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Zooplankton diversity and physico-chemical influences in Morikolong Beel, Nagaon District

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Abstract
The current study, which was carried out in the winter months of 2020 (February and March), examines the variety of zooplankton found in the Morikolong Beel in Nagaon. Additionally, the effects of different physico-chemical factors on the plankton population were observed. Six specimens in all were identified, of which two are classified as Cladocera and four as Copepoda. Located in the heart of the Nagaon district, Morikolong Beel is a wetland that faces numerous threats from urbanization. The appropriate preservation of the beel ecology was another focus of this investigation.

Keywords: Zooplankton, diversity, morikolong beel, physico- chemical characteristics

Introduction

Zooplankton are the microscopic free floating organisms present in an aquatic ecosystem and are cosmopolitan in nature which are found to inhabit all freshwater ecosystem in the world. The term plankton is coined by Victor Hensen and it is derived from the Greek word Planktos, meaning drifter or wanderer. The study of the diversity, abundance and special distribution of zooplankton in a freshwater aquatic waterbody is necessary to understand the tropodynamic and trophic progression of water bodies (Kar and Kar 2016) [1]. Zooplankton occupies a central position between the autotrophs and heterotrops and provide important food item in an aquatic ecosystem. They are also a good bioindicatior of environmental pollution as they response very quickly to changes in water quality. The freshwater zooplanktons are primarily categorized in three broad groups named Rotifera, Cladocera and Copepoda. Phylum Rotifera contains an infinite range of aquatic and semiaquatic settings that are home to rotifers. Leeuwen Heok was the first to describe these amazing creatures in 1703 (Battish, 1992) [2]. One of the most fascinating families of freshwater invertebrates is the rotifera, often known as wheel animalcules. Rotifers typically have lengths between 100 and 500 micrometers, with sizes ranging from 45 µm to 2.5 mm. The three primary classes of the phylum Rotifera are monogononta, Bdelloidea, and scisonidea. With 1500 species, Monogononta is the largest group; Bdelloidea is second with roughly 350 species. One significant component of freshwater zooplankton, rotifers serve as a bio-indicator of water quality and as a food source for numerous fish (Apaydn *et al.*, 2012). Very few Cladocera species exist in brackish water, and most of them are found in freshwater environments. They are referred to as "water flees" frequently. Cladocera vary in size from 500µm to 1mm. Microscopic crustaceans with a single compound eye are called cladoceras. They live in a variety of environments and are able to withstand extremely hostile climatic conditions (Geng *et al.*, 2005) [4]. In the groupings of zooplanktonic creatures that make up the second chain of an aquatic ecosystem, copepoda play a critical function. The dimensions are 1 mm to 5 mm. Their bodies are small and cylindrical, with several parts. The tropic status of an aquatic system can be ascertained by using the order Cyclopoid and the Harpacticoid, Copododes as bio-indicators (Geng *et al.*, 2005) [4].

In reaction to their physical and chemical environment, zooplankton have evolved sophisticated behaviors and distinctive life cycles. In order to adapt to seasonal variations in the environment and endure harsh conditions, they developed distinct structures (spines, for example) and functions. Branchionus is a Rotifer that has been observed in Punjabi waters in five distinct forms at different times of the year. The ability of the Daphnia species' helmet to withstand seasonal variations is well documented (Battish, 1992) [2]. The majority of lentic zooplankton species, such as Rotifers and Cladocera, developed unique egg forms known as "resting eggs." This can temporarily alleviate the unfavorable situation. For the purpose of making effective use of their surroundings and protecting themselves from predators numerous tactics are available to zooplankton, including cyclomorphosis, zooplanktonic fluctuation, and reproductive strategies. Along with being an essential component of sewage treatment and serving as a natural purifier, zooplankton is very valuable as food. Given that zooplankton is very susceptible to environmental changes and responds rapidly to both physical and chemical changes, it is also a useful indicator of changes in water quality. Diverse disturbances like as nutrient loading, acidity, sediment input, and so forth elicit a response from them. The purpose of this instrument is to comprehend the level of water contamination. Increased rotifer presence in an aquatic body suggests impending eutrophication. Fish rely on zooplankton as a basic food source, particularly during their larval phases. According to Kar *et al.* (2016) [1], zooplankton can be used to measure the population densities of aquatic forms or to offer information on the presence or absence of specific fish species, both of which are necessary for a successful aquaculture operation. Within this correspondence, the current investigation examines the physico-chemical characteristics and seasonal evaluation of zooplankton variety in the Morikolong Beel, Nagaon in the months of February and March 2020.

