



Short Communication

Zooplankton density and diversity of Bicherli Pond, Beawar, Raj., India

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Abstract

Zooplankton belonging to 23 species under 19 genera were observed from Bicherli pond, Beawar. Bicherli pond has been studied to evaluate the suitability of water for domestic use and maintaining for irrigation and other purposes. The investigations were carried out in Bicherli pond located at Ajmer District during February 1999 to January 2001. It was found that copepods were the dominant group at all sampling sites. Two peaks of zooplankton density were observed—one in May and other in November during 1999 to 2001. The mean maximum and minimum density were $3.84 \text{ No./L} \times 10^3$ and $2.26 \text{ No./L} \times 10^3$ respectively. Temperature and Zooplankton density were at their peak in summer months. Maximum population of Protozoa was observed in September and minimum was in January ranging from 0.10 to $0.72 \text{ No./L} \times 10^3$. Maximum population of Rotifers observed in July while minimum in September. Cladocera showed maximum density in May ($1.15 \text{ No./L} \times 10^3$) and minimum was recorded in September ($0.41 \text{ No./L} \times 10^3$). Copepoda showed two maxima, The first in May and the second in November and minimum was recorded in September ranged from 0.63 to $1.72 \text{ No./L} \times 10^3$. Zooplankton studies in Bicherli pond, Beawar were undertaken to assess the health and status of the pond. The presence of pollution indicator zooplankton species like *Brachionus*, *Moina*, *Daphnia*, *Cypris* and *Cyclops* shows that the pond is under pollution. So strategies should be employed to reduce the increasing levels of anthropogenic activities and make water suitable for domestic use.

Keywords: Fresh water, pond, physico-chemical characteristics, Zooplankton.

Introduction

Zooplankton constitute a relatively smaller population of aquatic biomass than phytoplankton. They form an important biotic component in the cycling of organic matter in an aquatic ecosystem. Zooplankton biomass directly reflects the prevailing condition of aquatic environment. Zooplanktons being a major link in energy transfer at secondary level, play a significant role in transformation of food synthesized by phytoplanktons to the higher trophic levels. Indiscriminate discharge of domestic sewage and other industrial wastes into pond waters are imposing considerable impact on distribution and diversity of zooplankton. Most of the fresh water zooplankton species are pollution indicators by their usual presence and absence.

Materials and methods

Bicherli pond is located in the Eastern corner of Beawar city at longitude $74^{\circ}22'$ and $74^{\circ}30'$ E and Latitude $26^{\circ}09'$ and $26^{\circ}30'$ N and receives an average rainfall of 434 mm annually. The gross and net catchment area of the pond are 8.98 Km^2 and 5.99 Km^2 (Table-1). At the pond, four sampling sites (1 to 4: Figure-1) were selected for regular monitoring water and plankton samples were collected at monthly intervals from these sites for a periods of two years. (February 1999 to January 2001). Physico-chemical parameters were analyzed according to standard methods Trivedy and Goel¹ and APHA². Temperature,

transparency and pH of water were recorded at the sites itself. For the estimation of dissolved oxygen (DO) and biochemical oxygen demand (BOD), water samples were collected separately in 300 ml BOD bottles and fixed at the sites. For collecting plankton samples, small cups made of bolting silk number 20 (76μ pore size) and 25 (64μ pore size) were used. Known quantity of water was filtered through these cups to retain zooplankton and preserved in formalin solution. Quantitative enumeration was done using Sedgwick Rafter cell method (APHA)². Zooplankton density was calculated as follows:

$$\text{No./m}^3 = C \times V' / V_n \times V_m$$

Where: C = number of organisms counted, V = volume of the concentrated sample ml, V_n = volume counted, ml, V_m = volume of the grab sample, m^3 .

To obtain organisms per liter divide by 1000. Occurrence of the species expressed in terms of the number of specimens was estimated using a 5 degree scale as follows:

Absent, R - rare less than 25 No./L, L- less frequent 25-50No./L, F- frequent 50-100No./L, Abundant more than 100No./L.

The identification of different zooplanktonic groups and species were done with the help of standard references²⁻⁵.

Table-1: Morphometric Features of Bicherli Pond.

No. Features	Morphometric	Pond
1	Longitude	74 ⁰ 22' and 74 ⁰ 30'E
2	Latitude	26 ⁰ 9' and 26 ⁰ 30'N
3	Accesses	53 km from Ajmer
4	Altitude	486 metres
5	Average rainfall	434 mm
6	Mean depth	3.2 metres
7	Water spread	21.35 hectares
8	Gross catchment	8.98 sq km
9	Net catchment	5.99 sq km
10	Storage capacity	6.87 million cubic feet
11	Tehsil	Beawar
12	District	Ajmer

Results and discussion

The ranges of monthly variations in physico-chemical characteristics are given in Table-2.

