

RESEARCH ARTICLE

Assessment of Zooplankton Diversity in Kosavampatti Lake at Namakkal District, Tamil Nadu

S. Vijayapriya, R. Latha, A. Malathi, M. Parameswaran, P. Kiruthika, G. Sharmila Banu*

Department of Zoology, Namakkal Kavignar Ramaligam Government Arts College for Women, Namakkal, Tamil Nadu, India

Received: 25 January 2019; Revised: 30 March 2019; Accepted: 11 April 2019

ABSTRACT

Kosavampatti Lake is a historical lake situated in Namakkal district. A lake usually helps in recharging groundwater, and the trees in and around the lake serve as a nesting place for birds. Zooplankton is the vital constituents of water flora which aids as the main component of the aquatic food chain. It sustains appropriate equilibrium between biotic and abiotic components of the water ecosystem. The present study aimed to deal with zooplankton diversity in Kosavampatti Lake. The investigation was carried out for 1 year, i.e., October 2017–September 2018. During the study period, the zooplankton population of Kosavampatti Lake water is characterized by five various classes, namely *Protozoa*, *Cladocera*, *Copepoda*, *Ostracods*, and *Rotifera*, with 19 different species which were noted and documented in Kosavampatti Lake. The main classes of *Rotifera* are the highest groups among zooplankton and the density of zooplankton community was higher in summer and lesser in monsoon. The results of various kinds of diversity indices strongly indicate that Kosavampatti Lake is absolutely polluted in nature.

Keywords: Diversity indices, Kosavampatti lake, water pollution, zooplankton

INTRODUCTION

Biodiversity denotes to variety and inconsistency among living organism and the ecological complexes in which they present. Human-induced activities pose series fears to the biodiversity, which cause ecological deprivation.^[1] Zooplanktons are microscopic free-floating organisms that are essential and maintain water quality assessment and aquatic currents. This plankton constitutes the basic food sources of the aquatic ecosystem, which supports fish and other aquatic animals.^[2] They occupy a transitional link between phytoplankton and fish as well as an aquatic food web. The size of the zooplankton community in the majority lakes ranges from a few tens of microns to >2 mm.^[3] The productivity of the water ecosystem is directly related to the density of zooplankton. This zooplankton normally responds more rapidly to environmental changes than other water organisms, and thus, plankton has been used currently as

an indicator to monitor and realize changes in the ecosystem.^[2] Mostly, *Rotifera*, *Cladocera*, *Copepoda*, *Ostracods*, and *Protozoa* constitute the primary classes of zooplankton. Recently, various studies on zooplankton diversity have been made by researchers that are emphasized more about water quality assessment.^[4-6] Zooplankton plays an integral role in transferring energy to the consumers, and hence, they form the next higher trophic level in the energy flow after phytoplankton.^[7] Ecological environment and mode of reproduction zooplanktons have attracted the attention of several workers throughout the world. Amsha Devi *et al.*^[2] examined a temple lake at Virudhunagar for zooplankton population and recorded a cyclic pattern with lowest in winter and then increasing through early and late part of summer as well as early autumn. They reported that Rotifers contributed normally more than half of the total zooplankton in the lake. *Cladocera* was the second highest population contributing to the total density and Ostracoda comprised generally lower among other groups to the total zooplankton. Kosavampatti Lake provides recharging groundwater, and the trees in and around the

*Corresponding Author:

G. Sharmila Banu,

E-mail: gsharmilabanu@gmail.com

lake serve as a nesting place for birds. Namakkal is a selection grade municipality with 39 wards, having a population of 120,957 as per the Census 2011. The total area is 55.24 km² and the floating population is greater than 25,000. In addition, under the Municipal Administration and Water Supply Government Order No. 29 dated March 18, 2013, Namakkal town was declared as “Heritage Town.”^[8] The lake locates on the Sendamangalam road on the eastern side of the bus stand in the town and northern side of the kosavampatti, which accounted for a water spread area of 36 acres.^[9] A decade earlier, this lake was the main source for drinking water supply and farm operations and the storage of water played a major role in recharging groundwater in the surrounding area in a big way.^[8] Hence, the present study aimed to determine the physicochemical parameters of water, zooplankton richness, abundance, evenness, dominance, diversity, and seasonal variation; the correlation between physical zooplankton densities was used to understand the intermediate relationship between the water quality and aquatic organisms. The results indicate the wealth of aquatic ecosystem which would be helpful for the aquaculture management practices

MATERIALS AND METHODS

Study area

Kosavampatti Lake is located at Namakkal District in Tamil Nadu, India, with latitude and longitude of 11° 13' 46.5312" N and 78° 10' 16.1688" E. The lake draws water during rainfall in Namakkal Municipality, and major activities carried out around the lake are fishing and irrigation for agriculture.

