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### RESEARCH PAPER

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## Phytoplankton Diversity of Garga Reservoir of Bokaro, Jharkhand

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### ABSTRACT

*The present study concerns monthly variations and biodiversity indices of phytoplanktons during July, 2012 to June, 2013 in the Garga Reservoir of Bokaro, Jharkhand, India. A total of 12 different species belonging to 7 different classes were recorded out of which 2 were Cyanophyceae, 4 Chlorophyceae, 2 Bacillariophyceae, 1 Charophyceae, 1 Rhodophyceae, 1 Dinoflagellates and 1 Euglenophyceae. Present study revealed maximum percentage wise compositions of Chlorophyceae (46.34%), and minimum was Bacillariophyceae (3.05%). Margalef's index (R1) and Menhinick index (R2) values (1.737 and 1.581) were found to be highest in February, 2013 and lowest values (0.514 and 0.756) were found in September, 2012. Simpson index ( $\lambda$ ) was found to be highest in May'13 (0.545) and lowest in July'12 (0.167). Shannon Weiner index ( $H'$ ) values were highest in June'13 (1.303) and lowest in November'12 (0.501)*

**Keywords:** Phytoplanktons Diversity, Cyanophyceae, Chlorophyceae, Bacillariophyceae, Charophyceae, Rhodophyceae, Dinoflagellates and Euglenophyceae.

### INTRODUCTION

Aquatic organisms are especially important as they form the most sensitive

component of the ecosystem and signal environmental disturbances (Carle, 1979). Phytoplankton, being the primary producer, forms the lowest trophic level

in the food chain of freshwater ecosystem, moreover, number and species of phytoplankton serves to determine the quality of a water body (Bahura, 2001). Distribution of phytoplankton and their variation at different zones of a water body is known to be influenced by physiochemical parameters of water. Phytoplankton study provides a relevant and convenient point of focus research on the mechanism of eutrophication and its diverse impact on an aquatic ecosystem (Meshram and Dhande, 2000).

## 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.

### Phytoplankton 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 litre is given by the equation.

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

V = 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.

## RESULTS AND DISCUSSION

The monthly variations in the occurrence of phytoplankton in Garga Reservoir have been noticed and presented in the table 1. Totally 12 different species of phytoplankton belongs to 7 different classes

**Cyanophyceae:-** It was represented by two genera namely *Anabaena* and *Spirulina*. They were observed only in December and January.

**Chlorophyceae:-** In it 4 genera were observed namely *Oedogonium* sp., *Spirogyra* sp., *Volvox* sp. and *Ulothrix* sp. *Oedogonium* appeared irregularly throughout the study period. *Spirogyra* sp. was found from December'12 to June'13. *Volvox* was seen only in December'12 and January'13. *Ulothrix* was observed from November'12 to June'13.

**Bacillariophyceae:-** It was represented by two genera namely *Nitzschia* sp. and *Navicula*. *Nitzschia* appeared only in the month of October and November where as *Navicula* was observed in December and January.

**Charophyceae:-** It was represented by 1 genus namely *Chara*. It was observed from December'12 to June'13. It was more numerous from April to June.

**Rhodophyceae:-** Only one genus *Batrachospermum* was observed from February to June. It was numerous in June'13.

**Dinoflagellates:-** *Ceratium* represented this class and was maximum in September. It was not observed in

November, December, January and March.

Euglenoides:- Euglena was observed throughout the year except September, November and December.

Maximum number of phytoplanktons was found in May and June.

