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Studies on the Diversity of Zooplankton and their Seasonal Variations in Govindgarh Lake at Rewa (M.P), India

KEYWORDS: Govindgarh Lake, Zooplankton Diversity and Seasonal variations.

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ABSTRACT *The paper deals with the diversity and seasonal variations of zooplankton in Govindgarh Lake, Rewa (M.P), during the period July 2011 to June 2012. Zooplankton is the intermediate link between phytoplankton and fish, which are the secondary producers in the aquatic environment. A total 23 species were found in this lake, among these 5 species belonging to the family protozoa, 10 species to rotifera, 5 species to cladocera and 3 species belonging to the family copepoda were collected from different site of Govindgarh Lake. Numerically copepoda was the dominant class throughout the study period. The study of season wise zooplankton analysis showed an average abundance of species in rainy season, lower in winter season and maximum occurrence in summer, due to the different environmental and inflow characteristics of water body.*

Introduction-

The term "Plankton" was first time used in 1887 by Victor Hansen. To designate the heterogenic assemblage of minute organism and the detritus in water (Welch, 1953).

Zooplankton are microscopic free swimming heterogeneous assemblage of minute floating animal forms found in aquatic ecosystems, are represented by wide array of taxonomic groups (protozoa, Rotifera, Cladocera, Crustaceans and Copepoda). 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. Zooplankton, formulate the base of food chains and food web in all aquatic ecosystems. All the secondary production in aquatic ecosystems directly or indirectly relies on plankton. They also play a major role in recycling nutrients as well as cycling energy within their respective environments. They are located in the pelagic zone of ponds, lakes, rivers and oceans where light penetrates.

Zooplanktons are important food item of omnivorous and carnivorous fishes (Alam *et al.*, 1987) the larvae of carps feed mostly on zooplankton (Bardach *et al.*, 1972). Many researchers worked on variation on zooplankton namely Ali *et al.* (1989); Bhuiyan *et al.* (1997) and Cottenie *et al.* (2001). Zooplankton communities respond to a wide variety of disturbances including nutrients loading (Dadson, 1992) and play a key role in the aquatic food chains (Sharma, 1998). Zooplanktons respond quickly to aquatic environmental changes such as pH, colour, odour and taste etc. for their short life cycle and are therefore used as indicators of overall health or condition of water body (Carriack and Schelskek, 1977).

A number of studies carried out on the condition of ecology and fresh water bodies in various parts of India Sinha and Islam (2002); Singh *et al.* (2002); Smitha *et al.* (2007); Islam (2007); Roy *et al.* (2010); Thirupathaiah *et al.* (2012); Sharma *et al.* (2012); Shivashankar and Venkataramana (2013); Shukla *et al.* (2013); Shrivastava (2013); Ahmed *et al.* (2013). But the ecological studies of fresh water bodies along with zooplankton diversity are very scanty in Rewa district so that the present investigation made an attempt to study the zooplankton species in Govindgarh Lake.

Material and Method-

Govindgarh Lake is situated about 20 km from Rewa city in Rewa district of Madhya Pradesh. Its geographical location being 81°15'20" E longitude and 24°24' N latitude. It is an artificial lake; its construction was started in 1856 and completed in 1916. The present area of lake is 307 hectares. Plankton sample were collected from the surface water of the four zones of the lake, during early hours of the day (7 am to 9 am) upto a period of one year, i.e. July 2011 to June 2012. The plankton net is made by the bolting nylon silk (mesh-size 50µm) is used for collection of zooplankton. 10 litres of water samples were filtered out through the net. After transferring the sample in air tight plastic bottles; it would keep carefully with labelling and preserved immediately using 4% formalin. Later, the collected sample were brought to laboratory and analysed qualitatively under the microscope for different size of zooplankton and identified using various authenticated monographs (Edmondson, 1959; Needham and Needham, 1966; Sharma, 1998; Sharma and Sharma, 2000; Altaff, 2003). After an accurate identification of each genus the density of zooplankton was estimated with simple "drop count method".

Result and discussion-

The ecology of zooplankton diversity in aquatic bodies of different part of country has been studied by a number of workers, viz. Suganan, (1997); Jha, (1997); Kumar *et al.* (2007); Tripathi *et al.* (2008a, b).

Gulati (1964) reported 25 genera of zooplankton from seven different north Indian lakes and reservoir. Verma and Shukla (1970) reported 18 genera of zooplankton in kamla Nehru tank, Muzaffarnagar, Mathew (1972) reported 27 genera of zooplankton in Govindgarh Lake Rewa.

