STUDIES ON PHYSICO-CHEMICAL ASPECTS AND ZOOPLANKTON DIVERSITY OF CHELLIKURICHI LAKE, THANJAVUR DISTRICT, TAMILNADU

ABSTRACT

Seasonal variations of zooplankton populations and selected physico-chemical parameters of Chellikurichi lake (Lat $10^{o}21'$N ; Long 79^{o}, 24'E) Thanjavur District, Tamil Nadu was carried out for a period of twelve months from July 2023 to June 2024. The physico-chemical parameters such as air and water temperature, pH, salinity, dissolved oxygen and total hardness were analyzed. In the study period, 23 species of zooplankton were analysed, of which 8 species of rotifera, 7 species of copepoda, 5 species of cladocera and 3 species of ostracoda were recorded. Rotifera appeared as dominant group of zooplankton with higher density (36.34%) followed by cladocera (30.63%), copepoda (20.12%) and ostracoda (12.88%). The season wise zooplankton analysis showed a maximum abundance of species in post monsoon and summer months and minimum in pre monsoon an monsoon months.

Keywords: Chellikuruchi lake, Physico-chemical parameters, Zooplankton

INTRODUCTION

Zooplankton play an important role in aquatic ecosystems as they constitute the most important link in energy transfer between phytoplankton and higher aquatic organisms (Iloba, 2002). In broad sense, plankton are considered as an idex of fertility (Prasad, 1969) and landings of fish are directly proportional to the quantity of plankton. Studies on zooplankton species composition and seasonal variations in an aquatic system is very much essential for predicting the productivity of the area and also its fisheries potential.

Researchers published on zooplankton ecology in freshwater lakes and ponds around India. Considerable works were done on the zooplankton of northern freshwater lakes of India (Khan and Chandrima Sinha, 2002; Rafiullah M.Khan *et al*., 2012; Pallavi Shukla *et al*., 2013; Balakrishna *et al.,* 2013; Vijayakumar Balai *et al.,* 2014; Qureshimatva Umerfaruq and Solanki, 2015; Korgaonkar and Bharamal, 2016; Dorlikar, 2016; Jayanta Sonowal and Debojit Baruah, 2017; Jogesh Laishram, 2020; Rituparna Sarkar *et al.,* 2020; Avijit Mukherjee, 2020; Khaire, 2020; Yeole, 2021; Patil and Chavhan, 2022; Vikas Kumar and Radha Koet Sah, 2023; Maqsooda Akhtar *et al*., 2023 and Dilipkumar G Bhalsing and Sunil N Pokale, 2025).

The zooplankton from the southern freshwater lakes has been studied by quite number of investigators (Ajith Verghese George and Mathewkoshy, 2008; Maheswari and Thiyagesan, 2013; Madhusudhana Rao *et al.,* 2014 ; Manickam *et al.,* 2015; Dhanasekaran *et al.,* 2017; Kalpana *et al.,* 2017; Mayavan Karthika *et al.,* 2017; Narasimman Manickam *et al.,* 2018; Sandhya and Benarjee, 2019; Dharma Guru Prasad and Shivabasavaiah, 2021; Dharma Guru Prasad, 2022; Latha and Ramachandra Mohan, 2022; Rajani, 2023 and Brilliant Rajan and Vincy Mary Varghese, 2024).In the present study, an attempt was made on the species composition, distribution and seasonal variation of zooplankton at Chellikurichi lake, Thanjavur district, Tamil Nadu.

Materials and Methods

Description of the Study area

The study was conducted at Chellikurichi lake (Latitude 10^{o}, 21N; Longitude 79^{o}, 24E) is situated at Pudukkottai Ullur village near Adirampattinam, Thanjavur district,

TamilNadu, India (figure. 1). The length of the lake is 2.5km and the width is varying from 1km. It is mainly used for public bathing, washing and agricultural purposes.

Collection of Water Sample

The water sample was collected for a period of one year from July 2013 to June 2014 of each month between 6.30 to 7.30 am.

Qualitative analysis of water sample

Physico-chemical parameters like atmospheric, water temperature and pH were recorded at the sampling site by using thermometer and Digital pH meter respectively. The dissolved oxygen was fixed in the same place at the same time by adding the reagents namely manganous sulphate followed by alkaline iodide and sulphuric acid (Winkler's method), other physico-chemical parameters (salinity, DO and Total hardness) were analysed in the laboratory as per standard methods for examinations of water suggested by APHA (2005).

Collection and identification of zooplankton

For qualitative and quantitative analysis of zooplankton, No.10 plankton net (blotting silk, mesh aperture size 158µm) were used for the present study. One hundred litre surface water were filtered through a specific net. Immediately after collection plankton samples were transferred in poly ethylene bottle (100ml) and preserved in 5 percent formalin. The enumeration and identification of zooplankton were made under research microscope (Coslab ISO 9001 Co.) by using suitable keys, standard texts and monographs (Battish, 1992; Reddy, 1994; Dhanapathi, 2000 and Altaff, 2004).

For quantitative analysis was made using plankton counting plastic slide (Sedgwick Rafter). The counting chamber is divided into 100 small squares with 1ml capacity. The zooplankton were counted in the small squares and calculated the numbers per litre of water filtered (Santhanam *et al.*, 1989) using the formula.

$$N = \frac{n \times v}{V}$$

N = Total number of plankton / Litre of water filtered

n = Number of plankton counted in 1ml of sample

v = Volume of concentrated sample (ml)

V = Volume of total water filtered (litre)

Statistical analysis

Correlation coefficient analysis between physico-chemical parameters and zooplankton density was done using SPSS version 27 software.

Results and Discussion

The physico-chemical parameters of water at Chellikurichi lake is represented in the Figure 2-7. Atmospheric temperature recorded in the study area are illustrated in figure 2. The atmospheric temperature varied from 28.5^{o}C to 35.5^{o}C. The minimum temperature (28.5^{o}C) was recorded in the monsoon period (October 2023) while the maximum temperature (35.5^{o}C) was observed during summer period (June 2024). The atmospheric temperature showed a positive correlation with water temperature. (r = 0.956) (Table 1).