Zooplankton population in Bicherli pond was composed of five major groups namely Protozoa, Rotifera, Cladocera, Copepod and Ostracoda. Among the different groups of zooplanktons, copepods (32.27%) exhibited the highest percentage of zooplankton density followed by cladocerans (25.89%), rotifer (14.86%), protozoans (13.91%) and Ostracods (13.08). 22 Zooplankton taxa was found in the samples (Table-3). Two peaks of zooplankton density were observed one in May and other in November in both the years. The mean maximum and minimum density were 3.84No./LX10³ and 2.26No./LX10³ respectively (Table-4). The maximum population of protozoa was observed in September and minimum was in January while rotifers was observed maximum in July and minimum in September. Cladocera show maximum density in May (1.15No./LX10³) and minimum was recorded in September (0.41No./LX10³). Copepods showed two maxima one in May and another in November. Minimum was recorded in September. Copepods ranged from 0.632.26No./LX10³ to 1.72No./LX10³. The Maximum density of Ostracods was recorded in June (0.59No./LX10³) and minimum was recorded in September (0.10No./LX10³). Copepods show highest percentage in Zooplankton population. Pollution indicator species like *Brachionus sp*, *Moina sp*, *Cyclops sp* and *Cypris shell* found in Bicherli pond.

Table-2: Water quality of Bicherli Pond.

Parameters	Values
Water Temperature	17.1 to 33.8 °C
pH	8.36 to 9.9
Transparency	15.2 to 30.2 cm
TDS	415 to 898 mgL ⁻¹
Conductivity	802 to 1327 umhos/cm
DO	6.46 to 10.62 mgL ⁻¹
BOD	60.6 to 173.5 mgL ⁻¹
COD	96.7 to 222.7 mgL ⁻¹
Total Hardness	80 to 267 mgL ⁻¹
Nitrates	0.00 to 0.242 mgL ⁻¹
Phosphates	13.2 to 38.7 mgL ⁻¹
Chloride	41.3 to 410 mgL ⁻¹
Fluoride	0.13 to 0.54 mgL ⁻¹
Total alkalinity	158.7 to 395 mgL ⁻¹
F CO ₂	nil to 6.21 mgL ⁻¹

Discussion: The zooplankton showed two peaks one in May and other in November at all sampling site during 1999 and 2000. Yadava *et al.*⁶ and Sanger and Sharma⁷ found bimodal pattern of zooplankton density with summer and winter maxima. Zooplankton were recorded to be comparatively higher in the summer season. Sarwar and Praveen⁸ observed that higher zooplankton number was recorded during summer in some tropical lakes. Maximum population of protozoa were recorded in September during the investigation period. A similar observation also reported by Singh⁹. Koussouris and Photis¹⁰ in Amvrakia lake (Western Greece) found the presence of Protozoans most important in respect to density.

Rotifera showed their maximum population in summer at all the sites. Similar observations were also recorded by Michael¹¹ and Baruah *et al.*¹². Cladoceran population was maximum in summers and the minimum values were recorded in monsoon. Similar result also found by Singh⁹ and Sinha *et al.*¹³. The Copepods formed the highest percentage in zooplankton population. Copepods showed two peaks, One in May and Other in November during both the years. Similar observation were also reported by Sharma and Hussain¹⁴. Ostracoda showed their maximum population in summer at all sites. Water temperature

showed positive correlation with total zooplankton, Protozoa, Rotifera, Cladocera, Copepoda, and ostracoda. Sharma and Hussain¹⁴ also reported positive Correlation of water temperature with Rotifera, Cladocera, Copepoda and Total zooplankton. Other factors like pH, total alkalinity, dissolved oxygen and nutrients also affect zooplankton density Davis¹⁵.

Table-3: Zooplankton Taxa recorded from Four Sampling Sites of Bicherli Pond.