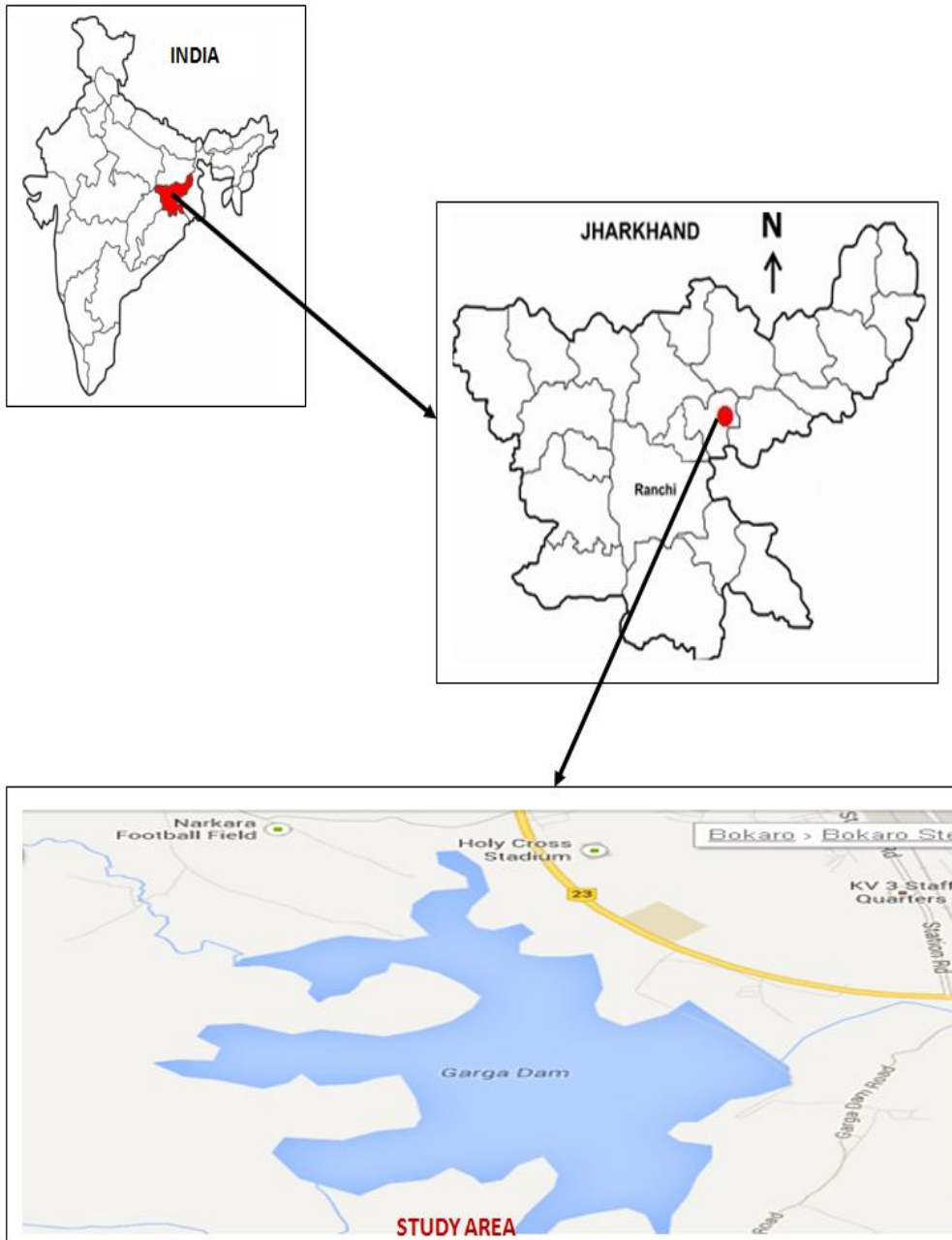


Table 1. Monthly variations of occurrence of Phytoplankton in Garga Reservoir (Unit/ml)  $\times$   $\pm$  SD of Four Observations.

