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Full Length Research Paper

Species Composition and Seasonal Fluctuation of Zooplankton in Koramagudda Kere, Lakkavalli range of Bhadra Wild life Sanctuary Karnataka India

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ABSTRACT
Seasonal changes in the diversity of Zooplankton and its relationships was, studied from 2007 to 2009. Comparatively, maximum density was recorded during pre-monsoon season and minimum density recorded during Post- monsoon season .It represented by four major groups namely Rotifera, Cladocera, Copepoda and Protozoan. Among these, a total of 09 species of zooplankton was recorded. In which Rotifera dominated followed by Cladocera, Copepoda and Protozoans.The Shannon-Weiner diversity index reveals that the highest index value (1.254), the Shannon's equitability index also followed the similar pattern. However, Simpson's diversity index was found high (5.526).The Simpsons equitability index also follows the similar pattern of Simpson diversity index. The ANOVA calculated as revealed the significance in, the Cladocera and Rotifera members. The Karl Pearson's correlation coefficient has revealed the significant positive relations.

***Key words**: Diversity, Zooplankton, Bhadra ,Seasonal,Occurrence.*

Introduction

Zooplanktons are the microscopic, free-swimming components of aquatic ecosystems, which are primary consumers on phytoplankton (Huliyal and Kaliwal, 2007). Zooplanktonic components of any aquatic ecosystem symbolise the balance between growth and reproduction in the relation to food availability and utilization. Zooplankton plays a key role in transferring energy from one trophic to another and thus is of foecal significance in maintaining equilibrium in a particular aquatic medium. Besides, they are also used as biological indicators of determining the physical and chemical nature of fresh water ecosystem. Zooplankton occupy a central position between the autotrophs and heterotrophs and are an important link in food chains, food web, energy flow and cycling of materials of a freshwater ecosystem (Sinha and Islam, 2002). They feed on phytoplankton and facilitate the conversion of plant material in to animal tissue they constitute the basic food for higher invertebrates like fishes, particularly their larvae. Most of the species are cosmopolitan in distribution .The distribution of zooplankton communities depends on many factors, some of which are change of climatic conditions, physico-chemical parameters and vegetation cover. According to Rajagopal *et al.*, (2011) zooplankton plays an integral role and serves as bio-indicator and it is a well-suited tool for understanding water pollution status. The occurrence and abundance of zooplankton depends on its productivity which in turn, is influenced by physico-chemical parameters and the level of nutrients in the water. Therefore, the present study deals with species diversity and seasonal fluctuation of zooplankton.

Materials and methods

The study was carried out in Lakkavalli range of Bhadra Wildlife Sanctuary, consisting an area of 223.17 km^2 (13° 34' to 13° 46' N and 75° 29' to 75° 45' E) in the Karnataka state of Southern India. The temperature in the valley ranges from 9-35°C. The region receives an annual rainfall of 1600 to 2000 mm during the southwest monsoon between June and September (Sathisha 2007). A distinct rainfall gradient results in a variation in vegetation types from semi-evergreen forest and moist deciduous forest through dry deciduous forest shoals and grassland type forest. It supports more than 19 waterholes that support a diversity of species including plants, animals, plankton, many microorganisms and macro invertebrates and vertebrates which are endemic. In view of this we have selected, Koramagudda kere that lies in (13° 37' 173" N and 75° 39' 095" E) (Map-1) and as a result ZooPlankton Diversity and Seasonal Fluctuations was made over a period of two years.

Collection of Plankton samples

For qualitative and quantitative analysis of zooplankton one liter of composite water samples at surface level were collected at interval of 30 days one liter of sample was fixed with 20 ml of percent Lugol's iodine solution and kept 24 hours for sedimentation. 100 ml of sample is subjected to centrifugation at 1500 rpm for 20 minutes and used for further investigation. Identification of Zooplankton was calculated by Lackey's drop count method. Identification of zooplankton was carried out by using (Tonapi, 1980 and APHA, 2005).

Data Analysis

The data were subjected to detail analysis.

