STUDIES ON ZOOPLANKTON DIVERSITY IN RELATION TO WATER QUALITY OF AMBE GHOSALE LAKE OF THANE CITY, (MS) INDIA

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ABSTRACT

Zooplanktons are known to dominate freshwater habitats. Zooplankton studied from the Ambe Ghosale Lake, Thane city of Maharashtra state was studied during January to December 2011. Fifteen Rotifers and twelve cladocerans and six Copepods were recorded during the study. In this study, we found that organisms like nauplii and rotifers predominated even among the cladocerans. We also found that zooplankton community of the lake of this system was characterized by species already known in similar environments. The climate, the presence of suspended solids, the consequent decreased availability of food, and the progressive water quality gradient towards eutrophication were the main factors governing the composition and structure of the zooplankton community and the climate was one of the main factors controlling population size in this community.

Key words: *Zooplankton, water quality, Ambe Ghosle lake.*

INTRODUCTION

Zooplanktons are integral components of aquatic food webs and contribute significantly to aquatic productivity in freshwater ecosystems (Gannon and Stemberger, 1978.). They have been studied from various inland aquatic environs of India, but a review of the limnological literature indicates limited information on their composition, ecology and role in aquatic productivity in the floodplain lakes in particular. Worldwide there are rotifer count is 2030 but only 360 species have been reported from India. This accounts for only 18 % of the total global fauna. The number of cladoceran species reported in India is 190 (Raghunathan and Kumar, 2002), though only close to a hundred species have been described in detail (Michael and Sharma, 1988). The global diversity of cladocerans is more than 600 species. Eutrophication is a natural process in lentic ecosystems (Esteves, 1988) and basically it refers to a nutritional enrichment of water bodies, mainly with essential nutrients as phosphorus and nitrogen (Ryding and Rast, 1989). Common sources of cultural eutrophication are due to sewage, erosion of land, and even the air is a source food web (Lampert and Sommer, 1997). Studies about the impact of eutrophication upon zooplankton abundance and composition have a long tradition in limnology (Bini *et al.,* 1997).

The large number of studies about the changes of zooplankton composition and abundance in response to tropic gradients, there are only few studies that take into account the zooplankton biomass dynamics. Additionally, beyond nutrient availability, zooplankton can be regulated by top-down effects (Santos *et al.,* 1994).

The aim of this paper was to describe the horizontal distribution of zooplankton abundance and biomass along a eutrophic gradient in Ambe Ghosle reservoir. Located in Thane district of Maharashtra (19^0 12’ 19.30” N and 72^0 58’ 50.61”E) is the main water body covers the area of 3.5 hectare^2

MATERIAL AND METHODS

Zooplankton samples were obtained by vertical hauls along the entire water column. During this process we used a conical net with 22 cm of diameter and 90 mm of mesh size. Samples were stored in 200 ml polyethylene bottles, stained with Bengal Rose and fixed with formalin 4%.

The collection site consisted of submerged aquatic plants species such as *Hydrilla verticellata, Nymphaea* spp*. Euryale ferox, Vallisnaria spiralis, Utricularia flexuosa, Nelumbo mucifera, Potamageton* spp*. Trapa natans, Lemna trisula, Pistia striates, Eichhornia crassipes, Salvinia* sp. *Nymphoides* spp. and *Azolla pinnata* along with littoral region. Horizontal sampling for Cladocera was done using Nylon Net (150 µm). For Chydorid Cladocerans the littoral sediment was scraped using a hand net. Water transparency, temperature and dissolved oxygen at the top and bottom of the sampling sites were obtained with the use of a Secchi disk and Yellow Springs® oxymeter-thermistor equipment respectively. Data of abiotic parameters of water is given in Table 2.

At the laboratory, subsamples of 1 ml were obtained using a Hensen-Stempel pipette; 700 organisms were counted and measured (with Zeiss graduated ocular) from each sample in a reticulated Sedgwick-Rafter chamber, with the use of a microscope. Zooplankton species were identified following the works of Koste (1978), Michael and Sharma, 1988; Korovchinsky, 1992).

Table 1 Composition and frequency of occurrence (%) of zooplankton species in study area during January to December 2011

