

A Study on Zooplankton Diversity of Bhandam Cheruvu, Warangal, T.S. India

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ABSTRACT: The present work aimed at the study of zooplankton diversity of Lake Bhandam, Warangal, T.S and the zooplanktons were collected by using small meshed plankton net of nylobolting NO. 25 by filtering a known volume of water sample through it. Among all the four major groups 12 species of Rotifers, 6 species of copepods, 7 species of Cladocerans and 4 species of Ostracodes were identified in this study. Different zooplankton species were found, but the dominance of certain species like *Brachinous sps*, *Keratella tropica*, *Mesocyclops leukarti* made it clear that the lake waters are nutrient enriched and hence eutrophicated. It is observed that the seasonal diversity of zooplankton is seen.

KEYWORDS: Bhandam Lake, Zooplankton, Rotifera, Ostracoda, Eutrophicated.

I. INTRODUCTION

Plankton is a heterogeneous group of tiny (microscopic) plants and animals which inhabit the water. The term plankton was first coined by Victor Hensen in 1887 to designate the heterogeneous assemblage of suspended microscopic materials, minute organisms and detritus in water which wander at the mercy of winds, currents and tides. However the use of the term has been confined to designate only the microscopic free floating organisms. They are also considered as the bio indicators of water quality and are therefore of much importance from limnological point of view. Zooplankton by their heterotrophic activity plays a key role in the cycling of organic materials in aquatic ecosystems and is used as bioindicators of environmental quality. The present paper deals with diversity of zooplankton in BhandamLake of Warangal district. Zooplankton organisms respond more quickly to environment than fish and are also easier to identify than algae. Thus they can be used as bio indicators. Rotifera typical planktonic form is Asplancha which is the largest of the rotifers and is also predacious (Planktonpredator), a secondary consumer or first level carnivore in planktonic ecosystem. The cladocerans possess photosensitive small eye which enables them to respond to changing diurnal system. The cyclopoids are widely distributed and are mostly littoral with a few limnetic species. The cyclopoids usually undergo a complex development by repeated metamorphosis upto six copepods stage, the sixth one being an adult. The species composition and the abundance of rotifers are intricately influenced by ecological changes perturbations in their environments. The phenomenon of cultural eutrophication, siltation, predation, habitat destruction etc. excise drastic impact on their community structure. Copepods and Cladocerans are of great importance not only as a major link in a food chain in an aquatic system but also, since they are used directly by fish and other larger animals. Zooplankton organisms have great significance as pollution indicators. As a major element in aquatic biota, the zooplankton community often exhibits dramatic changes in response to changes in the physicochemical properties of the aquatic environment. Hence zooplankton fauna or zooplankton association can be used as useful means for the assessment of water pollution.

Zooplanktons occupy a central position between the autotrophs and other heterotrophs and on an important link in food of a fresh water ecosystem. The occurrence and abundance of zooplanktons depends on its productivity .zooplankton play a very important role in increasing photosynthesis in some algae which pass through their nutrient rich elementary canal in viable condition. The study of zooplankton community is important as it provides ways of predicting productivity. Among the zooplankton, rotifers are apparently the most sensitive indicators of water properties and these are the important of zooplankton and are one of the principle links in the food chain.

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II. STUDY AREA

Bhandam cheruvu is located in the City of Warangal district, Telengana State. It is situated at 17°-8'-58" latitude and longitude 79°-32'-34" and is about 10 Kms away from Kakatiya University Campus, Warangal. This lake receives the domestic sewage from the city in various ways.

III. MATERIALS AND METHODS

The zooplankton samples were collected twice in month between 7 to 8 am by using plankton net of mesh size 64 μ for a period of one year, from June 2012-May 2013. The collected samples were kept in plastic bottles containing 4% formaldehyde. Zooplankton identification is done by following systematic keys of Pennak (1978), Edmondson (1992), Battish (1992) and Altaff (2004). Main characters are considered for identification are lorica, corona and type of trophi for rotifers; antennules, postabdomen, number and arrangement of spines, location of lateral setae and rostrum for cladocera; antennules, antenna, caudal setae, and endopodite for copepoda and antenna, valve shape and setae for ostracods.

Population density was quantified by Drop count method of Lackey (1938) and was calculated using the following formula of Lackey (1938):

$$N = n \times v / V$$

Where,

- N = Total no. of organisms/ lit of water filtered,
- n = Number of zooplankton counted in 1 ml plankton sample,
- v = Volume of concentrate plankton sample (ml),
- V = Volume of total water filtered through (L)

COLLECTION OF PLANKTON: Collection of rotifers was made employing a modified Haron-Trantor net with a square metallic frame of area 0.0625m² areas. Care was taken to avoid trapping of floating debris while towing the net. Collected samples were transferred to labeled vial bottles containing 4% formalin and samples were kept for setting for a period of 48 hrs to quantitative estimation. The sample was transferred to Sedgwick rafter cell and planktonic organisms numerically counted and identified the same was confirmed by Needham and Needham (1962), Patil and Gouder (1982) and Battish (1992). Statistical analysis of rotifers by using the following diversity index formulas.

