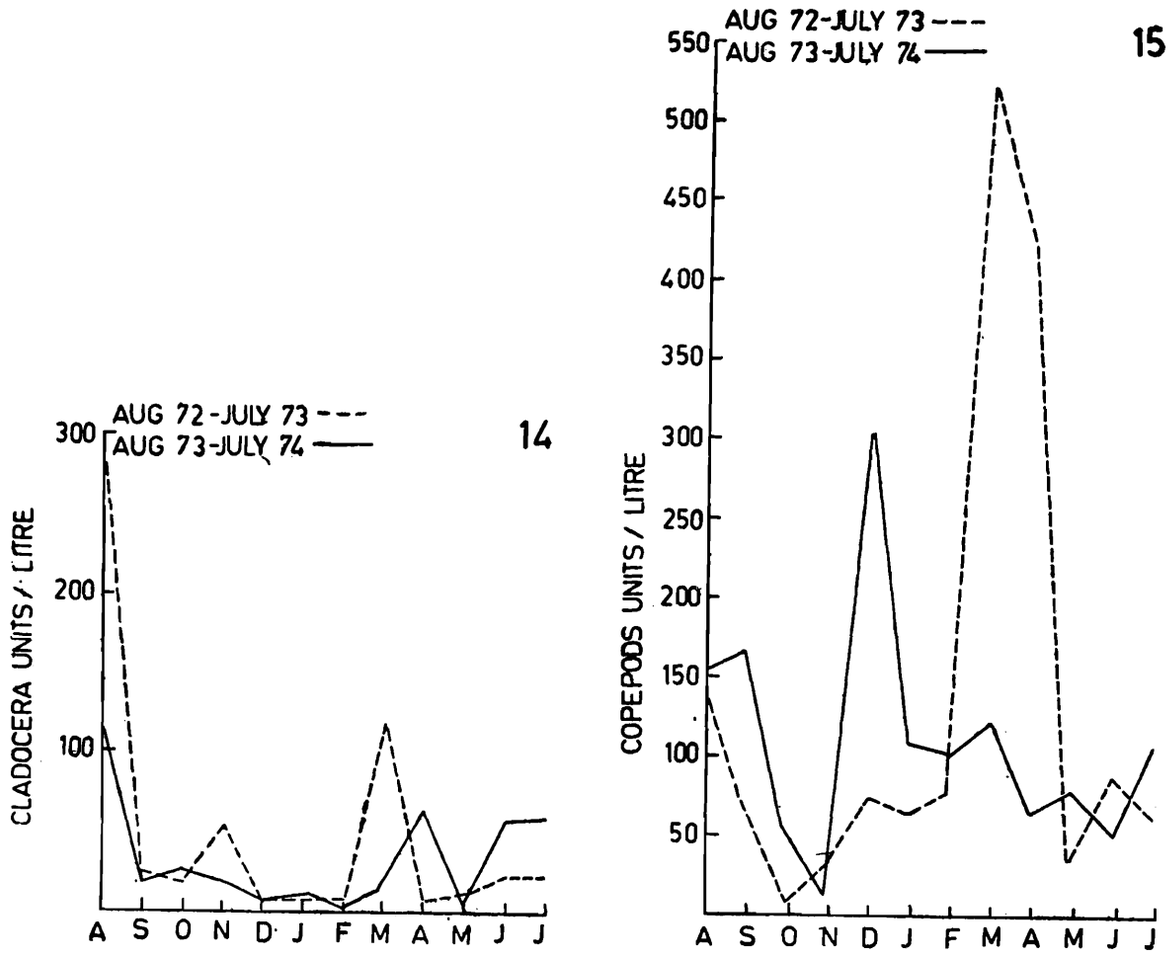
It is clear from the data that Rotifera is the dominant group. The Nauplius larvae are also found in good numbers and the Cladocera and Copepoda are better represened.

Rotifera

In this tank rotifers showed one pulse in the month of November 1972-(2571 units/ litre) and *B. angularis*, *B. Calyciflorus Filinia longiseta* were the dominant forms in this tank. Seasonal variations of the rotifers which dominated in the plankton sample is given (Tables IV, V). In all 6 species of *Branchionus* were recorded, out of which three were observed in sufficient numbers.

Cladocera

Cladoceran (Tables IV and V) were not found in abundance in the tank. In all 9 species of Cladocera were recorded from the plankton samples. Two maxima were noticed during the first year one in August, 1972 with 284 units/litre and the other in March 1973 with 119 units/litre. During the second year the maxima was in August 1973 with 120 units/litre. The dominant species was *Moina dubia* (Fig. 14).



Figs. 14 & 15. Seasonal variations in the Cladocera and Copepods population.

TABLE—IV. Zooplankton population of the tank, August, 1972 to July, 1973 (Units/Litre)

Name of the Genera and species	Aug. 72	Sept. 72	Oct. 72	Nov. 72	Dec. 72	Jan. 73	Feb. 73	March 73	April 73	May 73	June 73	July 73
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
ROTIFERA												
Rotaria rotaria (Pabeas)	22	8	134	—	55	—	6	—	—	—	—	—
Philodina sp.	5	—	—	—	2	—	—	—	—	—	—	—
Floscularia sp.	10	—	—	2	—	—	—	6	—	—	—	—
Sinatherina sp.	—	—	—	—	—	—	—	2	4	—	2	—
Conochilus unicornis Rousselet	2	5	—	—	—	—	—	—	—	—	—	—
Collotheca sp.	18	—	—	—	—	2	2	—	—	—	—	—
Synchaeta pectineta Ehrenberg	10	—	—	—	—	—	2	—	—	—	—	—
Polyarthra vulgaris Carlin	245	—	—	—	107	—	2	2	—	—	—	—
Filinia longiseta (Ehrenberg)	25	411	97	749	1037	254	56	140	87	461	51	523
Filinia terminalis (Plate)	—	—	3	—	—	—	—	—	—	—	—	5
Keratella cochlearis (Gosse)	335	2	—	—	—	—	12	11	16	—	—	—
Keratella tropica (Apstein)	107	6	52	—	—	32	5	—	4	—	—	—
Asplanchna intermedia Husson	33	—	—	—	55	—	—	—	—	6	—	13
Trichocerea sp.	2	—	—	—	—	—	—	—	—	—	—	—
Trichocerea cylindrica Imhof	48	—	—	—	—	16	18	—	—	—	—	—
Brachionus angularis (Gosse)	300	975	1159	654	36	528	354	401	49	137	650	60
Brachionus calyciflorus Wierzeiski	100	148	664	1120	5	—	35	45	132	30	63	260
Brachionus caudatus Barrois & Daday	10	2	15	9	—	—	—	—	—	4	8	—
Brachionus forticula Wierzeiski	376	12	3	—	6	18	17	2	33	28	8	—
Brachionus guadridentata Hermann	—	—	—	—	—	—	2	6	—	—	—	—
Brachionus urceolaris O. F. Muller	—	2	5	—	—	—	9	—	11	—	—	—
Epiphanes macrourus Barrois & Daday	4	22	—	—	—	—	12	—	—	—	—	—
Lecane sp.	—	—	—	27	—	32	2	—	—	—	—	—
Monostyla sp.	—	—	—	10	—	—	6	2	—	—	—	—
TOTAL :	1652	1593	2132	2571	1483	880	540	617	336	666	784	861

