



Research Paper

Comparative study of Phytoplankton and Zooplankton diversity of two sites of Narmada River Jabalpur, Madhya Pradesh

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Abstract: The present was undertaken to know diversity Phytoplankton and Zooplankton of two sites Gwarighat (Site A) and Khirahnighat (Site B) of Narmada River Jabalpur, The research was conducted from July 2023 to December 2023. Water sample were collected from both sites for estimation of Phytoplankton and Zooplankton. In the present study 16 phytoplankton species were recorded, representing Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae. The average Phytoplankton count was estimated (113 to 443) in per liter of water of site A. A total 13 Phytoplankton species were recorded, representing Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae 01 form site B. The average Phytoplankton count was estimated (97 to 302) in per liter of water form site B. A total of 09 species of Zooplankton was recorded from site A, Cladocera, Rotifera, Copepoda and Ostracoda from site A. A total 07 species of Zooplankton were recorded from site B,

Cladocera, Rotifera, Copepodac and Ostracoda species.

Keyword: Narmada River, Phytoplankton, Zooplankton Diversity.

Introduction:

The Narmada is a River in Central India and fifth largest River in subcontinent. It is also referred as “lifeline of Madhya Pradesh. Study of biodiversity of fish fauna and their identification is one of the interesting fields of biological research, which gives us an idea about the morphological variations and population diversity of fauna in polluted and non-polluted site of any particular habitat (Napit, 2013).

Plankton diversity is one of the most important ecological parameters in water quality assessment and good indicator of the changes in water quality. Planktons are elemental factor of aquatic community as they are major sources of biologically significant and organic carbon, situated at the base of the food chain (Rai *et al.*,

2016). Planktons are microscopic free swimming heterogeneous assemblage of minute floating animal forms found in aquatic systems, are represented by wide array of taxonomic groups. Phytoplankton are producer while Zooplankton occupies an intermediate link between phytoplankton and fish. (Abbasi *et al.*, 1996; Sugunan, 1980).

The zooplankton which play a role of converting phytoplankton into food, suitable for fish and aquatic animals have acquired importance in fishery research. The plankton can also play an important role in indicating the presence or absence of certain species of fishes on in determining the population densities (Rai *et al.*, 2016).

Physical and chemical characteristics of an ecosystem influence species composition and distribution of zooplankton (Vieira *et al.*, 2009). Thus, different group of zooplankton adopt various strategies to cope with the fluctuating extreme environmental conditions. Zooplankton community respond fast to various fluctuating water parameters particularly to temperature, conductivity, pH, alkalinity, and nutrient contents (Seminara *et al.*, 2008).

Materials and Methods:

Location and Place of work:

The research work were conducted in two sites of River Narmada Gwarighat and Khirahnighat, Jabalpur MP.

S. No.	Site/ Location	Place	Coordinates	
			Latitude (⁰ E)	Longitude (⁰ N)
1.	A. Gwarighat	Jabalpur	22°92'480	79°90'290
2.	B. Khirahnighat	Jabalpur	22°94'726	79°96'461

Collection and Preservation of Plankton:

Planktons were collected by using the plankton net of bolting silk No. 25.50 L of water is strained through the plankton net and 5% formalin is added in the sample to settle down the plankton and the precipitate volume is measured after few hours. After that drops of formalin (5-10%) was added and then sample is left undisturbed for 2 days so as to settle the planktons (Sharma, 2000).

Plankton Estimation:

Counting of the individual plankton was done by the following formula where the plankton density was expressed on individuals/litre. Phytoplankton and zooplankton were measured by per unit volume of water, by sedge wick rafter counting cell (Santtanam *et al.* 1989).

$$\text{Plankton / Litre} = \frac{N \times C \times 10}{Y}$$

N = Number of plankton counted in 0.1 ml. Concentrate.

C = Total volume of concentrate in ml.

Y = Total volume of water filtered for sample in litres.

Plankton diversity Calculated as per the Shannon-Wiener equation given by Shannon and Wiener (1949).

Calculation of Shannon's Species Diversity Index (H)

$$H = -S \left(\frac{n_i}{N} \right) \times \log \left(\frac{n_i}{N} \right) \text{ OR } -S \sum P_i \log P_i$$

Where.

H= Shannon index of diversity.

n_i = Number of individuals of each species.

N = Total number of individuals in the sample (i.e., N = $\sum n_i$).