S.No.	Taxon	I	II	III	IV
		Protozoa			
1.	<i>Monodinium sp.</i>	+	+	+	+
2.	<i>Oxytricha oblongatus</i>	+	+	-	+
3.	<i>Paramecium caudatum</i>	+	+	+	+
	Plomida	Rotifera			
4.	<i>Asplanchna intermedia</i>	+	+	-	+
5.	<i>Branchionus calciferous</i>	+	+	+	+
6.	<i>B. caudatus</i>	+	-	+	-
7.	<i>B. falcatus</i>	+	+	+	+
8.	<i>B. quadridantatus</i>	+	-	+	+
9.	<i>Keratella tropica</i>	+	-	+	+
10.	<i>Polyarthra multiappendiculata</i>	+	+	-	+
	Gnesiotrocha				
11.	<i>Filinia longiseta</i>	-	+	+	+
12.	<i>Testudinella mucronata</i>	-	+	+	+
		Cladocera			
13.	<i>Cariodaphnia sp.</i>	+	+	+	+
14.	<i>Daphnia lumholtzi</i>	+	+	-	+
15.	<i>Diaphanosoma sp.</i>	-	-	+	-
16.	<i>Moina Macrocopa</i>	+	+	+	+
	Calanoida	Copepoda			
17.	<i>Diaptomus sp.</i>	-	+	+	+
	Cyclopoida				
18.	<i>Cyclops sp.</i>	+	+	+	+
19.	<i>Eucyclops sp.</i>	+	+	-	+
20.	<i>Mesocyclops hyalinus</i>	+	+	+	+
		Ostracoda			
21.	<i>Cypris shell</i>	+	-	-	+
22.	<i>Stenocypris malcomsoni</i>	+	+	+	+

Table-4: Monthly variation in the density (no./LX103) of Zooplankton of Bicherli pond, Beawar.

Month	Protozoa	Rotifera	Cladocera	Copepoda	Ostracoda	Total zooplankton
February	0.24	0.42	0.78	0.91	0.33	2.68
March	0.29	0.45	0.86	0.95	0.37	2.92
April	0.33	0.37	0.91	1.06	0.42	3.09
May	0.37	0.45	1.03	1.23	0.45	3.53
June	0.41	0.62	0.9	0.94	0.52	3.39
July	0.47	0.68	0.79	0.88	0.54	3.36
August	0.57	0.37	0.64	0.77	0.33	2.68
September	0.65	0.28	0.44	0.71	0.18	2.26
October	0.53	0.31	0.56	0.76	0.28	2.44
November	0.44	0.36	0.71	1.11	0.33	2.95
December	0.34	0.4	0.76	0.7	0.34	2.54
January	0.14	0.41	0.78	0.95	0.34	2.62
February	0.26	0.45	0.82	0.91	0.35	2.79
March	0.33	0.47	0.79	0.94	0.39	2.92
April	0.36	0.39	0.85	1.04	0.44	3.08
May	0.4	0.49	1.05	1.41	0.49	3.84
June	0.42	0.58	0.91	0.93	0.57	3.41
July	0.46	0.75	0.81	0.87	0.49	3.38
August	0.64	0.37	0.63	0.77	0.4	2.81
September	0.7	0.26	0.45	0.71	0.18	2.3
October	0.53	0.32	0.54	0.83	0.31	2.53
November	0.4	0.38	0.68	1.3	0.36	3.12
December	0.34	0.41	0.72	1.05	0.38	2.9
January	0.14	0.44	0.76	0.92	0.39	2.65
Total Mean	0.41	0.43	0.76	0.94	0.38	2.92
Percentage	13.91	14.86	25.89	32.27	13.08	

High nutrients were recorded in Bicherli pond during and after monsoon. The rain water might have washed additional nutrients such nitrates and phosphates from surrounding area. Moitra and Bhowmik¹⁶ found Rotifer population correlating with low nitrate concentration. In this respect concentration of nitrates of Bicherli pond was minimum in summers and it coincided with summer maxima of rotifers. A number of zooplankton species are indicators of trophic status. The analysis of pollution indicator species is based on the presence of particular species, which is indicative particular environmental condition. Rotifers such as *Brachionus caudatus*, *B. caliciflorous*, *Keratella tropica* and *Asplancha sp* have been identified as eutrophic indicator species in India and elsewhere in world by Sladeczek¹⁷ and Sharma¹⁸. Gannon and Stemberger¹⁹ considered Cladocerans as bioindicators for eutrophication. Bajpai *et al.*²⁰ characterized *Moina sp.* and the Copepoda *Cyclops* as indicators of eutrophication. High densities of *Brachionus sp.*, *Asplanchna sp.* and *Fillinia sp.* in Bicherli pond indicate the eutrophic nature of the pond water. Similar observation also reported by Singh and Gupta²¹. The presence of pollution indicator zooplankton species shows that the pond was under pollution and shows a trend of increasing eutrophication.

Conclusion

Immediate action needs to be taken to reduce the increasing levels of anthropogenic activities because they reduce water quality. Strategies to be employed for the conservation and restoration of the pond to increase its aesthetic value, make it suitable for aqua cultural purposes and in general to make it more ecofriendly.

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