*Contd....*Table—IV

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
CLADOCERA												
Diaphanosoma sarsi Richard	—	—	—	4	—	—	—	46	—	3	3	—
Daphnia dubia Herrick	—	—	1	2	—	2	—	6	—	—	—	—
Daphnia carinata King	—	2	2	1	—	—	—	—	—	—	—	—
Simocephalus vetulus Schodler	—	—	—	—	7	2	—	—	—	—	—	—
Scapholeseris kingi Sars	—	—	—	—	—	1	4	—	—	—	—	—
Moina brachiata (Jurine)	80	2	—	—	—	—	—	7	—	—	—	—
Moina dubia de Guerne et Richard	203	20	11	48	1	—	4	60	8	8	15	20
Macrothrix spinosa	1	—	—	—	—	—	—	—	—	—	2	2
Chydorus sphaericus (O. F. Muller)	—	—	4	—	—	—	—	—	—	—	—	—
TOTAL :	284	24	18	55	8	5	8	119	8	11	20	22
COPEPODA												
Cyclops sp.	108	50	8	30	74	66	47	304	334	34	88	62
Mesocyclops hyalinus (Rehberg)	38	20	—	—	—	—	30	200	90	—	—	—
Diaptomus sp.	—	—	—	—	—	—	—	15	2	—	—	—
TOTAL :	146	70	8	30	74	66	77	519	426	34	88	62
Nauplius larvae	919	592	235	384	978	2379	1684	1668	478	277	731	441
TOTAL Zooplankton	3001	2279	2398	3040	2514	3330	2309	2923	2248	988	1623	1386

TABLE—V Zooplankton population of the tank, August, 1973 to July 1974 (Units/Litre)

Rotifera	Aug. 73	Sept. 73	Oct. 73	Nov. 73	Dec. 73	Jan. 74	Fev, 74	Mar. 74	April 74	May 74	June 74	July 74
1	2	3	4	5	6	7	8	9	10	11	12	13
Rotaria rotaria (Pallas)	3	—	—	5	27	—	—	—	—	—	—	4
Rhilodine sp.	—	—	—	—	4	—	2	—	—	—	—	—
Floscularia sp.	—	—	2	—	—	—	—	—	4	—	—	4
Sinantherina sp.	—	—	—	—	—	—	—	—	—	—	—	—
Conochilus unicornis Russelet	—	5	6	—	—	—	—	—	2	—	—	—
Collotheca sp.	—	—	—	—	—	—	10	—	—	—	—	—
Synchaeta pectineta Ehrenberg	—	2	—	—	—	—	—	—	—	—	—	—
Polyarthra vulgaris Carlin	—	10	8	2	—	—	—	—	—	—	—	—
Filinia longiseta Ehrenberg	485	423	16	23	32	28	17	2	11	19	57	135
Filinia terminalis (Plate)	—	5	—	—	—	2	9	—	—	—	—	—
Keratella cochlearis (Gosse)	25	20	27	700	657	775	1126	241	—	—	—	—
Keratella tropica (Apstein)	—	12	71	1098	386	716	485	221	5	24	28	8
Asplanchna intermedia Hudson	8	—	—	—	27	6	—	—	2	—	—	—
Trichocera cylindrica Imhof	—	—	—	—	17	8	—	—	—	17	10	—
Brachionus angularis (Gosse)	251	261	53	11	9	985	168	133	19	75	125	210
Brachionus calyciflorus Wierzetski	424	757	54	44	—	—	—	—	311	61	50	106
Brachionus forticula Weirzeiski	2	—	—	—	2	—	—	—	—	—	—	—
Brachionus guadridentata Hermann	—	—	—	2	—	—	—	—	—	—	—	—
Brachionus urceoiaris O. F. Muller	—	—	5	—	7	8	—	—	8	—	—	—
Epiphanes macrourus Barrois & Daday	—	50	2	—	—	—	—	—	38	—	—	—
Lecane sp.	—	—	—	5	2	0	—	—	—	—	—	—
Monostyla sp.	—	—	—	—	—	—	—	—	8	—	—	—
TOTAL :	1198	1545	244	1890	1170	2538	1817	59J	498	169	270	4
CLADOCERA												

TABLE V—Contd.

1	2	3	4	5	6	7	8	9	10	11	12	13
Diaphanosoma sarsi Richard	—	—	—	—	—	—	—	—	—	6	8	—
Daphnia dubia Herrick	—	—	5	13	—	3	—	10	—	—	—	—
Daphnia carinata King	—	5	5	—	—	2	—	3	—	—	—	—
Simocephalus vetulus Schdler	—	—	—	—	6	2	—	—	—	—	—	—
Scapholeberis kingi Sars	—	—	—	—	—	2	1	—	—	—	—	—
Moina brachiata Jurine	9	—	—	—	—	—	—	—	—	—	—	—
Moina dubia de Guerne et Richard	110	11	4	3	—	—	—	—	62	—	46	57
Macrothrix sp.	1	—	—	—	—	—	—	—	—	—	—	—
Chydorus sphaericus O. F. Muller	—	—	6	2	—	—	—	—	—	—	—	—
TOTAL :	120	16	20	18	6	9	1	13	62	6	54	59
COPEPODA												
Cyclops sp.	100	108	55	26	211	70	92	123	68	81	56	111
Diaptomus sp.	—	—	—	—	—	—	12	3	—	—	—	—
Mesocyclops hyalinus Rehberg	5	60	—	—	100	40	—	—	—	—	—	—
TOTAL :	155	168	55	26	311	110	104	126	68	81	56	111
Nauplius larvae	709	707	138	309	284	784	214	1531	167	470	649	460
Total Zooplankton	2185	2436	457	2243	137	3541	2136	2267	775	753	1020	1106

COPEPODA

Copepods (Tables IV and V figs 15) though present in the tank were not found in large numbers throughout the period of investigation. The pulses were dominated by cyclopoids and calanoids. The copepodid slages of cyclopoids and calanoids were counted with the adults copepods, efforts were made to identify and place them into particular species of copepods. The maximum number of copepods was 519 units/litre in March, 1973 during the first year. the maximum was in December, 1973 (311 units/litre) dominated by *cyclops* sp. and *Mesocyclops hyalinus*. Only three species of copepods *Cyclops* sp., *Mesocylops hyalinus*, *Diaptomus* sp. have been found.