Species richness (S): Total number of species in the study area.

Simpson's diversity index (D): This index represents the abundance ratio of individual species to that of total abundance values. It was calculated using the following formula

$D = 1/\sum pi2$

Where; 'pi' is the proportion of the ith species to total abundance value.

Simpson's equitability index (E): The chance of occurrence of individual species in one sample can be understood using this index, calculated using the formula

$E = D/S$

Where; 'D' is the Simpson's diversity index and 'S' is the species richness.

Shannon-Wiener's diversity index (H'): This index value was calculated by using the formula

$H' = -\sum pilnpi$

Where; pi is the proportion of the ith species to total abundance value.

Shannon-Wiener's equitability index (J): It was calculated using the formula

$J = H'/lnS$

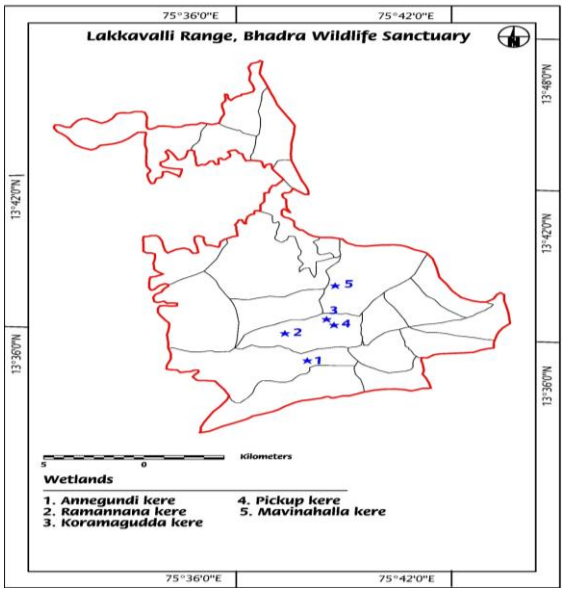

Fig 1. Selected wetlands in the study area

Results and Discussion

Zooplankton is the most fascinating group of microorganisms found in aquatic body. They play a vital role as primary consumers. The occurrence and abundance of zooplankton in water body depends on its productivity, which intern is influenced by physico-chemical parameters and level of nutrients. They occupy an intermediate position in food webs, many of them feed on phytoplankton. Zooplankton has been used as an indicator for monitoring the water quality, trophic status and pollution level. During present investigation, Zooplankton comprises of four major groups namely Rotifera, Cladocera, Copepoda and Protozoan.

Cladocera

The Cladocera are the zooplanktonic forms inhabiting almost all the niches of the fresh waterbodies and serve as indicators of aquatic pollution. They play a significant role in the structural-functional organization of water and process of their self purification and are an important food object for fish (Krylov *et al*., 2007). Thus they hold key position in food chain and energy transformation. About 600 species of freshwater Cladocera occur throughout the world of which 110 species have been recorded in India.A total of 2 genera and 2 species of Cladocerans have been recorded from this Koramagudda kere. The genera identified are *Diaphanosoma*, *Moina*, with single species each. Seasonally, maximum density recorded during pre-monsoon season and minimum density recorded during monsoon season (Table .1).

Copepoda

Copepods are known as one of the major zooplanktonic communities and significant chitin producers in planktonic, benthic and aquatic ecosystems. A few species of Copepods are used as bio-indicators for assessing the water conditions. Copepoda were

regarded as pollution sensitive organisms and they disappear when pollutions level increases. Similar variations were recorded by Maruthanayagam and Subramaniyan (2002). This wetland supported 2 genera and 2 species of Copepoda. Seasonally, maximum density recorded during post-monsoon season and minimum density recorded during monsoon season (Table .1).

