

Study of Zooplankton Abundance and Species Diversity in Shahjangi Pond of Bhagalpur, Bihar (India)

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ABSTRACT

The present study was conducted in Shahjangi Pond of Bhagalpur District of Bihar during April 2021 to March 2022. Zooplanktonic abundance and diversity were determined by using standard method. The principal aim of this study was to study more about the swamp's overall zooplankton diversity. Water samples were collected using zooplankton net and preserved with formalin (aqueous solution of formaldehyde) and 5% neutral buffer (10 ml) on the spot, then brought to the laboratory for further analysis. Totally 21 species of zooplankton of four different classes were recorded (rotifer, cladocera, copepod and ostracoda) in which Rotifera was the most dominant class followed by the cladocera, copepoda and ostracoda. From total 21 genera 10 were belongs to Rotifera, 6 from cladocera, 3 from copepoda and 2 from ostracoda. Shannon - Weaver index were employed to analysis the species diversity.

KEYWORDS: Rotifera, Cladocera, Shannon – Weaver index, Pond, Zooplankton

INTRODUCTION

Small wetlands like pond, river, lake, swamp, etc. support the lives of millions of living organisms, either directly or indirectly. On the banks of great rivers, human civilization began. However, most wetlands have already deteriorated and will continue to worsen as a result of growing population and anthropogenic stresses (Brraich and Saini, 2015). Freshwater bodies contribute directly to the advancement of human civilization. The quality of freshwater resources is decreasing at an alarming rate, and it has now become a global issue (Tiwari and Ali, 1987; Tiwari and Mishra, 1986; Reddy and Venkateswar, 1987 and Khulab, 1989). Plankton are extremely sensitive to changes in the environment, and they react swiftly to changes that affect plankton communities in terms of tolerance, abundance, diversity, and dominance in the habitat ((Mathivanan and Jayakumar, 1995).

Zooplanktons are the most important trophic link in the food chain, and as heterotrophic organisms, they play an important part in the organic material cycling

in aquatic ecosystems (Patra et al.). Furthermore, their diversity has gained prominence in recent years as a result of particular species' ability to detect degradation in water quality owing to pollution or eutrophication. When pollution affects the food chain, monitoring zooplankton as biological indicators could provide as a forewarning (Mahajan 1981). The chemical and physical qualities of water influence the species composition, distribution, and quantity of zooplankton in any body of water. Baruah et al. (1993), Alfred and Thapa (1996), Salaskar and Yeragi (2003). investigated the relationship between lake trophic state and zooplankton grazing capability.

In temperate freshwaters, there are many studies on seasonal variation of zooplankton, but there is little literature on freshwater zooplankton in India. Few works have been done on zooplankton population abundance in different types of wetlands (Sinha et al. 1994; Das 2002; Khan 2003; and Nandi and Das 2003). Earlier extensive limnological studies in Bhagalpur on freshwater ponds were reported with

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respective of (Nasar,1977), (Nasar and Dutta-Munshi, 1974; Sinha and Sinha, 1983). Hence, the aim of present study is to assess the zooplankton community species diversity index of Shajangi pond of Bhagalpur Bihar.

Materials and Methods

Study Area

The Zooplankton biodiversity in the Shajganga Pond of Bhagalpur district was studied season wise on monthly basis for one year April 2021- March 2022.

Collection and Preservation of Sample

For a period of twelve months (one year), plankton and water samples were taken from different locations of the pond. Samples were taken on a monthly basis i.e. first week of every month (6.00 A.M to 8.00 A.M). To gather zooplankton, 100 litres of water was filtered through a plankton net composed of bolting silk (150 m) for quantitative analysis. The plankton samples were transferred to polyethylene vials (90 ml) and preserved with formalin (aqueous solution of formaldehyde) and 5% neutral buffer (10 ml). The freshwater zooplankton species were examined under a microscope and identified using standard methods (Edmondson, 1959, Battissh, 1992, Murgan 1998 & Altaf 2004). The drop method was used to count the plankton. Formula $N = n \times v / V$ was used to compute the total number of Plankton present in one litre of water sample (Santhanam et al.). Where N = Total no of Plankton per litre of water filtered; n = Average number of plankton in 1 ml sample, sample; v = Volume of plankton concentrated (ml) and = Volume of total water filtered (liter).

