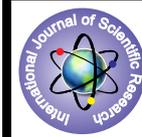


Seasonal Abundance of Crustacean Zooplanktons in Achencovil River, Kerala, India



Biology

KEYWORDS : Abundance, Crustacean zooplankton, Achencovil river, Hydrological parameters

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ABSTRACT

Crustacean zooplanktons are widely used as indicators of aquatic environment. The present study was carried out to know the factors that govern the diversity and abundance of crustacean zooplanktons in Achencovil river, a freshwater lotic perennial system in Kerala. Quantitative and qualitative analysis of crustacean zooplanktons besides hydrological parameters were carried out from July 2009 to June 2010, by taking samples from 3 segments of this river. Crustacean zooplankton community of this river comprised of 20 species belonging to Cladocera and Copepoda. The Cladoceran population showed dominance both in number and diversity with distinct seasonal variations. This study also revealed that hydrological parameters like DO, TDS and pH had great influence on the diversity and abundance of crustacean zooplanktons of this river.

INTRODUCTION

Zooplanktons are heterotrophic planktonic animals floating in water. They occupy a central position between autotrophs and other heterotrophs and form an important link in food web of the fresh water ecosystem. They act as good indicator of changes in water quality, because it is strongly affected by environmental conditions and response quickly to changes in environmental quality [1]. 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.

The crustacean zooplankton community was made up of cladocerans and copepods. 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 are high in stable environmental conditions and disappear as pollution level increases [2]. Hence qualitative and quantitative assessment of these crustaceans zooplanktons are of great importance. Moreover the diversity and abundance of zooplanktons are influenced by physico-chemical variables. So the present investigation was carried out to know the diversity and seasonal variation of crustacean zooplanktons in river Achencovil, a significant fresh water body in Kerala.

MATERIALS AND METHODS

A. Study site

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

a) Pandalam: located at latitude 9o 13' 59.37' N and longitude 76o 40' 38.4' E with an elevation of 66 ft above MSL.

b) Kollakadavu: located at latitude 9o 15' 16.19' N and longitude 76o 35' 15.15' E with an elevation of 28 ft above MSL.

c) Veeyapuram: located at latitude 9o 19' 29.07' N and longitude 76o 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 60-75µ. 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 [3, 4].

Surface water samples were collected in a 500 ml wide mouthed polypropylene bottle for analysing 5 physico-chemical characteristics. Analysis was done in the field and laboratory following standard methods [5]. Principle component analysis (PCA) of the category multivariate analysis using the software Biodiversity Pro was employed to find out the principle factors in water affecting the diversity and density of crustacean zooplanktons. The descriptive statistics were conducted while statistical significance of differences ($P < 0.05$) was determined by analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Hydrological Parameters

The values of various water quality parameters studied during different seasons in Achencovil River were presented in Table 1.

Table 1: Hydrological parameters recorded in Achencovil river during the study

Hydrological parameters	Segment 1	Segment 2	Segment 3	Annual Mean \pm SE
Temp	27.81	26.88	27.64	27.44 \pm 0.28
pH	6.73	7.09	7.09	6.97 \pm 0.12
DO	8.48	7.12	7.23	7.61 \pm 0.44
TDS	32.35	31.7	33.23	32.42 \pm 0.44
Conductivity	49.6	42.0	45.27	45.62 \pm 2.20

Temperature is a key factor which controls all chemical reactions and biological processes in a water body. During the present study, the annual mean water temperature was found to be 27.4 OC; with high values during summer and low during monsoon season at segment 3. This lower value in monsoon may be due to the effect of heavy rainfall. These variations were statistically significant ($P < 0.05$) between seasons. The pH of water comes in the range of 6 to 8 with annual mean of 6.9. It was relatively high in summer and monsoon at segment 2 and 3; and low in post monsoon season at segment 1. The recorded higher summer pH might be due to the presence of high photosynthetic organisms [6]. The observed high monsoonal values can be due to the cumulative effect of heavy rainfall and the resultant freshwater mixing [7]. These variations were statistically significant ($P < 0.05$) among different seasons and between segments.

The annual mean dissolved oxygen content was observed as 7.64 mg/L. The maximum value of DO was found in post monsoon season at segment 1 while minimum in monsoon at segment 2. The moderately high DO content throughout the year at all three segments reveals that the water quality of this river is good. The seasonal variations in the DO were statistically significant ($P < 0.05$). TDS values were maximum during summer (41.3 mg/L) at segment 1 and minimum at segment 2 during post monsoon season (28.1 mg/L) with annual mean of 32.4 mg/L. The higher TDS content of water at segment 1 may be due to agricultural run off from surrounding fields. The conductivity was observed in the range of 37.2 to 64.1mS. The highest

and lowest values were recorded at segment 1 during summer and pre monsoon season. The annual mean of conductivity was recorded as 45.6mS. The higher conductivity value at segment 1 is an indication of the presence of more ions, which could be due to influx of allochthonous and inorganic materials from the stream surroundings. The Principle component analysis on physico-chemical parameters shown on Table 2 explains that, there exist significant relationships with crustacean zooplankton diversity. In this study, variation in the diversity and density of crustacean zooplanktons are seemed to be essentially related to DO content of the river. TDS found to be PC2 and pH was the PC3.

Table 2: Principal component in the density of crustacean zooplankton population from Achencovil river during the study.