The surface water temperature closely followed the atmospheric temperature. The mean monthly values of surface water temperatures are depicted in figure 3. In the Chellikurichi lake, water temperature ranged between 27.1^{o}C (October 2023) and 32.5^{o}C (April 2024). Water temperature of Chellikurichi lake showed a positive correlation with pH (r = 0.767), salinity (r =0.276) and a negative correlation with dissolved oxygen (r = - 0.791).

The hydrogen ion concentrations (pH) of the water samples collected from the Chellikurichi lake was shown in the figure 4. The monthly mean values of hydrogen ion concentration of the study area ranged between 7.08 (October 2023) and 8.3 (April 2024). High values of hydrogen ion concentrations were observed in summer and low values were recorded in the monsoon period during the study period. Statistical analyses showed that the pH had a positive Correlation with water temperature (r = 0.767) and total hardness (r = 0.892) whereas with dissolved oxygen it had an inverse relationship (r= -0.752) (Table 1).

Data on salinity of water samples of the study area are presented in figure 5. They showed well-marked seasonal variations. The monthly mean salinity level of Chellikurichi lake varied from 0.512‰. (October 2023) to 0.711‰. (June 2024). Maximum salinity was recorded during summer and the minimum during the monsoon in the course of study period. Salinity of the Chellikurichi lake showed a weak correlation (r = -0.045) with pH while it showed a strong correlation with water temperature (r =0.204). At the same time, it showed negative correlation with dissolved oxygen (r = - 0.204).

Among the physico-chemical parameters studied, the dissolved oxygen (DO) showed a wide range of fluctuation and seasonal variation (figure 6). The mean monthly dissolvedoxygen level values of Chellikurichi lake showed a variation ranging from 6.42 ml/l (November 2023) to 4.35 ml/L (June 2024). Statistical analyses showed that dissolved oxygen hada negative correlation with water temperature (r = -0.791), pH (r = - 0.752) and salinity (r = -0.204) (Table 1).

In the present study the hardness was ranged 114 mg/L (November 2023) to 151 mg/L (May 2024) (figure 7). Total hardness of Chellikuruchi lake also showed a positive correlation with water temperature (r= 0.838), pH (r= 0.892), salinity (0.0005) and a negative correlation with dissolved oxygen (r= - 0.766)(Table 1).

Zooplankton results were correlated with physico-chemical parameters by applying simple correlation co-efficient (Table.1). The relationship of zooplankton with physico-chemical parameters was not uniform throughout the period of study. However, a positive correlation was observed almost all the physico-chemical parameters such as water temperature (r= 0.069), pH (0.378), DO (r = 0.156) and total hardness (r =0.4180) except with salinity (r= -0.289). Similar results were reported by Khaire (2000) and Maqsooda Akhtar *et al.* (2023). An inverse relationship between zooplankton density and dissolved oxygen were reported by Dorlikar (2016).

A check list of zooplankton observed in the Chellikurichi lake throughout the study period is given in the table 2. In the present study, a total number of 23 species of zooplankton were recorded. It includes 36.34% of rotifers, 30.63% of cladocerans, 20.12% of copepods and 12.88% of ostracods. Among the 23 species of zooplankton recorded, rotifers constitute major portion with about 8 species followed by 7 species of copepods, 5 species of cladocerans and 3 species of ostracods (figure 8-13). Rotifers was the dominant form throughout the study period. This observation in the present study is in the confirmity with the earlier reports of Pallavi Shukla *et al.,* (2013) from Maheshara lake in Gorakhpur; Vijay kumar Balai *et al.,* (2014) from Jaisamand lake, Udaipur; Mayavan Karthika *et al.,* (2017) from Perur lake, Coimbatore and Khaire (2020) from Chandani Dam, Maharashtra. The observations made by Rajani (2023) in Mulukanoor lake, Krimnagar district, Telangana and Dharma Guru Prasad and Shivabasavaiah (2021) in Sooley lake, Mandya district, Karnataka further supports the present findings. In the present study, population density was high during post monsoon and summer periods (figure 8). Similarly, high species diversity indices of zooplankton during summer months was reported by Kalpana *et al.*(2017) in Singanallur lake, Coimbatore, Tamilnaud; Dharma Guru Prasad (2022) in Marehalli lake, Mandya

district, Karnataka and Latha and Ramachandra Mohan (2022) in Thally lake (Little England), Krishnagiri District, Tamil Nadu. The present study with regard to density and distribution pattern of rotifers, cladocerans, copepods and ostracods agrees with the earlier reports made from Indian freshwaters.

Conclusion

The study was undertaken for the first time in this Chellikurichi lake and it reveals that all the physico-chemical parameters are at nearly permissible limit of WHO and ICMR recommended values (pH 6.5-8.5), DO (4.0 - 6.0) TH (300 mg/L). In the present study, 23 species of zooplankton were identified which were included rotifera, cladocera, copepoda and ostracoda. The diversity results clearly indicate that rotifera showed high diversity and ostracoda was showed low diversity during the study period. The zooplankton dominated by rotifera > cladocera > copepoda > ostrocoda.