Calculation of Plankton Diversity Index

The most widely used index for estimating the species diversity is Shannon - Weaver index (Shannon and Weaver, 1949) given by formula

$$H' = - \sum (n_i / N) \log_2 (n_i / N), \text{ where}$$

H' = Shannon – Weaver index

n_i = Importance value of each species (number of individuals)

N = Total of importance value

Results and Discussion

The density of zooplankton was observed between 356-1335 Unit/L, the maximum during June to August. The rotifer population fluctuated between 102 to 524 unit/l with the highest numbers between April 2021 to December. Similarly, Cladocera populations range from 101 to 655 unit/l, while Copepoda populations range from 72 to 203percent (Tab - 4), indicating that Cladocera are numerically more abundant than other zooplankton families in this pond. In the summer season (April-June), the no of rotifer-cladocera, populations became very closer, with a range of 255-655 unit/l. In November and December, rotifera, cladocera, and ostracoda populations showed similar trends i.e. decreasing population.

Rotifera occupied maximum 41.08% of the plankton population Cladocera was represented by 6 species occupied second maximum 37.52% of the plankton population. Ostracoda occupied minimum 7% of the plankton population with 2 genera.

The Shannon's diversity index (H) of Rotifera, Cladocera, Copepoda and Ostracoda were 2.38, 2.35, 2.41 and 2.44 respectively whereas species evenness were 0.96, 0.94, 0.96 and 0.98 respectively.

Sl. No.	Group/Class	Species	Total Number
1	Rotifera	Brachionusbidentata	4265
		Brachionuscalyciflorus	
		Brachionuscaudatuspersonatus	
		Keratellacochelearis	
		Keratellatropica	
		Asplanchnaintermmedia	
		Filinialongiseta	
		Lecanecurvicornis	
		L. donneri	
		Testudinellamucronata	
2	Cladocera	Alonaquadrangularis	3896
		Daphnia carinata	
		Ceriodaphniacornuta	
		Ceriodaphniareticulata	
		Moinbrachiataa	
		Moina flagellate	

3	Copepoda	Neodiaptomusschmakeri	1440
		Mesocyclopsaspericornis	
		Eucyclopsspp	
4	Ostracoda	Cyprisprotubera	727
		Cyprinotusnudus	

Table 1: List of Zooplankton species and its abundance in temporary water habitat

Classes→ Month ↓	Rotifera	Cladocera	Copepoda	Ostracoda	Total	
	n/l	n/l	n/l	n/l	n/l	%
April 2021	325	252	203	98	878	8.45
May	476	254	200	79	1009	9.71
June	524	472	158	66	1220	11.75
July	502	655	109	69	1335	12.85
August	501	595	72	51	1219	11.74
September	456	442	69	49	1016	9.78
October	365	298	90	41	749	7.21
November	318	182	117	68	685	6.56
December	352	178	52	77	659	6.34
January 2022	112	101	97	46	356	3.42
February	102	221	115	42	480	4.62
March	232	246	158	41	677	6.52
Total	4265 (41.08%)	3896 (37.52%)	1440 (13.87%)	727 (7%)		

Table 2: Month wise list of abundance of Zooplankton species (unit per litre) in SHAHJANGI pond of Bhagalpur, Bihar.

