

**ZOOPLANKTON DIVERSITY OF GARGA RESERVOIR OF BOKARO, JHARKHAND, INDIA**

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Abstract: The present study is on "Zooplankton diversity of Garga Reservoir of Bokaro District (Jharkhand)". The study was carried on from July'2012 to June'2013 at four selected sampling stations. Monthly variations and biodiversity indices of zooplanktons were observed. It revealed 11 different species of zooplanktons belonging to 4 different classes namely 3 rotifers, 4 cladocerans, 3 copepods and 1 ostracod. Among rotifers, *Brachionus falacatus* is abundant. *Ceriodaphnia cornuta* is predominant among cladocerans. Among copepods, numerical superiority was found in case of Nauplius. Ostracoda was represented by only one genus i.e. *Stenocypris*. Maximum percentage of *Cladocera* (34.89%) and minimum percentage of *Ostracoda* (6.77%) were observed. Margalef's index (R1) and Menhinick index (R2) values (1.038 and 1.061) were found to be highest in April, 2013 and October, 2012 respectively. Lowest values (0.558 and 0.577) were found in July, 2012 and February, 2013. The Simpson's index (n) varied from 0.222 in April'13 to 0.667 in July'12. The Shannon index (H') was found to be in the range of 0.451 in July'12 to 1.355 in April'13.

Key Words: Zooplankton diversity, Garga reservoir, rotifera, cladocera, copepoda, ostracoda.

INTRODUCTION

Aquatic organisms are especially important as they form the most sensitive component of the ecosystem and signal environmental disturbances (Carle, 1979). Zooplankton species have different types of life histories influenced by seasonal variations of biotic factors, feeding ecology and predation pressure. Zooplankton forms a major link in the energy transfer at secondary level in aquatic food webs between autotrophs and heterotrophs (Deivanai *et al.*, 2004). The distribution and diversity of zooplanktons in aquatic ecosystems depend mainly on the physico-chemical parameters of water (Harikrishnan and Azis, 1989). Zooplankton communities of freshwater bodies constitute an extremely diverse assemblage of organisms represented by most of the invertebrate phyla (Shivakumar *et al.*, 2001). The main objectives of this research are to determine the diversity and abundance of zooplanktons in Garga reservoir of Bokaro

MATERIALS AND METHODS**Study Site**

The area selected for the present study is Garga reservoir of Bokaro. It is 12 km from the City centre (23.67°N 86.10° E) near to the Railway station on the NH 23.

Study Period

The investigation was carried out for a period of 12 months from July'12 to June'13. Standard methodologies of APHA (2005), Jhingran *et al.*, (1967), Dey and others were followed. Samples were collected on monthly basis.

Zooplankton Analysis

Collection: Phytoplankton net (mesh size 25µm) was swept from 1 to 4m depth and phytoplanktons collected were transferred into separate plastic bottles/containers. 50 lit of water were sieved through phytoplankton net to obtain phytoplanktons.

Fixation: Phytoplanktons were fixed and preserved in 4% formalin

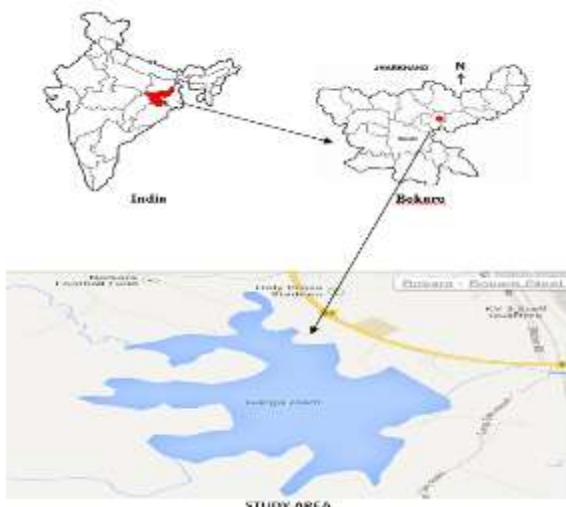
Identification: 1 ml of the phytoplankton sample was transferred into a Sedgwick rafter plankton counting slide. The chamber was covered and phytoplankton was examined under low power of a microscope. The number of phytoplankton taxon (N) per liter is given by the equation.

$$N = \frac{AXCX100}{V} = \frac{AXCX1000}{50}$$

A= No. of phytoplankton in 1ml of the sub sample filling the Sedgwick-rafter chamber.

C= ml of the phytoplankton setting volume of phytoplankton.

V= volume of the water sample filtered=50 liter.

