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RESEARCH ARTICLE

STUDIES ON ZOOPLANKTON DIVERSITY AND PHYSICO-CHEMICAL PARAMETERS OF RAMNAGAR ANNUA, CACHAR, ASSAM

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ABSTRACT

Diversity of Zooplankton is one of the most important ecological parameters as these are the intermediate link between phytoplankton and fish and plays a key role in cycling of organic materials in an aquatic ecosystem. These are one most important biotic component influencing all the functional aspects of an aquatic ecosystem such as food chains, food web and cycling of matter. The study conducted with an aim to study the zooplankton diversity including physico-chemical parameters. The study was carried out in Ramnagar annua (N 24°49'57.3", E 92°45'23.7") which is an oxbow-lake from September 2012 to August 2013 during different seasons. The physico-chemical parameters indicate the prevalence of good quality of water in the wetland. A total of 26 species of zooplankton were found from the study area. The species richness of the group rotifera (44.18%) was highest. A total of 12 species belonging to 7 genera and 6 families were found during the period of investigation. These were followed by cladocerans, which were represented by 6 families comprising 9 species and 9 genera. There were 4 species of copepoda belonging to 2 families and 2 genera. The lowest diversity was exhibited by ostracods being represented by only species belonging to a single family.

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INTRODUCTION

Wetlands being one of the most productive ecosystems are crucial for biodiversity conservation. Floodplain lakes are common features of the river systems in North- East India. The richness of wetlands depends a lot on its plankton community because they are placed on the base of the food pyramid. The Ramnagar annua (N 24°49'57.3", E 92°45'23.7") which is an Oxbow lake is situated about 7 km from Silchar town. The zooplankton is heterotrophic plankton. Its diversity is one of the most important ecological parameters as these are the intermediate link between phytoplankton and fish and plays a key role in cycling of organic materials in an aquatic ecosystem. These are one most important biotic component influencing all the functional aspects of an aquatic ecosystem such as food chains, food web and cycling of matter. It is a good indicator of changes in water quality because it is strongly affected by environmental conditions and responds quickly to changes in environmental quality. These are not only useful as bioindicators to help in detecting pollution load, but are also helpful for ameliorating polluted waters. The distribution of zooplankton community depends on a complex of factors such as, change of climatic conditions, physical and chemical parameters and vegetation cover (Rocha *et al.*, 1999; Neves *et al.*, 2003). Zooplankton constitute important food item of many fishes. Hence, zooplankton communities based

on their quality and species diversity are used for assessing the productivity vis-à-vis fishery resource, fertility and health status of the ecosystem. Information on zooplankton diversity of floodplain wetlands of the country is scanty. Some reports of Khan from Kashmir (1987), Rai and Datta Munshi from Bihar (1988), Sugunan (1995), Khan (2002, 2003) and Ganesan and Khan (2008) from southern Bengal, Sharma (2005, 2010) and Sharma and Sharma (2008), Kar and Barbhuiya (2004) from Assam; Sharma (2009) from Manipur. Keeping in view the importance of such wetlands and general wetlands and general dearth of literature, the work was undertaken to assess the physico-chemical quality of water and diversity, abundance and seasonal variation of zooplankton community of these wetlands of Barak valley of Assam.

MATERIALS AND METHODS

The study was conducted in an oxbow-lake viz., Ramnagar annua of Barak valley twice in a month during the study period from September 2012 to August 2013. For the statistical analysis, data were divided into three groups viz., Premonsoon (March - May), Monsoon (July - September) and Postmonsoon (November - January). Qualitative sampling of zooplankton was done with the aid of plankton net of mesh size 25µm by sweeping and towing it through the weeds in the water. Quantitative samples were collected by filtering 100 L water. Collected specimens were transferred carefully to a plankton tube and preserved in 5% formalin for taxonomic identification. Analysis was done on a Sedgwick – Rafter