Field sampling

The surface water sample was collected from the pond once in a fortnight in the early hours of the day from October 2017 to September 2018. The water samples were collected using a 1-L container for the estimation of water quality parameters. The collected samples were immediately taken to the laboratory for analysis. The estimation was done using the standard book of Kumar and Kakrani.^[10]

Zooplankton sampling

Zooplankton samples were collected by filtering 100 L of water from the surface of the water body through plankton net (40 µm mesh size) and was fixed immediately with 4% formalin. The systematic identification of zooplankton was made using standard keys of Dhanapathi^[11] and Altaff.^[12] The quantitative analysis of planktonic organisms was carried out using Sedgwick Rafter's Plankton Counting Chamber. The surface water samples were collected from the collection site between 8.00 am and 10.00 am in plastic bottles. The different physicochemical characteristics were analyzed as per the procedure is given in APHA.^[13]

RESULTS AND DISCUSSION

Zooplankton is the significant foodstuffs for most of the aquatic organisms. Virtually, larval stages of all the fishes depend on zooplankton and few of them solely depends on planktons. Monthly distribution and variation of zooplankton species are shown in Table 1. The zooplankton pollution has obviously been detected based on the aquatic composition including Copepods, *Cladocera*, *Ostracods*, *Protozoa*, and *Rotifera*. The present study recorded the zooplankton density and composition in a monthly variation. The concentration of zooplankton was recorded in the month of March, April, and May which exhibited maximum; the minimum was documented in the month of September, October, and November. Zooplankton concentration showed at higher density in the summer season, which exhibited in Figure 1. Similarly, the maximum concentration of zooplankton population was also reported during summer by Joshep and Yamakanamardi,^[14] Amsha Devi *et al.*,^[2] and Karthika *et al.*^[1] The maximum population found in the summer is due to the greater water temperature as it augments the biological activity and proliferation of zooplankton. In addition, the composition and abundance of each zooplankton group varied from time to time and season and depended on limnological characteristics of the water body. In the present study, the various groups of zooplankton and their respective species such as Copepods – 4, *Cladocera* – 3, *Ostracods* – 3, *Protozoa* – 4, and *Rotifera* – 5 are presented in Table 1. *Rotifera* was found to be the dominant group and has higher diversity among zooplankton

Table 1: Distribution of zooplankton at Kosavampatti Lake from October 2017 to September 2018

Organisms	2017			2018								
	October	November	December	January	February	March	April	May	June	July	August	September
Cladocerans												
<i>Alona</i>	++	+	+	+	+	+	+	++	+	+	+	+
<i>Bosmania</i>	++	+	+	+	+	+	+	++	+	+	+	+
<i>Daphnia</i> sp.	++	+	+	+	+	+	+	++	+	+	+	+
Copepods												
<i>Diaptomus</i>	+	+	++	-	++	+	++	+	++	++	++	+
<i>Eyclops</i>	+	+	+	-	++	+	++	+	++	++	++	+
<i>Heliodiaptomus</i>	+	++	+	+	+	++	++	++	+	+	+	+
<i>Paracyclops</i>	++	+	+	+	+	+	+	++	+	+	+	+
Ostracods												
<i>Cyclocypris</i>	++	+	+	+	+	+	+	++	+	+	+	+
<i>Cyperis</i>	++	+	+	+	+	+	+	++	+	+	+	+
<i>Steno cypris</i>	++	+	+	+	+	+	+	++	+	+	+	+
Protozoa												
<i>Diffugia</i>	+	++	+	+	++	++	++	+++	+	+	++	++
<i>Nebela</i>	+	+	++	+	++	++	++	+	+	+++	++	++
<i>Paramecium</i>	+	++	+	+	+	++	++	++	+	++	++	+
<i>Vorticella</i>	++	+	+	+	+	+	+	++	+	+	+	+
Rotifers												
<i>Brachionus</i>	+	++	+	-	+	+	++	+++	++	+	+	+
<i>Gastropus</i>	++	+	+	+	+	+	++	+++	+	+	+	+
<i>Keralullo</i>	+	++	+	+	+	++	++	+++	++	++	++	+
<i>Polyartha</i>	+	+	+	+	+	++	++	+++	+++	+	+	+
Rotaria	+	+	++	+	++	++	++	+++	+	++	++	+

