

A Review of Alarming Biodiversity of Zooplankton in River Sone in Bhojpur Region of Bihar (India)

Sunita Kumari Sharma

Department of Zoology
Maharaja College, Arah-802301 (India)
Email- sunitasharmavksu@gmail.com, aniketsonu36@gmail.com

Abstract

Among Lotic systems rivers are found to be one of the important niche of plankton diversity. Plankton constitute most basic trophic level *i.e.* producers and microconsumers in the freshwater aquatic bodies. In the present study an assessment of Zooplankton has been carried out in river Sone in Bhojpur region of Bihar at five different sampling stations in a stretch of about 30 kms. The study revealed the presence of 11 species of Rotifers including two families and five genera, seven species of Cladocera including five families and six genera, five species of copepod including three families and five genera and three species belonging to ostracods. Although their numbers varied in different seasons, depending upon a number of variables including rainfall and abundance of nutrients¹¹. Their Biodiversity Indices have also been calculated.

Zooplanktons are a type of heteromorphic planktons that range from microscopic to large species. They are non motile and weak swimmers, suspended in fresh & ocean waters. Usually they move in sunlight zone where food resources are abundant. They have been reported to be very good bio indicators for free water bodies. Zooplanktons play important role in food web by linking the primary producers (by consuming phytoplankton, mainly various bacterioplankton and sometimes zooplanktons) and higher trophic levels. The freshwater zooplanktons comprise of-

- Protozoa
- Rotifers
- Cladocerans

- Copepods
- Ostracods

Most of the protozoans are usually not sampled due to their minute size. Heterotrophic nanoflagellates (about 1.0 -20µm in size) are more abundant (10^5 - 10^8 L⁻¹ in highly eutrophic zone of this river), Ciliates (8-300 µm in size) in fresh water body. Only 10^2 - 10^4 L⁻¹ Ciliates are found in fresh water ecosystem. Quantitative analysis and evaluations were carried out according to Edmondson⁶ and Telesh¹⁹.

Rotifers :

Rotifers are the most important soft-

bodied metazoans (invertebrates) having a very short life cycle among the plankton. Only 100 widely spread rotifer species are planktonic and their life cycles are influenced by temperature, food and photoperiod. Dhanapathi⁵ found that they increase in large quantity rapidly under favorable environmental conditions.

Cladocerans:

Cladocerans are a crucial group among zooplankton and form the most useful and nutritive group of crustaceans for higher members of fishes in the food chain. This group feeds on smaller zooplankton, bacterioplankton and algae.

Copepods:

Copepods have the **toughest exoskeleton** and the longest and the **strongest appendages** which help them to swim faster than any other zooplankton. Feeding habits differ in three orders of copepods.

1. Cyclopoid copepods are commonly **carnivorous** (live on other zooplankton and fish larvae) though they also feed on algae, bacteria and detritus.
2. Calanoid copepods are generally **omnivorous** (feed on ciliates, rotifers, algae, bacteria and detritus) however their food intake is dependent on their age, sex, season and food availability.
3. Harpacticoid copepods are **primarily benthic**.

Ostracods:

Ostracods are mainly **bottom dwellers**

of river and live on detritus and dead phytoplankton. These organisms are food of fish and benthic macro invertebrates. Growth and distribution of zooplankton are dependent on:

Abiotic Parameters	Biotic Parameters
➤ Temperature	➤ food limitation
➤ Salinity	➤ Predation
➤ Stratification	➤ Competition
➤ Pollutants	
➤ Ph	
➤ Transparency	
➤ Dissolved oxygen	
➤ Some micronutrients	

Sample collection was carried out from January 2019 to June 2019 monthwise at five sampling stations namely Babura(S1), Koelwar(S2), Bahiara(S3), Sandesh(S4) and Sahar(S5). Zooplankton samples were collected by filtering 50 liters of the river water through standard plankton nylon net with mesh size 55µm. The concentration samples were preserved in 4% formalin solution soon after collection. Identification was carried out by using standard methods. Six indices were used to estimate zooplankton diversity and species richness.

- ❖ Species diversity index was calculated based on Simpson¹⁹ and Shannon-Weiner¹⁸
- ❖ Species richness index was adopted by Margalef⁹ and Menhinick¹¹
- ❖ Equitability index by Magurran¹²
- ❖ Dominance index or Simpson's index of diversity of diversity was calculated using formula 1- Simpson index.

