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Study on the zooplankton diversity of Hasanpur Barahi, Swamp, Madhepura

Saurav Kumar & Arun Kumar*

University Department of Zoology, B.N.Mandal University, Madhepura, Bihar, India

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Abstract- The Swamp of Hasanpur Barahi, Madhepura district in the state of Bihar is where the current work was done in 2022. It is known that planktonic organisms can interact with a variety of water contaminants. According to data analysis, the months of October 2022 during the observation period had the highest monthly abundance of zooplankton. Copepods were the most prevalent group of zooplankton. When rotifers populations are high in a given month, it means that untreated residential sewage from the catchment region has entered directly and contaminated the organic matter. Since May 2022 was when the greatest and minimum diversity (D) was discovered, it is clear that the community in this area is generally stable. According to the current study, the winter population maxima of copepods can be related to favourable temperature and the abundance of food, including bacteria, nano-plankton, and suspended detritus.

Key words: Hasanpur Barahi Swamp, zooplankton, population maxima

INTRODUCTION

A wide group of microscopic organisms known as plankton drift in aquatic settings, primarily in lakes and oceans. These species are essential to aquatic environments and are at the base of the marine food chain. Phytoplankton and zooplankton are the two main kinds of plankton that can be roughly categorised.

Phytoplanktons are microscopic, photosynthetic creatures that are primarily made up of different kinds of bacteria and algae. Photosynthesis, which results in the production of oxygen and organic matter, is carried out by phytoplankton using sunlight and nutrients like nitrogen and phosphorus. They act as the main food sources for many marine creatures and are the principal producers in aquatic habitats. Zooplankton is a term used to describe small, drifting organisms such microscopic crustaceans,

fish larvae, and other tiny invertebrates. They consume phytoplankton or other zooplankton and are either herbivores or carnivores. Zooplankton are a crucial link in the food chain that transfers energy from primary producers (phytoplankton) to larger marine creatures and fish at higher trophic levels.

Ocean currents and water currents, which can carry planktonic creatures' great distances, are in charge of them. Seasonal variations in their number and make-up, as well as changes in the availability of nutrients and temperature, can affect both. Monitoring plankton populations is essential for comprehending the dynamics and health of aquatic ecosystems. Plankton populations can also act as markers of climatic and environmental change.

The responses of various plankton species to seasonal variations in the physical and chemical properties of water, as well as their frequency and timing of occurrence, vary. Every organism in a water body, whether it be a plant or an

*Corresponding author :

Phone : 9006991000

E-mail : prf.arunkumar@gmail.com

animal, tiny or large, plays a crucial part in the flow of energy in the system, and as a result, the current study will be lacking without having a thorough understanding of primary producers. Consequently, an effort was conducted to assess the plankton of Hasanpur Barahi Swamp.

MATERIALS & METHODS

Study Area- The Hasanpur Barahi Swamp being looked into is an elderly Swamp. The Swamp receives water during floods and is closed off after the wet season, providing flood control that can be used for home and agricultural needs. Fish culture is currently not being fully utilised in Swamp. However, it has the potential to generate revenue and employment for the region through fish farming.(Fig 1)



Fig. 1. Hasanpur Barahi Swamp, Madhepura

During the year 2022, samples of plankton were gathered from two stations in the Hasanpur Barahi Swamp at monthly intervals using a plankton net made of ordinary bolting silk cloth. Plankton analysis, both quantitative and

qualitative, was performed on the material. Then, quantitative estimates were made. Samples were collected from 0.5 m depth by 1l plastic bottle. Samples were fixed using lugo's solution.

Qualitative analysis was done by Needham and Needham (1963)¹ & APHA (2005)². Quantitative analysis was done by counting in Sedwick-Rafter (S-R) counting chamber as described in APHA (2005)². Expressed by zooplankton unit per litter.

RESULT & DISCUSSION

Bihar's freshwater ecology is home to an abundance of plankton. The quantity and quality of other higher organisms that belong to various trophic levels of the water body's food chain are determined by the quality and quantity of planktons. As a result, plankton is crucial to the systems' energy flow. An essential part of the ecosystem, phytoplankton adapts to changes in the environment quickly. This is because the plankton is crucial to the movement of organic materials and energy throughout the ecosystem.³

Zooplankton

There were Seven different zooplankton species identified, and three of those species *Cyclops* sp., *Mesocyclops* sp., and *Diaptomes* sp., were copepods. Cladocera included the genera *Daphnia* and *Ceriodaphnia* sp.. *Keratella* sp. and *Bmchiones* sp. belonged to the Monogononta.