Simpson's diversity index (Krebs, 1994) The Simpson's diversity index (D) is calculated using the following equation: $D = 1 / \sum_{i=1}^s (P_i)^2$, Where 'pi' is the proportion of individuals of the ith taxon in the community. Simpson's index gives relatively little weight to the rare species and more weight to the common species. It ranges in value from 0 (low diversity) to a maximum of (1-1/s), where s is the number of taxa.

Shannon-Wiener Index (Williams & Feltmate, 1992). This is a widely used method of calculating biotic diversity in aquatic and terrestrial ecosystems and is expressed as:

$$H = -\sum_{i=1}^s (P_i) (\log_2 P_i)$$

Where, H= index of species diversity, s= number of species, pi= proportion of total sample belonging to the ith species.

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Table:1 Showing the Zooplankton diversity in 2012-13

1.Rotifera	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Simpson_1-D	0.8767	0.88	0.875	0.8233	0.9078	0.8831	0.8863	0.8571	0.8247	0.8484	0.8907	0.8913	0.9006
Shannon_H	2.193	2.196	2.23	2.055	2.421	2.252	2.289	2.04	1.883	2.011	2.344	2.344	2.382
2.Cladocera	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Simpson_1-D	0.8472	0.828	0.6311	0.7917	0.8494	0.8551	0.8471	0.8551	0.8465	0.8356	0.8314	0.8167	0.8506
Shannon_H	1.911	1.776	1.044	1.679	1.919	1.939	1.909	1.939	1.909	1.874	1.871	1.81	1.925
3.Copepoda	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Simpson_1-D	0.8209	0.7456	0.7273	0.7715	0.8238	0.8256	0.8264	0.823	0.8306	0.8266	0.8103	0.7764	0.8277
Shannon_H	1.753	1.377	1.342	1.627	1.76	1.769	1.771	1.76	1.784	1.771	1.723	1.644	1.774
4.Ostracoda	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Total
Simpson_1-D	0.7449	0.7245	0.4444	0.64	0.7491	0.7328	0.7353	0.7398	0.7108	0.7368	0.7256	0.74	0.7495
Shannon_H	1.376	1.334	0.6365	1.055	1.385	1.354	1.354	1.366	1.292	1.358	1.341	1.366	1.385

A large H value indicates greater diversity, as influenced by a greater number and/or a more equitable distribution of species.

IV.RESULTS AND DISCUSSION

During the study period from (June-2012 to May- 13) 21 species were identified in this lake. These species are belonging to 4 major groups i.e. Rotifera, Copepoda, Cladocera and Ostracoda. Among all the four major groups 12 species of Rotifers, 6 species of copepods, 7 species of Cladocerans and 4 species of Ostracodes were identified in this study. The season wise diversity index value of the different plankton groups were given in (Table No. 1) and the Seasonal Diversity was given in (Table No.2) and also represented by figure 1 and figure 2 . Rotiferan form a significant component of the zooplanktons. The rotiferans exhibit a very wide range of morphological variations and adaptations. Among the zooplankton rotifers respond more quickly to the environmental changes and used as a change in water quality (Gannon and Stemberger 1978).

Rotifers are regarded as Bioindicators of water quality. Rotifers play a vital role in the trophic tiers of freshwater impoundments and serve as living capsule of nutrition (Suresh Kumar et al., 1999). In the present study they dominated with 12 species as compared to other groups of zooplankton. Taxonomic dominance has been reported in several water bodies (Kudari et al., 2005; Kanagasabhapati and Rajan, 2010). This pattern is common in lakes, ponds, reservoirs and rivers (Neves et al., 2003). Segers (2003) highlighted the dominance of rotifer population which was due to its preference for warm waters. Planktonic rotifers have a very short life cycle under favorable conditions of temperature, food and photoperiod. Since the rotifers have short reproductive stages they increase in abundance rapidly under favorable environmental conditions (Dhanapathi, 2000). Among all the groups of zooplankton rotifer group of zooplanktons showing high Shannon values during winter with 2.250 and low with 2.145 during summer and the Simpson diversity indices values showing high during the winter season with 0.883 and low during the monsoon and summer with 0.863. The rotifer group population shows higher during the monsoon season when compared with the

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winter and summer. This is due to positive correlation with water temperature, pH, dissolved oxygen and nutrients such as amonical nitrogen and phosphorous. Similar results were observed by Shashikant (2012) and Priyavada et al., (2012). The differences in periodicity and population density of different rotifera species are due to biotic interactions and nutritional content of the lake and reservoir. The rotifera species exhibit marked differences in their tolerance and adaptability to changes in physico-chemical and biological parameters of freshwater ecosystem.

