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A study of seasonal variations in zooplankton diversity of Pagara dam of Morena district, Madhya Pradesh, India

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ABSTRACT

Pagara dam is situated on Asan river at about 13 Km from Jaura town of Morena District of Madhya Pradesh. The dam was constructed for irrigation of the nearby villages. The study was carried out to assess the seasonal variations in zooplankton diversity of the reservoir. Total 23 species of zooplankton were identified. Out of these 4 species belonged to Protozoa, 11 species belonged to Rotifera, 5 species belonged to Cladocera and 3 species belonged to group copepoda. Rotifera was found to be the most dominant group, followed by Cladocera and Copepoda. Protozoa was the least dominant group. Seasonally, Rotifera and Protozoa were found to be maximum during summer and minimum during monsoon. In case of Cladocera and Copepoda, maximum numbers were found in summer and least in winter.

Keywords: Pagara dam, Zooplankton, Seasonal variations, Asan river.

INTRODUCTION

Water is the most productive resource for zooplankton and other microorganisms. Zooplanktons are integral components of aquatic food web and contribute significantly to aquatic productivity in freshwater ecosystems. They feed on phytoplanktons which directly provide food source for larval vertebrates as well as related to the growth of larger organisms and fish. They play an important role in the conservation of energy from primary to secondary level. Zooplankton diversity depends on physico– chemical parameters and other environmental factors.

Study area

Pagara Dam is situated at about 13 Km from Jaura town of Morena District of Madhya Pradesh. The dam is located on Aasan river (Fig-1). It is a masonry dam which was constructed in 1931. The dam is located at latitude 26°14′04.9″N and longitude 77°49′33.4″E. The FTL (Full tank Level) of the dam is 199.34m. The dam was constructed mainly for irrigation purpose.