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RESULT AND DISCUSSION

Zooplankton

The monthly variations in the occurrence of zooplankton in Garga Reservoir have noticed and presented in the table 7. Totally 11 different species of zooplankton belonging to four different classes were noticed.

Rotifera

3 genera namely *Brachionous*, *Caudatus*, *B. falcatus* and *Conochilus arboreus* were observed. *B. caudatus* was more numerous in June whereas *B. falcatus* and *Conochilus arboreus* were more in February.

Cladorera

It was represented by 4 genera namely *Ceriodaphnia cornuta*, *Moina micrura*, *Moina brachiata* and *Diaphanosoma sarsi*.

Ceriodaphnia cornuta was found more in number during January 2013. It was observed from November'12 to April'13. *Moina micrura* was more

numerous during December'12 and January'13. *Moina brachiata* was seen only in December'12 and January'13. *Diaphanosoma* showed irregular presence throughout the year.

Copepods

This class was represented by 3 genera namely *Cyclops*, *Nauplius*, and *Heliodiaptomus viduus*. *Cyclops* sp. was observed from November'12 to June'13. It was numerous from April '13 to June'13. *Nauplius* sp. was observed throughout the year except in November'12 and June'13. *Heliodiaptomus viduus* was observed November'12 and February'13. *Nauplius* was found more in number during February 2013.

Ostracoda

Stenocypris sp. was the only representative genes during the investigation period. It was minimum in October'12 and showed continuous presence from March'13 to June'13. Maximum numbers of zooplanktons were found in January'13 and February'13.

Table 7: Monthly variations of occurrence of Zooplankton in Garga Reservoir (Unit/ml) $\bar{X} \pm SD$ of Four Observations.

ZOOPLANKTON	July'12	Aug'12	Sep'12	Oct'12	Nov'12	Dec'12	Jan'13	Feb'13	Mar'13	Apr'13	May'13	June'13
ROTIFERA												
<i>Brachionus caudatus</i>	3 ± 1.41	1 ± 0.82				1 ± 0.82	1 ± 1.41		2 ± 0.82	2 ± 1.41	4 ± 0.82	5 ± 1.83
<i>B. falcatus</i>	2 ± 1.41	3 ± 0.82	4 ± 1.83	6 ± 2.58	2 ± 0.82			5 ± 1.83	4 ± 2.16	2 ± 0.82	2 ± 0.82	1 ± 0.82
<i>Conochilus arboreus</i>								4 ± 2.58	3 ± 0.82	2 ± 0.82	1 ± 0.82	1 ± 1.15
CLADOCERA												
<i>Ceriodaphnia Cornuta</i>					4 ± 1.83	6 ± 2.58	15 ± 5.89	4 ± 1.41	2 ± 1.83	1 ± 0.82		
<i>Moina micrura</i>						6 ± 2.16	4 ± 1.83		1 ± 0.82	1 ± 1.41	2 ± 0.82	3 ± 0.82
<i>Moina brachiata</i>						1 ± 0.82	2 ± 1.41					
<i>Diaphanosoma sarsi</i>					2 ± 1.41			1 ± 0.82	2 ± 1.63	2 ± 0.82	3 ± 1.63	5 ± 1.82
COPEPODS												
<i>Cyclops</i>					1 ± 1.41	1 ± 0.82	1 ± 0	3 ± 1.63	3 ± 1.41	4 ± 0.82	4 ± 1.41	5 ± 1.63
<i>Nauplius</i>	1 ± 0.82	1 ± 1.41	2 ± 1.82	1 ± 1.41		4 ± 2.45	3 ± 1.63	7 ± 2.83	2 ± 1.41	1 ± 0.82	1 ± 1.41	
<i>Heliodiaptomus viduus</i>					3 ± 0.82			3 ± 1.41				
OSTRACODA												
<i>Stenocypris</i>				1 ± 0.82					2 ± 1.41	3 ± 1.41	3 ± 1.63	4 ± 2.16
Total No. of Individuals	6	5	6	8	12	19	26	27	21	18	20	24
Total No. of Species	3	3	2	3	5	6	6	7	9	9	8	7

Percentage composition

Percentage composition of various classes of zooplanktons is represented in table 8. It revealed maximum percentage of Cladocera (34.89%) and minimum percentage of Ostracoda (6.77%).