In the present study male specimens were recorded on few occasions. The following data shows the specimen were recorded.

Specimens involved	Dates
Brachionus angularis	10.10.1972.
	14.09.1973.
	30.01.1974.
Barchionus calyciflorus	27.09.1973.
Keratella cochlearis	28.02.1974.
Keratella tropica	28.11.1973.

NAUPLIUS LARVAE

These crustacean larvae (Fig. 16) 9 were found in large numbers especially from January to March 1973 and in March 1974. The maximum number of nauplii recorded was 2379 units/litre in January, 1973. This period i.e. from January to march could be taken as an intensive breeding period of the copepods. This view is further supported by the increase iu the number of adults in the samples in March and April, 1973 and clearly indicates new recruitment.

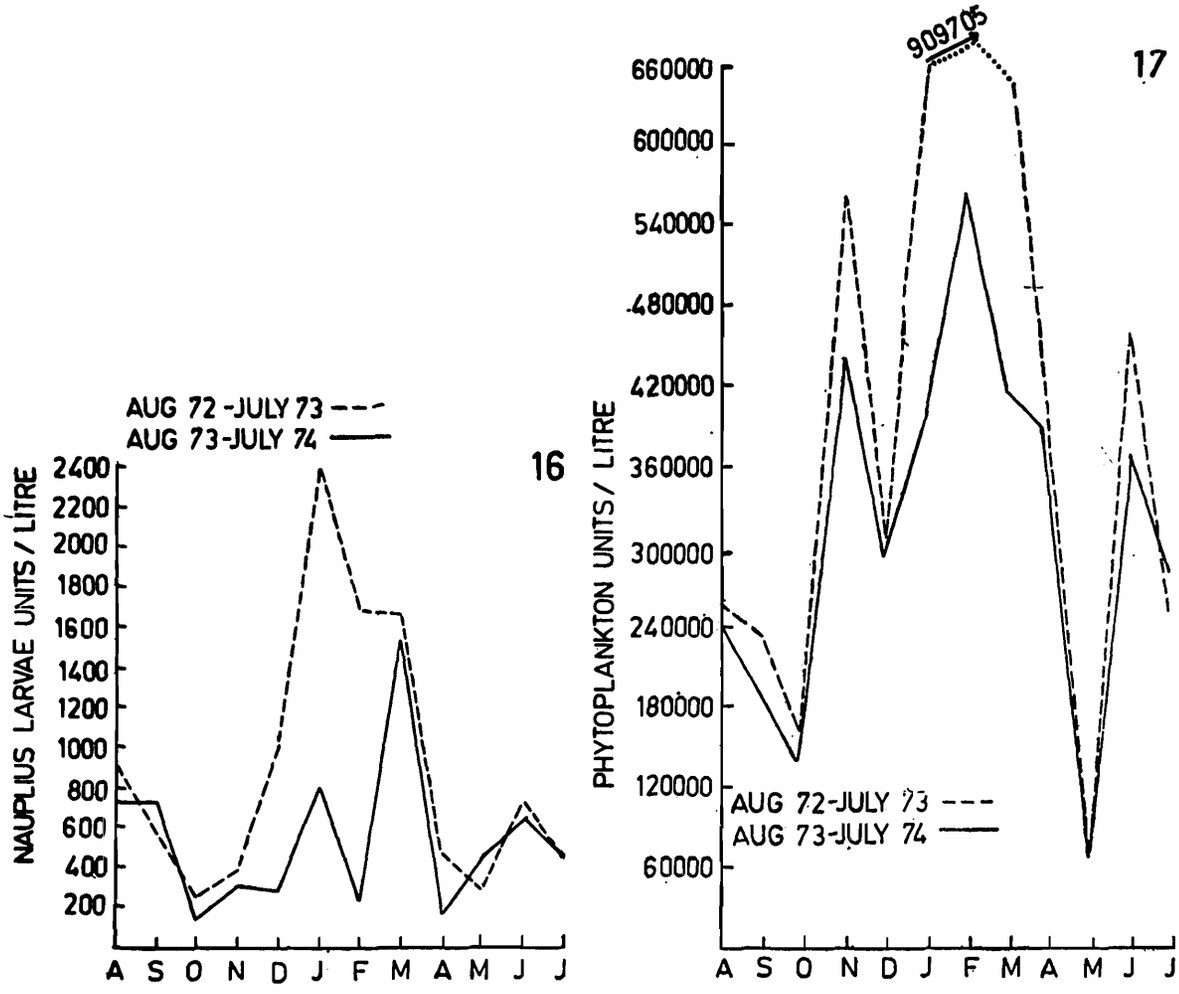
Table showing average annual percentage composition of the zoo and phytoplankton during 1972-73 and 1973-74.

Average annual percentage of	Years 1972-74	Years 1973-24
Zooplankton	0.55%	0.54%
Phytoplankton	99.45%	99.46%

C. PHYTOPLANKTON

Phytoplankton from the samples was recorded and the indentifications of the various forms were made upto genera only. During the two year study, 21 genera of algae were recorded (Table VI). Of these 5 belong to Myxophyceae, 7 to Chlorophyceae, 2 to Euglenophyceae and 7 to Bacillariophyceae. The seasonal variations in the total phytoplankton (Tables VII, VIII and fig. 17) showed a major pulse in February 1973 and one in February, 1974.

The Table showing the annual average units/litre of the phytoplankton and percentage composition of the major groups during 1972-73 and 1973-74.



Figs. 16 & 17. Seasonal variations in the nauplius larvae and phytoplankton population.