Species	January	May	July	November
Rotifera				
Brachionus angularis Gosse, 1851	78.9	10.12	---	72.6
Brachionus bidendata Anderson, 1889	100	56.8	5.2	78.2
Brachionus caudatus Barrois et Daday, 1894	78.9	22.4	---	11.7
Brachionus c. personatus Ahlstrom, 1940	73.6	12.2	18.3	5.2
Brachionus calyciflorus Pallas, 1766	5.9	---	---	---
Brachionus patulus O. F. Muller, 1786	6.8		1.8	2.5
Brachionus quadridentata Hermann, 1783	4.9	2.5	---	2.8
Brachionus falcatus Zacharias, 1898	26.3	---	3.8	11.2
Dipleuchlanis propatula Gosse, 1886	55.8	1.2	---	9.7
Filinia longiseta Ehrenberg, 1832	68.5	---	11.4	11.8
Euchlanis dilatata Ehrenberg, 1832	2.3	2.5	---	55.8
Filinia opoliensis Zacharias, 1898	57.2	22.5	50.5	12.7
Keratella cochlearis Gosse, 1886	22.4	44.2	---	11.6
Polyarthra sp.	100	95.2	96.4	100
Keratella cochlearis tecta Gosse, 1886	---	65.2	2.5	5.3
Cladocera				
Bosminopsis deitersi Richardi, 1895	94.3	68.2	36.1	63.5
Bosmina hagmani Stingelin, 1904	22.4	4.8	11.5	22.4
Diaphanosoma birgei Korinek, 1981	11.2	5.2	4.6	2.5
Diaphanosoma sp.	5.2	4.3	11.2	4.6
Moina micrura Kurz, 1874	3.8	---	---	2.5
Moina minuta Hansen, 1899	2.5		2.5	2.8
Simocephalus vetulus Mueller, 1776	5.8	2.2	11.2	2.5
Moina macrocopa, Straus 1820	---	2.2	12.2	8.6
Daphnia gessneri Herbst, 1967	---	4.5	---	---
Kurzia longirostris Daday, 1898	11.2	2.8	4.8	5.5
Moina sp	8.8	2.5	4.2	5.8
Ilyocryptus spinifer Herrick, 1882	8.8	2.5	2.8	4.2
Copepoda				
Acanthocyclops vernalis Fischer, 1853	22.2	11.3	5.2	2.8
Mesocyclops longisetus Thiebaud, 1914	2.5	4.8	8.2	6.4
Cyclopoida copepodites	---	2.8	---	4.8
Nauplius	100	100	100	100
Harpacticoida copepodites	11.8	2.5	4.2	6.8
Calanoida copepodites	6.5	2.8	14.2	8.8

RESULTS AND DISCUSSION

36 taxa were identified; Rotifera was the richest group with 15 taxa. This pattern is common in tropical freshwaters, whether in lakes, ponds, reservoirs, rivers, or streams. Cladocera was represented by 12 taxa and Copepoda by 6 taxa (Table 1). The zooplankton community showed a typical structure, constituted by known species from similar environments in this lake. It is likely that the climate, as well as other natural characteristics of the system in question, is an influential factor for the composition of the zooplanktonic community. In this study, small organisms like nauplii and rotifers predominated even among the cladocerans.

An important consideration when there is a predominance of smaller species in lakes is the possible relation to suspended material in the water column due to the constant influence of the wind. Kirk and Gilbert (1990) documented that the presence of sediments in suspension in natural ecosystems can influence the structure of the zooplankton community by favoring rotifers. Several species of rotifers tolerate a high concentration of suspended material because their corona and mastax structures are highly efficient at identifying and selecting the material that will be ingested through the sensorial bristles of the mouth, avoiding inorganic particles.

Thus the predominance of Rotifera in this lake system may be related to material in suspension; this aspect was observed with the predominance of *Brachionus caudatus* and *Brachionus angularis*, as well as the occurrence of *Keratella cochlearis* and Polyarthra spp. Rotifers are opportunistic organisms (r-strategist species adapted to a fast population growth during favorable seasons) whose densities change with temperature in a short time (Matsumura-Tundisi *et al.,* 1990).

Environments where microphytoplankton dominates show a great abundance of micro consumers ingesting indirectly bacteria and remains. The low diversity of Daphnia seems to be an outstanding feature of cladoceran assemblages in tropical systems, either oligotrophic or eutrophic (Pinto-Coelho *et al.,* 2005).

Copepoda was mainly represented by immature forms of nauplii and copepodites. The feeding habit of the juvenile and immature forms is based essentially on the filtration of small particles. A factor which can determine the proportion of young to adult forms is predation intensity and the balance between predation by invertebrates and vertebrates. According to Hutchinson (1967) and Anderson (1970), the cyclopoid copepods are essentially predators, capturing a variety of planktonic organisms, including small Cladocera.

The low number of adults of Copepoda Calanoida may be related to the very low feeding rates on bacteria and picoplankton in the more eutrophic lakes, as well as the high concentrations of suspended solids. In addition, there is probably a high rate of predation by invertebrates, since the presence of partially eaten adult Calanoida was noted in most of the samples. When primary production is low, small species dominate the consumption of available resources and may exclude the bigger species by diminishing the resources to levels that are inadequate for larger species (De Mott, 1989).

The presence and also the frequency of occurrence of cyanobacteria, for example Microcystis, can inhibit the feeding and even increase the mortality of Copepoda. According to Lampert (1987), even at low densities, copepods avoid to consume these toxic cyanobacteria. In laboratory tests with purified toxins, Dussart and Defaye (1995) confirmed that the sensitivity to these toxins varies among species and also with the ecological characteristics of the biotope.

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