

# Heterogeneity of zooplanktons in Boranakanive reservoir of Tumakuru District, Karnataka, India.

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## ABSTRACT

The zooplankton heterogeneity of Boranakanive reservoir at the Tumakuru District of Karnataka (India) was studied for a span of one year from July 2017 to June 2018 on a monthly basis. The study revealed a total occurrence of 29 zooplankton species. Among which, 15 Rotifera species belonged to 6 various families, 7 Cladocerans were belonging to 4 different families, 5 Copepoda species from 2 families and 2 Ostracod species. Among the four mentioned groups of zooplanktons, the chronology for species diversity went to be in the order as Rotifera>Cladocera>Copepoda>Ostracoda. Also, population wise the chronology of the zooplankton groups was observed to be as Rotifera>Copepoda>Cladocera>Ostracoda. Numerically, the Rotiferans came up as the dominant group throughout the study period. The monthly zooplankton count exhibited the highest population during the month of March and the least during the February month. The existence of zooplanktons is always directly impacted by the environmental factors of the water body along with the anthropological influence on it.

*Key words* : Zooplankton heterogeneity, Rotifera, Cladocera, Copepoda, Ostracoda.

## Introduction

Zooplanktons have an indispensable role in the energy flow or the nutrient cyclic process of any aquatic ecosystem. They are vital organisms of any water body as they play a crucial role in interlinking the aquatic food chain. The rapid growth rates of zooplanktons help them aid as significant biological indicators of any change in the environment during shorter or even longer time scales (Schindler, 1987; Pearl *et al.*, 2003). Zooplanktons are widely investigated upon due to their short life span, large density, drifting nature, high group or species diversity and varied tolerance to stress. Also, they are primarily shaped by the physical and chemical environment of the ecosystem and are modified by the influence of biological interactivities. The

zooplanktons are classified into some major groups like Cladocera, Copepoda, Rotifera and Ostracoda. The zooplankton community also helps us understand the fluctuations in the trophic status or water quality of any water body.

The present study was undertaken at the Boranakanive reservoir, holding a purpose to investigate and evaluate the heterogeneity of zooplanktons in the reservoir. The Boranakanive reservoir is located at 6 km east of Huliya town, of Tumakuru District, Karnataka. The Boranakanive reservoir is just lentic freshwater ecosystem. It was constructed as early as 1892 for minor irrigation purpose during the British rule under the administration of the then Mysore State Maharaja, His Highness Sri Jayachamarajendra Wodeyar X GCSI.

## Materials and Methods

### Study area

The Boranakanive reservoir falls at 76° 37'59. 60"N longitude and 13° 35'54.55"E latitude. It stands approximately 80ft above the ground level, having a catchment area of 913.09 Sq.Km, the Dam is built to provide irrigation facilities to 675.00 Ha, of lands covering 5 villages. Our study was carried out around the dam site on a monthly interval.

### Zooplankton Collection and Enumeration

For our study, samples were collected during the early hours of the day (7 am to 11 am) from the littoral water surface. The plankton net of No: 25, made up of bolting nylon silk (meshsize 62µm) was used for sampling, it is conical shaped net having a reducing cone with a vial/bottle at its tapering end. The sample collections of zooplanktons for qualitative studies were done by towing the plankton net in surface water horizontally and obliquely. Whereas, for quantitative analysis 10 litres of water was collected in a known volume of plastic bucket from around the study site (Fig 1.) and pooled together to consider as a final sample to be filtered through the net. Filtered samples were collected in well labelled 100 mL plastic container and preserved by adding 4% formalin. Later, the bottles were carried to the laboratory and kept aside overnight. The qualitative study of the zooplanktons were conducted by using the methods given by Needham and Needham (1966), Adoni *et al.* (1985), Pennak (1978), Tonopi (1980), Battish (1992), Ranga Reddy (1994) and Dhanapati (2000). Later, the species identification was confirmed with the help of experts from Zoological Survey of India (ZSI).