Factor	Eigen value	Score variable	Proportions Eigen value
Dissolved oxygen	0.59592	28.24653	2.79549
TDS	0.47021	10.63237	2.20451
pH	0.27353	-15.14437	0

Crustacean Zooplankton Diversity

Crustacean Zooplankton community of Achencovil river comprised of 20 species belonging to cladocera (11 species) and copepoda (9 species) were recorded on Table 3. The species abundance of cladocera was found to be higher than copepods. A total of 11 species of cladocera belonging to 7 genera and 6 families were obtained during the period of investigation. There were 9 species of copepods belonging to 3 families and 8 genera.

Table 3: List of crustacean zooplanktons identified from Achencovil river during the study

Sl. No.	Species	Season			
		SUM	PRM	MON	POM
A. CLADOCERA					
	Family-Daphnidae				
1	Ceriodaphnia cornuta	+	+	+	+
2	Daphnia carinata	-	+	+	+
	Family- Bosminidae				
3	Bosmina longirostris	+	+	+	+
4	Bosmina fatalis	+	+	+	-
	Family-Sididae				
5	Diaphanosoma excisum	+	+	+	-
	Family-Moinidae				
6	Moina micrura	+	+	+	-
	Family-Chydoridae				
7	Chydorus ventricosus	-	+	-	+
8	Alona quadrangularis	-	-	+	-
9	Alona rectangula	-	+	-	-
10	Alona verrucosa	+	+	+	-
	Family-Macrotriciidae				
11	Macrotrix spinosa	-	+	-	-
B. COPEPODA					
	Order-Cyclopoida				
	Family-Cyclopidae				
12	Mesocyclops leuckarti	+	+	+	+
13	Mesocyclops hyalinus	+	-	-	+
14	Trophocyclops prasinus	+	+	+	+
15	Eucyclops serrulatus	+	+	+	+
16	Microcyclops varicans	+	+	-	+
	Order-Calanoidea				
	Family-Diaptomidae				
17	Filipinodiptomus insulanus	+	-	-	+
	Family-Pseudodiaptomidae				
18	Pseudodiaptomus nostradamus	+	+	-	+
19	Mysis sps	+	+	+	+
20	Naupius larvae	+	-	-	+

Numerical Density

The total numerical density of crustacean zooplankton community

varied between 25.33 N/L and 45 N/L during the study period and was given on Table 4.

Table 4: Seasonal variations in the density of Crustacean zooplankton in Achencovil river during the study period

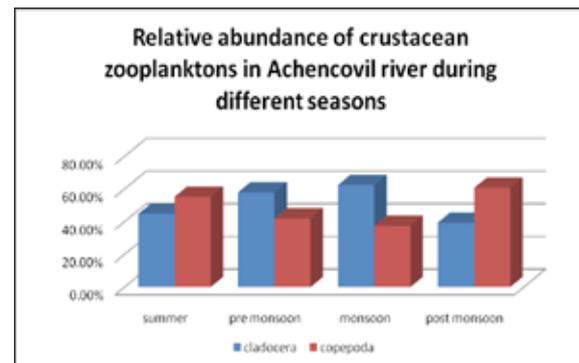
Season	Cladocera				Copepoda			
	Seg 1	Seg 2	Seg 3	Seasonal Mean ± SE	Seg 1	Seg 2	Seg 3	Seasonal Mean ± SE
Summer	32	26	35	31 ± 2.64	42	38	35	38.33 ± 2.03
Pre-Monsoon	46	40	49	45 ± 2.64	31	34	33	32.67 ± 0.88
Monsoon	43	38	45	42 ± 2.08	27	24	25	25.33 ± 0.88
Post-Monsoon	28	25	34	29 ± 2.64	45	41	48	44.67 ± 2.03

Cladocerans dominated the population density with annual mean of 36.75 N/L, while copepods are contributed by 35.25 N/L. Copepods formed the dominant component contributed maximum to the density during post monsoon season while cladocerans dominated the crustacean zooplankton population density during pre monsoon season. The observed maximum pre monsoonal cladoceran density may be due to high phytoplankton density. Similar results were also observed [8]. High density of copepods recorded during post monsoon season can be explained as the result of settling of rain water and return of favourable condition [9].

Relative Abundance

Relative abundance of cladocerans was higher in pre-monsoon (57.94%) and monsoon (62.38%) compared to copepods, whereas the copepods dominated the crustacean zooplankton population during other seasons (Summer – 55.28%, Post Monsoon – 60.63%). Fig1 shows the relative abundance of crustacean zooplanktons in Achencovil river during the study.

Fig1: Relative abundance of crustacean zooplanktons in Achencovil river during the study



Numerically Abundant Species

During the present study, the species those controlled the bulk of crustacean zooplankton density were Ceriodaphnia cornuta, Mesocyclops leuckarti, Eucyclops serrulatus, Bosmina longirostris, Diaphanosoma excisum, Trophocyclops prasinus, Bosmina fatalis and Daphnia carinata.

Based on the present study, the river Achencovil was found rich in diversity and density with respect to crustacean zooplanktons. But the density of crustacean zooplankton showed distinct seasonal variations. This numerical variation in peak periods for different groups of zooplankton may be due to different abiotic and biotic factors. Since the diversity and density of zooplanktons are influenced by the quality of water, it is necessary to conserve the riverine ecosystem for the maintenance of existing biodiversity.

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