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Table-1Correlation co-efficient between zooplankton population and physico-chemical parameters

	Air Temperature	**Water Temperature**	**pH**	**Salinity**	**DO**	**Total Hardness**	**Zooplankton Density**
Air Temperature	1						
Water Temperature	0.956**	1					
pH	0.742**	0.767**	1				
Salinity	0.353	0.276	-0.045	1			

DO	-0.741**	-0.791**	-0.752**	-0.204	1		
Total Hardness	0.757**	0.838**	0.892**	0.005	-0.766**	1	
Zooplankton Density	-0.020	0.069	0.378	-0.289	0.156	0.418	1

**. Correlation is significant at the 0.01 level (2-tailed).

Table-2List of Zooplankton species recorded in the Chellikurichi Lakeduring the study period

ROTIFERA

Brachionus calyciflorus
Brachionus budapestinensis
Brachionus quadridentatus
Brachionus diversicronis
Brachionus caudatus
Brachionus falcatus
Brachionus rubens
Brachionus patulus

COPEPODA

Eucyclops speratus
Mesocyclops hyalinus
Mesocyclops leuckarti
Mesocyclops aspercornis
Thermocyclops hyalinus
Sinodiaptomus indicus
Heliodiaptomus viduus

CLADOCERA

Daphnia magna
Daphnia pulux
Diaphanosoma sarsi
Moina cornuta
Moina brachiata

OSTRACODS

Cypris protubera
Cpris decaryi
Heterocypris dentatomarginatus

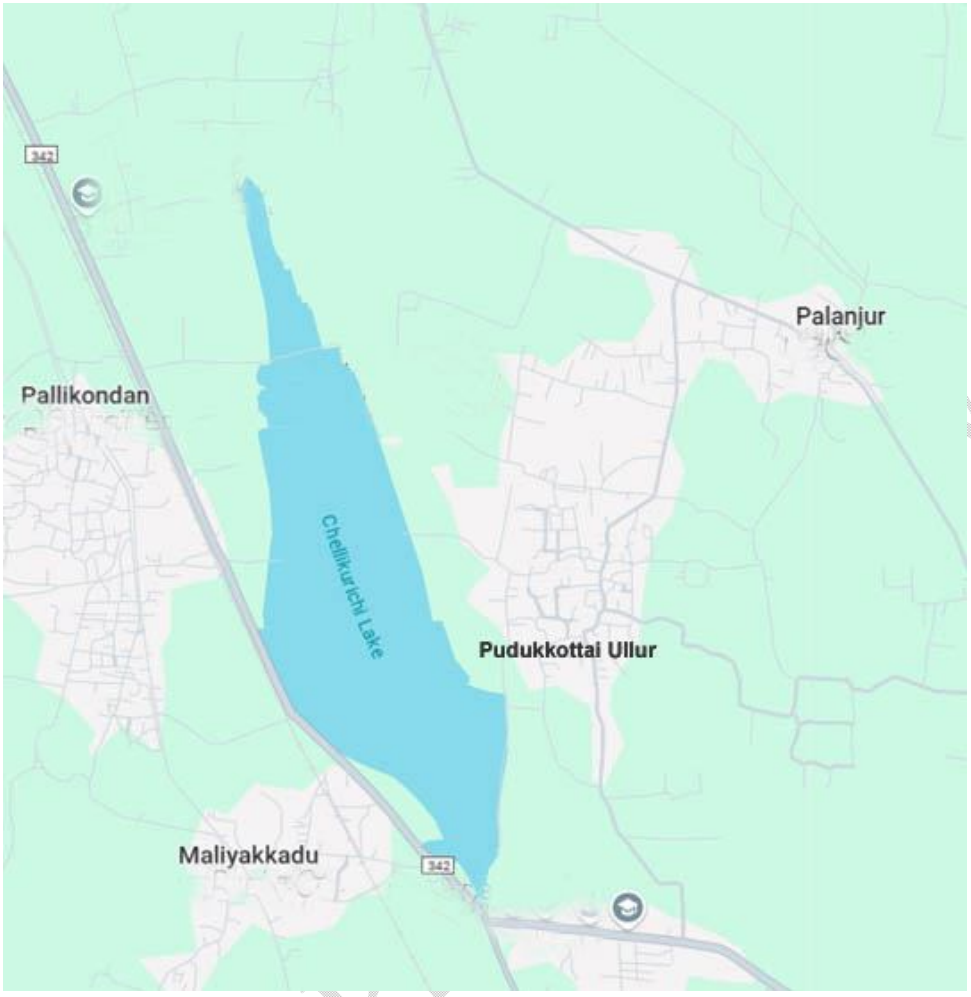

Fig.1: Location of Chellikurichi Lake

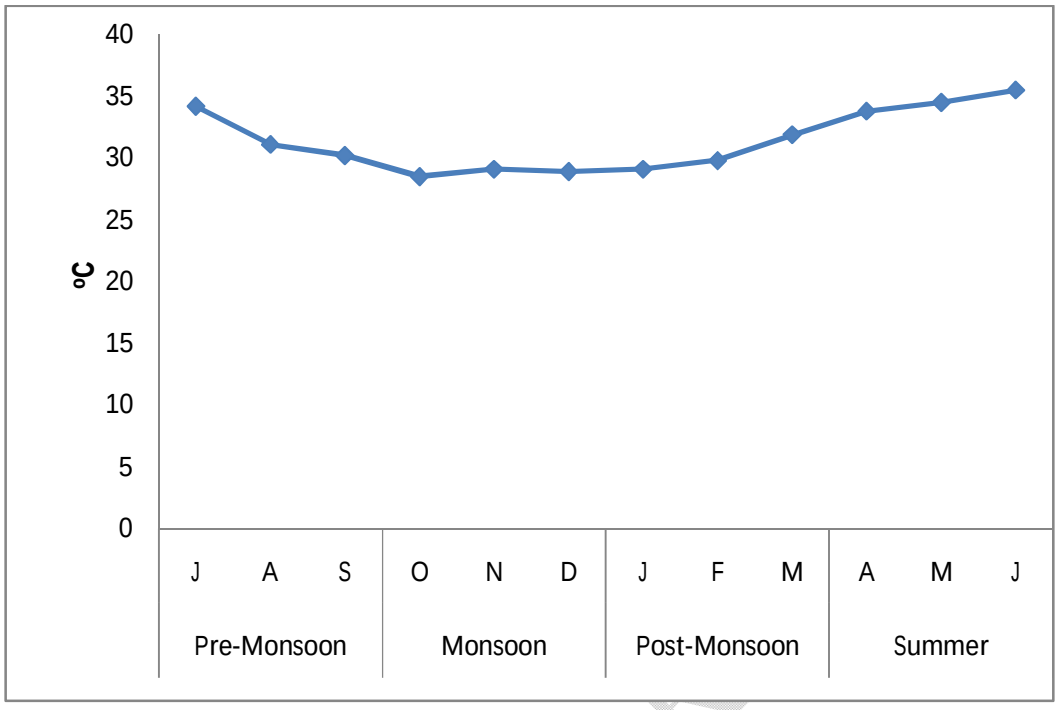

Fig.2. Monthly variation of atmospheric temperature at Chellikurichi lake

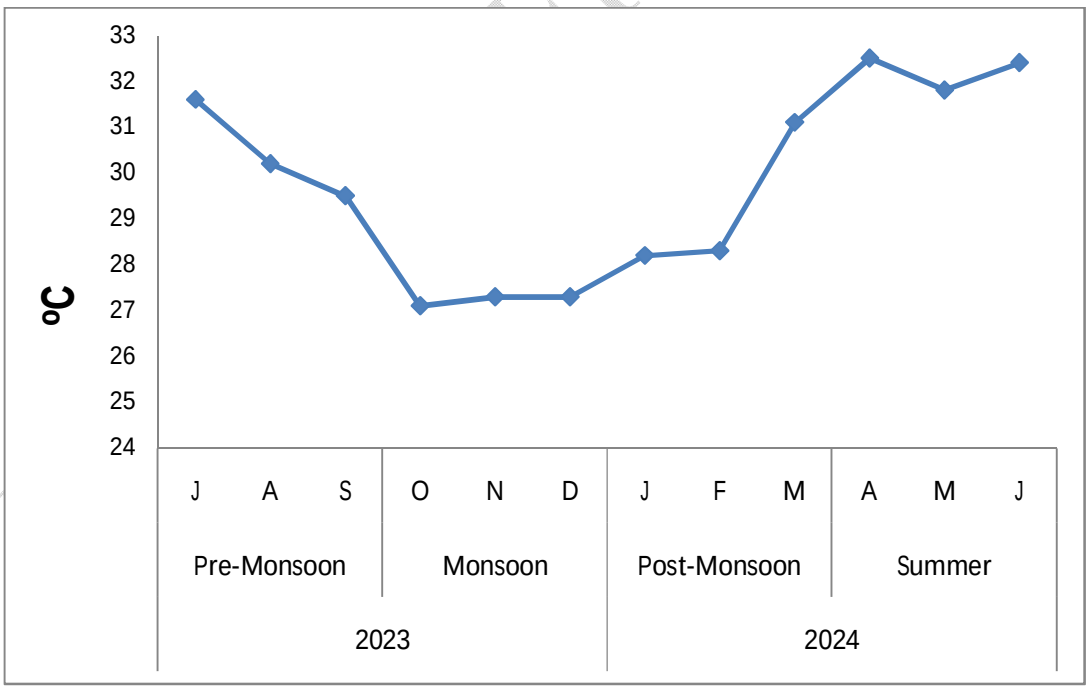

Fig.3. Monthly variation of water temperature at Chellikurichi lake

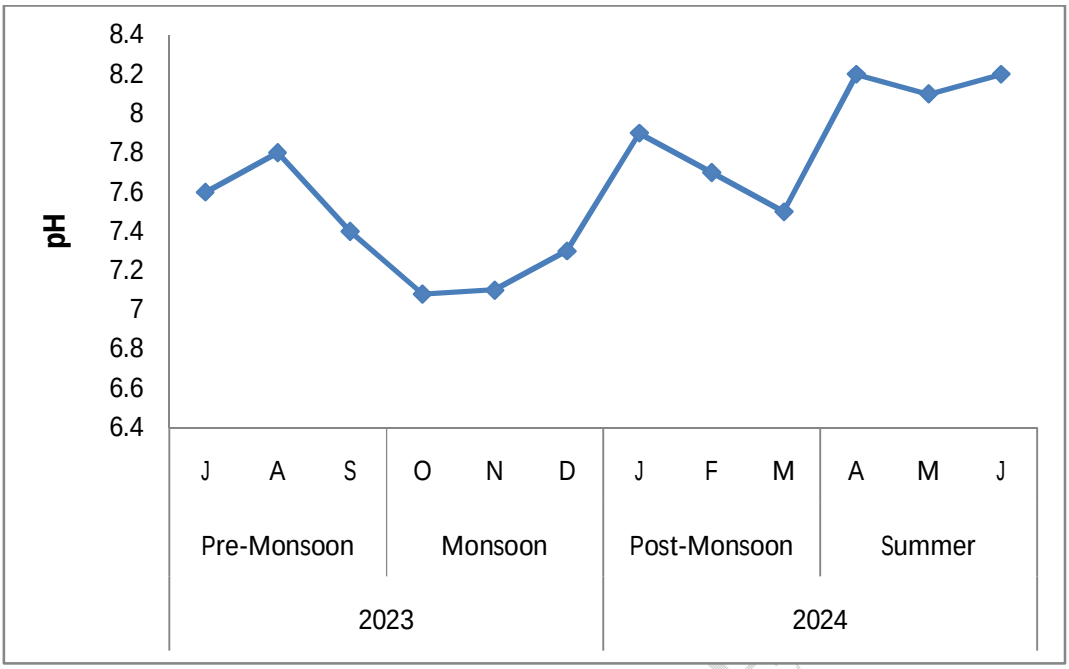

