

# Seasonal Variations in the Zooplankton Diversity of River Achencovil

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**Abstract-** Zooplanktons are heterotrophic planktonic animals floating in water. They serve as good indicators of changes in water quality. The present study was undertaken to observe the seasonal fluctuations in diversity of zooplanktons of Achencovil river, a significant freshwater body in Kerala. Both qualitative and quantitative analysis of were conducted from July 2009 to June 2010, by taking samples from 3 segments of the river. Zooplankton community of Achencovil river comprised of 28 species belonging to Cladocera (11sps), Copepoda (9sps) and Rotifera (8sps). Cladocerans showed dominance both in number and diversity, followed by Copepods and Rotifers. This study also reveals that different groups of zooplanktons have their own peak periods of density, which is affected by local environmental conditions prevailing at that time.

**Index Terms-** Zooplanktons, seasonal variation, diversity, Achencovil river

## I. INTRODUCTION

Zooplanktons are minute aquatic animals that are non motile or are very weak swimmers. They contribute significantly to biological productivity of freshwater ecosystem. They serve as good indicator of changes in water quality, because it is strongly affected by the environmental conditions and it is quickly responded to changes in environmental quality (Gannon and Stemberger, 1978). They are not only useful as bioindicators, but also helpful for ameliorating polluted waters. Zooplankton species are cosmopolitan in nature. They consist of fresh water, brackish and marine water forms. The freshwater zooplankton comprises Protozoans, Rotifers, Cladocerans, Copepods and Ostracods.

Planktonic protozoans are group of unicellular ciliated or flagellated organisms. They feed on either picoplankton or nanoflagellates and small nanophytoplanktons according to their size. Heterotrophic nanoflagellates are more abundant than ciliates in freshwater body. Heterotrophic nanoflagellates are more abundant than ciliates in freshwater body. Rotifers, the tiny wheel animalcules are considered nature's water purifier. They are prominent group among the zooplankton of a water body irrespective of its trophic status. This may be due to the less specialized feeding, parthenogenetic reproduction and high fecundity. Among the zooplankton, rotifers respond more quickly to environmental changes and used as changes in water quality (Gannon and Stemberger, 1978). Cladocerans are tiny aquatic crustaceans and are also known as water fleas. They are highly responsive against pollutants and hence serve as good

biological indicators of water pollution. Copepods have been known to the most abundant zooplankton in the river systems. They dominate most aquatic ecosystems because of their resilience and adaptability to changing environmental conditions and ability to withstand varying environmental stresses (Barnes et al, 1988). They are high in stable environmental conditions and disappear as pollution level increases (Das et al, 1996). Ostracods are mainly bottom dwellers of lakes. They live on detritus and dead phytoplanktons.

Investigations of freshwater zooplankton community structure have significant potential for assessing aquatic ecosystem health. Their dominance and seasonality are highly variable in different water bodies according to nutrient status, age, morphometry and other locational factors. Therefore changes in aquatic environment accompanying anthropogenic pollution are a cause of growing concern and require monitoring of surface waters and organisms inhabiting them. So the present study was carried out to understand the diversity and seasonal variation of zooplanktons in Achencovil river, a freshwater lotic perennial system in Kerala.

## II. MATERIALS AND METHODS

### A. Study Site

Three segments of Achencovil river were selected for the present study. They were:

- a) **Pandalam:** This station selected for sampling is near to the bridge on MC road at Pandalam and located at latitude 9° 13' 59.37' N and longitude 76° 40' 38.4' E with an elevation of 66 ft above MSL.
- b) **Kollakadavu:** This station is located at latitude 9° 15' 16.19' N and longitude 76° 35' 15.15' E with an elevation of 28 ft above MSL.
- c) **Veeyapuram:** This station is the point where the Achencovil river meets and merges with Pampa river in Alappuzha district and 6 km East of Harippad town. It is located at latitude 9° 19' 29.07' N and longitude 76° 27' 54.31' E with an elevation of 6 ft above MSL.

### B. Sampling and Analysis

Monthly samples were collected from these study sites during July 2009 to June 2010 and the data were incorporated into seasonal data considering January, February, March as summer; April, May, June as pre monsoon; July, August and

September as monsoon; October, November and December as post monsoon.