TABLE VI

Phytoplankton distribution in the tank

Name of Genera :

MYXOPHYCEAE

Microcystis
Oscillatoria
Spirulina
Anabaena
Nostoc

CHLOROPHYCEAE

Eudorina
Pandorina
Pediastrum
Spirogyra
Scenedesmus
Strurastrum
Closterium

EUGLENOPAYCEAE

Euglena
Phacus

BACILLARIOPHYCEAE

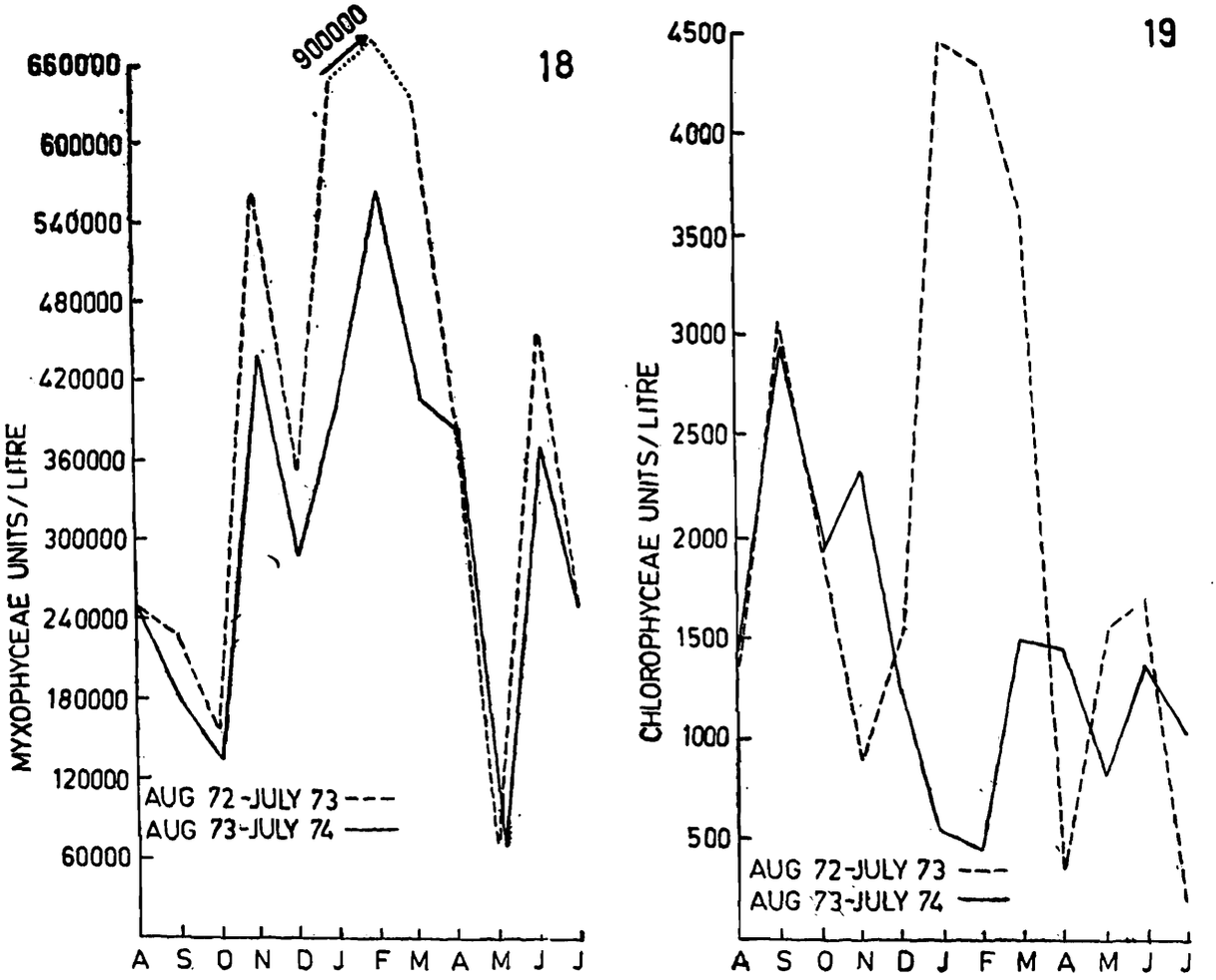
Cyclotella
Fragillaria
Pinnularia
Asterionella
Navicula
Synedoa
Stephanodiscus

	Years	
Annual average units/litre of total Phytoplankton	1972-73 410208	1973-74 313732
Annual agerage percentage of		
(a) Myxophyceae	98.9%	99,0%
(b) Chlorophyceae	0.5%	0.54%
(c) Euglenophyceae	0.3%	0.2%
(d) Bacillariophyceae	0.3%	0.3%

The data of the annual average units/litre of the phytoplankton clearly showed the abundance of the phytoplankton in the tank. The percentage composition of the various groups indicates that Myxophyceae was the dominant group and ranged from 98.9 to 99%. The Phytoplankton population during the first year (1972-73) was better represented in the tank. Extensive increase of the phytoplankton has resulted in the decrease of the zooplankton.

Myxophyceae

It was quite interesting that myxophyceae population was very rich dominated by



Figs. 18 & 19. Seasonal variations in the Myxophyceae and Chlorophyceae population.

TABLE—VII Phytoplankton population of the tank, August 1972 to July 1973 (Units/Litre)

Name of Genera	August 72	Sept. 72	Oct. 72	Nov. 72	Dec. 72	Jan. 73	Feb. 73	March 73	April 73	May 73	June 73	July 73
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
MYXOPHYCEAE												
Microcystis	38520	142504	70695	187562	9686	55990	49589	32662	24813	22860	22168	39592
Oscillatoria	1648	17449	18824	8920	22767	448640	54125	437807	283239	10245	4289	—
Spirulina	211180	69472	65486	267665	239451	148009	311525	162715	78288	33750	433485	207361
Anabaena	—	—	—	—	—	—	—	—	1871	1515	1059	—
Nostos	—	—	—	—	—	—	—	—	—	—	—	—
TOTAL :	251348	229425	155005	564147	351904	651639	902371	643501	393323	68370	461001	246953
CHLOROPHYCEAE												
Eudorina	—	396	—	—	—	—	1210	—	—	—	535	—
Pandorina	—	—	—	—	—	—	201	—	—	120	91	—
Pediastrum	—	886	—	—	—	—	592	—	—	220	153	—
Spirogyra	—	—	333	270	38	795	—	—	281	300	—	—
Staurastrum	—	395	—	405	—	—	—	—	—	—	—	—
Scenedeanus	1168	1409	1561	—	1045	3046	1944	2895	—	930	838	—
Closterium	—	—	—	235	494	632	432	750	76	—	102	186
TOTAL :	1168	3086	1894	910	1577	4473	3379	3645	357	1560	1719	186
EUGLENOPHYCEAE												
Englena	1408	222	226	1380	565	453	1613	4437	1568	240	—	84
Phacus	432	—	360	—	188	55	157	320	—	—	244	113
TOTAL :	1840	222	486	1380	753	588	1775	4757	1568	240	244	197
BACILLARIOPHYCEAE												
Cyclostella	232	—	—	—	—	—	—	—	—	—	—	228
Fragillaria	—	111	—	—	—	508	—	—	921	—	122	—
Pinularia	—	—	817	—	—	—	—	817	—	—	—	257
Asterionella	709	—	392	—	12	110	587	—	—	—	—	—
Synedra	232	514	971	270	—	3205	—	—	—	—	—	580
Novicula	—	160	260	1245	—	—	593	375	365	—	—	—
TOTAL :	1153	785	2440	1515	12	3823	1180	1192	1286	—	122	1065
TOTAL PHYTOPLANKTON	255529	233518	159825	567952	304246	660443	909705	653095	396534	70170	463036	248401