In investigation 11 species of Rotifers including 2 families and 5 genera, 7 species of cladocera including 5 families and 6 genera, 5 species of copepoda including 3 families and 5 genera and 3 species belonging to Ostracoda were noted.

Some of the crustacean population reported were *Daphnia*, *Cyclops*, *Nauplius*, *Mesocyclops* etc. only one species of hymansomatid crustacean *Neorthynchplex patnahi*, which is near to Maner reported by Ng. *et al.*,¹⁴ in river Ganges near Patna.

It has been found that composition of zooplankton community is strongly effected by change in physicochemical parameters of water which depends on change in season.

- The density of rotifers was maximum in February (31%) and minimum at summer in May (20.21%).
- Cladoceran density maximum during winter (45.83%) and minimum during the premonsoon in June (31.63%).
- Copepods showed their maximum density

during summer (26.95%) and minimum density (16.66%) during winter.

- Ostracods showed their maximum density during summer and minimum during winter (7.5%).

The values for biodiversity indices that is Simpson index, Dominance index, Shannon-weiner index, Menhinik index and Equitability index¹⁰ are represented in the Table-1. Shannon-weiner index values are in the range of 4.51 to 4.61 and Margalef richness index⁹ values are in the range of 4.25 to 4.62 confirms the mesotrophic status of this river. Simpson index¹⁹ values as low as 0.040 and maximum 0.045 while Dominance index is high as 0.95 are good indicators of rich diversity of species in this river. From the equitability index (0.95 to 0.98) it is evident that distribution of zooplankton species during the study was even and follows the Lorenz graph. Evenness, is therefore, best used as a baseline value to which future studies can be can be much more possible. No major fluctuation was found in the equitability index during entire study period.

Zooplankton species identified in Sone River:

Rotifera	cladocera	copepoda	Ostracoda
Family: Brachionidae	Family: Sidae	Family: Diaptomidae	<i>Cypris subglobosa</i>
<i>Brachiounus bidentata</i>	<i>Diphanosoma</i>	<i>Diaptomus</i>	<i>Stenocypris</i>
<i>B. ureceolaris</i>	Family: Daphnidae	<i>Heliodiaptomus viddus</i>	<i>Eucypris</i>
<i>B. forficula</i>	<i>Ceriodaphnia</i>	Family: Cyclopidae	
<i>B. calyciflorus</i>	<i>reticulata</i>	<i>Cyclops leuckartii</i>	
<i>B. quadidentatus</i>	Family: Moinidae	<i>Mesocydops hyalinus</i>	
<i>Keratella tropica</i>	<i>Moina micrura</i>	Family: Canthocamptidae	
<i>Keratella vulga</i>	Family: Bosminidae	<i>Nauplii</i>	
<i>Lecane arculata</i>	<i>Bosmina longirostris</i>		
<i>Filinia longiseta</i>	<i>Bosmina coregoni</i>		
Family: Asplanchnidae	Family: Chydoridae		
<i>Asplanchna prodonta</i>	<i>Alone rectangula</i>		

Spatial variation of Zooplanktons abundance has been noted in the study which might be due to varied salinity and nutrients¹³. Similar Zooplankton diversity was reported by Altaff² in his manual of Zooplanktons.

Dominance of Rotifers at all three sampling sites indicates the semipolluted health status of this river in this area.³ The species composition of Zooplanktons with identical composition has also been reported by Ferdous and Muktedir⁷. Seasonal fluctuation in the movement and abundance of zooplanktons has been reported by Sadguru *et al.*¹⁷ and also by

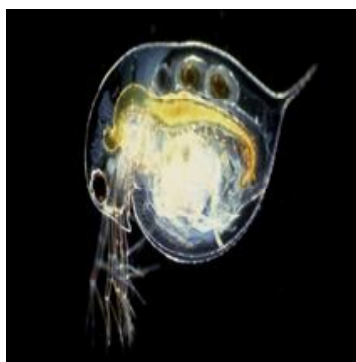
Prakash and Srivastava¹⁵.

So it can be interpreted that zooplankton population of this river in Bhojpur region is represented by about 21 species and their population is highly sensitive to changes in physico-chemical parameters of the river.

So they are good bio-indicators, reflecting the health and pollution status of the river. The correlation of various diversity indices and dominance of rotifers indicate semi-polluted state of river Sone in this area.