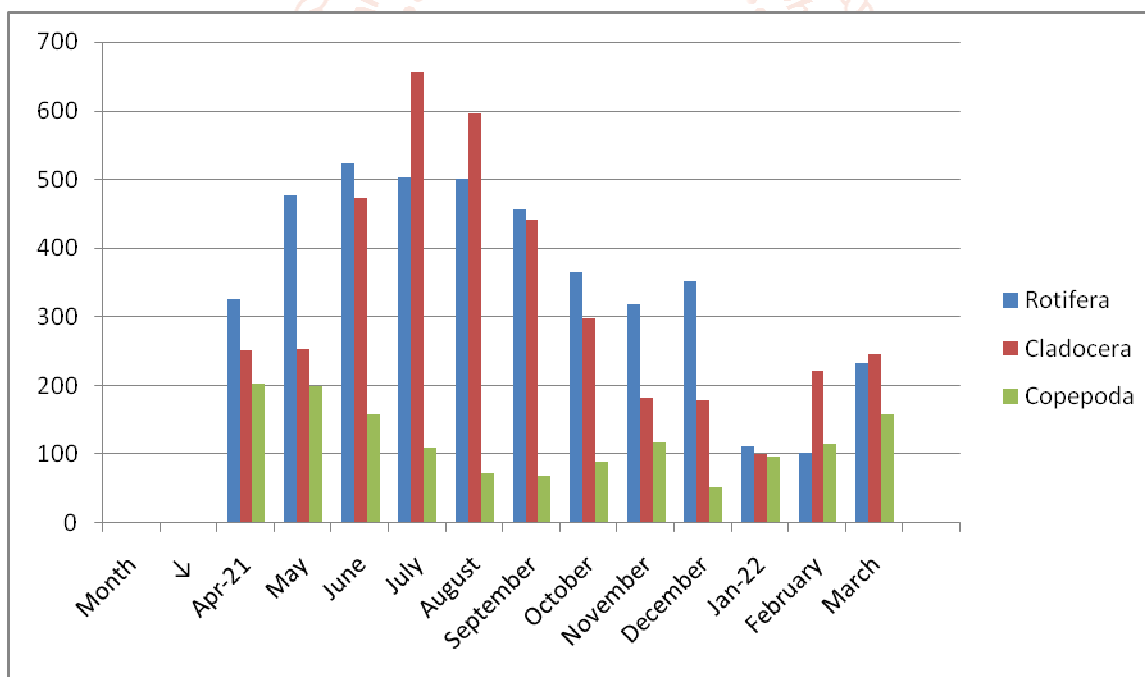


Fig 1: Graphical Representation of Month wise No of abundance of Zooplankton species (unit per litre) in SHAHJANGI pond of Bhagalpur, Bihar.

INDICES	Rotifera	Cladocera	Copepoda	Ostracoda
Shannon's diversity index(H)	2.38	2.35	2.41	2.44
Species Evenness	0.96	0.94	0.96	0.98

Table 3: Table Shows Shannon's diversity index (H) and species evenness of Zooplanktons of SHAHJANGI pond of Bhagalpur, Bihar.

Zooplankton is important not just for converting plant food to animal food, but also as a food supply for higher creatures, particularly in the freshwater

ecosystem. The availability and adaptability of zooplanktons in a wetland are influenced by the external circumstances. The density of zooplankton in

a wetland is mostly influenced by temperature, light, and pH, all of which have a strong relationship (Karuthapandi et al., 2012).

Among all four categories (Rotifera, Cladocera, Copepoda and Ostracoda) of zooplankton community rotifer had higher species abundance which is similar to the study of Karuthapandi et al., 2012. The no of rotifers were maximum in summer and monsoon (July- September) season. Shivakumar and Altaff, 2004, Manickam et al. 2012 and Manickam, 2014 were identified 13 species of rotifera with maximum population during summer and minimum population during monsoon in a perennial freshwater lake and reservoir of Dharmapuri District Tamil Nadu, India. Cladocera, which includes water fleas, can be found in practically all freshwater habitats. These are a crucial link in the aquatic food chain, as they provide a nutritious diet for both young and adult fishes, as well as prawn larvae. There are over 600 species of freshwater cladocerans known to exist in the world (Korovhinsky, 1996). In this study, the cladocera population was placed second (3896) in terms of number of individuals. In the earlier study, summer has the highest population of cladocera, which can be attributed to the favorable temperature and availability of favorable food such as bacteria, nanoplankton, and suspended detritus, whereas in the monsoon, factors such as water temperature, dissolved oxygen, turbidity, and transparency play an important role in controlling cladocera diversity and density (Edmondson, 1996).

Copepoda are a crucial facet of the aquatic food web. They are in intermediate trophic level among bacteria, algae and protozoa on one hand and small and large plankton predators on the other (Manickam et al. 2015). In the present study 3 species of copepod were identified in Shahjangi pond of Bhagalpur, Bihar, India. In this study, the copepoda population was placed third (1440) in terms of number of individuals and its numbers were maximum during summer (158-203 unit /l) season. Karmaker 2021 studied that during the summer, rising temperature led to increased water evaporation, which was followed by rich nutrients and an increased level of zooplankton abundance in the lake, however zooplankton abundance fell during the monsoon owing to pond dilution caused by rains.

Ostracoda is commonly known as 'mussel shrimp' or 'seed shrimps' are small crustacean. They can be found in a range of aquatic habitats, including lakes, pools, streams, and notably shallow areas with a lot of weeds or algae (Manickam et al. 2015). In the present study 2 species of ostracoda were identified and its population was also recorded maximum during

summer. The high degree of positive association between temperature and plankton density, the current study demonstrates that water temperature can favourably encourage zooplankton population diversity.

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