Qualitative sampling of zooplankton was done with the aid of plankton net of mesh size 60-75 $\mu$ . Quantitative samples were collected by filtering 200 L water. The collected specimens were carefully transferred to a tube, narcotized with 5% formalin and preserved in freshly prepared 5% formalin. These were taken to the laboratory and first sorted out into different groups using a dissection microscope. Taxonomic identification was done with the help of Olympus Stereoscopic Dissection Microscope and using relevant literatures (Petersen, 2010; Yule and Sen, 2004). The descriptive statistics were conducted while statistical significance of differences ( $P < 0.05$ ) was determined by analysis of variance (ANOVA).

### III. RESULTS AND DISCUSSION

Zooplankton community of Achencovil river comprised of 28 species belonging to Cladocera (11sps), Copepoda (9sps) and Rotifera (8sps) (Table. 1).

The relative abundance of zooplankton population in this river depicted in Fig. 1 shows during summer, rotifers were dominated (39.36%) followed by copepods (33.53%) and cladocera (27.11%). The cladocerans marked higher abundance during pre monsoon (41.41%) and monsoon (45%) while copepods formed the dominant group during post monsoon season (42.01%).

#### A. Cladocera

The Cladoceran population identified from Achencovil river during the present study were represented by 11 species belonging to 7 genera and 6 families; Daphnidae, Bosminidae, Sididae, Moinidae, Chydoridae and Macrotrichidae. Quantitative analysis during the period of study showed that the family Chydoridae exhibit maximum diversity of species. It is represented by 4 species; *Chydorus ventricosus*, *Alona quadrangularis*, *A. rectangula* and *A. verrucosa*. *Ceriodaphnia cornuta* belongs to the family Daphnidae, found to be predominant species among the identified cladocerans. Among the family Bosminidae; *Bosmina longirostris* and *B. fatalis* were recorded. From all other families only a single species were recorded.

The percentage composition of the identified cladocerans varied between 0.67% and 24.94%. Among them, *Ceriodaphnia cornuta* (24.94%) dominated followed by *Bosmina longirostris* (15.65%), *Diaphanosoma excisum* (14.29%), *B. fatalis* (12.47%), *Daphnia carinata* (11.79%), *Moina micrura* (9.75%), *Alona verrucosa* (4.54%), *Chydorus ventricosus* (3.40%), *Alona quadrangularis* (1.59%), *A. rectangula* (0.91%) and *Macrotrix spinosa* (0.68%). In this study, minimum numbers of cladocerans were reported in summer (31N/L) and post monsoon season (29N/L) at segment 2 (Table. 2). This group exhibit highest peak at segment 3, during pre monsoon (45N/L) and monsoon with seasonal mean peak value of 42N/L. This observed maximum pre monsoonal density may be due to high phytoplankton density. Similar observation was earlier made by Santhanam and Perumal (2003). The decrease in the density of cladocerans may be due to seasonal variation. Therefore, a clear seasonal fluctuation was

observed in the density of cladoceran population of Achencovil river. These seasonal variations in the density of cladocerans are statistically significant ( $P < 0.05$ ).

#### B. Copepoda

The Copepod population identified from Achencovil river during the present study were represented by 9 species belonging to 8 genera and 3 families. Among them, *Mesocyclops leuckarti* (24.57%) dominated followed by *Eucyclops serrulatus* (19.39%), *Trophocyclops prascinus* (14.66%), *Mysis sps* (12.29%), *Pseudodiaptomus nostradamus* (9.93%), *Microcyclops varicans* (8.51%), *Mesocyclops hyalinus* (4.96%), *Filipinodiaptomus insulanus* (3.54%) and Nauplius larvae (2.13%). In this study, cyclopoid copepods were dominant over calanoid copepods.

Copepoda exhibit highest peak at all 3 segments during post monsoon season and the seasonal mean peak value was 44.67 N/L (Table.3). It can be explained as the result of settling of rainwater and return of favourable condition. The minimum number was found in monsoon season with seasonal mean value of 25.33 N/L. Similar observation was earlier made by Padnavati and Goswami (1996). This decrease in the density of copepod may be due to environmental variation. So there exists seasonal fluctuation in the density of copepod population of Achencovil river. The seasonal variations in the density of copepods are statistically significant ( $P < 0.05$ ).