TABLE—VIII Phytoplankton populations of the tanks August 73 to July 1974 (Units/Litre)

Name of the Genera	August 73	Sept. 73	Oct. 73	Nov. 73	Dec. 73	Jan. 74	Feb. 74	March 74	April 74	May 74	June 74	July 74
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
MYXOPHYCEAE												
Microcystis	60716	147412	1014	115491	52542	22085	21892	16761	18034	45401	31600	59880
Oscillartoria	—	—	—	1860	15192	270799	329807	284380	278280	6710	7146	—
Spirulina	186125	34114	60796	320644	218018	111131	244176	108782	85856	42143	331433	186306
Anabaena	—	—	—	—	—	—	—	—	266	463	706	—
Nostoc	—	—	—	—	—	—	—	495	1363	—	—	—
TOTAL :	246841	181528	131326	437995	285752	404015	565875	409923	383799	64717	370885	246185
CHLOROPHYCEAE												
Eudorina	—	359	—	—	—	—	—	—	—	—	113	—
Pandorina	—	118	332	—	171	—	—	—	—	—	80	—
Pediastrum	822	540	—	—	202	—	98	—	—	126	286	—
Spirogyra	103	—	1350	557	75	176	—	—	66	110	—	—
Scenedesmus	408	1219	82	1515	550	164	230	1409	1329	591	900	510
Staurastrum	—	650	156	249	—	—	—	—	—	—	—	—
Closterium	—	—	—	—	248	206	132	80	66	—	—	—
TOTAL :	1333	2936	1420	2321	1246	546	460	1489	1461	827	1379	1033
EUGLENOPHYCEAE												
Euglena	328	560	2470	777	258	308	273	363	109	41	153	194
Phacus	141	—	156	—	156	—	187	114	118	—	100	220
TOTAL :	469	560	2626	777	414	308	460	477	227	41	253	414
BACILLARIOPHYCEAE												
Cyclestella	208	—	—	275	—	—	—	—	—	—	—	430
Fragillaria	—	—	—	—	—	32	—	—	—	—	33	—
Pinnularia	—	—	549	—	—	—	—	148	—	190	—	400
Asteriobiella	91	—	254	—	231	—	84	—	—	—	—	—
Naviculra	75	963	—	655	1038	105	—	154	—	42	—	—
Synedra	1369	1104	1369	1674	246	354	—	—	—	—	—	500
TOTAL :	1743	2363	217[2]	2604	1515	491	84	302	—	232	33	1380
TOTAL PHYTOPL NKTON	250186	187385	138044	443697	288927	405390	566879	412191	385487	62812	372550	248963

common genera such as *Microcystis*, *Oscillatoria*, *Spirulina* and *Anabaena Nostoc* were very few. The maximum Myxophyceae population was found in the month of February 1973-74 and minimum in may 1973-74. In other months there was a fluctuation in the number, Marked variations in their population were observed in different seasons, but a definite cycle was noticed. The major pulses were generally due to *Microcyistis*, *Oscillatoria* and *Spirulina*. *Anabena* was found in large number from August to september 1972 (Fig. 18).

Chlorophyceae

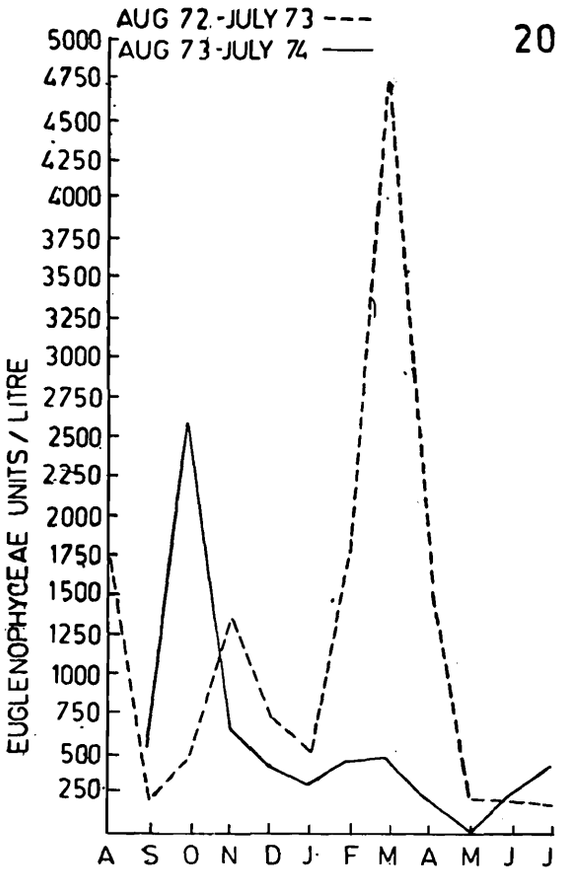
The members of Chlorophyceae showed seasonal variations in their members (Fig. 19). The tank had moderate chlorophyceae population and the maximum was in January 1973. The algae that contributed to chlorophyceae peak were *Scenedesmus* and *Pediastrum*.

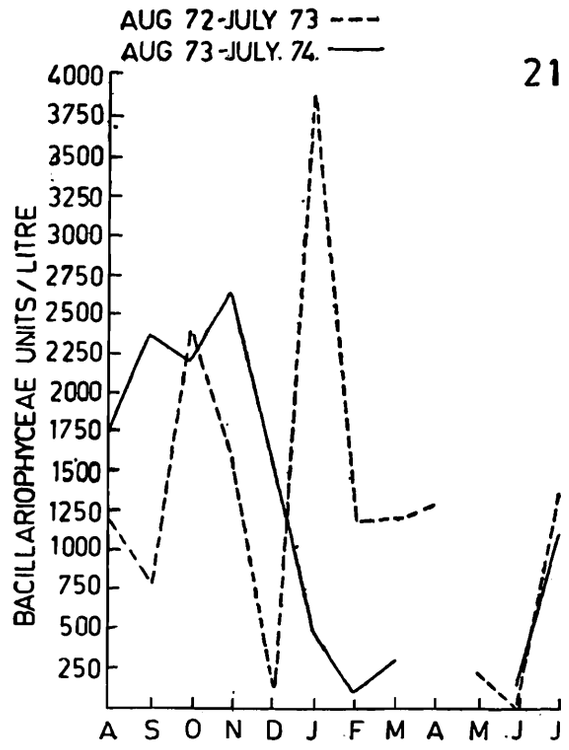
Euglenophyceae

The seasonal variations in Englenophyceae (Fig. 20) showed major pulse in March 1973, and in October 973. *Englena* and *Phacus* produced the various peak periods in the tank.