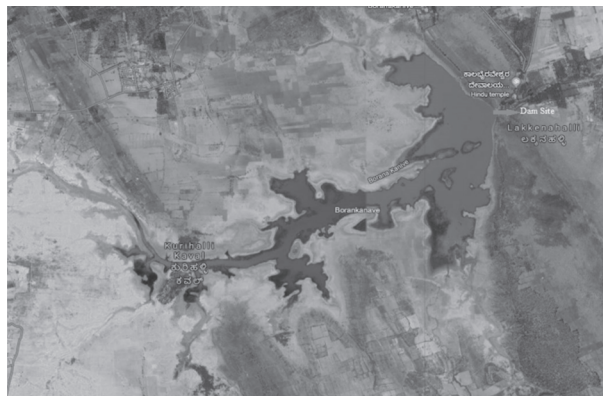


Fig. 1. Location of the Dam site of Boranakanive reservoir

Quantitative studies were done by using the 'Sedgwick-Rafter counting cell'. Samples were properly agitated to distribute the organisms evenly and by using a pipette, 1 mL of the sample was transferred onto the cell. The cover slip was placed properly, avoiding any air bubble. The planktons were allowed to settle down and counting was done under a compound light microscope by taking good number of replicates to later calculate the average count per millilitre to express results in Ind./L (Welch, 1948). Further, calculations were carried out using the applicable formulae (Karuthapandi *et al.* 2016).

$$\text{Sedgwick-Rafter cell zooplankton (Ind./L)} = \frac{a \times C \times 1000}{L}$$

Where,

a = average numbers of zooplanktons counted in the cell

C = volume of concentrate in mL

L = volume of water filtered in litres

### Physico-chemical Parameters

Basic parameters like ambient temperature, surface water temperature and pH of water were checked in relation to have a better understanding of the existence of zooplankton community in the reservoir. The atmospheric and surface water temperature was recorded with the help of mercury thermometers and the pH of water was recorded with the help of a digital portable pH meter (ELICO model Li-120).

### Results and Discussion

In this study, we recorded a total of 29 species of zooplanktons. Among which, 15 species were rotifers, 7 species were cladocerans, 5 species were copepods and 2 species were of ostracods (Table 1). Among the rotifers, family *Brachionidae* contained highest number of species representing 9 species, followed by family *Philodinidae* exhibiting 2 species, after which other families like *Euchlanidae*, *Filiniidae*, *Lecanidae* and *Testudinellidae* comprised of 1 species each. The cladocerans exhibited a total of 7 species, among which, the *Chydoridae* family comprised of 3 species followed by the *Daphniidae* family having 2 species and then *Moinidae* and *Sididae* families having 1 species each. The copepods had a total of 4 species of which, 3 species belonged to the family of

Table 1. List of Zooplankton species recorded in Boranakanive reservoir.

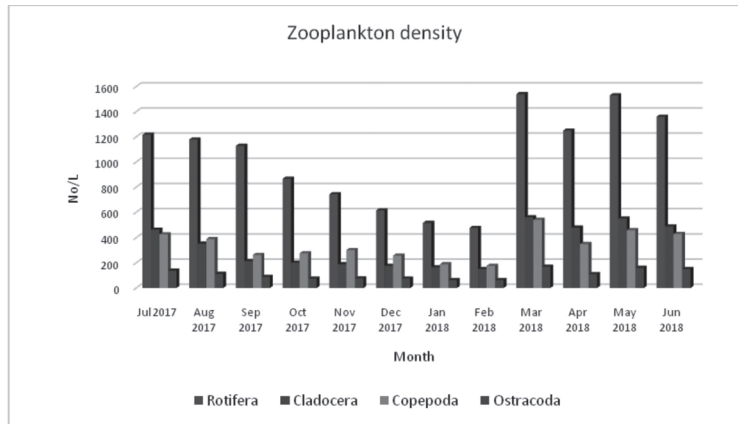
Sl. No.	Name of the Species	Jul 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018
<b>ROTIFERA</b>													
<b>Brachionidae</b>													
1.	<i>Brachionus angularis</i>	+	+	+	+	+	+	+	+	+	+	+	+
2.	<i>Brachionus calyciflorus</i>	+	+	+	+	+	+	+	+	+	+	+	+
3.	<i>Brachionus caudatus</i>	+	+	+	+	+	+	+	+	+	+	+	+
4.	<i>Brachionus diversicornis</i>	+	+	+	+	+	+	+	+	+	+	+	+
5.	<i>Brachionus falcatus</i>	+	+	+	+	+	+	+	+	+	+	+	+
6.	<i>Brachionus forficula</i>	+	+	+	+	+	+	+	+	+	+	+	+
7.	<i>Brachionus rubens</i>	+	+	+	+	+	+	+	+	+	+	+	+
8.	<i>Brachionus quadridentatus</i>	+	+	+	+	+	+	+	+	+	+	+	+
9.	<i>Keratella tropica</i>	+	+	+	+	+	+	+	+	+	+	+	+
<b>Euchlanidae</b>													
10.	<i>Euchlanis dilatata</i>	+	+	+	+	-	+	-	+	+	+	+	+
<b>Filiniidae</b>													
11.	<i>Filinia longiseta</i>	+	-	+	+	+	-	+	+	+	+	+	+
<b>Lecanidae</b>													
12.	<i>Lecane bulla</i>	+	+	+	+	+	+	+	+	+	+	+	+
<b>Philodinidae</b>													
13.	<i>Filinia poliensis</i>	+	+	-	+	+	+	+	-	+	+	+	+
14.	<i>Rotaria septunia</i>	+	+	+	-	+	+	+	+	+	+	+	+
<b>Testudinellidae</b>													
15.	<i>Testudinella patina</i>	+	+	+	-	+	+	-	+	+	+	+	+
<b>CLADOCERA</b>													
<b>Chydoridae</b>													
16.	<i>Chydorus sphaericus</i>												
17.	<i>Coronella rectangular</i>	+	+	+	+	+	+	+	-	+	+	+	+
18.	<i>Dunheediocrassa</i>	+	+	+	-	+	+	-	+	+	+	+	+
<b>Daphniidae</b>													
19.	<i>Ceriodaphnia cornuta</i>	+	+	+	+	+	+	+	+	+	+	+	+
20.	<i>Simocephalus xipinosus</i>	+	+	+	+	+	-	+	+	+	+	+	+
<b>Moinidae</b>													
21.	<i>Moina micrura</i>	+	+	+	+	-	+	+	+	+	+	+	+
<b>Sidiidae</b>													
22.	<i>Diaphanosomaarsi</i>	+	+	-	+	+	+	+	-	+	+	+	+
<b>COPEPODA</b>													
<b>Cyclopidae</b>													