P_i= Importance probability for each species, (i.e., P_i = n_i / N)

Results and Discussion:

Phytoplanktons species collected from Gwarighat of Narmada River, Jabalpur

In this present study, 16 phytoplankton species were recorded, representing Chlorophyceae contributed 08 species, Bacillariophyceae contributed 03 species, Cyanophyceae contributed 04 species and Euglenophyceae also contributed 01 species (Table 1, Fig.1a & 1b).

Result of the present study correlated with other workers. Sharma *et al.*, (2011) recorded several species of phytoplankton belonging to three different orders (Chlorophyceae, Bacillariophyceae, Cyanophyceae) were recorded during the study period. They reported Chlorophyceae is the dominant order of phytoplankton, followed by Cyanophyceae and Bacillariophyceae from four sampling sites Omkareshwar, Mandleshwar, Maheshwar and Barwani of Narmada River.

Phytoplankton species collected from Khirahnighat of Narmada River, Jabalpur

In this present study, 13 phytoplankton species were recorded, representing Chlorophyceae contributed 06 species, Bacillariophyceae contributed 02 species, Cyanophyceae 04 species and Euglenophyceae 01 species (Table 2; Fig.1a & 1b).

Result of the present study correlated with other researchers. Sharma *et al.*, (2015) recorded several species of phytoplankton. A total of 27 taxa of Phytoplankton belonging to four 4 families were found in order of Chlorophyceae (47%) >Cyanophyceae (27%) >Bacillariophyceae (23%) >Euglenophyceae (3%) were recorded Chlorophyceae is the dominant order of phytoplankton from Dongarwada site in Hoshangabad of Narmada River during March 2010 to February 2011.

Zooplankton species collected from Gwarighat of Narmada River, Jabalpur

In the present study at Gwarighat, a total of 09 species of zooplankton was recorded, Cladocera contributed 03 species, Rotifera contributed 02 species, Copepoda contributed 04 species and Ostracoda also contributed 01 species (Table 3; Fig.2a & 2b).

Result of the present study correlated with other workers. Saini *et al.*, (2015) recorded several species of zooplankton. A total of 13 species were found belonging to four different classes, Copepoda, Cladocera, Rotifera and Protozoa. Copepoda and Cladocera is dominate class of Zooplankton from Lamhetaghat and Bhedaghat Narmada River Jabalpur during October 2010 to September 2012.

Zooplankton species collected from Khirahnighat of Narmada River, Jabalpur

In the present study of Khirahnighat, total 07 species of zooplankton were recorded, Cladocera contributed 02 species, Rotifera contributed 02 species, Copepoda contributed 02 species and Ostracoda contributed 01 species (Table 4).

Result of the present study correlated with other workers. Sharma *et al.*, (2010) recorded several species of zooplankton. A total of 39 species were found belonging to four different groups, Copepoda, Cladocera, Rotifera and Protozoa. Rotifera is dominate group of Zooplankton from different sampling sites Omkareshwar, Mandleshwar, Maheshwar and Barwani of Narmada River.

Conclusion: In the present study revealed higher diversity of Phytoplankton and Zooplankton at Gwarighat (site A) as compared to Khirahnighat (site B). Similarly overall shannon wiener diversity index for Phytoplankton and Zooplankton

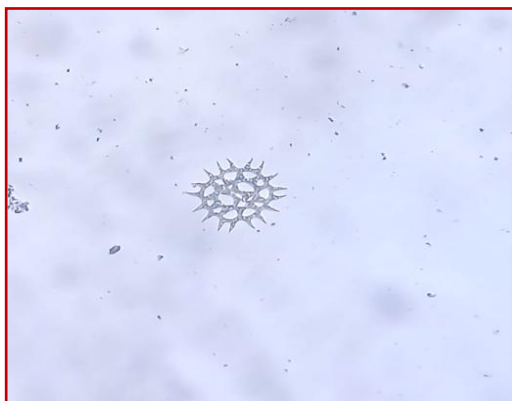
were recorded higher in site A as compared to site B.