Bacillariophycae

The members of Bacillariophyceae occured only during certain months of the year. The diatoms showed a winter maxima in January 1973 and in November 1973 (Fig. 21). The diatoms causing pulses were *Synedra*, *Navicula* etc.





Figs. 20 & 21. Seasonal variations in the Euglenophyceae and Bacillariophyceae population.

Names of species of fish stocked in the tank.

The fry of the following fish species were released in the tank vix. (i) *Catla* (2) *Cirrhina mrigala* (3) *Labeo rohita* (4) *Cyprinus carpio*. In addition to the above fishes *Puntius stigma* and *Lebestes reticulatus* were also present in very large numbers.

The average annual fish production in the tank is as follows :

Gandhisagar tank Managed by Fisherman's Society : 7020 kg in 1972-73 (369 kg/h)
: 20, 735 kg. in 1973-74 (109 kg/h)

This shows that the fish yield is quite adequate in the tank. The fish yield were more during the second year of investigation.

DISCUSSION

Comparison of the annual percentage composition of the plankton of the tank investigated showed that the tank was extremely rich in phytoplankton (99.45 to 99.46%) and the zooplankton was very much limited (0.54% to 0.55%). The major bulk of the phytoplankton (98.9 to 99.0%) was formed by Myxophyceae. The other three groups namely, Chlorophyceae, Euglenophyceae, and Bacillariophyceae together represented only (1 to 1.1%). The zooplankton was composed of Rotifera, Cladocera, Copepoda and nauplii. In the present tank rotifers and nauplii dominated the sample. The rotifers were 51.60% during the first year and 63.30% during the second. The nauplius larvae were 40.40% and 31.20% during first and the second year respectively. Clodocera ranged between 2.10% to 1.90% and Copepoda from 5.90 to 6.60%.

The present tank is used for pisciculture and is stocked heavily with fish. Every year, more than two lakhs of carp fry are released into the tank. Besides the fry some fishes of the previous stock are also present in the tank. The forage activities of this large fish population is mainly responsible for the depleted numbers of the large Zooplanktons such as Cladocera and Copepoda. Though the nauplii are present in good numbers forming 31 to 40 percent of Zooplankton, the adult copepods were limited to only about 6.60%. In the tank, the nauplii greatly exceeded the adults forming 31 to 40% of the Zooplankton. It is almost certain that this gives some measures of mortality during the life cycle but at present we can not attribute this to mortality with certianty as we have no direct evidence in the form of experimental data. As given earlier that besides the old fish stock every year more than two lakh fry of major carps like *Catla Catla*, *Cirrhina mrigala*, *Labeo rohita*, *Cyprinus carpio* are realeased in the tank.

The average annual yield of fish in this tank was 7020 Kg in 1972-1973 and 20,735 Kg in 1973-74. The freeding activity of the fry, fingerlings, fresh fish and *Catla catla* might be responsible for the reduced number of the adult Copepods. It is well known that the organisms choose their food on the basis of their size, abundance, edibility and the ease with which it is caught as stated by Brooks and Dodson (1965) when the environment provides a choice, the predator most consistently chooses the largest food morsel available. They have shown that in the predation by Clupeid *Alosa pseudohargengus* upon lake zooptankton in which the usual large size crustacean dominants, such as

Daphnia, *Diaptomus* are eliminated and are replaced by small sized basically littoral species. It is also likely that the low percentage of Cladocera ranging between 2.10 to 1.90 percent could have been due to predatory impact. It may be thus inferred that the forage activity of this large fish population is probably responsible for the depleted number of adult Crustaceans. This view is further supported by kalninya (1967) who made similar observations in connection with the zooplankton utilised by fish and their fingerling. Shetty *et al* (1962) who established correlation between plankton and fisheries stated that that young of almost all fishes and many adults feed on plankton and often a direct relationship is seen between the density of plankton and number of plankton feeding fish. During the two year study of the plankton 24 species of rotifers were recorded. The major pulse was observed in November, 1972 and January 1974. This showed that rotifers showed only one pulse per year in the tank. Arora (1965-66) studied the systematics and from variations of the rotifera from Nagpur. George (1961) recorded 32 species of plankton rotifers from 30 tanks in Delhi state. Michael (1964) recorded 30 species rotifers from perennial ponds from Barrackpore and stated that six of them were dominant. George (1961) stated that *Keratcila valga f. tropica* Apstein or the different species of *Branchionus* always showed numerical superiority over the other rotifers. He has reported the presence of more than two species of one genus in a single sample. The genus *Branchionus* entered into such a species composition as many as four species namely *B. calyciflorus*, *B. falcatus* *B. quadridentratus* and *B. bidentata* were recorded from single sample. The genus *Filinia* also showed two species. Pennak (1957) has pointed out that whenever two species of the same genus are present in a sample, one is almost always abundant than the other. He also observed that two species of the same genus appear occassionally in a single sample. In the present investigation it was observed that three genera, namely *Branchionus*, *keratella* and *Filinia* entered into such a species composition and as many as two species of *Branchionus* viz. *B. angularis* *B. calyciflorus* were present in a single sample. The other genera showing such a species composition in a single sample were *Filinia keratella*. Generally there was observed a numerical superiority of one species over the other as pointed out by Pennak (1957). When the sample contained few individuals of each composite species, then the numberical superiority of one species over the others was not observed.

Though the rotifers form a valuable food for the carp fry, only a few workers from India have studied their ecology. Alikuhni *et al.* (1955) observed the quantitative variations of rotifer from nursery tanks in Calcutta. Das and Srivastava (1956) made a few remarks on the rotifers present in a tank in Lucknow. George (1961) studied the periodicity, species composition and diurnal migration of rotifers from shallow ponds in Delhi. Michael (1964) studied the seasonal variations of some planktonic forms and the major factors influencing the growth of the loricate rotifers. He opines that those rotifers with well developed lorica (*Branchionus*, *keratella*) usually have their maximum intensity during the summer months with peak in April or May and this

period coincided with higher total alkalinity and temperature. This was also observed by Gray (1953) and Byars (1960). The non-loricate forms such as *Asplanchna* occured only during September October and December to February and further stated that the presence of large amout of phytoplankton and the prevalent temperature condition might have been responsible for this (Welch, 1952).