Copepods are considered as important food item for various kinds of fish, play a key role in the energy transformation at different trophic levels. As a nature of copepod they prefer Eutrophication environment to grow in high number. Freshwater copepods constitute one of the major zooplankton communities occurring in all types of water bodies. They serve as food to several fishes and play a major role in ecological pyramids. Abundance of copepods in summer and winter is due to the lake which is rich in organic matter supporting higher number of Cyclopoids, thus suggesting their preponderance in higher trophic state of water. Similar observations are made by Somani and Pejavar (2004) in Masunda Lake. The copepodans species showed high Shannon diversity values with 1.765 in winter and low with 1.524 in monsoon season. the Simpsons diversity index was high during the winter season with 0.824 and lowest was observed during the 0.766. The dominance among Copepoda have been reported by several investigators, Gouder and Joseph, (1961) and Rajashekar et al., (2010) from the ecological point of view. Each phytoplankton group is more important resource for all the developmental stages of cyclopoida copepods. Copepoda domination may also be due to their feeding on diatoms, Rotifera and Cladocera, reported by Hutchinson (1967) and high reproduction capacity.

Fig 1 Graph showing the seasonal variation of Zooplankton

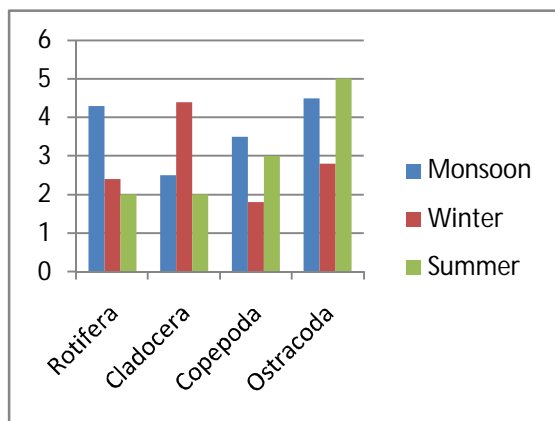
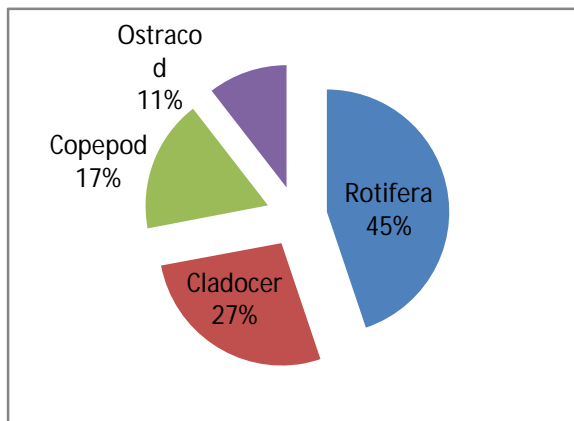


Fig 2 Graph showing the annual zooplankton



Cladocerans considered to be most important components of zooplankton community. The group appears to prolifer more in ponds, lakes and reservoirs. Cladocerans are the most useful and nutritive group of crustaceans for higher members of fishes in the food chain. In the present investigation Cladocera species showed high Shannon diversity index value in winter (1.926) and low value in monsoon with 1.602. The Simpson diversity index value showed highest in winter with 0.851 and lowest in monsoon with 0.744. As the Cladocerans are prefer to live in clear waters, Our study was agreeable with earlier reports. In this study, the genus *Daphnia* and *Moina* were the third and fourth dominant order respectively.

The Ostracods are the entomostracans crustaceans having the bivalve carapace enclosing the laterally compressed body. They inhabit all kinds of fresh and marine water. Ostracod represented very low diversity and population density as compared to other groups of zooplankton. The ostracodan species showed high Shannon values during the winter season with 1.364 and lowest values with 1.1 in the monsoon season. The Simpson's diversity index values showing high during the winter season with 0.739 and lowest during the monsoon season with 0.638. The similar results were reported by Sukand and Patil (2004) in Fort Lake of Belgaum and Kedar et al. (2008) in Rishi freshwater lake of Washim district.

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V.CONCLUSION

The overall study reveals that among all the zooplankton, rotifer has maximum diversity and population density in all the seasons. During the study period it was observed that the less diversity in monsoon due to the dilution factor and the raise in the diversity were observed during the winter season due to favourable environmental conditions. The dominance of zooplankton in the lake was due to the continuous supply of food material which in turn indicates the eutrophic nature of the lake. The present study concluded the dominance of species like Brachinous sps, Keratella tropica, Mesocyclops leukarti indicating the eutrophic nature of the water body.

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