#### C. Rotifera

The Rotifer population identified from Achencovil river during the present study were represented by 8 species belonging to 6 genera and 5 families; namely Branchionidae, Asplanchnidae, Trichocercidae, Lecanidae and Testudinellidae. Quantitative analysis during the period of study showed that the family Branchionidae exhibit maximum diversity of species. It is represented by 4 species; among them *Brachionus angularis* was found to be predominant species. From all other families only a single species were recorded.

The percentage composition of the identified rotifers varied between 5.69% and 20.54%. Among them, *Brachionus angularis* (20.54%) dominated followed by *Brachionus calyciflorus* (17.57%), *Keratella tropica* (15.84%), *Asplanchna priodonta* (13.37%), *Trichocera rattus* (10.89%), *Lecane bulla* (8.66%), *Brachionus caudatus* (7.43%) and *Testudinella patina* (5.69%). In this study, minimum numbers of rotifers were reported in monsoon (23N/L) at segment 2 (Table. 4). This group exhibit highest peak at segment 3, during summer (48N/L). Arora and Mehra (2003) while analysing seasonal dynamics of rotifers in relation to physico chemical conditions of lotic water body made similar observations in increased densities in summer and reduced densities in winter. In summer, the absence of inflow of water brings stability to the water body. The availability of food is more due to production of organic matter and decomposition. These factors contribute for high species density.

In most of the aquatic ecosystem different zooplankton groups acts as one of the major primary consumer as a result, their diversity, abundance and seasonality affects the other biotic

components there in. The zooplankton population of the concerned habitat was found to be dominated by cladocerans both in number and diversity followed by copepods and rotifers. Therefore the present study on qualitative and quantitative changes occurring in the riverine ecosystems is necessary in order to understand and preserve the biodiversity of Achencovil river.

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Table 1: List of zooplankton species identified from Achencovil river during the study

Sl.No:	SPECIES/SEASONS	SUM	PRM	MON	POM
A	ROTIFERA				
	Family-Brachionidae				
1	<i>Brachionus angularis</i>	+	+	+	+
2	<i>Brachionus calyciflorus</i>	+	+	+	+
3	<i>Brachionus caudatus</i>	+	+	-	+
4	<i>Keratella tropica</i>	+	+	+	+
	Family-Asplanchnidae				
5	<i>Asplanchna priodonta</i>	+	+	+	+
	Family-Trichocercidae				
6	<i>Trichocera rattus</i>	+	+	+	+
	Family-Lecanidae				
7	<i>Lecane bulla</i>	+	+	-	+
	Family-Testudinellidae				
8	<i>Testudinella patina</i>	+	-	-	+
B	CLADOCERA				
	Family-Daphnidae				
9	<i>Ceriodaphnia cornuta</i>	+	+	+	+
10	<i>Daphnia carinata</i>	-	+	+	+
	Family- Bosminidae				
11	<i>Bosmina longirostris</i>	+	+	+	+
12	<i>Bosmina fatalis</i>	+	+	+	-
	Family-Sididae				
13	<i>Diaphanosoma excisum</i>	+	+	+	-
	Family-Moinidae				
14	<i>Moina micrura</i>	+	+	+	-
	Family-Chydoridae				
15	<i>Chydorus ventricosus</i>	-	+	-	+
16	<i>Alona quadrangularis</i>	-	-	+	-
17	<i>Alona rectangula</i>	-	+	-	-
18	<i>Alona verrucosa</i>	+	+	+	-
	Family-Macrotrichidae				
19	<i>Macrotrix spinosa</i>	-	+	-	-
C	COPEPODA				
	Order-Cyclopoida				
	Family-Cyclopidae				
20	<i>Mesocyclops leuckarti</i>	+	+	+	+
21	<i>Mesocyclops hyalinus</i>	+	-	-	+
22	<i>Trophocyclops prascinus</i>	+	+	+	+
23	<i>Eucyclops serrulatus</i>	+	+	+	+
24	<i>Microcyclops varicans</i>	+	+	-	+
	Order-Calanoidea				
	Family-Diaptomidae				
25	<i>Filipinodiaptomus insulanus</i>	+	-	-	+
	Family-Pseudodiaptomidae				
26	<i>Pseudodiaptomus nostradamus</i>	+	+	-	+
27	Mysis sps	+	+	+	+
28	Nauplius larvae	+	-	-	+

