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Studies on zooplankton diversity in Barchar Dam, Sidhi (M.P.)

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Abstract

A study was carried out to examine the diversity and density of zooplankton in Barchar dam, Sidhi (M.P.). 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 (2012) and summer (2013). The study on physico-chemical parameters has shown a variation in different seasons in the selected reservoir. The maximum zooplankton density recorded in Barchar dam was during summer season with 5123 no./100 litre, while in winter it was 1314 no./100 litre. 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.

Keywords: zooplankton, diversity and dam

1. 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) ^[1].

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) ^[2]. According to Schmaitz, *et al.* (1984) ^[3], 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 hills of many wonders" nestles peacefully in the Northern spurs of the Vindhya, a place of tranquil forest glades and quiet rivers and streams where calm and repose are all-pervading. This loveliest of Nature's gift is also hallowed ground blessed by the gods and sanctified by the faith of pilgrims for Bhavensens spiritual legacy stretches back to legendary ages. It was in these deep forest that many sents spent their many years of life at Barchar dam, Sidhi (M.P.) Rewa (M.P.) is 80 km. north from Sidhi city and Barchar dam 140 km. from Rewa, lies between latitude 23°15' north and longitudes 81°45' east Sidhi is a hilly tract due to this reason all ground is undulating except some part near Sidhi is plain. The slope (steep) of the eastern region is towards west and of western region is towards east but the slope in all regions is towards north.

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The present work includes the different sites of Barchar dam which is of great significance.

2. Materials and Methods

Samples for physico-chemical parameters like Temperature, pH, DO were collected from the fixed stations during winter and summer of 2012 and 2013 respectively. Atmospheric and water temperature of reservoirs were recorded using Celsius mercury thermometer calibrated up to 0.1 °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) [4].

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) [4] 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) [5]. The sample of plankton thus collected was preserved in 4% formaldehyde for analysis in the laboratory (Pennak, 1978) [6]. 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) [7]. 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) [8, 9] and counted under compound microscope.

3. 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 Barchar dam. Ganapathi (1962) [10] observed similar variation in in Almati reservoir. The pH value during winter as well summer season was 7.3. Mishra *et al.* (2003) [11] 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 Barchar dam, seven species of zooplankton were recorded during winter as well as summer season, of which only one species belongs to Protozoa, one species of Rotifera, one species of Cladocera and, three species of Copepoda was present. Similar results were obtained by several workers. Rawat (1991) [12] recorded 9 species of rotifers, 8 cladocerans and 4 copepods from Tumaria reservoir, located at the foot hills of Uttarakhand. Singh *et al.* (1990) [13] reported 15 rotifers, 3 cladocerons and 2 copepods in Nanaksagar, a reservoir located in Tarai area. The zooplankton community of Barchar damresembled 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. Protozoa, Rotifera, Cladocera and Copepoda, insect larvae and insect eggs were also recorded in various densities. Season wise analysis indicated 180 no/100 L and 176 no /100 L during winter and summer season respectively.

Table 1: Seasonal variations in physico-chemical parameters of water in Barchar dam.

Parameters	Seasons	
	Winter	Summer
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 Barchar dam during winter and summer season

S. No.	Species	No./100 L					
		Winter			Summer		
		S ₁	S ₂	S ₃	S ₁	S ₂	S ₃
1	<i>c</i>	32	31	34	23	24	21
2.	<i>c</i>	30	24	36	32	33	35
3.	<i>Daphnia pulex</i>	36	32	41	27	40	39
4.	<i>Cyclops sp</i>	30	24	28	32	39	28
5.	<i>Diaptomus sp</i>	29	23	42	34	30	39
6.	<i>Nauplius</i>	12	19	25	30	18	17
Total		169	153	206	178	184	179
Grand Total		528			541		
Average (No./100L)		176			180		

S₁, S₂ and S₃ indicate sampling stations

Table 3: Average density (no/100 L) of different zooplankton groups in Barchar dam during winter and summer season

S. No.	Zooplankton group	Winter	%Age	Summer	%Age
1.	Protozoa	32	18.18	23	12.78
2.	Rotifera	30	17.05	33	18.33
3.	Cladocera	36	20.45	35	19.44
4.	Copepoda	77	43.75	89	49.44
Total		176	100.0	180	100.00

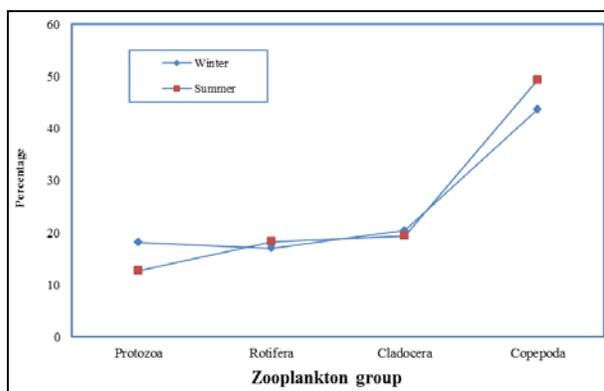


Fig 1: Average density (no/100L) of different zooplankton groups in Barchar dam during winter summer season

In Barchar dam, seven species of zooplankton were recorded during winter as well as summer season, of which only one species (*Diffugia sp.*) belonged to protozoa, one species

(*Keratella tropica*) belonged to Rotifera, one species (*Daphnia pulex*) to Cladocera and three species (*Cyclops sp*, *Diaptomus sp* and *Nauplius*) (Table 2). Group wise analysis of zooplankton during winter revealed maximum percentage of Copepoda (43.75%), Cladocera (20.45%), Rotifera (17.05%) and Protozoa (18.18%) in winter season, whereas during summer season, highest contributor was Copepoda (49.44%), Cladocera (19.44%), Rotifera (18.33%) and Protozoa (12.78%) (Table 3).

In Barchar dam, zooplankton density followed the order of Copepoda > Cladocera > Rotifera > Protozoa during winter as well as summer season. This is in accordance with Chaurasia and Adoni (1985) [14] who observed similar pattern in shallow eutrophic lake, Sagar.

4. Conclusion

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

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