Fig.4. Monthly variation of pH at Chellikurichi lake

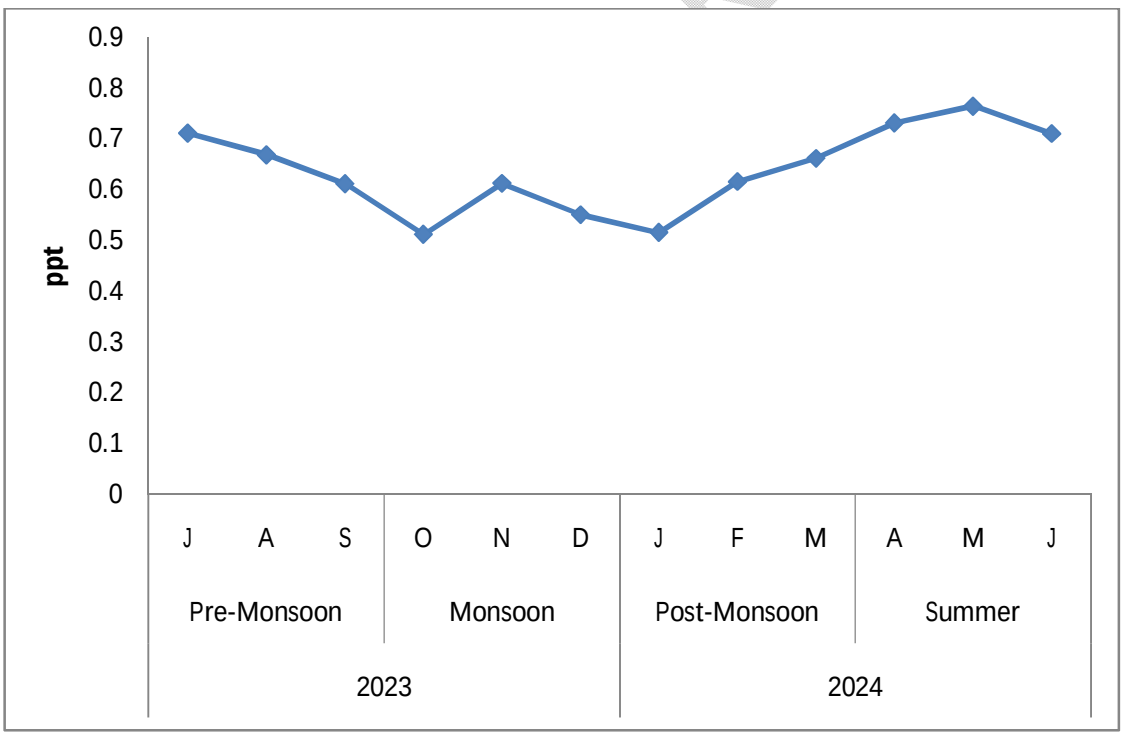

Fig.5. Monthly variation of salinity at Chellikurichi lake

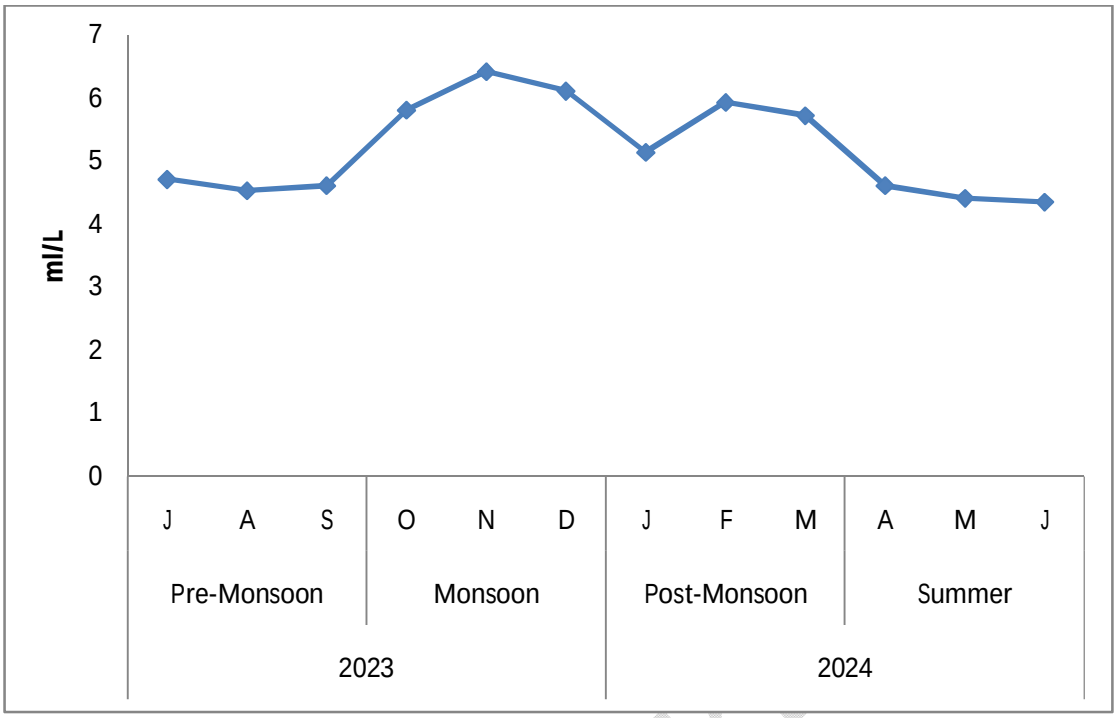

Fig.6. Monthly variation of dissolved oxygen at Chellikurichi lake

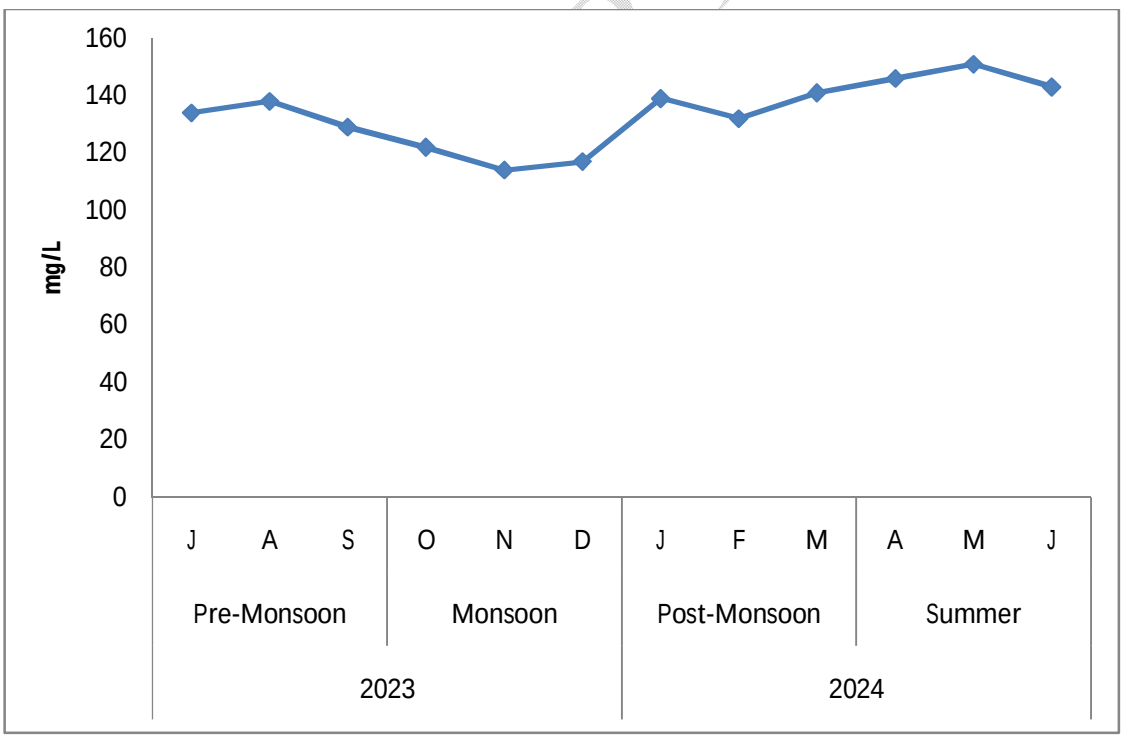

Fig.7. Monthly variation of total hardness at Chellikurichi lake

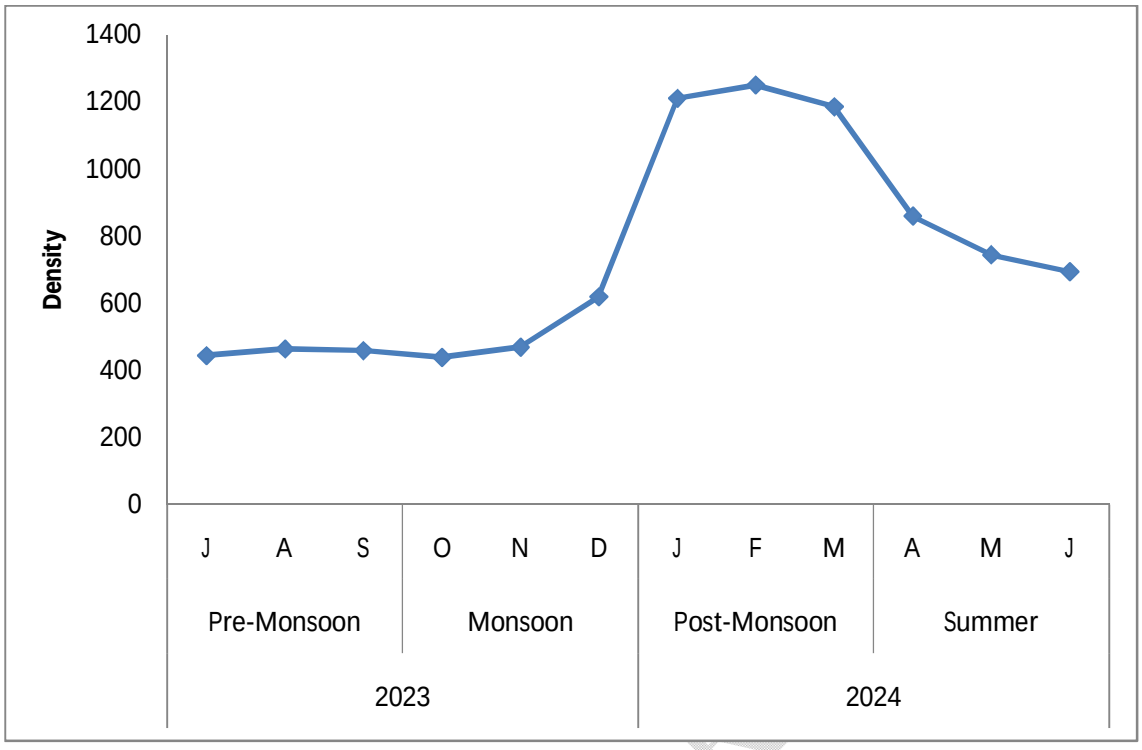

Fig.8. Monthly fluctuations of zooplankton density (individual/L) recorded in Chellikurichi lake