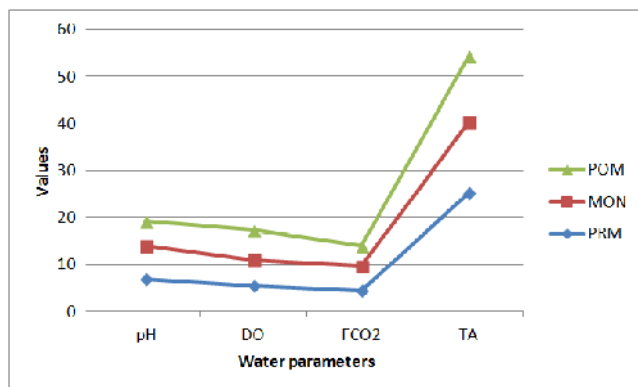
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counting cell, under a light microscope. Detailed taxonomic identification was done with the help of a stereoscopic microscope having different magnifications following the literature of Edmondson (1959), Sharma and Michael (1987), Michael and Sharma (1998), Battish (1992). Analysis involved transfer of 1 ml sub sample from each samples to the Sedgewick-Rafter counter and counting of cells within 20 squares of the cells, chosen randomly. The cells counted were used for quantitative estimation of cell density using the following standard formula of APHA (2005). Water samples were also collected periodically from these water bodies in a 500 ml bottle for analyzing the physico-chemical characteristics. A centigrade thermometer was used to measure water temperature. DO was measured by Winkler's Titration method (APHA, 1995). FCO₂, alkalinity was measured by titration method (Welch, 1948). Other characteristics like pH, phosphate, nitrate, chloride, sulphate were also calculated.

RESULTS

Physico-Chemical Characteristics

The various water quality parameters were studied during different seasons viz., Premonsoon (March - May), Monsoon (July - September) and Postmonsoon (November - January) are given in the Table 1. There are remarkable variations in the air and water temperature, being highest during the Premonsoon season as this comprises with other seasons. The pH value was recorded slightly high during the monsoon season. The Dissolved oxygen was lowest during Premonsoon season; this could be attributed due to high temperature during that season.



Note: PRM = Pre-monsoon; MON = Monsoon; POM = Post-monsoon.

Figure 1. Seasonal variation in pH, Dissolved Oxygen (DO), Free CO₂ (FCO₂), Total alkalinity (TA) in Ramnagar annua

Table 1. Physico-chemical parameters of water of Ramnagar annua

Parameters	PRM	MON	POM
Air temperature (°C)	35.2	30.7	28.4
Water temperature (°C)	28.4	25.6	23.5
pH	6.9	7.1	5.3
Dissolved Oxygen (mg/l)	5.47	5.56	6.37
Free CO ₂ (FCO ₂) (mg/l)	4.44	5.21	4.41
Total Alkalinity (TA) (mg/l)	19.12	15.10	14.12
Total Dissolved Solids	0.05	0.04	0.03
Total Suspended Solid	0.04	0.07	0.06
Total Hardness (ppm)	9	7	10
Phosphate (mg/l)	1.23	1.13	1.08
Nitrate (mg/l)	0.34	0.12	0.23
Chloride (mg/l)	11	11	12
Sulphate (mg/l)	11	12	11

Note: PRM = Pre-monsoon; MON = Monsoon; POM = Post-monsoon

The Free CO₂ was highest during monsoon season was possibly due to high temperature and heavy rainfall. The Total alkalinity was higher during Premonsoon season (Fig 1). Hardness was lower during monsoon as compared with other season. While the phosphate, nitrate, chloride and sulphate varied moderately.

Diversity of zooplankton

From the oxbow lake the recorded zooplanktonic organisms were rotifers, copepods, cladocerans and ostracods which comprised a total of 26 different species. Table 2 depicts the occurrence of different species during three different seasons during the study period.

