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Analysis of zooplankton diversity with respect to physico-chemical parameters in an artificial reservoir, Getalsud Dam in Ranchi, Jharkhand

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Abstract- Getalsud dam is located in Ranchi district of Jharkhand state. Water of this dam is supplied in town areas of Ranchi. The dam has been constructed on River Subernarekha in the year 1969 and was opened in year 1971 for electricity production and water supply. Zooplanktons constitutes one of the most important component of aquatic food chain. The present investigation deals with the study of zooplankton diversity of the locally situated artificial reservoir taken for study. In the present study, total 3420 species of zooplankton were found in which most abundant were rotifers i.e. 1010 and 29.53%. Least found species were of Millipedes and Ostracods i.e. 280 and 8.16%. Copepods and protozoans were also collected in a sum of 25% and 11 % respectively. Statistical analysis was done using SPSS software. The physico-chemical parameters were also observed like temperature, pH, DO, temperature, conductivity, turbidity and alkalinity.

Key words: Zooplanktons, diversity, Rotifers, Millipedes, physico-chemical parameters

INTRODUCTION

Zooplanktons are microscopic assemblage of free floating organisms that occurs either at or near the water surface in aquatic bodies.[1] Size of these small creatures varies from few micrometers to even 1mm.[2] Zooplanktons play important role in aquatic ecosystem as they form an important link between the members of first trophic level and the members of highest trophic level in aquatic food chain. These small creatures occupy intermediate position in the food web mediating the transfer of energy from lower levels of trophic levels to the higher levels. Plankton diversity is controlled by a number of physicochemical factors prevailing in the water body in which they reside and thus at times they acts as important bio indicators also. The factors include assessment of water quality, temperature, pH, alkalinity, availability of food, geomorphic nature of the environment and the surrounding locality along with the biotic factors.

The scientific management of any water body requires a balance between the different members of trophic levels and thus the planktonic community including phyto plankton as well as zooplanktons which are important members for the management of water bodies. Planktons have also been reported to be tools used for the assessment of water quality.[3]

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MATERIALS & METHOD

Study Area

The present investigation was carried in an artificial water body located 37 km away from Ranchi city and has been named as Getalsud dam to assess the distribution, occurrence and hydro chemical profile of the same. The dam has been constructed on Subarnarekha River and was

opened in 1971. An attempt was made to study the zooplankton diversity along with different physicochemical parameters of the dam for a period of 1 year (March, 2022-February, 2023).

Fig. 1- Getalsud Dam, Jharkhand

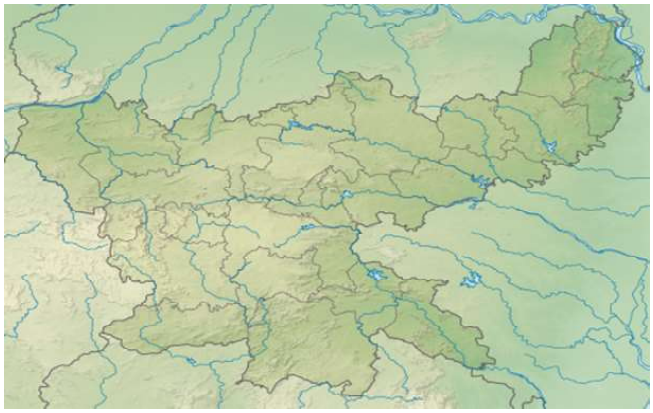

Fig. 2- Physical map of Jharkhand

Fig. 3- Subarnarekha River basin map, Jharkhand

Table 1- Coordinates of Getalsud Dam, Jharkhand

Country	India
Location	Ormanjhi, Ranchi, Jharkhand
Coordinates	23°27′24″N 85°33′19″E
Status	Functional
Opening date	1971
Owner(s)	JSEB
Dam and spillways	
Type of dam	Concrete gravity dam
Impounds	Subarnarekha River
Height	116 ft (35 m)
Reservoir	
Catchment area	717 km^2 (277 sq mi)
Normal elevation	1,954 ft (596 m)
Power Station	
Operator(s)	JSEB
Turbines	2 x 65 MW Francis-type

Getalsud Dam is an artificial reservoir situated in Ormanjhi, Ranchi, Jharkhand. It was constructed across the Subarnarekha River and was opened in 1971. It is a popular picnic spot for the residents of Ranchi and Ramgarh District. The dam provides a small-scale fishing opportunity to the local people of Rukka. The main purpose of the dam is to fulfill the drinking water requirements of the residents of Ranchi. Apart from that, it is used for industrial purposes and generating electricity.