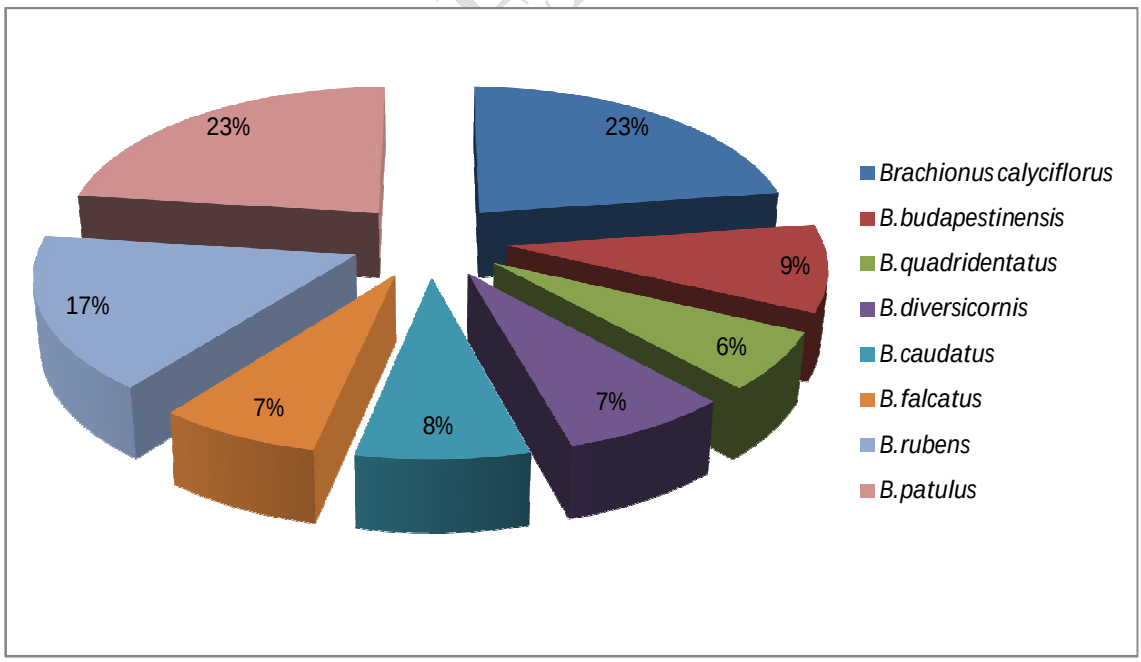

Fig.9: Percentage composition of rotifera recorded in Chellikurichi lake

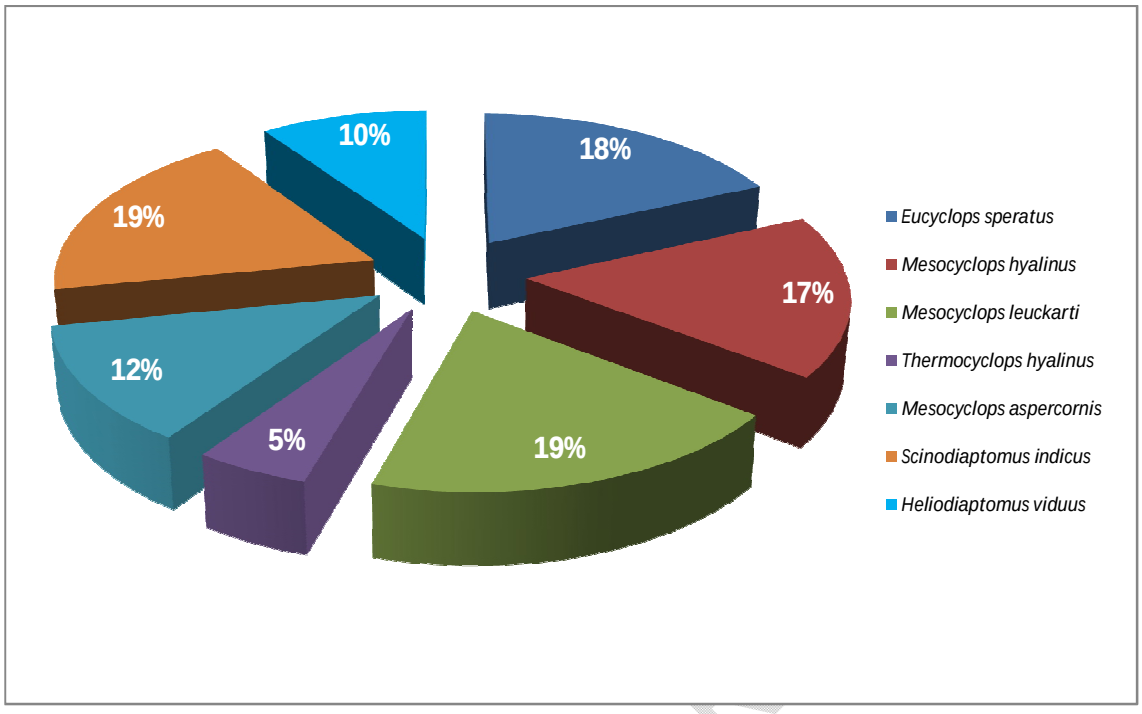

Fig.10: Percentage composition of copepoda recorded in Chellikurichi lake

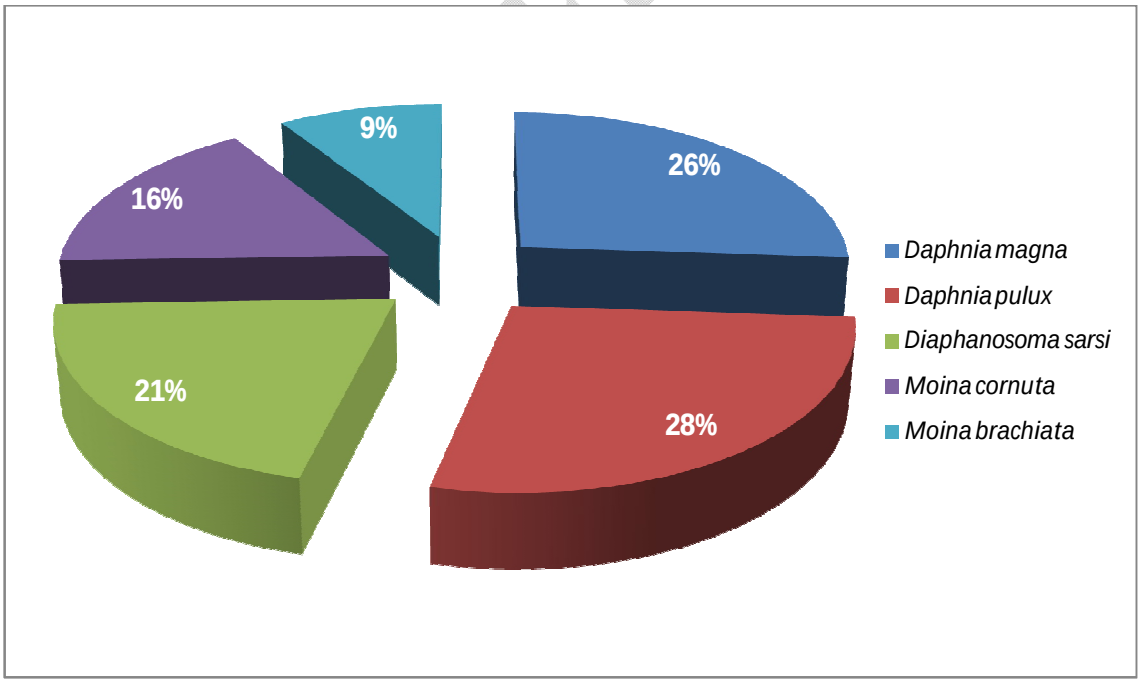

