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Studies on Zooplankton Diversity in Dimbhe Reservoir, Maharashtra, India

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ABATRACT

A study was carried out to examine the diversity and density of zooplankton in Dimbhe (Pune, Maharashtra) reservoir, India. Various water quality parameters viz. water temperature, pH, DO which influence the diversity and production of zooplankton were studied. Sampling was carried out during two seasons viz. winter (2008) and summer (2009). The study on physico-chemical parameters has shown a variation in different seasons in the selected reservoir. The maximum zooplankton density recorded in Dimbhe was during summer season with 5123 no./100 litre, while in winter it was 1314 no./100 litre. A total of seven species of zooplankton were recorded each during both the seasons with Copepoda being most commonly observed order and Cypris sp the most dominant. The variations in density and diversity in the reservoir can be related to variation in their physico-chemical parameters which in turn may be due to geographical position and various anthropogenic activities. The present study aims at providing a preliminary knowledge on the productivity and diversity of zooplanktons which can be utilized during the formulation of management measures to improve the productivity of the reservoir.

Key words: zooplankton, diversity and reservoir.

INTRODUCTION

The zooplankton constitute an important component of secondary production in aquatic ecosystems that play a key role in energy transfer from primary to higher level in the ecosystem. The most significant feature of zooplankton is its immense diversity over space and time. Thus, similar aquatic systems may have dissimilar assemblage of organisms varying in species composition and biomass. Further, in spite of convergent similarities, zooplankton species have different types of life histories influenced by seasonal variations of abiotic factors, feeding ecology and predation pressure. Zooplankton diversity is one of the most important ecological parameters in water quality assessment. Various indices like richness, diversity and evenness index can be calculated with the data on taxonomy of different zooplankton is available (Sakhare, 2007).

Zooplankton comprising of rotifers, cladocerans, copepods and ostracods are considered to be most important in terms of population density, biomass production, grazing and nutrient regeneration in any aquatic ecosystem. Their diversity and density is mainly controlled by availability of food as favorable water quality (Chandrasekhar and Kodarkar, 1997). According to Reid (1961), the plankton population on which the whole aquatic life depends directly or indirectly is governed by the interaction of a number of physical, chemical and biological conditions and the tolerance of the organisms to variations in one or more of these conditions. The water quality parameters and nutrient status of water play the most important role in governing the production of planktonic biomass. In the

present study an attempt has been made to study zooplankton diversity and populations density from selected reservoir.

The main purpose of this paper is to outline the zooplankton diversity from Dimbhe reservoir Dimbhe reservoir is situated near village Dimbhe at Taluka Ambegaon in District Pune on the river Ghod. Catchment area of the reservoir is 298.00 sq. km. Average rainfall in the reservoir is 382.42 mm. Gross water storage capacity of Dimbhe reservoir is 382.22 million m^3. The reservoir has maximum water level of 721.18 metre. The dam has length of 852 m and maximum height of dam is 72.1 m. Total number of submerged villages due to construction of dam is 24 and area under submergence is 2202 ha. Construction of dam was started in 1977 and it was completed in 2000. The reservoir has two canals-one is Dimbhe left bank canal having a length of 55 km and other is Dimbhe right bank canal with a length of 116 km.

MATERIALS AND METHODS

Samples for physico-chemical parameters like Temperature, pH, DO were collected from the fixed stations during winter and summer of 2008 and 2009 respectively. Atmospheric and water temperature of reservoirs were recorded using Celsius mercury thermometer calibrated up to 0.1 ^{0}C. The pH of the water samples was measured with the help of pH meter. The dissolved oxygen content of the water was determined by Winkler's titrimetric method (APHA, 1998).

For the qualitative and quantitative analysis, the plankton samples were collected using bolting silk (20 µ aperture) conical shape plankton net from the selected sites following standard methods (APHA, 1998) during the winter season and summer season of each site. The actual volume of water passed through plankton net during its operation (towing) was determined by the formula (Santhanan *et al.* 1989). The sample of plankton thus collected was preserved in 4% formaldehyde for analysis in the laboratory (Pennak, 1978). The volume of plankton was measured volumetrically. Later on qualitative and quantitative analysis was performed in laboratory. The preserved zooplankton samples were diluted to 80 ml with distilled water for their taxonomic study and numerical estimation. For the quantitative study of zooplankton, a 'Sedgwick Rafter Counting Cell' was used adopting the procedure outlined by Welch (1948). While stirring the sample in a zigzag motion, a sub-sample of 1 ml was removed using a pipette. This sub-sample was then transferred into a one ml Sedgwick Rafter Counting Cell to determine the species composition and density of zooplankton. All the zooplankton in the counting chamber was observed and identified using standard keys (Battish, 1992; Needham and Needham, 1962) and counted under compound microscope.