Table 8: Percentage composition of various classes of Zooplankton of Garga Reservoir, Bokaro

Month	Rotifera	Cladocera	Copepoda	Ostracoda	Total
July'12	5		1		6
Aug'12	4		1		5
Sep'12	4		2		6
Oct'12	6		1	1	8
Nov'12	2	6	4		12
Dec'12	1	13	5		19
Jan'13	1	21	4		26
Feb'13	9	5	13		27
Mar'13	9	5	5	2	21
Apr'13	6	4	5	3	18
May'13	7	5	5	3	20
Jun'13	7	8	5	4	24
Total	61	67	51	13	192
%	31.77%	34.89%	26.56%	6.77%	

Diversity indices of Zooplankton

Monthly variations in Richness, Evenness and Diversity of zooplankton of Garga reservoir were computed and entered in table 9.

The Margalef index (R1) was maximum in April'13 (1.038) and minimum in July and September'12 (0.558). The Mehinick index (R2) was low in February'13 (0.577) and high during October'12 (1.061).

The Alatalo evenness (E5) of zooplankton was maximum in September'12 (1.284) and minimum in October'12 (0.489).

The Simpson's index (n) varied from 0.222 in April'13 to 0.667 in July'12. The Shannon index (H') was found to be in the range of 0.451 in July'12 to 1.355 in April'13. the values Hill's first diversity (N1) ranged between 1.57 in July'12 to 3.88 in April'13. The values of Hill's second diversity (N2) ranged between 1.5 in July'12 to 4.5 in April'13.

Among the diversity indices, N1 is measure of abundant species and N2 is measuring of very abundant species.

Table 9: Monthly variations of the various diversity indices for the Zooplankton observed in Garga Reservoir, Bokaro (Jharkhand)

Indices		July'12	Aug'12	Sep'12	Oct'12	Nov'12	Dec'12	Jan'13	Feb'13	Mar'13	Apr'13	May'13	June'13
Richness	No	2	2	2	3	3	3	3	3	4	4	4	4
	R1	0.558	0.621	0.558	0.962	0.805	0.679	0.614	0.607	0.985	1.038	1.001	0.944
	R2	0.816	0.894	0.816	1.061	0.866	0.688	0.588	0.577	0.873	0.943	0.894	0.816
Evenness	E1	0.651	0.723	0.918	0.671	0.922	0.697	0.534	0.938	0.955	0.978	0.971	0.976
	E2	0.785	0.826	0.945	0.696	0.918	0.717	0.599	0.934	0.94	0.97	0.96	0.967
	E3	0.57	0.651	0.89	0.545	0.877	0.576	0.399	0.902	0.919	0.96	0.947	0.956
	E4	0.955	1.01	1.134	0.734	1.089	0.903	0.966	1.08	0.98	1.16	1.124	1.098
	E5	0.877	1.025	1.284	0.489	1.141	0.819	0.923	1.124	0.973	1.215	1.168	1.132
Diversity	λ	0.667	0.6	0.467	0.652	0.333	0.515	0.576	0.33	0.271	0.222	0.232	0.236
	H'	0.451	0.501	0.636	0.736	1.012	0.766	0.586	1.03	1.323	1.355	1.345	1.352
	N1	1.57	1.651	1.89	2.089	2.753	2.152	1.797	2.803	3.758	3.88	3.841	3.868
	N2	1.5	1.667	2.143	1.533	3	1.943	1.736	3.026	3.684	4.5	4.318	4.246

No	No. of species
R1	Margalef index
R2	Mehnick's index
E1	Pielou evenness
E2	Sheldon evenness
E3	Help evenness
E4	Hill evenness
E5	Alatalo index
λ	Simpson's evenness
H'	Shannon evenness
N1	Hill's first diversity
N2	Hill's second diversity



Figure: Monthly Variation of Zooplanktons

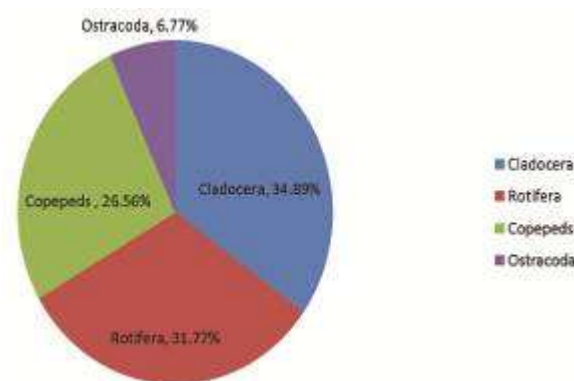


Figure: Percent composition of various classes of Zooplanktons

CONCLUSION

The result showed that water of Garga reservoir is suitable for drinking, irrigation and fish culture. Plankton study was carried out to understand its relation with water quality parameters and fish production. Among phytoplanktons Chlorophyceae was more prominent and among zooplanktons Cladocera and Rotifera showed dominance.

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