Sample collection and Analysis

1. Water:

Water samples were collected in sterile glass bottles from a depth of 1 to 4 meters. Sample was collected in early morning between 8.00 to 9.00 am. Water parameters like Dissolved Oxygen (DO), pH, temperature, alkalinity, turbidity and conductivity were determined using suitable kits. All parameters were determined using standard methods of APHA.[4,5] The data obtained were summarized with Microsoft Excel using appropriate tests.

2. Zooplankton Sampling:

The zooplankton samples were collected using Plankton nets (size 55 micrometer) mesh size after decanting approximately 100 litres of water. The collected samples were fixed using 5% formalin and few drops of lugol solution. Samples were further concentrated to 10 ml and water analysed in the laboratory under microscope in Sedgewick rafter counting chambers. Identification was done with the help of key manuals.[6-12] Species diversity was calculated using SPSS software.

Fig. 4- Sampling site at Getalsud Dam, Jharkhand

Fig. 5- Zooplanktons identification (ZSI)

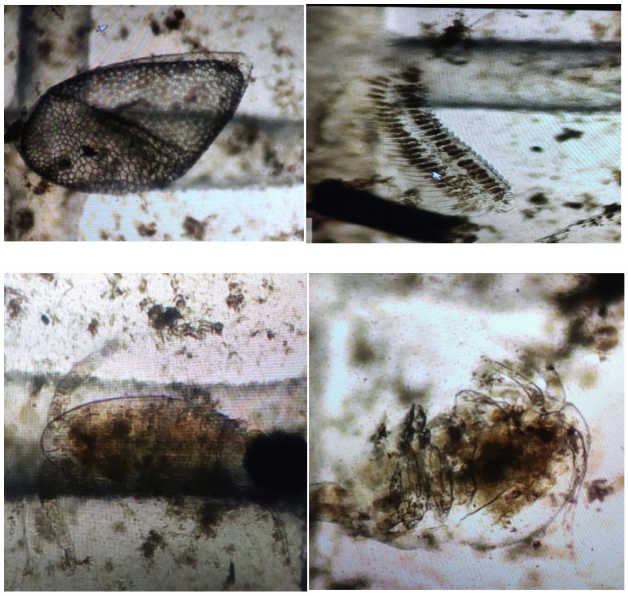

Fig. 6- Zooplanktons captured

RESULTS & DISCUSSION

In the present table , the average data of selected physico-chemical parameters (i.e., dissolved oxygen, pH, temperature, conductivity, turbidity, alkalinity, sulphate, chloride, phosphate, nitrate) have been shown on a monthly basis during March 2022 to February 2023.

Table 2- Monthly variation of physico-chemical parameters of Getalsud Dam.

Parameters	Unit	March	April	May	June	July	August	September	October	November	December	January	February
DO	mg/L	4.6	4.9	4.4	4.5	4.6	4.7	4.8	4.9	5	5	4.6	4.9
pH	pH value	8.1	9	7.1	6.9	7.1	7.1	7.2	7.3	7	7.6	8.8	8.1
Temperature	OC	30.1	31	28.2	25.5	25.9	27.4	28.1	28.1	31.1	35.2	32.1	30.6
Conductivity	us/cm	254.7	244	281	309	309	312	316	318	321	327	281.7	321.8
Turbidity	JTU	0.7	1.5	1	1.2	1.3	1.3	1.2	1.3	1.4	1.5	1.5	1
Alkalinity	ppm	49	45	51	77.8	77.3	61.5	63.4	64.5	70	74	56.5	63.8
Sulphate	ppm	16.8	13.6	16.5	16.4	15.9	18.7	18.4	19.3	17.3	9.3	5.4	9.5
Chloride	ppm	23	34.9	13.9	11.9	11.1	17.8	15.9	11.9	40.8	42.9	39.9	31.3
Phosphate	ppm	0.5	2.2	0.4	0.02	0.02	0.04	0.03	0.04	4	4.3	2	2.3
Nitrate	ppm	1.8	1.2	3.2	4.3	4.3	4.3	4.2	4.3	4.9	5	3.9	4.6