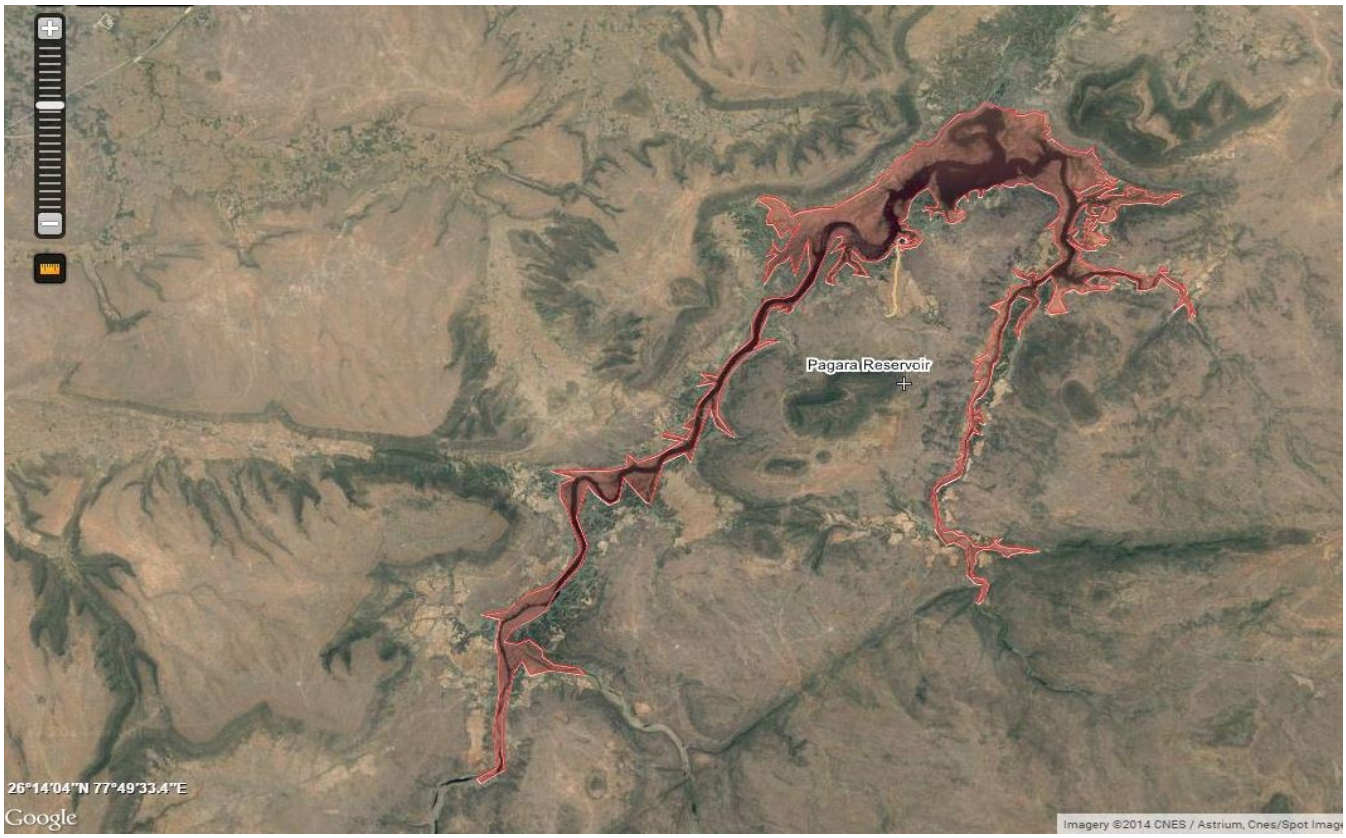

Fig. 1 : Satellite view of Pagara Reservoir (courtesy Google map)

Fig. 2: Sampling Sites for collection of water samples

The water is used for irrigation of 870 acre land of the nearby villages. Pagara is the nearest village, after the name of which the dam is known as Pagara dam. Besides irrigation, the water is also used for drinking purpose and fish culture by local fishermen.

MATERIAL AND METHOD

Study on zooplanktons was carried out for one complete year from June 2016 to May 2017 to assess the seasonal variations in the zooplankton diversity. Both qualitative and quantitative studies were under taken. Samples were collected, once in a month, in the morning hours between 9.00 A.M. and 11.00 A.M at four different stations A,B,C and D(Fig.2). Samples were collected by filtering 50 liter surface water through a plankton net made up of bolting silk cloth no. 20. Extreme care was taken in order to keep water undisturbed at the time of sampling. The collected samples were preserved in 4 % formalin. The preserved samples were brought to the laboratory for qualitative and quantitative analysis. Zooplanktons were identified by using the methods given by Battish (1992) and Dhanapati, (2000). Quantitative studies were made by using Sedgwick rafter cell. Sample was properly agitated to distribute the organisms evenly. By using a pipette, one ml of sample was transferred onto the cell. The cover slip was placed properly, avoiding any air bubble. The planktons were allowed to settle for some time and counting was made under microscope. All the planktons, present in the cell were counted by moving the cell, vertically and horizontally, covering the whole area.

RESULTS

The species and numbers of zooplanktons, collected from four different sampling stations, are given in table: 1,2,3 and 4.

Table 1: Zooplankton species checklist and disribution at different sampling station during the study period (cells/lit.)

ORDER	FAMILY	SPECIES	STATION			
			A	B	C	D
Protozoa	Centropyxidae	*Centrophxis sp.*	+	+	-	+
		Centropyxis aculeata	+	+	+	-
	Difflugidae	*Difflugia lebes*	+	+	-	+
		Difflugia muriformis	+	-	-	-
Rotifera	Brachionidae	*Brachionus angularis female*	+	+	-	+
		Brachionus angularis	+	+	+	+
		Brachionus falcatus	-	+	+	+
		Brachionus forficula	-	-	+	+
		Brachionus calyciflorus amphiceros	+	-	-	-
		Brachionus caudatus	-	+	+	+
		Brachionus diversicornis	+	-	-	+
		Keratella tropica	+	+	+	+
		Keratella tecta	+	-	-	-
		Keratella cochlearis	-	+	-	-
		Keratella procurva	-	-	-	+
Cladocera	Dapnidae	*Moina brachiata*	-	-	+	-
		Moina sp.	+	+	-	-
		Daphnia pulex	+	-	-	-
	Bosminidae	*Bosmina longirostris*	-	-	+	-
		Chydorus sphaericus	+	-	+	+
Copepoda	Cyclopidae	*Mesocyclops sp.*	+	-	-	-
		Thermocyclops crassus	-	-	+	-
		Phyllodiaptomus blanci	+	+	-	-

Table : 2 Group wise seasonal variation in zooplanktons at four stations in Pagara reservoir from June 2016 to May 2017 (cells/lit.)