In the present investigation *Brachionus angularis, B. forficula, keratella tropica, keratella cochlearis* were observed in good numbers. The rotifers generally showed peak periods in different seasons and the peak periods were between January in case of *B. angularis* and *B. calyciflorus* and in August in *B. forficula* and *K. cochlearis*. This showed that loricate rotifers did not always show peak period in summer months in all the water bodies. George (1966) pointed out a summer periodicity (April, May) of rotifers in Delhi water but the preaent observation reveals that such periodicity cannot be attributed to total number of rotifers as stated by Nayar (1970). Pennak (1949, 1955) also could not notice any seasonal periodicity for the rotifers while working on North American water bodies. In the present investigation the rotifers did not show any definite seasonal periodicity and the pulses are noticed irregularly in the tank.

Brachionus calycciflorus is a cosmopolitan species and more common in warm water, it was present throughout period of investigation except in January. The presence of this species is euryplastic and can tolerate wide range of temperature. Nayar (1970) has made similar observations for this species ; while working on the plankton ecology of Piliani tank and college pond in Rajasthan.

Many workers have stated that the rotifera are cosmopolitan and this view is supported by large number of investigators like Rousselet (1909), Thomasson (1955), Russell (1960) Amren (1964) and Green (1964). Cosmopolitinism is found common in many species of rotifera but there are considerable differences in the species list of tropical and temperate region plankton as suggested by Green (1972).

In the present study it has been found that most of the rotifer species found at Nagpur are cosmopolitan but at the same time species like *Branchionus caudatus, keratella tropica* which are cosmotropical in nature are also found in the samples.

Green (1972) pointed out that in tropical region the cosmopolitan species are more than cosmotropical species because the temperatuae is often high at temperate latitude to enable a tropical rotifer for their substantial population and also stated that the short life cycle, small size and opportunity, pattern of life make them ideal as cosmopolitan species. The present data corroborates the view of Green (1972) as very few cosmotropical rotifers were found during the investigation.

Filinia longiseta occurred almost throughought the two years of investigation reaching a maxima in December in first year and in August in the second year. A similar occurrence has been noted for some rotifers by Nayar (1970). It can be presumed that such distribution are probably controlld by some other factors other than temperature.

Trichocerca cylindrica was recorded in both

years but its occurrence was irrregular and was comparatively very poor. The reduced number of *Trichocerca cylindrica* during winter months might be due to the prevailing low temperature.

Asplanchna intermedia was sparse in the tank and its appearance was not continuous through the two years and the maximum density was noticed in December 1972. It can be concluded that there is not any specific period for the appearance of this species. It is a predatory form swallowing whole roifers and crustaceans as colonial algae as stated by Edmondson (1959).

In the present observations *Keratella cochlearis and Polyarthra vulgaris* were found to be in the surface layers tolerating wide range of temperature. This is in conformity with the observations of Pejler (1957) who reported the occurrence and abundance of 39 species of rotifers in Alpine lakes, 10 subalpine lakes, numerous tanks and ponds and pointed out that *Keratella cochlearis* and *Polyarthra vulgaris* were eurythermal forms.

In all 9 species of Cladocera belonging to 9 genera were observed the tank. *Moina dubia* was found to be dominant in the present tank with maxima in August '72 and '72. Remaining Cladocerans were found in small numbers. In all total Cladoceran numbers were very much poor as compared to rotifers the reason might be due to forage activity of the fish, fry, fingerlings and adults fishes. The other probable reason for the depleted number of Cladocera might be due to the presence of excess of phosphate on concentration. Phosphate promotes the production of blue green algae which may release toxic substances in the medium and provoke high pH due to intense photosynthesis during the day time which might have reduced the number of Cladoceran population in the tank. This is in conformity with the observation of Dumont (1968) who has given the same reason for the extinction of cladoceran species. This view is further well supported by O'Brien and Noyelles Jun (1972) while discussing the effect of photosynthetically elevated pH on Zooplankton mortality and pointed out that abundance of phytoplankton causes toxic effect on *Ceriodaphnia reticulata*.

Among the Copepods sp. was the dominant form and it was present throughout the two year period. It is interesting to note that the maximum intensity shown by *Cyclops* sp. in the two years, follows definite pattern, in the the tank. If the peak is in winter (November to January) in one year then in the subsequent year it is in summer or vice versa. With a present data of two years no specific reasons can be attributed to the alternatively changing seasonal peak periods of *Cyclops*. sp., *Mesocyclops hyalinus* found in considerable number but the other copepod *Diaptomus* sp. was found only during certain months of the year.

The phytoplankton was quite rich and the average units/litre were 410208 in 1972-73 and 313732 in March 1973-74. The major pulse were found in February 2973-74. The myxophyceae dominated the samples and the maximum number of Myxophyceae recorded was 902371 units/litre in February 1973., 565875 units/litre in Feburary 1974. Taking into account Myxophyceae as an indicator of the trophic status of the water body, the tank can be classified as on Eutrophic system. Eutrophic lake is rich in nutritive material such as N_2, phosphorus

and calcium (Welch, 1952) The present tank is also rich in nutritive material which shows eutrophic nature of the tank. Earlier workers have suggested many possible factors for production of algal population (bloom) in lakes and ponds. Smith (1924). Pearsall (1932), Ganapati (1940), Komorovsky (1953), Chacko acd Krishnamurthy (1954), Singh (1955), George (1962), have associated the abundant growth of phytoplankton with one or more factors namely light intensity, high temperature, stagnation, high Nitrogen and Phosphate content, high pH, high carbonates and bicarbonates. Vyas and Kumar (1968) showed a direct correlation with pH and temperature.

The present tank is polluted by domestic sewage, faecal pollution and seepage of textile mill effluent from an adjoining tank. The phosphate content of the water was quite high and ranged between 2.1 to 11mg/ litre and ammonia from 0.2 to 1.05. There is noticed stagnation of water in the tank as it is situated in the heart of the city and is not exposed to direct wind. The factor such as high phosphate content, stagnation, high bicarbonate values and low turbidity (good transparancy) seem to be associated with the phytoplankton richness in the tank.

