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Research Article

COMPARATIVE ACCOUNT OF PLANKTONIC DIVERSITY OF GAURIPADA LAKE, KALYAN, MAHARASHTRA, INDIA

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ABSTRACT

In freshwater system, zooplanktonic organisms form an important group as most of them feed upon and incorporate the primary producers into their bodies and make them available to higher organisms in food chain. Thus the zooplankton occupies a central position between the autotrophs and heterotrophs and forms an important link in food-webs. In the present study the qualitative analysis of zooplankton community was carried out for the period of two years. About 13 genera were recorded which includes rotifers, cladocerans and copepods. The qualitative study of zooplankton showed seasonal trend of occurrence in the lake, where rotifers were observed during all the seasons, cladocerans were is maximum during monsoon season and copepods were pre-dominantly observed during monsoon season.

Keywords: Zooplankton, Qualitative analysis, Seasonal variation, Gauripada Lake.

INTRODUCTION

Studies on fresh water bodies such as ponds, lakes, reservoirs, rivers, streams have gained much importance in recent years. These water bodies harbors wide array of aquatic organisms in particular plankton. In the aquatic food webs zooplankton plays a vital role as they consume the primary producers (phytoplankton) and form a major food source for tertiary producers. Zooplankton is also considered as the basic principle natural fish feed. Further, zooplankton communities often respond quickly to environmental changes because most of the plankton species have short generation times.They form very important parts of freshwater community and contribute significantly to aquatic productivity. Therefore the information about plankton is essential to understand the functioning and trophic dynamics of different water bodies. In addition certain planktonic organisms are valuable in the trophic status of various aquatic biotopes. With this view in mind, the present investigation on qualitative analysis of zooplankton community of Gauripada Lake, Kalyan, Maharashtra was carried out for the period of two years (2009-2011). Gauripada Lake under study is one of the perennial resources of the city. It is located about 4.5 km away from Kalyan railway station. Gauripada lake is located between latitude $19^0$15'7" North and longitude $73^0$8'56" East. It covers an area of 22,915 m^2 and depth of 1.5 to 3.0 m. It is located behind Birla College, Milind Nagar Road, Gauripada (Kalyan). It was created in 1990.The lake provides many important services to human. It supplies water for domestic and other uses. But still it lacks basic facilities. This Lake is also leased to the "Karnala Devi Macchimar Society", Gauripada, Kalyan. Composite fish culture is practiced by the fishermen in this Lake. Fishing activity is carried out almost throughout the year.

MATERIALS AND METHODS

The present investigation was conducted for the period of two years from June 2009 to May 2011 from two sampling sites. The samples were collected in the morning between 7.00 am and 8.00 am. The water was filtered through plankton net of a 20 µm mesh size made of bolting silk cloth and the concentrate was collected in clean polythen bottle containing 4% formaline. Identification of zooplankton was done under compound microscope using standard keys (Krishnapillai & Ediriweera, 1986; Pennak, 1953; Ward & Whipple, 1968) and (APHA, 2004). For

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physico-chemical analysis water samples were collected in clean and labeled plastic bottles. Water samples collected were transported to laboratory within 1-2 hrs to prevent from any change in any physico-chemical characters and unwanted growth of microbes. The physico-chemical factors such as Temp, pH, Turbidity, DO, BOD, COD, Total alkalinity, TDS, TSS, TS, Silicate, Nitrate, Phosphate and Sulphate were studied once in every month at definite interval during study period. Water parameters were estimated as per (APHA, 2004) and (Trivedi & Panjwani, 1986).

Figure 1. Google map showing Gauripada Lake.

Figure 2. Photograph of Gauripada Lake.

RESULT AND DISCUSSION

In the present investigation about 13 genera have been observed which showed the presence of Rotifera - 01, Cladocera - 04, Copepoda - 07 and Euphausid - 01. During the first year of investigation, the Rotifera was represented by 01 genus, where *Brachionus sp.*, was present throughout the year. The Cladocera was represented by 04 genera. *Penila sp., Daphnia sp. and Bosmina sp.,* was present throughout the year, whereas *Moina sp.* was present only during monsoon season. The Copepoda was represented by 06 genera. *Cyclop sp., Siriella sp., Nauplius sp.,* were present throughout the year whereas *Diastylis sp., Calanius sp.* and *Sergestid sp*., were absent during pre-monsoon season. The Euphausid did not represent any genera (Table 1).