<i>Phytoplankton</i>	July' 12	Aug' 12	Sep' 12	Oct' 12	Nov' 12	Dec' 12	Jan' 13	Feb' 13	Mar' 13	Apr' 13	May' 13	June' 13
<i>Cyanophyceae</i>												
<i>Anabaenae</i>						2 $\pm$ 0.82	3 $\pm$ 1.41					
<i>Spirulina</i>						5 $\pm$ 1.83	5 $\pm$ 1.41					
<i>Chlorophyceae</i>												
<i>Oedogonium</i>	1 $\pm$ 0.82	1 $\pm$ 0.82	2 $\pm$ 0.82		2 $\pm$ 1.15		2 $\pm$ 1.41		1 $\pm$ 0		1 $\pm$ 1.63	1 $\pm$ 0.82
<i>Spirogyra</i>						2 $\pm$ 0.82	2 $\pm$ 1.41	3 $\pm$ 1.41	5 $\pm$ 2.94	7 $\pm$ 1.63	7 $\pm$ 2.92	6 $\pm$ 1.83
<i>Volvox</i>						3 $\pm$ 1.41	3 $\pm$ 1.41					
<i>Ulothrix</i>					2 $\pm$ 0.82	1 $\pm$ 1.41	3 $\pm$ 1.41	2 $\pm$ 1.15	3 $\pm$ 0.82	5 $\pm$ 1.41	5 $\pm$ 2.94	6 $\pm$ 3.67
<i>Bacillariophyceae</i>												
<i>Nitzschia</i>				2 $\pm$ 0.82	1 $\pm$ 0.82							
<i>Navicula</i>						1 $\pm$ 0	1 $\pm$ 1.15					
<i>Charaphyceae</i>												
<i>Chara</i>						1 $\pm$ 1.41	2 $\pm$ 0.82	2 $\pm$ 1.63	3 $\pm$ 1.41	4 $\pm$ 2.16	4 $\pm$ 0.82	5 $\pm$ 1.41
<i>Rhodophyceae</i>												
<i>Batrachospermum</i>								1 $\pm$ 0.82	2 $\pm$ 0.82	2 $\pm$ 1.15	3 $\pm$ 1.63	5 $\pm$ 2.16
<i>Dianoflagellates</i>												
<i>Ceratium</i>	2 $\pm$ 0.82	4 $\pm$ 0.82	5 $\pm$ 3.56	3 $\pm$ 1.41				1 $\pm$ 0.82		1 $\pm$ 1.41	1 $\pm$ 0.82	2 $\pm$ 0.82
<i>Euglenoids</i>												
<i>Euglena</i>	1 $\pm$ 1.41	2 $\pm$ 0.82		2 $\pm$ 0.82			1 $\pm$ 0.82	1 $\pm$ 0	2 $\pm$ 1.15	3 $\pm$ 1.41	2 $\pm$ 0.82	1 $\pm$ 0.82
<b>Total No. Of Individuals</b>	4	7	7	7	5	15	22	10	16	22	23	26
<b>Total No. Of Species</b>	3	3	2	3	3	7	9	6	6	6	7	7

Table 2. Percentage compositions of various classes of Phytoplankton of Garga Reservoir, Bokaro.

Month	Cyano phyceae	Chloro phyceae	Bacillari ophyceae	Charap hyceae	Rhodo phyceae	Dianofla gellates	Eugle noids	To tal
July '12		1				2	1	4
Aug '12		1				4	2	7
Sep' 12		2				5		7
Oct' 12			2			3	2	7
Nov '12		4	1					5
Dec' 12	7	6	1	1				15
Jan' 13	8	10	1	2			1	22
Feb' 13		5		2	1	1	1	10
Mar '13		9		3	2		2	16
Apr' 13		12		4	2	1	3	22
Ma y'13		13		4	3	1	2	23
Jun' 13		13		5	5	2	1	26
Tot al	15	76	5	21	13	19	15	164
%	9.15%	46.34%	3.05%	12.8%	7.93%	11.59%	9.15%	

Percentage composition:- Percentage composition of various classes of phytoplanktons is represented in table 2. It revealed maximum percentage of Chlorophyceae (46.34%) and minimum percentage of Rhodophyceae (7.93%)

**Table 3. Monthly variations of the various diversity indices for the Phytoplanktons 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	N0	3	3	2	3	2	4	5	5	4	5	5	5
	R1	1.443	1.028	0.514	1.028	0.621	1.108	1.294	1.737	1.082	1.294	1.276	1.228
	R2	1.5	0.756	0.756	1.134	0.894	1.033	1.066	1.581	1	1.066	1.043	0.981
Evenness	E1	0.929	0.816	0.863	0.983	0.723	0.783	0.762	0.845	0.836	0.79	0.771	0.81
	E2	0.925	0.817	0.909	0.981	0.826	0.74	0.682	0.78	0.797	0.713	0.692	0.737
	E3	0.888	0.726	0.819	0.972	0.651	0.654	0.603	0.725	0.729	0.642	0.615	0.671
	E4	2.158	1.224	1.05	1.427	1.01	0.958	0.916	1.049	1.141	0.852	0.53	0.891
	E5	2.81	1.378	1.111	1.646	1.025	0.937	0.88	1.066	1.206	0.794	0.339	0.851
Diversity	$\lambda$	0.167	0.333	0.524	0.238	0.6	0.352	0.32	0.244	0.275	0.329	0.545	0.305
	H'	1.02	0.896	0.598	1.079	0.501	1.085	1.226	1.36	1.158	1.271	1.24	1.303
	N1	2.775	2.451	1.819	2.944	1.651	2.961	3.41	3.899	3.186	3.567	3.458	3.683
N2	5.988	3	1.91	4.2	1.667	2.838	3.122	4.091	3.636	3.039	1.833	3.283	