Group	Summer	Average	Monsoon	Average	Winter	Average
Protozoa	225.5	56.37	380.75	95.18	545.5	136.37
Rotifera	1472.25	368.06	1006.25	251.56	704.5	176.12
Cladocera	294.75	73.68	206.25	51.5	164.5	41.12
Copepoda	334.75	83.68	233.25	58.31	179.5	44.87

Table : 3 Annual variation in zooplankton composition in Pagara reservoir from June 2016 to May 2017(cells/lit.)

Group	Number of Organisms	Percentage
Rotifera	3183	55.38
Protozoa	1151.75	20.03
Copepoda	747.5	13.00
Cladocera	665.5	11.57

Table : 4 Group wise seasonal variation in zooplankton composition in Pagara reservoir from June 2016 to May 2017 (cells/Lit.)

Season	Protozoa	Rotifera	Cladocera	Copepoda
Summer	225.5	1472.25	294.75	334.75
Monsoon	380.75	1006.25	206.25	233.25
Winter	545.5	704.5	164.5	179.5

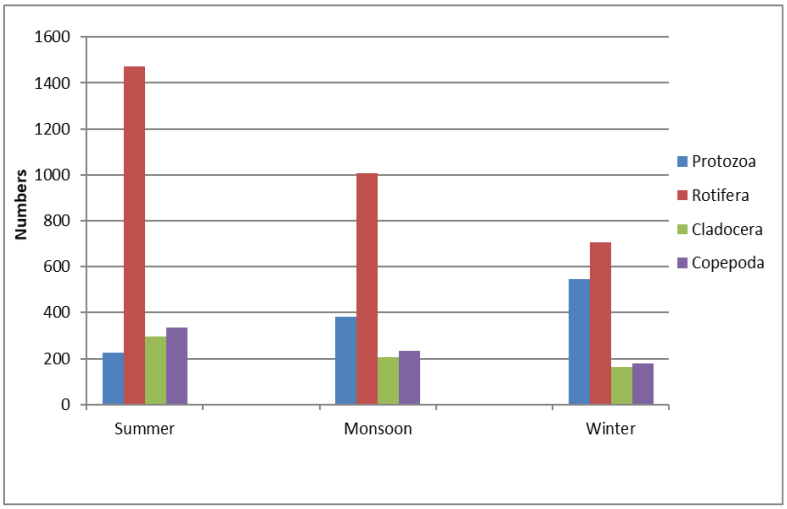

Fig. 3: Seasonal variation in different group of Zooplanktons at Pagara reservoir from June, 2016 to May 2017

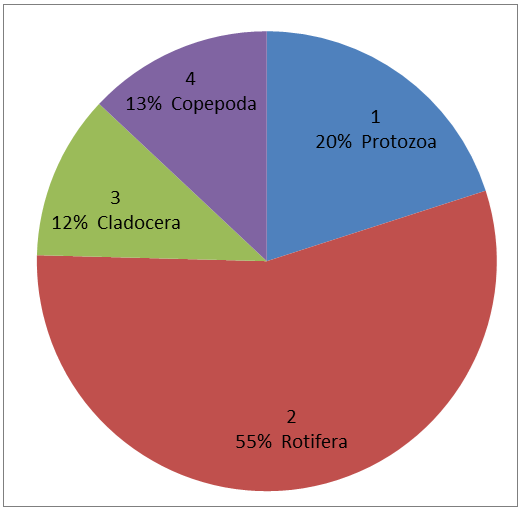

Fig. 4: Annual variation in Zooplanktons at Pagara reservoir from June, 2016 to May 2017