Table 2. Seasonal distribution of zooplankton in Ramnagar annua

Zooplankton Species	PRM	MON	POM
ROTIFERA			
Family Brachionidae Wesenberg-Lund			
Genus <i>Brachionus</i> Pallas			
<i>Brachionus patulus</i> Müller	+	-	+
<i>Brachionus angularis</i> Gosse	+	-	-
<i>Brachionus bidentata</i>	-	+	-
<i>Brachionus bidentata bidentata</i> Anderson	-	+	-
<i>Brachionus quadridentatus quadridentatus</i> Hermann	+	-	+
Genus <i>Keratella</i> Bory de St. Vincent			
<i>Keratella tropica</i> (Apstein)	-	+	-
<i>Keratella cochlearis</i> (Gosse)	+	+	+
Family Euchlanidae Bartos			
Genus <i>Dipleuchlanis</i> De Beauchamp			
<i>Dipleuchlanis propatula</i>	-	+	+
Family Notommatidae Remane			
Genus <i>Cephalodella</i> Bory de St. Vincent			
<i>Cephalodella forficula</i> (Ehrenberg)	+	+	-
Family Mytilinidae Bartos			
Genus <i>Mytilina</i> Bory de St. Vincent			
<i>Mytilina</i> sp.	-	+	-
Family Filinidae Bartos			
Genus <i>Filinia</i> Bory de St. Vincent			
<i>Filinia</i> sp.	+	+	-
Family Lecanidae Bartos			
Genus <i>Lecane</i> Nitzsch			
<i>Lecane</i> sp.	-	-	+
CLADOCERA			
Family Chydoridae Stebbing			
Genus <i>Chydorus</i> Leach			
<i>Chydorus</i> sp.	-	+	+
Genus <i>Alonella</i> Sars			
<i>Alonella</i> sp.	+	+	-
Genus <i>Alona</i> Baird			
<i>Alona</i> sp.	-	-	-
Genus <i>Pleuroxus</i> Baird			
<i>Pleuroxus</i> sp.	-	+	+
Genus <i>Diaphanosoma</i> Fischer			
<i>Diaphanosoma excisum</i> Sars	+	-	+
Family Bosminidae Sars			
Genus <i>Bosminopsis</i> Richard			
<i>Bosminopsis deitersi</i> Richard	-	-	+
Genus <i>Bosmina</i> Baird			
<i>Bosmina tripurae</i>	+	-	+
Genus <i>Ceriodaphnia</i> Dana			
<i>Ceriodaphnia</i> sp.	+	-	+
Family Macrothricidae Baird			
Genus <i>Macrothrix</i> Baird			
<i>Macrothrix</i> sp.	-	-	+
COPEPODA			
Family Diaptomidae Baird			
Genus <i>Neodiaptomus</i> Kiefer			
<i>Neodiaptomus schamakeri</i> (Poppe and Richard)	-	-	+
Family Cyclopidae Dana			
Genus <i>Mesocyclops</i> Claus			
<i>Mesocyclops</i> sp.	+	-	+
<i>Nauplius</i> stage	-	+	+
<i>Copepodite</i> stage	+	+	+
OSTRACODA			
Family Cypridae			
Genus <i>Cypris</i>			
<i>Cypris</i> sp.	+	+	-

The species richness of the group rotifera (44.18%) was highest. A total of 12 species belonging to 7genera and 6 families were found during the period of investigation. These were followed by cladocerans (32.55%), which were represented by 6 families comprising 9 species and 9 genera. There were 4 species of copepoda (18.60%) belonging to 2 families and 2 genera. The lowest diversity was exhibited by ostracods (4.65%) being represented by only species belonging to a single family. Fig 2 depicts the percentage contribution of zooplankton in the study area. The juveniles of copepoda viz., copepodite and nauplius stage were found in large numbers during the post-monsoon season. During pre-monsoon season 13 species of zooplankton were recorded from the study area while 14 species were found during monsoon season. But during the post-monsoon season the maximum number of zooplankton species i.e., 16 species were found during the period of investigation.

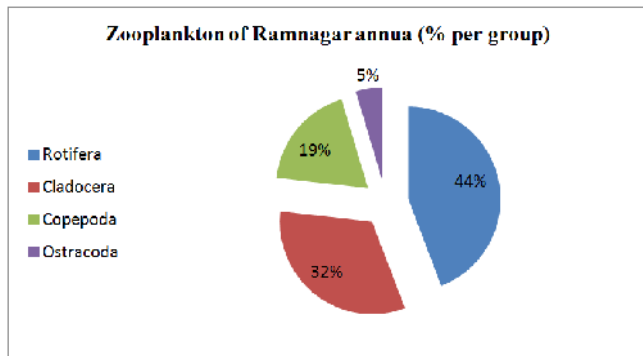
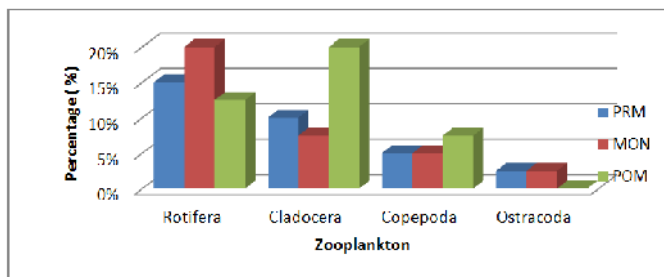


Figure 2. Percentage contribution of different zooplankton groups in Ramnagar annua

Relative abundance of zooplankton

The relative abundance of rotifera was higher during pre-monsoon (15%) and monsoon (20%) as compared to cladocera (10% - 7.50%), copepoda (5%) and ostracoda (2.50%). Whereas the cladocera dominated the zooplankton population during post-monsoon season (20%) followed by rotifera (12.50%). Fig. 3 shows the relative abundance of different groups of zooplankton during three different seasons.