Some of the reported Zooplankton species:

Daphnia



Cyclops



Nauplius



Table-1. Zooplankton community structure and alpha-biodiversity indices of Sone river in Bhojpur Area From January-19 to June-19.

Mont	Simpson index	Dominance index	Shanon-Weiner index	Margalef Richness index	Menhinic index	Equitability index
Jan	0.44	0.95	4.51	4.56	1.67	0.96
Feb	0.041	0.95	4.75	4.62	1.74	0.97
Mar	0.043	0.95	4.55	4.40	1.52	0.96
Apr	0.043	0.95	4.55	4.37	1.49	0.96
May	0.045	0.95	4.49	4.43	1.54	0.95
Jun	0.040	0.95	4.61	4.25	1.38	0.98

Table-2. Correlation matrix of the physico-chemical variables of Sone river of Bhojpur Area from Januray-19 to June-19.

r	Temp	pH	Trans	Cond	DO	Hardness	BOD	COD	Rotifera	Cladocera	Copepoda	Ostracoda	Density of Org
Temp	1												
pH	0.905	1											
Transparency	-0.498	-0.728	1										
Conductivity	0.626	0.343	0.335	1									
DO	-0.099	0.272	-0.723	-0.733	1								
Hardness	0.963	0.814	-0.306	0.793	-0.283	1							
BOD	0.915	0.753	-0.423	0.655	-0.258	0.937	1						
COD	0.873	0.888	-0.625	0.48	0.087	0.873	0.902	1					
Rotifera	-0.209	0.172	-0.419	-0.484	0.821	-0.255	-0.306	0.125	1				
Cladocera	-0.826	-0.867	0.523	-0.539	-0.078	-0.859	-0.828	-0.975	-0.228	1			
Copepoda	0.805	0.614	-0.287	0.566	-0.428	0.774	0.834	0.62	-0.624	-0.509	1		
Ostracoda	0.527	0.406	0.06	0.754	-0.263	0.7	0.6	0.651	0.105	-0.748	0.164	1	
Density of Org.	0.882	0.771	-0.53	0.544	-0.039	0.891	0.948	0.925	-0.085	-0.863	0.638	0.685	1

The values (r) ranging from 0.576 and above, 0.708 and above are significant at $P \leq 0.05$ (2-tailed) and $P \leq 0.01$ (2-tailed), respectively.

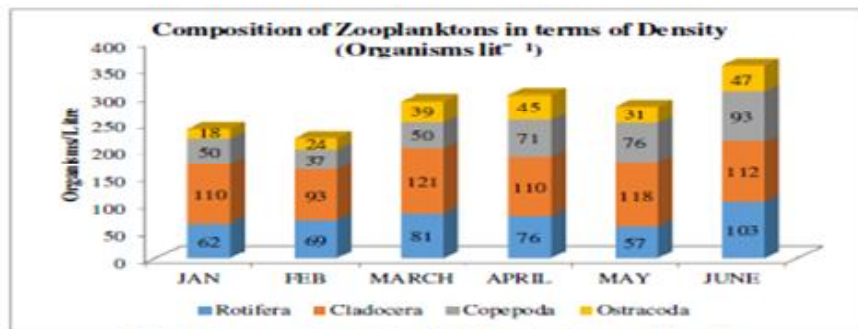


Fig. 1. Composition of Zooplanktons in terms of density.

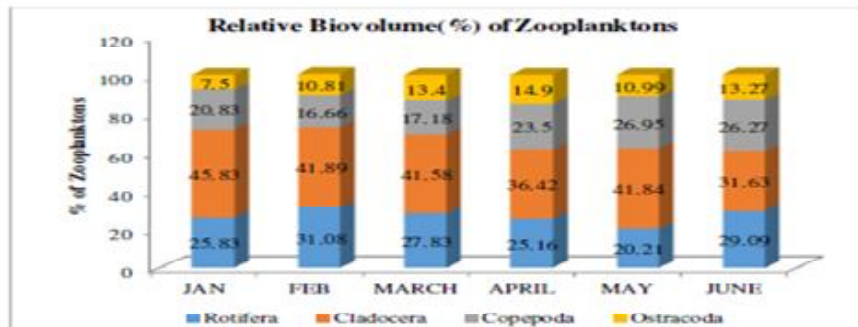


Fig. 2. Relative biovolume (%) of Zooplanktons

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