In this study 23 genera of zooplankton were recorded. Zooplankton represented by four groups of phylum viz. Protozoa, Rotifera, Cladocera and Copepods. Copepoda and Rotifera were dominant as compared to the other groups of zooplankton in the lake. Among, these protozoa comprise of 5 species, rotifera 10 species, cladocera 5 species and copepoda 3 species. The zooplankton population was comprised protozoa (10.83%), rotifera (31.94%), cladocera (15.01%) and copepoda (42.22%). It was noticed that the copepoda contributes a major part of zooplankton populations.

During the study, total average density of zooplankton was higher during summer season and the minimum number of zooplankton was recorded in rainy and winter season respectively (Table 3 & Fig. 4)

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Table (1) Mean Value of Monthly Variation in Zooplankton (Organism/L) At Govindgarh Lake from July 2011 to June 2012

Groups	Station A											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Protozoa	18	5	1	21	16	17	18	13	33	27	57	51
Rotifera	63	22	25	28	29	26	43	37	42	46	123	147
Cladocera	15	12	0	14	28	11	7	31	19	31	47	57
Copepoda	32	26	27	25	27	27	42	62	63	43	96	108
Total	128	65	53	88	100	81	110	143	157	147	323	363
Station B												
Protozoa	10	7	3	12	13	17	11	15	30	18	33	43
Rotifera	34	16	20	43	31	27	28	30	40	80	95	165
Cladocera	20	23	11	14	9	8	21	23	15	12	45	67
Copepoda	44	48	64	73	63	73	45	48	125	87	152	132
Total	108	94	98	142	116	125	105	116	210	197	325	407
Station C												
Protozoa	12	9	5	10	11	6	9	11	21	18	31	38
Rotifera	27	24	15	45	21	33	19	37	67	59	121	160
Cladocera	24	14	22	19	22	19	15	24	26	20	72	64
Copepoda	66	56	52	73	57	52	71	48	107	123	151	156
Total	129	103	94	147	111	110	114	120	221	220	375	418
Station D												
Protozoa	8	7	9	23	15	12	14	15	18	18	38	51
Rotifera	62	46	37	56	32	38	68	66	60	56	112	146
Cladocera	24	15	13	28	14	23	14	31	33	20	77	71
Copepoda	87	78	70	77	48	55	48	43	102	123	92	133
Total	181	146	129	184	109	128	144	155	213	217	319	401

Protozoa: Protozoa was represented by *Difflugia*, *Paramecium*, *Arcella*, *Opercularia* and *Vorticella*. The abundance of protozoans was higher during summer season. Average abundance of protozoans ranged from 1 org/L to 57 org/L (Table 1). This group was rarely found in rainy season (Table 2 & Fig. 1).

Rotifera: Rotifera are second dominant group of zooplankton in respect to abundance with mean value 165 org/l. (Table 1) *Keratella*, *Branchionus* and *Monostyla* were the dominant rotifers throughout the study period. Beside these three rotifera, *Philodina*, *Asplanchna*, *Polyarthra*, *Trichotria* and *Filinia* were also identified. Rotifera are most abundant in summer season and least in rainy and winter season respectively (Table 2 & Fig. 1, 2).

According to Adoni (1975); Gannon and Stemberger (1978) the density of rotifera as well as their diversity increases due to increase in eutrophication. Bhowmic (1968) suggested that increased in zooplankton population in summer is due to higher concentration and increased photosynthetic activity. A more or less similar trend of zooplankton diversity has been observed in the Ramgarh Lake Gorakhpur by Shrivastava *et al*. (2006).

Table (2) Mean Value of Seasonal Variation in Zooplankton groups (organism/l) from July 2011 to June 2012

Groups	Rainy Season			
	Station A	Station B	Station C	Station D
Protozoa	12	8	9	12
Rotifera	35	29	28	51
Cladocera	11	17	20	20
Copepoda	28	58	62	78
Winter Season				
Protozoa	16	14	10	14
Rotifera	34	29	28	51
Cladocera	20	16	20	21
Copepoda	40	58	57	49
Summer Season				
Protozoa	42	31	27	32
Rotifera	90	95	102	94
Cladocera	39	35	46	51
Copepoda	78	124	135	113

Table (3) Mean Value of Monthly and Seasonal Variation in Total Zooplankton (organism/L) from July 2011 to June 2012

Month	Station A	Station B	Station C	Station D
July	128	108	129	181
August	65	94	103	146
September	53	98	94	129
October	88	142	147	184
November	100	116	111	109
December	81	125	110	128
January	110	105	114	144
February	143	116	120	155
March	157	210	221	213
April	147	197	220	217
May	323	325	375	319
June	363	407	418	401
Seasonal variations				
Rainy	84	111	119	160
Winter	109	116	114	134
Summer	248	285	309	288