During the period of second year of study, the Rotifera was represented by 01 genus, where *Brachionus sp*. was present throughout the year. The Cladocera was represented by 03 genera. *Penila sp.*, was present throughout the year, whereas *Daphnia sp.*, and *Bosmina sp*, were absent during pre-monsoon season. The Copepoda was represented by 06 genera. *Cyclop sp. and Nauplius sp.* were present throughout the year, whereas *Diastylis sp, Siriella sp., Calanus sp.*, and *Sergestid sp.* were absent during pre-monsoon season. The Euphausid did not represent any genera (Table 2). In Gauripada Talav, the occurance of zooplankton varied during different season. Rotifera was observed throughout the study period i.e during all the season. Maximum density of Cladocera was noticed during monsoon season. Copepoda was pre-dominanlty observed during monsoon and post-monsoon season. The diversity and population dynamics of zooplankton is under the control of number of factors, such as physico-chemical characteristics of the environment, pollution status and all types of interaction among biotic communities. A number

of studies indicate that temperature, dissolved oxygen, and organic matter have major influence on zooplankton community.

During the present investigation, the qualitative study of zooplankton showed seasonal trend of occurrence of all the species in Gauripada Lake. Rotifers are smallest multi cellular, 'wheel-bearing' organisms found in all aquatic and semi aquatic habitat, but are predominantly freshwater inhabitants. Because of their high feeding and assimilation efficiencies, they play important role in energy flow and nutrient cycling, accounting for more than 50% of the zooplankton production in some freshwater systems (Saler & Sen, 2002; Deb *et al*., 1937; Jaya, 1994; Mandal, 1976; Moitra & Mukherjee, 1972; Mukhopadhyay *et al*., 1981; Nasar, 1977; Vasisht & Sharma, 1976) and (Somani, 2002) have reported higher rotifer densities in winter. (Patil, 1987) observed its continuous presence throughout the period of investigation in Gandhisagar tank, Nagpur. (Goswami & Mankodi, 2012; Haque *et al*., 1988; Kar & Kar, 2013; Khan *et al*., 1986; Malathi, 1999; Nayar, 1970; Pawar & Supugade, 2014) also supported this observation.

Table 1. Seasonal occurrence of Zooplankton in Gauripada Lake during first year of study.

Zooplankton	Monsoon	Post-monsoon	Pre-monsoon
A) Rotifera			
Brachionus sp.	++++	+++	+++
B) Cladocera			
Penila sp.	++++	++	+++
Daphnia sp.	+++	+++	++
Moina sp.	++	-	-
Bosmina sp.	++	++	+
C) Copepoda			
Cyclop sp.	+	+++	+
Diastylis sp.	+	++	-
Siriella sp.	++	++++	++
Calanus sp.	++	+++	-
Nauplius sp.	++	++	+++
Diaptomus sp.	-	-	-
Sergestid sp.	++	+++	-
D) Euphausid			
Calyptopis sp.	-	-	-

Abundant '++++', Moderate '+++', Rare '++', Very Rare '+', Absent '-'

Table 2. Seasonal occurrence of Zooplankton in Gauripada Lake during second year of study.

Zooplankton	Monsoon	Post-monsoon	Pre-monsoon
A) Rotifera			
Brachionus sp.	++++	++++	+++
B) Cladocera			
Penila sp.	+++	+++	++
Daphnia sp.	++++	+++	-
Moina sp.	-	-	-
Bosmina sp.	++	+	-
C) Copepoda			
Cyclop sp.	++	++++	++
Diastylis sp.	++	+++	-
Siriella sp.	+++	+	-
Calanus sp.	++	++	-
Nauplius sp.	+	++	+++
Diaptomus sp.	-	-	-
Sergestid sp.	++	+++	-
D) Euphausid			
Calyptopis sp.	-	-	-

Abundant '++++', Moderate '+++', Rare '++', Very Rare '+', Absent '-'

Table 3. Values of physico-chemical parameters of Gauripada Talav during first year of study.