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
$\lambda$	Simpson's evenness
H'	Shannon evenness
N1	Hill's first diversity
N2	Hill's second diversity

**Diversity indices of phytoplankton**

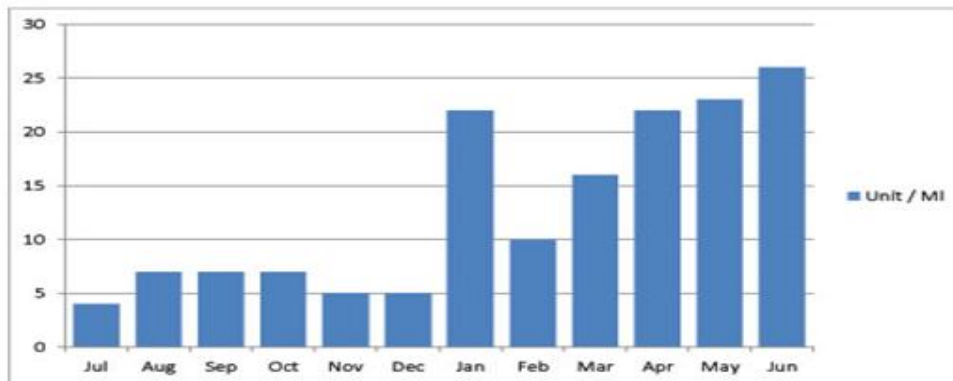
Phytoplankton community characteristics such as species richness, evenness and diversity were calculated in the Garga reservoir during July'12 to June'13 and presented in the table 3.

The Margalef index (R1) of phytoplankton was minimum (0.514) during September'12 and maximum (1.737) during February'13. The Menhinick index (R2) was maximum (1.581) during February'13 and minimum (0.756) during August and September'12.

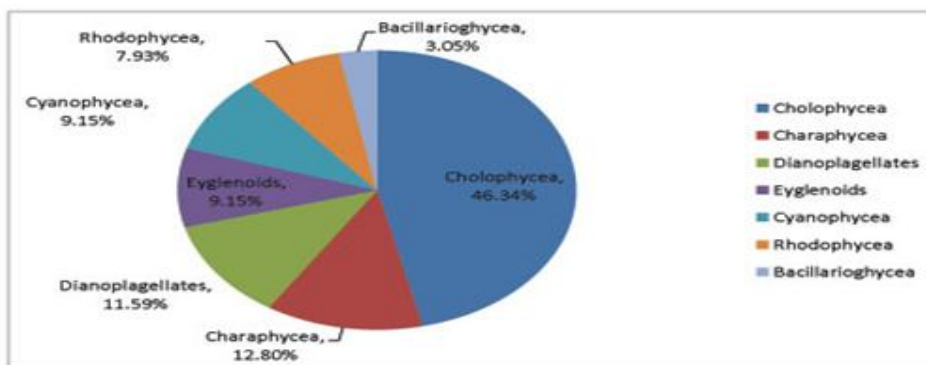
Evenness indices E1, E2, E3, E4 and E5 refer to how the species abundances are distributed among the species. The

Alatalo evenness (E5) is preferred over others. It was maximum (2.81) during July'12 and minimum (0.339) during May'13.

The Simpson's Index (n) for the phytoplankton community was ranging from 0.167 in July'12 to 0.6 in November'12. The Shannon index (H') of phytoplankton was low during the month of November'12 (0.501) and high during the month of February'13 (1.36). While the values of Hill's first diversity (N1) ranged between 1.651 in November'12 and 3.899 in February'13. The Hill's second diversity (N2) ranged from 1.667 in November'12 to 5.988 in July'12.



**Monthly Variations of Photoplanktons**



**Percentage Composition of Various Classes of phytoplanktons**

## CONCLUSION

Primarily the water resource of Garga reservoir is utilised for drinking, irrigation and fish culture. Phytoplankton study was carried out to understand its relation with water quality parameters and fish production. Among them Chlorophyceae (46.34%) was most prominent and the least was Bacillariophyceae (3.05%). The maximum phytoplankton was in June'13 (26 unit/ml) and minimum was in July'12 (4 unit/ml).

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