Rotifers

Rotifera, is one of the oldest groups and minor phylum of invertebrates, are commonly termed as Wheel-Animacules. Although, Rotifers represents a very small group of animal kingdom, yet they are often considered qualitatively and quantitatively the most abundance metazoans in inland water. They are regarded as bio-indicators of water quality. Taxonomic dominance of Rotifers is reported by workers such as Cavalli *et al.* (2001) and Dayananda (2009). This observation shows that lower temperature and availability of nutrient favours the Rotifers population. In the present study high density was recorded during post-monsoon with less nutrients and low temperature. This water body lodged 2 genera and 2 species of Rotifers. If, species diversity considered *Brachionuis* represented by one species followed by *Keratella* with single species. Seasonally, maximum density recorded during pre-monsoon season and minimum density recorded during monsoon season (Table .1).

Protozoa

Protozoans are the most abundant animals which play an important role in controlling the numbers and biomass of bacteria. They are eukaryotic organisms that feed hetero-trophically and showed diverse motility mechanisms. Protozoans considered as pollution indicators in sewage and silage discharge water Cairns (1965). This wetland has 3 genera and 3 species of Protozoa. Seasonally, maximum density recorded during pre-monsoon season and minimum density recorded during Post- monsoon season (Table.1). The species diversity and indices calculated among the zooplankton were represented in **Table.2** .The Shannon-Weiner diversity index reveals that the highest index value (1.254) ,the Shannon's equitability index also followed the similar pattern. However, Simpson's diversity index was found high (5.526).The Simpson's equitability index also follows the similar pattern of Simpson diversity index. The ANOVA calculated as revealed that, the Cladocera and Rotifera members have represented the significance to ANOVA test indicating the differences among the density encountered during the study period. All other species do not exhibit the significance to the ANOVA test revealing constant encounter of the species during the study period. (Table.3). As the season changes there is a fluctuation in the diversity of the Zooplankton and the wetland is free from pollution.

Table. 1. Seasonal variation of zoooplankton density in Koramagudda kere (O/L), 2007 to 2009

Phytoplankton	**2007 – 08**			**2008 – 09**		
	Monsoon	**Post-monsoon**	**Pre-monsoon**	**Monsoon**	**Post-monsoon**	**Pre-monsoon**
	Mean ± Sd (Min - Max)	**Mean ± Sd (Min -Max)**	**Mean ± Sd (Min - Max)**	**Mean ± Sd (Min - Max)**	**Mean ± Sd (Min - Max)**	**Mean ± Sd (Min - Max)**
Cladocera	32.25 ± 2.754 (29 - 35)	34.75 ± 3.096 (32 - 39)	40 ± 3.651 (36 - 44)	35.25 ± 2.5 (32 - 38)	37 ± 2 (34 - 38)	44.66 ± 6.028 (39 - 51)
Copepoda	16.75 ± 2.217 (14 - 19)	24.5 ± 9.747 (18 - 39)	19.75 ± 7.500 (10 - 28)	15.5 ± 2.082 (13 - 18)	21 ± 6.481 (15 - 30)	31 ± 7 (24 - 38)
Rotifera	24 ± 6.325 (16 - 30)	34.25 ± 3.096 (30 - 37)	37 ± 9.487 (23 - 44)	20.25 ± 2.630 (18 - 24)	30.75 ± 6.076 (24 - 38)	46 ± 3.606 (42 - 49)
Protozoans	6.25 ± 2.217 (4 - 9)	4.75 ± 3.594 (2 - 10)	21.5 ± 12.369 (4 - 32)	4.75 ± 2.217 (2 – 7)	8.5 ± 9.678 (1 - 22)	30.33 ± 2.517 (28 - 33)

Table. 2. Species diversity indices calculated among the zooplankton (O/L) recorded in the study sites

Diversity indices	Koramagudda kere
Simpson diversity index	**5.526**
Simpson equitability index	**1.381**
Shannon-Weiner diversity index	**1.254**
Shannon-Weiner equitability index	**0.904**

Table .3. Correlation coefficient of zooplankton in Koramagudda kere

Zooplankton	Cladocera	Copepoda	Rotifera	Protozoans
Cladocera	1	0.476	**0.626**	**0.721**
Copepoda		1	**0.740**	**0.638**
Rotifera			1	**0.778**
Protozoans				1

***Bold** letters indicates significant at the 0.05 level*

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