During the time of observations, among the Monogononta zooplankton, *Keratella* sp. and *Bmchiones* sp. consistently showed up in all months. Among the Copepod, *Cyclops* sp. and *Mesocyclops* sp. consistently

Table1. Puopulation of zooplankton (unit per litre) during the study year 2022

Genus/ Months	Copepods			Cladocera		Monogononta	
	<i>Cyclops</i>	<i>Mesocyclops</i>	<i>Diaptomes</i>	<i>Daphnia</i>	<i>Ceriodaphnia</i>	<i>Keratella</i>	<i>Bmchiones</i>
January	96	30	200	99	76	51	48
February	125	58	126	85	8	89	58
March	89	69	156	56	79	50	122
April	56	45	89	46	100	52	45
May	199	82	49	89	126	175	199
June	134	65	85	0	89	188	58
July	89	56	0	49	15	40	69
August	56	122	59	76	102	45	84
September	48	28	87	89	59	85	38
October	111	10	122	99	76	46	46
November	89	868	36	88	89	151	89
December	87	94	81	58	83	45	57

appeared throughout the entire observation period in all the months. Except for July 2022, when it was absent, *Diatomes* sp. consistently appeared in all other months. *Daphnia* sp. was consistently present throughout the whole observation period, with the exception of June 2022, when it was discovered to be less so. February 2022 and July 2022 both saw low numbers of *Ceriodaphnia* sp. (Table 1)

Pollutants from the discharge of sewage and industrial water with a range of characteristics load are received by the dam. Singh *et al.* (2012)⁴ suggests that there are noticeable seasonal fluctuations in the appearance and abundance of different plankton. Seasonal variation in the zooplanktons in temperature as well as tropical climates are a frequent element of any aquatic ecosystem. It appears that two relatively high concentrations of nutrients, such as phosphate and nitrates, are directly associated to the higher phytoplankton population during monsoon months. Workers have emphasised the use of diatoms as markers of contamination.

In the current study, it was discovered that various phytoplankton grow at various temperatures. Despite their immense relevance, zooplankton play a significant role in fish production by providing food for fish in freshwater ponds and lakes. Two taxa of Rotifers, three taxa of Copepods, and two taxa of cladocerans have been identified in the current study. This is more in line with the hypothesis put forth by Pennok (1957)⁵, who claimed that the plankton in open water rarely contains more than 1 to 3 taxa of copepods, 2 to 4 species of cladoceram, and 3 to 7 taxa of rotifers.

According to observations, the density and diversity of rotifers are significantly influenced by parameters such as water temperature, turbidity, transparency, and others throughout the summer and monsoon seasons. Similar to the findings of Shalini *et al.* (2017)⁶, the largest number of *Keratella* sp. in the summer and early rainy season shows euphotic condition of Konar Dam. The current analysis supports Ugale *et al.* (2005)⁷ conclusion that the greatest number of species were present during the winter season as opposed to the summer and monsoon season.

One explanation for the fewer species is that there are fewer nutrients in the dam, which leads to lower productivity. Another explanation is that vital components like pH and dissolved oxygen are being depleted. The majority of cladoceran species are primary consumers that ingest tiny algae and four types of particulate matter found

in detritus. As a result, they have an impact on the benthic food chain of a lake ecosystem's cycling of matter and energy. The present study's cladoceran population maxima throughout the winter can be linked to the favourable temperature and amount of food, including bacteria, nanoplankton, and suspended detritus.

Rotifers react to environmental changes far more swiftly than other planktonic species. In municipal and industrial discharges, rotifers predominated while copepods and cladocerans were less common. Since the water temperature and the availability of food to organisms actually affected the copepod population during the summer, Choubey (1997)⁸ reported a high density of copepods during October. According to Pullie and Khan (2003)⁹, the presence of cladocerans throughout the winter months may be caused by suitable weather conditions, the availability of food in the form of nanoplankton, and suspended debris. The diversity and density of cladocerans are also significantly influenced by physicochemical parameters as DO, water temperature, and turbidity.

According to Jain *et al.* (1997)¹⁰, temperature affects the physical, chemical, and biological characteristics of the ponds, while pH measures the water's acid-base balance. An important part of the biology of cultured organisms is determined by the amount of gaseous oxygen dissolved in an aqueous solution, or DO. According to McLeay *et al.* (2001)¹¹, a high alkalinity value denotes the existence of both weak and strong bases like carbonates, bicarbonates, and hydroxides. Water's overall hardness is influenced by pH and dissolved solids. Groundwater and surface water nitrate concentrations can be linked to biochemical and anthropogenic sources such fertilisers used in agriculture. The dominance of copepods and rotifers is influenced by the availability of nutrients (Kumar *et al.*, 2006)¹². The summer months had the highest concentration of zooplankton, and the monsoon season saw the lowest concentration. The present data show a fast decrease in the zooplankton population during the rainy season, which may be related to a sudden drop in temperature and a dilution in the concentration of minerals and salts in marsh water. Cladocera's dominance of the zooplankton peak was discovered to be caused by ideal temperature and nutritional conditions and a decreased oxygen content during summer nights.

Cladocerans, however, were prevalent from March to June and either absent or present in very small quantities

during the remaining months, according to Bohra and Kumar (2004)¹³. According to Winkler (2002)¹⁴, an increase in atmospheric temperature increased the rate of evaporation, and the copepods' favourable relationship with temperature suggested that warm seasons after winter were better for copepod development. According to Pandey *et al.* (2009)¹⁵, the race between cladocerans and other zooplankton groups may be to blame for the drop in cladoceran numbers during rainy months. However, cladoceran richness was also reported to be highest in summer and lowest in winter.

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