No	Parameter	Gauripada Talav (2009-2010)											
		June	July	Aug	Sept	Oct.	Nov	Dec	Jan	Feb	March	April	May
1	pH	7.4	7.31	7.75	8.12	7.05	7.32	6.56	7.27	7.6	7.79	7.16	6.81
2	Temp^{0}C	29	23	18	23	26	24	17	18	25.5	28	31.25	32.5
3	Turbidity (NTU)	6	6.5	21.5	7	8.5	7	17.5	16.5	12.5	2	8.5	12
4	DO (mg/L)	2.35	2.51	3.33	4.14	3.73	3.97	5.12	3.5	2.27	2.03	1.78	4.87
5	COD (mg/L)	48	43.5	50	16	74	38	48	92	106	110	128	75
6	BOD (mg/L)	30.5	32	42.88	22.25	21	8	2.25	20	7	2.5	10	23
7	Total Alkalinity (mg/L)	273	277.5	152	146	139	138	150	100	189	187	159	121
8	TDS (mg/L)	402.5	397.5	355	305	385	778.5	835	917	948	694.5	1231.5	981
9	TSS (mg/L)	331	172.5	204	330	184.5	67.5	20.5	141.5	69.5	114	57.5	145
10	TS (mg/L)	733.5	570	559	635	565	846	855.5	1058.5	1017.5	808.5	1289	1126
11	Silicate (mg/L)	0.011	2.11	3.65	3.795	4.155	3.61	5.055	3.6	2.44	1.8	5.9	3.525
12	Nitrate (mg/L)	1.9	0.852	0.645	1.48	3.12	1.705	5.715	1.96	1.395	1.33	1.225	1.19
13	Phosphate (mg/L)	7.08	0.262	27.31	0.205	0.182	0.26	5.5	0.012	0.96	5.2	0.327	3
14	Sulphate (mg/L)	47.61	48.82	59.88	53.34	52.5	48.749	48.749	130.37	81.19	84.385	141.46	90.04

During the present study no exact seasonal pattern was observed in the presence of Rotifera in the Gauripada Lake. *Brachionus sp.* observed throughout the investigation might have flourished well in this Lake as it has no particular food preference and can feed on algae, organic detritus as well as bacteria (Dhanapathi, 2000) and hence can thrive well in changing food conditions. It is also suggested that *Brachionus sp.* is a continuous breeder and hence one or other species breeds in every month resulting in the dominance of this genera.

Cladocera are one of the most important fresh water biological indicators for wide range of environmental variables. They show strong response to several environmental factors and are very sensitive to change in pH. They are filter feeders. They feed on algae. They are the favorable prey of vertebrate and invertebrate predators from aquatic environment. They are also well established to form the food of both young and adult fishes (Alikunhi, 1952; Welch, 1952; Michael, 1968; Pennak, 1953). Many researchers have reported summer maxima of Cladocerans, (Bhandarkar & Gaupale, 2008; Dad, 1981; Das & Srivastava, 1959; Kar & Kar, 2013; Khan & Khan, 1985; Malathi, 1999; Nene, 1985; Patil, 1987; Pramod, 1996;Sharma & Hussain, 2001; Sharma & Mankodi, 2011; Somani, 2002) observed monsoon maxima of Cladocerans. During the present investigation the Cladocera showed their maximum density during monsoon season and minimum density during pre-monsoon in all the Lake under study. Abundance of Cladocerans might be attributed to thick deposits of organic matter brought about by monsoon rain. Their success mainly depends on ability to feed efficiently on a wide range of organic matter.