Table 1. Continued ...

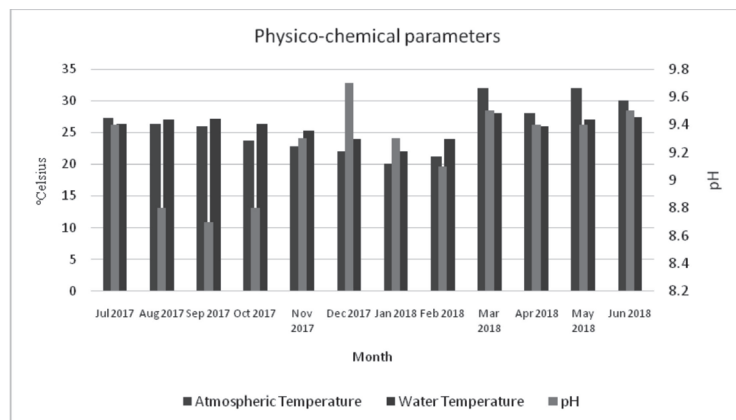
Sl. No.	Name of the Species	Jul 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018
23.	<i>Mesocyclopsleukarti</i>	+	+	+	+	+	+	+	+	+	+	+	+
24.	<i>Mesocyclopspeipiensis</i>	+	+	+	+	+	+	+	+	+	+	+	+
25.	<i>Thermocyclopscrassus</i>	+	+	+	+	+	+	+	+	+	+	+	+
26.	<i>Diaptomidae</i>	+	+	+	+	+	+	+	+	+	+	+	+
27.	<i>Heliodaptomusviduus</i>	+	+	+	+	+	+	+	+	+	+	+	+
	<i>Nauplius larvae</i>	+	+	+	+	+	+	+	+	+	+	+	+
	<b>OSTRACODA</b>												
	<i>Cyprididae</i>												
28.	<i>Cyprretta sp.</i>												
29.	<i>Hemicypris sp.</i>												

*Cyclops* and 1 from *Diaptomidae* along with the presence of *Nauplius larvae*. The ostracods had 2 species namely *Cyprretta species* and *Hemicypris species*. The overall chronology for the diversity of species happens to be as Rotifera>Cladocera>Copepoda>Ostracoda.

The zooplankton density varied between 868 ind./L and 2810 ind./L throughout the study span (Table 2). The total highest density was observed in the month of March 2018 and the least density was seen in the month of February 2018. Similarly, for the groupwise density on a monthly basis, the rotifers exhibited highest population with maximum number of species coming from the *Brachionus* family. The highest total of rotifers was 1540 ind./L in the month of March 2018. Following the rotifers was the cladoceran population (560 Ind./L) further followed by the copepods (540 Ind./L) and then the ostracods (170 Ind./L) in the same month. Hence, the overall groupwise population percentage (Table 3) of zooplanktons for the entire study period (annual basis) can be written in a chronological



Graph 1. Monthly variations in Zooplankton density of Boranakanive Reservoir.