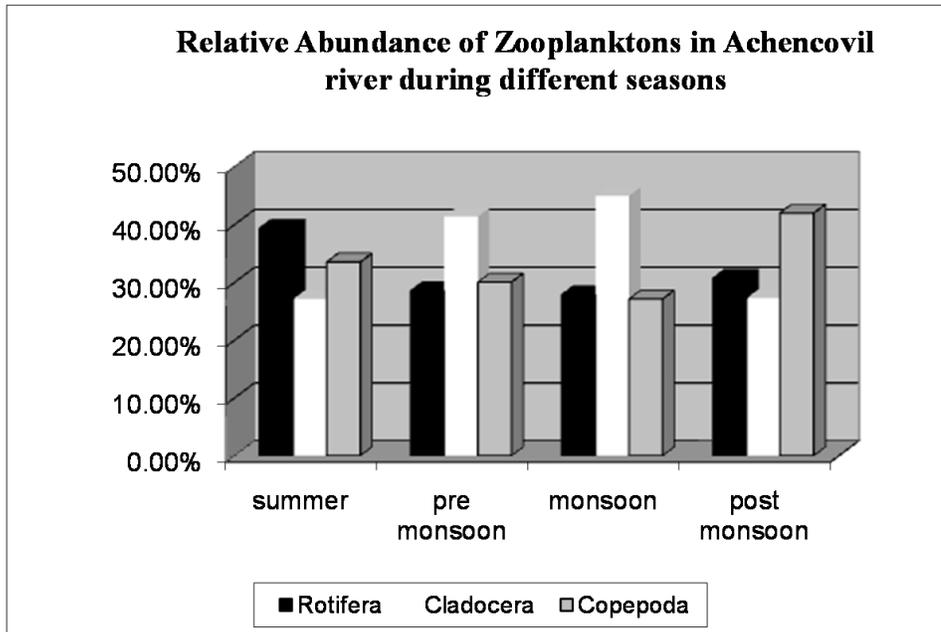


Fig 1: Relative abundance of zooplankton population in Achencovil river during different seasons

Table 2: Seasonal variations in the density of cladoceran population in Achencovil river during the study.

Season	Segment 1	Segment 2	Segment 3	Seasonal Mean $\pm$ SE
Summer	32	26	35	31 $\pm$ 2.64
Pre monsoon	46	40	49	45 $\pm$ 2.64
Monsoon	43	38	45	42 $\pm$ 2.08
Post monsoon	28	25	34	29 $\pm$ 2.64
Annual Mean $\pm$ SE	37.25 $\pm$ 4.31	32.25 $\pm$ 3.92	40.75 $\pm$ 3.71	

Table 3: Seasonal variations in the density of copepod population in Achencovil river during the study.

Season	Segment 1	Segment 2	Segment 3	Seasonal Mean $\pm$ SE
Summer	42	38	35	38.33 $\pm$ 2.03
Pre monsoon	31	34	33	32.67 $\pm$ 0.88
Monsoon	27	24	25	25.33 $\pm$ 0.88
Post monsoon	45	41	48	44.67 $\pm$ 2.03
Annual Mean $\pm$ SE	36.25 $\pm$ 4.98	34.25 $\pm$ 4.28	35.25 $\pm$ 5.51	

Table 4: Seasonal variations in the density of rotifer population in Achencovil river during the study.

Season	Segment 1	Segment 2	Segment 3	Seasonal Mean $\pm$ SE
Summer	48	42	45	45 $\pm$ 1.73
Pre monsoon	31	28	34	31 $\pm$ 1.73
Monsoon	27	23	28	26 $\pm$ 1.53
Post monsoon	36	30	32	32.67 $\pm$ 1.77
Annual Mean $\pm$ SE	35.5 $\pm$ 4.56	30.75 $\pm$ 4.03	34.75 $\pm$ 3.64	