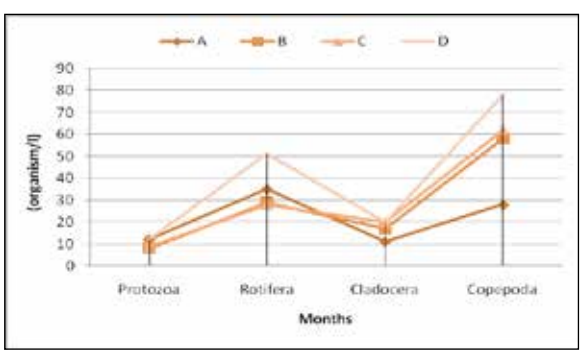

Fig. 1 Rainy Season variation in Zooplankton groups (organism/l)

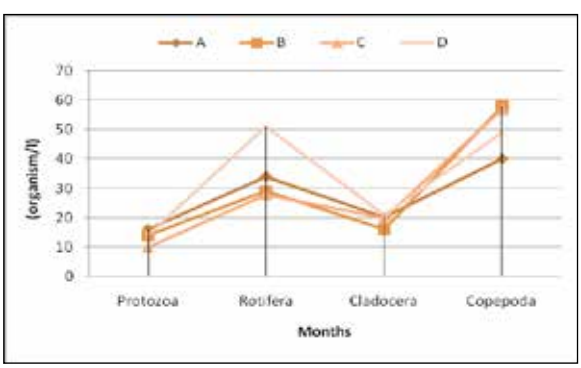

Fig. 2 Winter Season variation in Zooplankton groups (organism/l)

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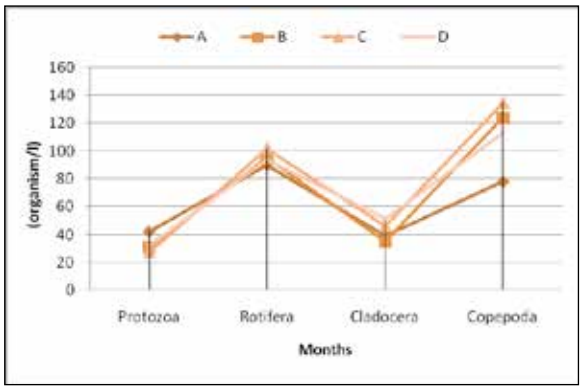

Fig. 3 Summer Season variation in Zooplankton groups (organism/l)

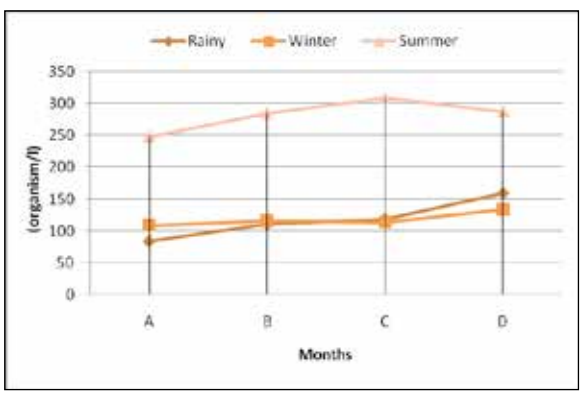

Fig. 4 Seasonal Variation in Total Zooplankton (organism/L) from July 2011 to June 2012

Cladocera: A total of 5 genera of cladocera were observed in Govindgarh Lake. These are *Daphnia, Ceriodaphnia, Moina, Simocephalus* and *Bosmina*. Cladocera ranged from 0to 77 org/L (Table 1). Cladocera was the most dominant in summer season and lowest in rainy season (Fig. 1 & 3).

It has been reported that the density and biomass of cladocerans was primarily determined by food supply (Singh *et al*. 2002). In the present study similar observation were abundant when the food supply (phytoplankton) was maximum. During summer the cladocerans population was moderate due to dense growth of rotifers and thus avoiding competition. It was found that the temperature is the primary factor affecting the occurrence and distribution of cladocerans (Qadri and Yousuf, 1980).

Copepoda: Copepoda are most dominant group of zooplankton. Copepoda were abundant throughout the study period *Cyclops* and *Nauplii* were dominant constituents of copepods. It's ranged from 25 to 156 org/l (Table 1). Other member of copepoda was *Diaptomus*. The abundance of copepoda was found to be highest in summer season and lowest in winter season (Fig. 2 & 3).

Copepoda constitutes a major zooplankton communities occurring in almost all the water bodies, which serve food for many fish and play vital role in ecological pyramids. Nearly 120 species recorded from India (Uttangi, 2001).

The present study would give a preliminary knowledge on the diversity and productivity of zooplankton and reasons for the variation in Govindgarh Lake. The overall view in this study reveals that the fluctuation of zooplankton occurs distinctly in the study area and normally in rainy season, there is a less population due to the dilution factors and its effects leads to less photosynthetic activity by primary producers. The population raises a bit higher level during winter season due to favourable environmental conditions. But in summer stability of water body and availability of food is more due to decomposition of organic matter and the density of zooplankton might be high due to less predators.

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