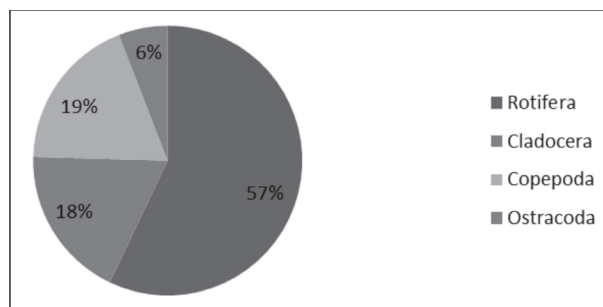
Graph 2. Monthly variation in Physico-chemical Parameters of Boranakanive reservoir.

**Table 2.** Monthly record of Zooplankton density from July 2017- June 2018.

Zooplankton Groups	Jul 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018
Rotifera (No/L)	1217	1178	1129	866	743	615	516	478	1540	1250	1530	1360
Cladocera (No/L)	464	353	214	202	189	176	164	151	560	480	550	490
Copepoda (No/L)	427	389	263	276	302	258	189	176	540	350	460	430
Ostracoda (No/L)	138	113	88	75	76	75	63	63	170	110	160	150
Total zooplanktons (No/L)	2246	2033	1694	1419	1310	1124	932	868	2810	2190	2700	2430

**Table 3.** Annual percentage of zooplanktons

Zooplankton groups	Annual %
Rotifera	57
Cladocera	18
Copepoda	19
Ostracoda	6

**Fig. 3.** Annual Percentage of Zooplankton Population

order as Rotifera>Copepoda>Cladocera>Ostracoda.

The zooplanktons serve as biological indicators due to their rapid response in accordance with the environmental changes (Manickam *et al*). The monthly profile of few basic physico-chemical features of the reservoir are given in Table 4, as the temperature and pH play crucial deciders of the ecological environment by directly influencing the existence of any living organism. The atmospheric temperature for the study period ranged between 20°C to 32 °C and the surface water temperature ranged between 22 °C to 28 °C. In both the atmo-

spheric and water temperature, the highest and the lowest values were observed in the month of March and January respectively. Coming to the pH of water, it was observed to be ranging between 8.7 and 9.7 throughout the study period. The range of pH clearly reveals the alkaline nature of water in the reservoir. Usually, more number of rotifers thrive in alkaline water bodies and in acidic water they occur less (Arora, 2006). The given graphs 1 and 2 bring to the limelight that an increase in temperature in the months from March to June accordingly made way for the rotiferan population to rise during the same months of the study span. The overall analysis shows that, there was an increase in the numbers of zooplanktons during high temperature as it plays a key role in the existence of the zooplanktons and mainly that of rotifers (Arora J. and Naresh, 2003). The population of rotifers majorly depends upon the food availability and temperature of the environment (Lougheed and Chow-fraser, 1998). The annual percentage of the total zooplanktons for the study period was distributed into, a major percentage of 57% comprising of rotiferans, followed by 19% of copepods, followed by the cladocerans for 18% and the least being that of the ostracods making upto 6% of the total zooplanktons recorded (Table 3 and Fig 3).

The present study on the heterogeneity of the zooplanktons of Boranakanive reservoir brought to our knowledge, the diverse species of the zooplankton community of the freshwater body. It also

**Table 4.** Monthly profile of Temperature and pH of reservoir during the study span.

Parameters	Jul 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017	Jan 2018	Feb 2018	Mar 2018	Apr 2018	May 2018	Jun 2018
Atmospheric Temperature °C	27.3	26.3	26	23.7	22.8	22	20	21.3	32	28.1	32	30
Water Temperature °C	26.3	27	27.1	26.4	25.3	24	22	24	28	25.9	27	27.4
pH	9.4	8.8	8.7	8.8	9.3	9.7	9.3	9.1	9.5	9.4	9.4	9.5

brought to our learning that, the occurrence of zooplanktons and their population density was directly impacted by the environmental factors and also fluctuates due to the same. Mainly, the high density of rotifers indicated towards the alkaline nature of water in the reservoir, thereby proving the role of zooplanktons as bio-indicators. The study recommends that the overall zooplankton composition in relation to the physico-chemical features would prove to be a significant and supportive tool in the determination of the trophic status of the water body.

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