DISCUSSION

Zooplanktons, in Pagara Dam, comprised of protozoa, rotifers, cladocerans and copepods. Among all the zooplanktons, recorded in Pagara Dam, rotifera was the most dominant group (Fig. 1). The group was represented by *Brachionus angularis female, B.angularis, B.forficula, B. falcatus, B. calyciflorus amphiceros, B. caudatus, B. diversicornis, Keratella tropica, K.tecta, K. cochlearis,* and *K. procurva.* Rotifers were found to be dominant throughout the study. Rotifers represented 55.38% of all zooplanktons recorded from the Pagara

reservoir. The total number of rotifers was recorded at four Stations during June 2016 – May 2017 was 3183 cells/lit. Seasonally, the number was highest during summer, followed by monsoon and lowest during winter (Fig. 4). Deshmukh (2001) recorded 28 species of rotifers from Chhatri Lake of Amravati with maximum number of species in summer. Akin-Oriola (2003) also observed rotifera as the most dominant zooplankton in Ogunpa and Ona rivers, Nigeria. The dominance of rotifers was attributed to their short development rate and fish predation on large zooplanktons. Rajshekhar *et al*. (2010) recorded 24 species of zooplanktons in a fresh water reservoir of Gulberbarga district, Karnataka. Rotifer was the dominant group throughout their study period. Highest count was recorded during summer. Similarly, Rajkumar (2012) observed 23 species of zooplanktons. In his observation, he found number of rotifers to be highest during summer followed by monsoon and lowest during in winter.

The group Protozoa was mainly represented by *Centrophyxis sp., C. aculeate, Diffugia muriformis,* and *D. lebes* in our study. The number of Protozoa found during the study period was 1151.75 cells/lit. The protozoans were collected in maximum in January 2017. Protozoa represented 20.03% of the total population of zooplanktons, recorded at the Pagara reservoir.

In the present study, Copepods were represented by *Mesocyclops sp., Thermocyclops* and *Phyllodiatomus blanci*. Copepoda was the second largest group of zooplanktons representing 13 % of the total population of zooplanktons. Maximum number of copepods were collected during summer (May 2017). The number was minimum in winter (Fig. 4). This pattern of seasonal fluctuation of copepods has also been observed by Mahor (2011) in Tighra reservoir of Gwalior.

The number of Cladocera was found to be more during May, June and July 2016. Total number of Cladocera, recorded during the study period, was 665.5cells/lit which represented 11.57% of total population of zooplanktons. Cladocera was represented by four genera: *Daphnia pulex, M. brachiata, Moina sp.,* and *Bosmina longirostris.* Sharma and Singh (2012) also reported as highest number of zooplanktons in summer season and lowest in winter in Tighra Reservoir Gwalior (M.P.). Cladocera is an order of small crustaceans, commonly called “water fleas”. It has been reported that the density and biomass of cladocerans was primarily determined by food supply (Smitha *et al*. 2007).

Jhingran (1989) recorded cladoceran population to be most abundant in February, followed by July and October in Ramgarh reservoir in Rajasthan. Sharma and Diwan (1993) studied plankton dynamics of Yeshwant Sagar reservoir in which the Cladocera showed maximum density in June. They reported rotifers to form a dominant group during summer in Yeshwant Sagar reservoir. Khare (2005) observed an increasing trend in the months of winter season with peak during summer months - March to June. He recorded minimum population during rainy season. Kadam *et al*., (2006) observed maximum number of rotifers during summer season. Cladocerans are a crucial group among zooplanktons and form the most useful nutritive group of crustaceans. Cladocerans feed on small zooplanktons, bacteria planktons and algae. They are highly responsive to pollutants and even react against the low concentration of contaminants. Among all the zooplanktons, copepods have the toughest exoskeleton and the longest and strongest appendages. Vasanth Kumar *et al*., (2011) recorded a total of 61 species of dominant group. Sehgal *et al*. (2013) recorded total seven species of zooplankton. Nimbalkar *et al.* (2013) identified 33 species of zooplankton.

CONCLUSION

Total 23 species of zooplankton were identified during the study period belonging to four groups Protozoa, Rotifera, Cladocera and copepoda. Rotifera was the most dominant group, followed by Cladocera and Copepoda. Protozoa was the least dominant group. Seasonal variations were observed in the distribution of all groups of zooplanktons. Rotifera, cladocera and copepoda were found in maximum number during summer, followed by winter. The number was minimum during monsoon. In case of protozoa, maximum number was recorded during monsoon, followed by summer and least in winter.

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Conflicts of interest: Not declared

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