During the present study it was observed that phosphate content and dissolved oxygen showed a positive correlation coefficient, $r = 0.63$). Similarly the correlation coefficient (r values) between total phytoplankton and phosphates ; between total phytoplankton and D. O. values were found to be 0.58 and 0.50 respectively. This showed that there was a definite correlation in the abundance of the phytoplankton and high phosphate content. The presence of rich growth of the phytoplankton may also have been due to the reduced number of *Daphnia* and other large Cladocera (Hrbacek et al. 1961).

Lakshminarayana (1965) while correlating pH and phytoplankton density stated that relatively high pH value were observed when phytoplankton was rich. Vyas and Kumar (1968) pointed out that the summer maxima of phytoplankton correspond with high pH but the pH values were comparatively lower during the months of September (rains) and December (winter) when the maximum production of phytoplankton was attained. During the present study it was observed that maximum production of phytoplankton was in different months and the pH was relatively high and varied betweed 8.5 to 9.62.

The present data reveals a somewhat direct relationship of Zooplankton production. The microcrustacean generally feed on minute phytoplanktonic forms, epiphyton and also detritus. The peaks of phytoplankton and zooplankton follow one another or sometime coincided, showing direct relationship. Pahwa and Mehrotra (1966) also showed direct relationship between zooplankton and phytoplankton. Diatom showed a definite pulse in winter as was also shown by George (1966) for Delhi tank. Bush and Welch (1972) found blue green algae not very abundant and occurred in the water which is warmest. Munawar (1974) observed most of the maxima of phytoplankton in winter and minima during monsoon season. He further stated that Diatoms were the dominant group of phytoplankton in all the water bodies of Hyderabad in all the seasons. It was observed that fluctuations in turbidity dissolved oxygen, and pH were found

especially during the monsoon season as shown by (Vaas 1954, Chow 1958, Tucker 1958) who observed that variation in chemical factors of fresh water tank have generally been found to be due to effect of rain fall. The normal pattern of water level in the tank was found to be decreased in the summer months bringing about a change in the chemical factors.

The turbidity range was between 28.7 to 146mg/litre. The effect of turbidity is noticed in terms of changes in Phyto-and Zooplankton population. This observation corroborates well with the view of Jermolajev (1958) who opines that heavy turbidity is injurious to phytoplankton and zooplankton.

Carbon dioxide was not observed during the period of investigation. This could be correlated with high pH as shown by Sarker and Rai (1964) that pH of water was distinctly alkaline sinee co_2 was absent and Co_3 was recorded in appreciable quantities.

In the present study it has been observed that the total hardness was always above 80 mg/litre which indicates that the tank is suitable for growth of organisms as pcinted out by Swingle (1967). He states that pond water having total hardness of 50 mg/litre or above are suitable for favourable growth.

The phosphate content of the tank was high and the phytoplankton was quite rich during both the years. Thus a close relation between phosphate content and phyto-plankton abundance has been noticed as stated by Tucker (1957).

Rai (1974) also stated that increase in phosphate ion concentration is related to phytoplankton yield.

Kow (1963) found direct relationship between phytoplankton and copepods and their peaks coincided, but in the present study it is found rhat the peaks are not exactly coincided but follow one another showing definite relatinships.

Ali (1972) has given that water having pH 6 to 9.7 are fit for fish rearing and the lethal effect start on acid side at pH 9.5. In the present tank pH was alkaline and ranged between 8.5 to 9.62. This shows that the present tank is fit for fish rearing as the pH of water was quite good excepting on one or two occastions where it is above 9.5 and this may be due to fertilization by excess of phosphate ion which results into photosynthetically high pH.

Thus, the physico-chemical factors reveal that this tank is favourable for fish rearing, if the excess of phosphate ion concentration is reduced to certain extent to minimise phytoplankton population. This tank can provoke a good yield as the food base of the tank can ensure better nourishment for suitable fish crop. It should be mentioned that during the present investigation the population of zooplankton was found to be very much less as compared to phytoplankton population and this may be due to feeding activity of the fish stock. It is suggested to increase zooplankton population in order to enhance more fish production. Though the tank is presently exploited and is under pisciculture, a better treatment of the tank such as prevention of entry of organic matter, reduction of phosphate ion concentration to certain extent is necessary to obtain a maximum fish yield.

Summary

Plankton ecology of tank from Nagpur has been studied. The tank is leased to

fishermen for rearing fishes, water samples and plankton was collected once a week for a period of two pears. The physical chemical factors recorded include temperature, turbidity, pH, free carbon dioxide, carbonate and aud bicarbonate alkalinity, chloride, total hardness, dissolved oxygen, phosphate and free ammonia.

Plankton samples were collected separately for qualitative and quaniitative analysis, In the quantitative estimation, of phytoplanktonic forms were enumerated by "drop method". Total hardness, phosphate and free ammonia were recorded only during one year of investigation.

The Zooplankton composed of rotifers, cladocera, copepods and nauplius larvae. The annual percentage composition of the various groups showed that rotifers were the dominant forms. During the course of study 24 species of rotifers, 9 of Cladocero and 3 copepoda were recorded. Nauplius larvae were recorded throughout the both years. The annual % composition of various group is given.

The phytoplankton contained major groups namely Myxophyceae. Chlorophyceae, Euglenophyceae and Bacillariophyceae. The annual % composition of these groups is given. The Myxophyceae was the dominant group.

The tank is stocked with large number of fish which feed on Cladocera and Copepoda, hence their number is reduced in the Plankton samples. However the rotifers dominared in the Zooplankton.

ACKNOWLEDGEMENTS

This work was carried out in the Department of Zoology, Institute of Scienc, Nagpur, I am greatly indebted to Dr. V. S. Marathe, Head of the Department of Zoology Institute of Science, Nagpur for guidance, advice and constant encouragement, throughout the period of investigation. My thanks are also due to Dr. A. Gopalakrishna, Director, Institute of Science, Nagpur for providing the necessary facilities. I am also thankful to Dr. R.G. Michael, Zoology Department, North Eastern Hill University, Shillong, Dr. J. Green, Zoology Department, westfield College, Hambstead, London, Dr. M.G. George, Department of Biology, University of Waterloo, Waterloo, Ontario and many other persons for providing literature.

I am thankful to the Director, Zoological Survey of India, Calcutta for permission to send this paper for publication and to Dr. A.K. Ghosh, Officer-in-Charge, Eastern Regional Station, Zoological Survey of India, Shillong and to Dr. Asket Singh, Deputy Director, Eastern Regional station, Zoological Survey of India, Shillong for encouragement and suggestions.

Thanks are also due to Maharashtra Government for award of Junior Research during tenure of which the present investigation were carried out.

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