References:

- Napit, M. K. (2013) Study of fish fauna of Bundelkhand region with special reference to Damoh District. *International Journal of Advance Research*, 1, 24-30.
- Rai, S., Shukla A. and Ahirwar B.K. (2016) Plankton diversity seasonal variation and population dynamics in river Narmada at Jabalpur region, *Agriculture Science*, 6, 11-16.
- Abbassi, S. A., Arya, D. S., Hameed, A. S. and Abbassi, N. (1996) Water quality of a typical, River of Kerala, Punnurpuzha. *Pollution Research*, 15, 163-166.
- Sugunan, V. V. (1980) Seasonal fluctuation of plankton of Nagarjunasagar Reservoir AP, India. *Journal Inland Fisheries Society India*, 12(1), 79-91.
- Vieira, A. C. B., Ribeiro, L. L., Santos, D. P. N. and Crispim, M. C. (2009) Correlation between the zooplanktonic community and environmental variables in a reservoir from the Northeastern semi-arid. *Acta Limnologica Brasiliensia*, 21(3), 349-358.
- Seminara, M., Vagaggini, D. and Margaritora, F. G. (2008) Differential responses of zooplankton assemblages to environmental variation in temporary and permanent ponds. *Aquatic Ecology*, 42, 129-140.
- Sharma, A. P. (2000) Manual of fishery limnology. G. B. Pant University of Agriculture and Technology, Pantnagar, 115.
- Santhanam, R., Velayutham, P. and Jegatheesan, G. (1989) A manual of freshwater ecology Delhi, India. Daya Publication House, 1-109.
- Shannon, C. D. and Weaver, W. (1949) The mathematical theory of communication. University of Illinois Press, Urbana.
- Sharma, S., Singh, K., Prajapati, R., Solnki, C. M., Sharma, D., Sengupta, T. and Vyas, A. (2011) Diversity and seasonal abundance of phytoplankton of River Narmada MP India. *World Rural Observations*, 3(2), 14-28.
- Sharma, J., Parashar, A., Bagare, P. and Qayoom, I. (2015) Phytoplanktonic diversity and its relation to physicochemical parameters of water at dogarwadaghat of River Narmada. *Current World Environment*, 10(1), 206.
- Saini, D., Dube, K. K., Shrivastava, S. B. and Pandey, A. K. (2015). Seasonal and diet variations in plankton production in relation to physicochemical parameters and its impact on fisheries in river Narmada from Lamhetaghat to Bhedaghat near Jabalpur MP. *Journal Experimental Zoology India*, 18, 951-960.
- Sharma, S., Siddique, A., Singh, K., Chouhan, M., Vyas, A., Solnki, C. M. and Sengupta, T. (2010) Population dynamics and seasonal abundance of zooplankton community in Narmada River (India). *Researcher*, 2(9), 1-9.



Chlorella sp.



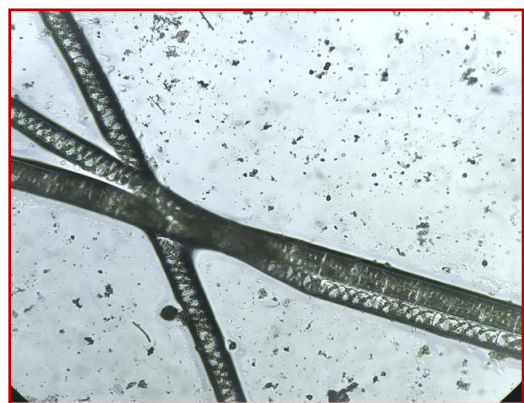
Pediastrum sp.



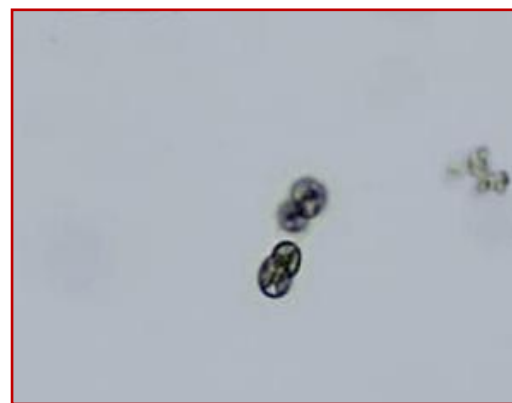
Eudorina sp.



Microspora sp.

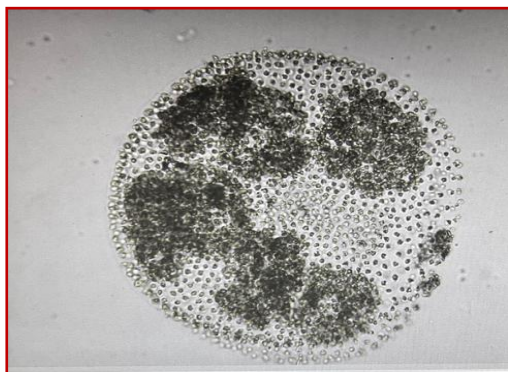


Spirogyra sp.