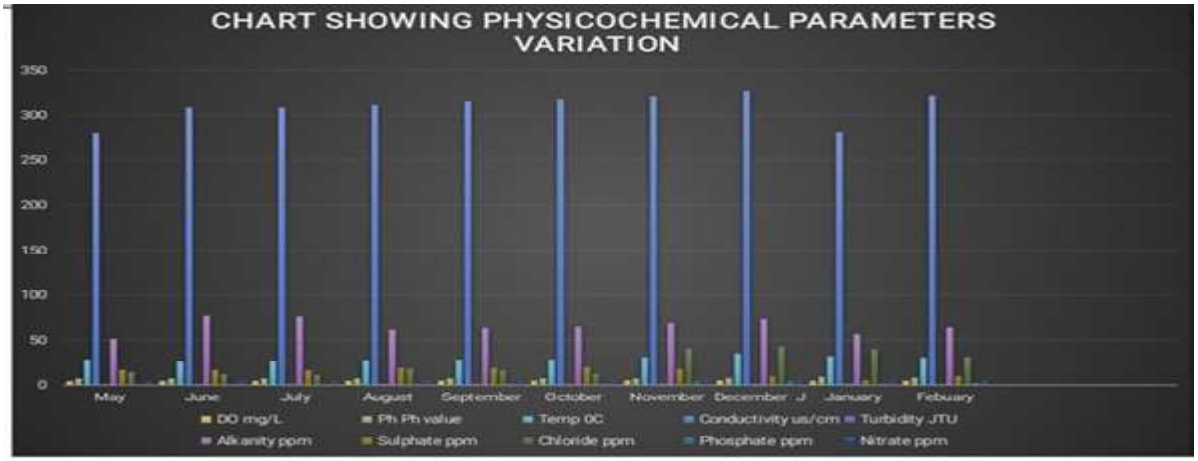

Fig. 7- Monthly variation of physico-chemical parameters of Getalsud Dam

Total 3420 species of zooplankton were recorded in Getalsud Dam, which comprised of Rotifera, Copepods, Cladocerans, Milipedes, Ostracodes and Protozoa. 1130 species were found in pre monsoon, 990 species were found in monsoon and 1310 species were found in post monsoon period. Maximum species found here was of *Rotifers* i.e. 1010. *Rotifers* are indicator of water quality, so maximum percentage of this species i.e. 29.44% found here indicates that quality of water is very good Least found species are of *Millipedes* and *Ostracods* i.e. 280. Average temperature recorded here in post monsoon period was 28°C

Table 3- The species diversity indices of zooplankton observed in Getalsud Dam, Ranchi.

	Pre monsoon				Monsoon				Post monsoon			
Zooplankton	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23
Rotifera	30	140	200	150	20	90	70	40	60	40	70	100
Copepods	100	90	110	100	140	20	40	30	40	30	60	90
Cladocerans	40	100	100	70	10	20	20	80	20	60	50	80
Milipedes	30	20	0	10	70	30	30	0	10	50	0	30
Ostracodes	0	10	20	20	10	0	0	90	70	30	10	20
Protozoa	30	80	30	10	10	30	20	30	40	20	20	40
Total	230	440	460	360	260	190	180	270	240	230	210	360

Fig. 8- Percentage composition of zooplankton recorded in the Getalsud Dam during March 2022 to February 2023.