Material and methods

Study area details

Assam's wetland resources are abundant, and these areas have long been valued for their potential to produce food and fodder. Wetlands are one of the state's most important natural resource. One of the oxbow Lake-shaped wetlands in

the Nagaon district is Morikolong Beel. The Morikolong Beel is situated in the district's center, between 260 14'31.9" to 260 13'44.29" N and 920 17'44.3" to 920 19'48.0" E. The distance from Nowgong University in Nagaon is roughly 4 km (Figure 1).

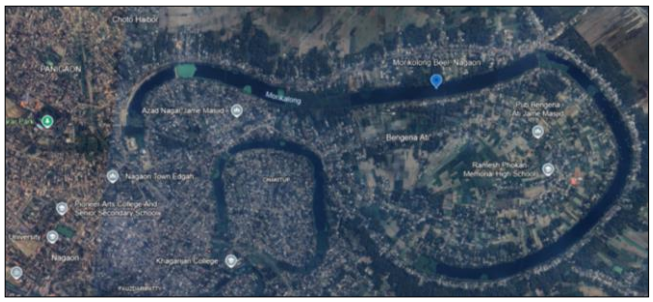


Fig 1: Satellite view of study area (Morikolong Beel, Nagaon, Assam)

Sample collection

Zooplankton samples were collected using conical plankton net weekly during morning hours about 7 AM to 9 AM except for nanoplankton all categories of plankton can be easily collected by plankton net, the sample collection where done by plankton unit containing the mesh size 55µ. Measuring the mesh size will vary cloth to cloth and variety of materials such as silk, organic, muslin, nylon etc. are used. For the physico-chemical parameters of water various instruments like TDS metre, Lux metre, Sachi disc, hygrometer, pH meter, thermometer etc. are used. The water samples were collected in 250 ml dark bottles. Once the sample has been collected it was fixed and preserved at the earliest using 4% formalin and 70% methyl alcohol.

Slide preparation

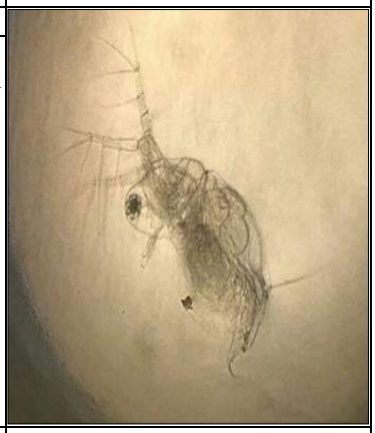
For accurate identification of zooplanktons slides are prepared. From the zooplanktonic concentrate preserved in 4% formalin and 70% methyl alcohol are transferred into tube for alcohol degradation. A succession of steps in the degradation of alcohol is as follows: 30% methyl alcohol, 50% methyl alcohol, 70% methyl alcohol, dipped in Eosin (aqueous) solution, transferred to 90% methyl alcohol, and finally, absolute alcohol. Then, one drop of glycerine is added to the slide, covered with a cover slip, and examined under a light microscope at the necessary magnification (10X at first, then 40X). The zooplanktons were then identified using the standard literature on freshwater zooplanktons of India (Battish, 1992) [2] and various review papers listed in the reference section.

Results and discussion

Identified Zooplanktons from study area

With the aid of literature and photographs, some specimens are identified after the produced slide is carefully examined under a microscope. The recognized samples and their morphological traits are covered in table 1.