Cosmarium sp.

Figure 1a: Phytoplankton species of Gwarighat and Khirahni ghat, Narmada River Jabalpur



Volvox sp.



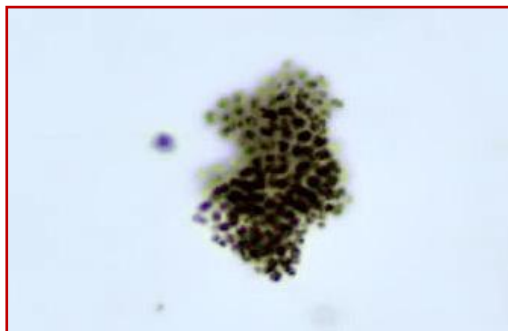
Zygnema sp.



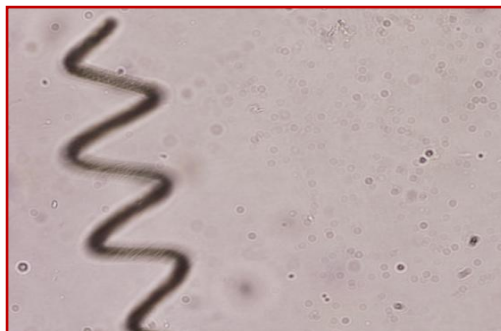
Nitzschia sp.



Diatoma sp.



Microcystis sp.



Spirulina sp.



Euglena sp.

Figure 1b: Phytoplankton species of Gwarighat and Khirahni ghat, Narmada River Jabalpur



Daphnia sp.



Keratella sp.



Cyclops sp.



Mesocyclops sp.

Figure 2a: Zooplankton species of Gwarighat and Khirahni ghat, Narmada River Jabalpur



Leydigia sp.



Branchionus sp.



Moina sp.



Pseudodiaptomus sp.

Figure 2b: Zooplankton species of Gwarighat and Khirahni ghat, Narmada River Jabalpur

Table 01: Month wise variation in population density of Phytoplankton (N/litre) of Gwarighat during study period

S.No.	Phytoplankton	Months												Total
A	Chlorophyceae	July		August		September		October		November		December		
		15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	
1	Chlorella sp.	16	15	26	14	19	29	42	35	28	33	34	22	313
2	Cosmarium sp.	07	00	16	24	17	21	18	22	34	26	14	17	216
3	Eudorina sp.	00	19	21	17	18	26	20	23	14	17	23	21	219
4	Microspora sp.	12	10	14	17	23	44	29	13	27	55	29	40	313
5	Pediastrum Simplex	05	13	13	20	17	25	24	32	29	36	28	27	269
6	Spirogyra sp.	13	12	22	29	32	28	33	27	34	26	42	47	345
7	Volvox sp.	15	13	25	29	36	47	27	31	38	42	35	45	383
8	Zygnema sp.	07	05	08	17	15	26	21	18	08	14	09	18	166

B	<i>Bacillariophyceae</i>													
9	<i>Diatoma sp.</i>	03	00	06	25	19	08	33	15	21	34	28	09	201
10	<i>Microcystis sp.</i>	02	08	08	15	17	28	31	32	27	46	34	30	278
11	<i>Nitzschia sp.</i>	06	05	03	03	17	12	09	14	03	12	16	13	113
C	<i>Cyanophyceae</i>													
12	<i>Anabaena sp.</i>	03	24	04	23	31	09	13	23	34	05	39	44	252
13	<i>Nostoc sp.</i>	01	00	12	22	10	14	26	12	20	16	24	20	177
14	<i>Oscillatoria sp.</i>	00	02	05	03	08	28	23	25	37	26	19	21	197
15	<i>Spirulina sp.</i>	02	03	17	28	31	28	29	26	19	18	24	39	264
D	<i>Euglenophyceae</i>													

16	<i>Euglena sp.</i>	00	05	00	13	13	10	19	35	26	34	29	46	230
	Total phytoplankton count per litre	92	134	200	299	323	383	397	383	399	440	427	459	3936
	Total average phytoplankton count per liter	113		249.5		353		390		419.5		443		

Table 02: Month wise variation in population density of Phytoplanktons (N/litre) of Khirahni ghat during study period