RESULTS AND DISCUSSION

During the study, variations were noticed between air temperature and water temperature in different seasons (Table 1). Air temperature was always higher than the water temperature and showed direct effect on water temperature. During summer season, maximum air and water temperature was 36.3°C and 33.3°C in Dimbhe reservoir. Ganapathi (1962) observed similar variation in in Almati reservoir. The pH value during winter as well summer season was 7.3. Mishra *et al.* (2003) have also reported a similar finding of pH range of 7.2 to 8.5 that favours the growth of plankton. Dissolved oxygen content ranges from 5.46 to 6.33 mg / l during winter and summer seasons. Seasonal variations in physicochemical parameters are given in Table 1.

In Dimbhe, seven species of zooplankton were recorded during winter as well as summer season, of which only one species belongs to Rotifera, one species of Cladocera, four species of Copepoda and only one species of Ostracoda was present. Similar results were obtained by several workers. Rawat (1991) recorded 9 species of rotifers, 8 cladocerans and 4 copepods from Tumaria reservoir, located at the foot hills of Uttarakhand. Singh *et al.* (1990) reported 15 rotifers, 3 cladocerons and 2 copepods in Nanaksagar, a reservoir located in Tarai area. The zooplankton community of Dimbhe reservoir resembled the species spectrum of tropical reservoirs, as supported by these investigators. The total standing crop of zooplankton showed peak population during summer. The diversity study revealed four groups of zooplankton *viz.* Rotifera, Cladocera, Copepoda, Ostracoda. Nauplius, insect larvae and insect eggs were also recorded in various densities. Season wise analysis indicated 1314 no/100 l and 5123 no /100 l during winter and summer season respectively. It showed maximum density for nauplius (3547 no/100 l) during winter as well summer season.

Table 1. Seasonal variations in physico-chemical parameters of water in Dimbhe reservoir

Parameter	Season	
	Winter	Season
Air Temp (C)	29.7±0.20	36.33±0.16
Water Temp (C)	27±0.53	33.33±0.33
pH	7.3-7.6	7.3-7.5
Dissolved Oxygen (mg/l)	6.33±0.14	5.46±0.17

Values are mean ±standard error and average of sampling sites

Table 2. Species wise zooplankton density in Dimbhe reservoir during winter and summer season

Sl. No.	Species	No./100 l					
		Winter			Summer		
1	*Keratella tropica*	300	240	560	320	330	650
2	*Bosmina* sp	100	360	280	160	440	390
3	*Cyclops* sp	300	240	140	320	330	260
4	*Mesocyclops* sp	200	120	280	240	220	390
5	*Diaptomus* sp	700	240	420	640	330	390
6	*Phyllodiaptomus* sp	400	120	140	320	220	260
7	*Cypris* sp	900	840	420	560	550	260
8	Nauplius	6200	1920	2520	3840	1430	1950
9	Insect larvae	#	240	140	#	330	#
10	Insect eggs	#	240	#	#	110	130
	Total	9100	4560	4900	6400	4290	4680
	Grand Total	22677			15370		
	Average (No./100L)	5669			5123		

 # Organisms were not present during sampling
I, II and III indicate sampling stations

Table 3. Average density (no/100 l) of different zooplankton groups in Dimbhe reservoir during winter and summer season

Sl. No.	Zooplankton group	Winter	Summer
1	Rotifera	367	433
2	Cladocera	247	330
3	Copepoda	1100	1307
4	Ostracoda	720	457
5	Nauplius	3547	2407
6	Insect larvae	127	110
7	Insect egg	80	80
	Total	4640	5123

In Dimbhe, seven species of zooplankton were recorded during winter as well as summer season, of which only one species (*Keratella tropica*) belonged to Rotifera, one species (*Bosmina* sp) to Cladocera, four to Copepoda and only one species (*Cypris* sp) to Ostracoda (Table 2). Among Copepoda *Phyllodiaptomus* sp was dominant in both the season. Group wise analysis of zooplankton during winter revealed maximum percentage of nauplius (57.33%) followed by Copepoda (17.78%), Ostracoda (11.64%), Rotifera (5.93%), Cladocera (3.99%), insect larvae (2.05%) and insect egg (1.29%) whereas during summer season, highest contributor was nauplius (46.97%) followed by Copepoda (25.50%), Ostracoda (8.91%), Rotifera (8.46%), Cladocera (6.44%), insect larvae (2.15%) and insect egg (1.56%) (Table 3).

In Dimbhe, zooplankton density followed the order of Copepoda > Ostracoda > Rotifera > Cladocera during winter as well as summer season. This is in accordance with Kedar *et al.* (2008) who observed similar pattern in Rishi Lake, Maharashtra.

CONCLUSION

The present study would give a preliminary knowledge on the diversity and productivity of zooplankton and the reasons for the variation in Dimbhe reservoir. This information can be utilized during the formulation of management measures to improve the productivity the reservoir.

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