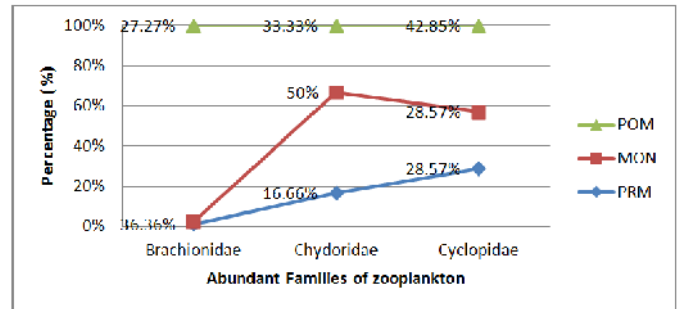
Note: PRM = Pre-monsoon; MON = Monsoon; POM = Post- monsoon.

Figure 3. Seasonal variations in relative abundance of different groups of zooplankton

Numerically abundant species

The zooplankton communities which were found during investigation contained various species. But only few commonly occurring and abundant species contribute maximum to density. During the investigation, the species those controlled the bulk of zooplankton population density were belonging from Brachionidae, Chydoridae and

Cyclopidae families. The relative abundance of Brachionidae (36.36%) was high during the Premonsoon season, whereas Chydoridae family (50%) dominated during monsoon season and the relative abundance of Cyclopidae family (42.85%) was highest during the post-monsoon season. Fig 4 depicts the abundance of some commonly occurring family of zooplankton.



Note: PRM = Pre-monsoon; MON = Monsoon; POM = Post- monsoon.

Figure 4. Seasonal variation in relative abundance of major families of zooplankton

DISCUSSION

From the observation, it was found that zooplankton species recorded was comparatively high. Mainly four groups of zooplankton rotifera, cladocera, copepoda and ostracoda were identified in the present study. The higher amounts of zooplankton availability may be due to the favorable conditions of physico-chemical parameters and the availability of nutrients in the lake. Here the pH is found to vary between 6.9 –7.1 which was favorable condition for the aquatic life. The dissolved oxygen content in the lake was always found to be moderately high throughout the year varying between 5.47 – 6.37. This reveals that the lake is not in immediate threat of eutrophication. Moreover the nutrients such as phosphate, nitrate, chloride and sulphate were present only in trace amounts. The average amounts of water parameters show the good quality of water which was similar to the findings of Sukumaran and Das (2002). Though their contribution to diversity the relative abundance of rotifera was higher during pre-monsoon and monsoon as compared to cladocera, copepoda and ostracoda. Whereas the cladocera dominated the zooplankton population during post-monsoon season followed by rotifera. The results revealed that high diversity of zooplankton community only species of four families contribute the high density. The relative abundance of Brachionidae was high during the Premonsoon season, whereas Chydoridae family dominated during monsoon season and the relative abundance of Cyclopidae family was highest during the post-monsoon season. Such dominance of families in lake has been reported from other parts the country as well (Khan 2003, Sanjar and Sharma 1995).

Conclusion

A total of 26 species of zooplankton were found from the oxbow lake. The species richness of the group rotifera (44.18%) was highest. A total of 12 species belonging to 7genera and 6 families were found during the period of investigation. These were followed by cladocerans (32.55%), which were represented by 6 families comprising 9 species and 9 genera. There were 4 species of copepoda (18.60%)

belonging to 2 families and 2 genera. The lowest diversity was exhibited by ostracods (4.65%) being represented by only species belonging to a single family. The high value of species richness reflects the suitability of the habitat for the organisms on the other hand it is correlated with the ecosystem of the lake. The rotifera dominated the overall composition of water body followed by the cladocera. In spite of a large number of species composition only few groups of species contributed maximum to the density.

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