S.No	Phytoplankton	Months												Total
A	Chlorophyceae	July		August		September		October		November		December		
		15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	
1	<i>Chlorella sp.</i>	06	15	16	14	09	15	22	25	18	23	24	22	209
2	<i>Cosmarium sp.</i>	07	00	16	14	07	11	18	22	34	26	14	17	186
3	<i>Eudorina sp.</i>	00	09	11	17	18	26	20	23	14	17	23	21	199
4	<i>Microspora sp.</i>	12	10	14	17	21	24	19	16	22	23	19	24	221
5	<i>Spirogyra sp.</i>	05	13	09	13	17	20	24	32	29	36	28	17	243
6	<i>Volvox sp.</i>	13	12	22	19	32	18	23	27	34	26	22	28	276
B	Bacillariophyceae													
7	<i>Fragilaria sp.</i>	07	05	08	17	15	26	21	18	08	14	09	18	166
8	<i>Microcystis sp.</i>	15	13	25	29	36	47	27	31	38	40	25	35	361
C	Cyanophyceae													
9	<i>Anabaena sp.</i>	02	08	08	15	17	28	21	18	21	26	29	20	213
10	<i>Diatoma sp.</i>	06	05	03	03	17	12	09	14	03	12	16	23	123
11	<i>Oscillatoria sp.</i>	03	00	06	15	09	08	33	15	21	34	28	09	181
12	<i>Spirulina sp.</i>	03	24	04	23	31	09	13	23	34	05	39	24	232

E	Euglenophyceae													
13	<i>Euglena sp.</i>	01	00	14	24	10	14	23	22	20	26	24	17	195
	Total plankton count per litre	80	114	156	220	239	258	273	286	296	308	300	275	2805
	Total average phytoplankton count per liter	97	188	248.5	279.5	302	287.5							

Table 03: Month wise variation in population density of Zooplanktons (N/litre) of Gwarighat during study period

S.No	Zooplankton	Months												Total	
A	Cladocera	July	August				September		October		November		December		
		15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th		
1	<i>Daphnia sp.</i>	13	12	22	20	17	21	43	29	36	31	39	28	311	
2	<i>Leydigia sp.</i>	00	09	11	23	24	28	20	35	40	37	24	46	297	
3	<i>Moina sp.</i>	12	14	13	19	22	29	31	29	44	34	42	37	326	
B	Rotifera														
4	<i>Brachionus sp.</i>	04	04	17	10	26	16	30	37	25	23	39	44	275	
5	<i>Keratella sp.</i>	18	09	13	18	15	27	25	33	43	35	28	34	298	
C	Copepoda														
6	<i>Calanoid sp.</i>	15	14	22	18	27	31	35	26	33	42	31	34	328	
7	<i>Cyclops sp.</i>	12	15	14	25	03	46	37	29	44	39	41	33	338	
8	<i>Mesocyclops sp.</i>	09	14	07	18	19	24	22	42	31	35	53	49	323	
9	<i>Pseudodiaptomus sp.</i>	00	11	08	19	17	25	27	24	35	28	31	29	254	
D	Ostracoda														

10	Cypris sp.	16	09	15	23	26	23	38	36	27	26	38	47	324
	Total Zooplankton count per litre	99	111	142	193	196	270	308	320	358	330	366	381	3074
	Total Average Zooplankton count per liter	105	167.5			233		314		344		373.5		

Table 4: Month wise variation in population density of Zooplanktons (N/litre) of Khirahni ghat during study period

S.No	Zooplankton	Months												Total
A	Cladocera	July		August		September		October		November		December		
		15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	15 th	30 th	
1	<i>Daphnia sp.</i>	12	14	23	15	24	27	35	46	23	20	29	23	291
2	<i>Moina sp.</i>	04	09	08	14	17	26	16	23	41	34	32	29	253
B	Rotifera													
3	<i>Brachionus sp.</i>	00	06	12	17	21	24	25	21	32	27	29	39	253
4	<i>Keratella sp.</i>	01	08	09	25	19	40	25	39	22	28	33	41	290
C	Copepoda													
5	<i>Cyclops sp.</i>	12	16	18	23	11	15	13	20	38	26	19	17	228
6	<i>Mesocyclops sp.</i>	13	19	23	27	32	25	29	37	28	19	26	31	309
D	Ostracoda													
7	<i>Cypris sp.</i>	09	10	21	14	24	38	19	26	37	22	23	20	263
	Total Zooplankton count per litre	51	82	114	135	148	195	162	212	221	176	191	200	1887
	Total Average Zooplankton count per liter	66.5		124.5		171.5		187		198.5		195.5		