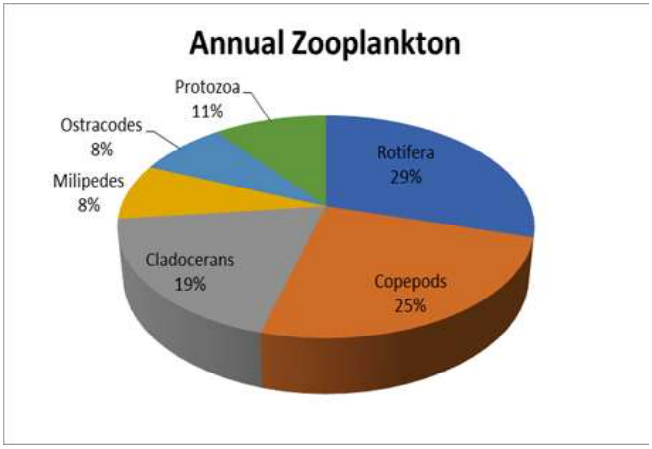

Table 4- Values of diversity indices showing diversity in different months during the period of study from March 2022 to February 2023.

MONTHS	Simpson Diversity	Shanon Diversity
March 2022	0.733	0.633
April 2022	0.772	0.674
May 2022	0.702	0.583
June 2022	0.709	0.603
July 2022	0.63	0.541
August 2022	0.858	0.609
September 2022	0.752	0.643
October 2022	0.758	0.647
November 2022	0.979	0.708
December 2022	0.817	0.747
January 2023	0.743	0.621
February 2023	0.791	0.711

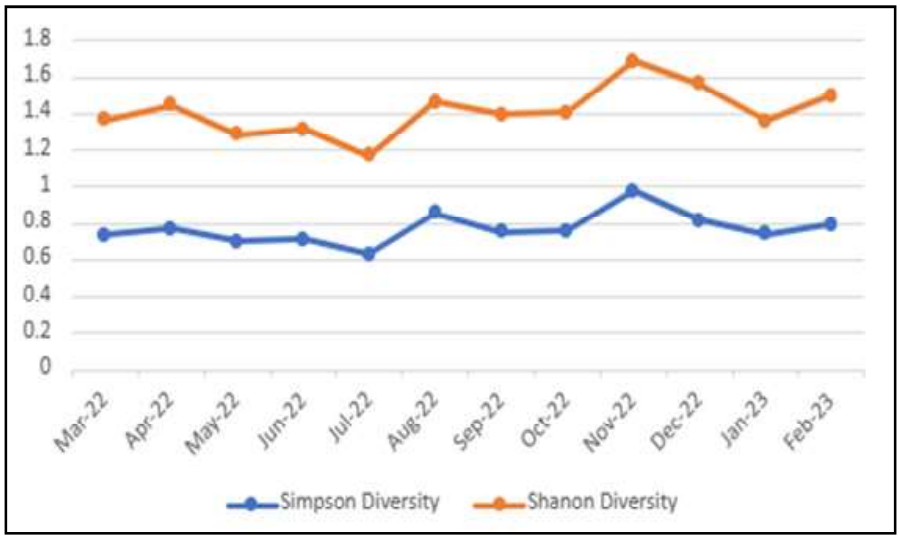

Fig. 9- Graph showing diversity indices

Rotifers are classified as the most important component of zooplankton community, because they proliferate at higher rate in water bodies. The most abundant species observed was of *Brachionus* genera in the *Rotifer* group. One recent study of Bhimtal lake indicated that zooplanktons here consisted of *Brachionus, Cephalodella, Lacane* etc.

Copepods are also considered as major zooplankton community since they play a role in different trophic levels for energy transformation.

Cladocera are classified as important component of zooplanktons. 650 species of different genera were found. *Daphnia* and *Alona* were the dominant genera of this species seen in a recent study of Kashmir lake.

Milipedes, Ostracodes and *Protozoa* species were also found along the above species.

CONCLUSION

3420 species of zooplankton were found belonging to Rotifera, Copepods, Cladocerans, Milipedes, Ostracodes, Protozoa. Most abundant species found were of *Rotifers* which indicate that the quality of water is very good. So we can conclude that water of this dam is potable for drinking, agriculture, aquaculture etc.

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