Copepods are the largest and the most diversified group of crustaceans. At present they include over 14,000 species and 2,280 genera and 210 families. They are important contributors of zooplankton population dynamics and are almost universally distributed. They form a primary food source of plantivorous fish and hence constitute an essential link in aquatic food chain. Copepods are minute crustaceans (0.3 to 2.5 mm) and pass through a series of naupliar and copepod stages during their development. Many researchers have reported summer peaks of copepods (Adholia & Vyas, 1992; John, 1975; Malathi, 1999; Singh *et al*., 1993), while some have reported copepod maxima in January or February (Khan & Khan, 1985; Nene, 1985) recorded winter abundance of copepods, while (Malathi, 1999;Sharma & Mankodi, 2011) observed lowest copepod density in December and November respectively. (Somani, 2002) recorded copepod maxima in monsoon and minima in summer in Masunda Lake, whereas in Kacharali Minima and maxima were recorded in winter. During the present investigation the copepods showed their maximum density

in post-monsoon season and minimum density during monsoon season. Water temperature mostly affects the population density of copepods. (George, 1961) and several others also reported that temperature is the main factor regulating the production of zooplankton; they found higher production of zooplankton during the period of low temperature. The lower density of copepods, during monsoon season may be due to increase in water level.

Table 4. Values of physico-chemical parameters of Gauripada Talav during the second year of study.

No	Parameter	Gauripada Talav (2010-2011)											
		June	July	Aug	Sept	Oct.	Nov	Dec	Jan	Feb	March	April	May
1	pH	7.36	7.28	7.73	6.99	6.57	6.98	6.99	7.27	7.17	7.44	6.84	7.14
2	Temp℃	29	29	28	29	27	28	22	23	25	25	31	29.5
3	Turbidity (NTU)	11	21	10.65	9.5	4.5	12.5	17.5	13.5	3.5	11	13.5	12
4	DO (mg/L)	3.49	1.62	2.51	2.19	4.3	2.35	5.71	2.68	2.67	0.73	2.44	1.78
5	COD (mg/L)	56	39	28	60	316	80	74	174	42	72	122	250
6	BOD (mg/L)	14	46	23.5	8.5	4	11.5	9.4	29	25	29.5	43	37
7	Total Alkalinity (mg/L)	108	44	35	27	42	39	101	275	258	122	160	234
8	TDS (mg/L)	763.5	515	379.5	377.5	557.5	554.5	702	804	695	972.5	802.5	791.5
9	TSS (mg/L)	393	232	187.5	165	31	45	141	61	247.5	47	440.5	246
10	TS (mg/L)	1156.5	747	567	542.5	588.5	599.5	843	865	942.5	1019.5	1243	10.37
11	Silicate (mg/L)	0.009	6.465	7.125	13.125	24	50.4	36.5	49.32	18.2	36.95	32.1	25.34
12	Nitrate (mg/L)	1.96	0.91	0.318	3.79	6.24	7.99	8.55	10.15	4.75	1.386	2.295	2.805
13	Phosphate (mg/L)	10.3	3.61	0.245	0.49	0.287	0.195	0.215	0.235	2.55	0.283	0.404	2.99
14	Sulphate (mg/L)	23.9	21.185	30.12	27.36	50.88	109.89	128.15	65.65	61.75	136.38	67.25	49.05

CONCLUSION

Plankton diversity varies from season to season. Such variation mostly related to abiotic factors (Table 3 and 4). Therefore composition and diversity of zooplankton provide information on the characteristics and quality of the water body. Reported that rotifers are chiefly fresh water forms and abundance of these organisms as recorded during present investigation can be related to favourable water temperature and availability of abundant food in the form of bacteria, nanoplankton and suspended detritus which is suitable condition for their survival. In sum, maintaining the quality of water is one of the most important one for man since it is directly linked with its daily life in rural area as well as in semi urban areas where the water body under investigation is located. People use unprotected water drawn from rivers, lakes and wells for drinking and domestic purposes. Zooplankton is a good indicator of changes in water quality because it is strongly affected by environmental conditions and responds quickly. Hence, qualitative and quantitative study of zooplankton of these water bodies is of immense important. The work presented in this paper is a small attempt in this direction.

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