Table 1: Zooplankton identified from Morikolong Beel, Nagaon, Assam

Sl. No.	Identified Specimen	Order	Morphological characters identified		Figure
			Male	**Female**	
1.	*Daphnia sp.*	Cladocera	▪ Head large without rostrum. ▪ Antennules long and movable. ▪ Antennules contain long stout anterior setae or flagella. ▪ First leg with hook and long flagellum.	▪ Body is oval or elliptical except when modified by crest on head in some species. ▪ Body is usually compressed and degree of compression where is in different species. ▪ Dorsal and ventral edges margins rounding over towards each other posteriorly. ▪ Posterior shell spin present. ▪ Antennules small or rudimentary which is placed behind rostrum. ▪ Anterior most part is long and tongue shaped.	
			Male	**Female**	
2.	*Moina sp.*	Cladocera	▪ Males are smaller than female with long antennule. ▪ Male contains hook and first leg.	▪ Body is thick and head large, front is rounded. ▪ Large eyes sometimes with deep depression above eye. ▪ Antennules long, more or less spindle shaped, freely movable. ▪ Fornices are not well developed. ▪ Dorsal and ventral margins of carapace without spinules but a few spinules present on ventral edge ▪ Post abdomen extended into conical post anal part bearing ciliated spines and bident.	

3.	*Eucyclop sp.*	Cyclopoida	▪ Body elongated cephalothorax flattened dorso-ventrally. ▪ Antennule 11 to 12 segmented. ▪ Receptaculum seminalis divided into interior part with a depression in the middle and posterior part convex. ▪ Leg 5 with separate segment from thorax with 5 appendages	
4.	*Ectocyclops sp.*	Cyclopoida	▪ Body short and stout. ▪ Dorsoventrally flattened. ▪ Abdomen wide. ▪ Antennule 9 to 11 segmented. ▪ Fifth leg fused with the metasomal segment.	
5.	*Diaptomus sp.*	Calanoida	▪ Diaptomidae are cylindrical in shape. ▪ Body is divisible into six segments. ▪ Narrow 5 segmented (in male) and 2-3 segmented (in female). ▪ Urosome is separated by a major articulation. ▪ The fifth legs in the female are small and symmetrical. ▪ In males 5th legs are asymmetrical. ▪ The first expodite is short and carries a variety of outgrowths.	
6.	*Hapacoida sp.*	Harpacticoida	▪ Biramous appendages with the exception of first pair of antennae. ▪ The prosome is formed by cephalothorax. ▪ The urosome generally has 5 somites in the females and 6 somites in the males. ▪ In the females, the last segment of the thorax is fused with the first dominal segment forming the large genital segment.	

Physico-chemical parameters of water sample

One of the most significant factors affecting the quality of water is temperature, a physical parameter that can change the properties of water and has a significant impact on chemical and biological activities (Tamuli *et al.,* 2018) [5]. Research throughout the study period revealed that the water temperature of Morikolong Beel is approximately 21.5 degrees throughout the winter months of February through March. In general, the rate of chemical and biological reactions doubles for every 10° increase in temperature. The beel's water pH is somewhat alkaline, or roughly 7.38, throughout the winter months.The acidity of the basin soil and the abundance of aquatic vegetation affected the fluctuations in the pH of the water (Yadav *et al*., 1987) [6]. The ability of water or a solution to conduct electric current is known as conductivity, and it is mostly determined by the kind and quantity of ionized salts present (Tamuli *et al.,* 2018) [5]. In the months of February and March, Morikolong Beel's conductivity ranges from 30 to 31.1 µs/cm. The total dissolved solids (TDS) in water is mostly made up of organic matter, suspended particles, calcium, magnesium, sodium, potassium, bicarbonate, chlorine, sulfate, and other ions (Tamuli *et al.,* 2018) [5]. TDS in Morikolong Beel varied between 14 and 15 ppm in February and March.

Conclusion

The diversity of zooplankton found in the Morikolong Beel in Nagaon during the winter months of February through March of 2020 is reported in this study. Six specimens in all were identified, two of which are classified as Cladocera and four as Copepoda. The measurements of physico-chemical parameters that are related to zooplanktonic abundance include water temperature, pH, conductivity, and

TDS. As a key link between land and water, wetlands are the most significant ecosystem on the planet. They are the passageway that allowed life to flourish and evolve. The center of the Nagaon district is where Morikolong Beel is located. This is a lake within Oxbow. Pollution in the waterbody is indicated by an increase in nutrient levels and zooplankton abundance. It was shown during the study time that the area of the beel significantly decreases for various developmental activities. The building of an urban solid waste dump and the disposal of household sewage, which both cause problems with the lake's deterioration, are currently the two most concerning issues surrounding the Beel. The ecosystem of beel faces threats from multiple directions as a result of human activities. Therefore, it is important to establish appropriate conservation techniques to ensure the Beel ecosystem is properly preserved.

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