Fig.11: Percentage composition of cladocera recorded in Chellikurichi lake

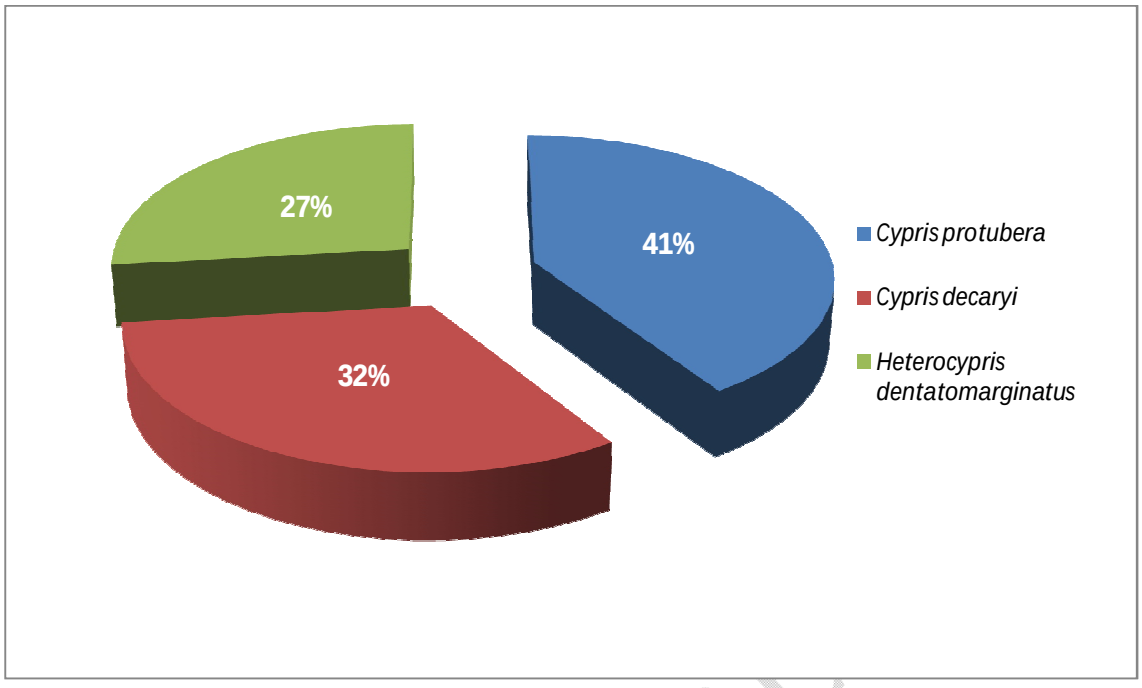

Fig.12: Percentage composition of ostracods recorded in Chellikurichi lake

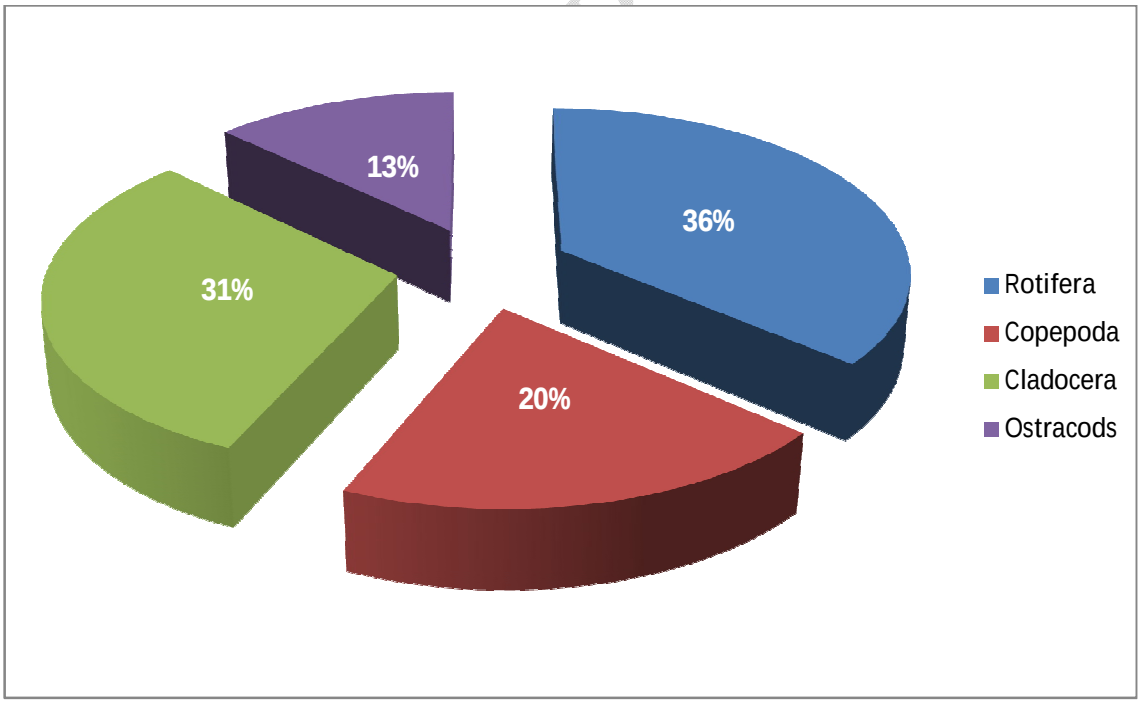

Fig. 13: Percentage composition of total zooplankton recorded in Chellikurichi lake