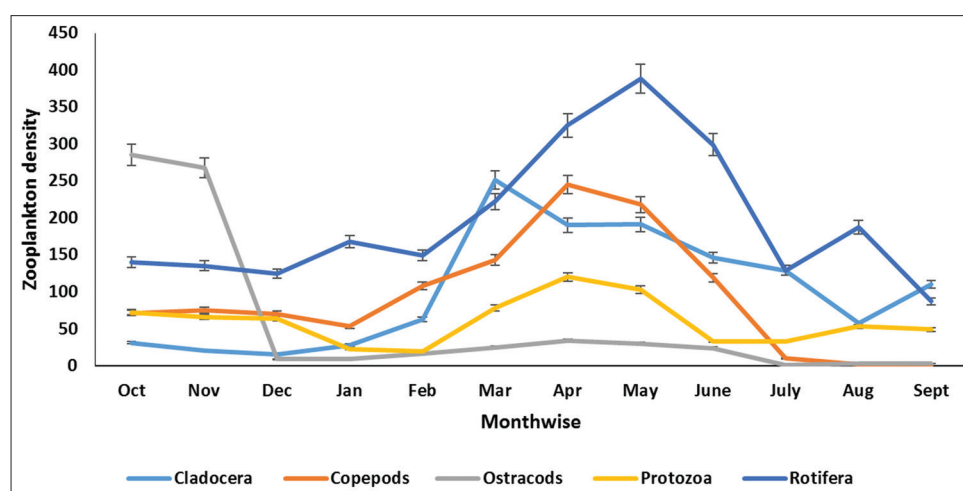


Figure 1: Monthly distributions of zooplankton population in Kosavampatti Lake from October 2017 to September 2018

community, as presented in Figure 2. Normally, *Rotifera* dominates among zooplankton, indicating that the lake water became polluted in nature.

Similarly, Malik and Shikha^[15] have observed maximum density and diversity of rotifer in Bhimtal Lake of Kumaon Region, Uttarakhand. Rotifer group was dominated by *Brachionus* sp. The presence of different species of *Brachionus*, *Rotaria*, *Gastropus*, *Polyartha*, and *Keratella*

shows that the lake is approaching toward eutrophication and is naturally polluted as observed by other workers.^[16,17] The density of rotifer in Kosavampatti Lake during the study period is as follows – May > September > January. The maximum density of cladoceran was observed in the March due to the favorable condition of abiotic factors and the availability of abundant food. Sharma *et al.*^[18] have observed

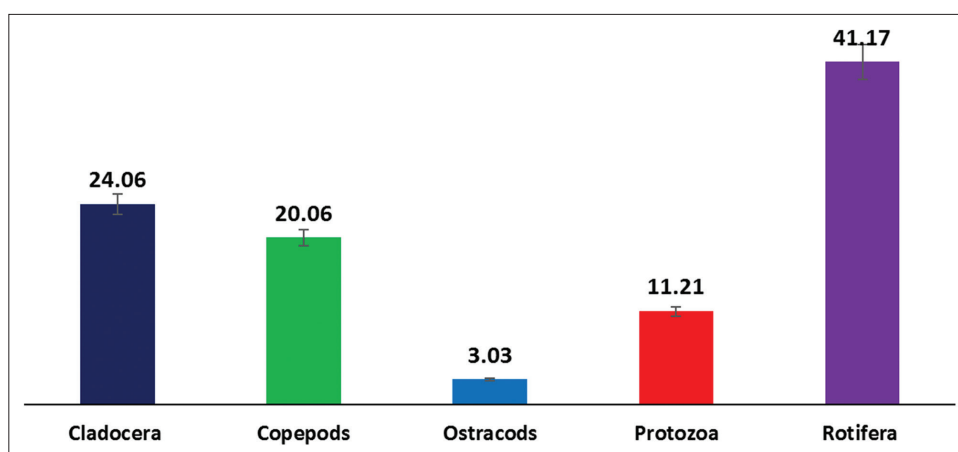


Figure 2: Percentage of zooplankton population in Kosavampatti Lake from October 2017 to September 2018

the maximum density of cladoceran in winter compared to other seasons in Temple Pond, Birpur, India. This group was dominated by *Alona*, *Daphnia* sp., and *Bosmina* sp., indicating that the lake is towards organically polluted. Cladoceran was the next dominant group among zooplankton community consisting of 24% of the zooplankton population [Figure 2]. The density of cladocerans in Kosavampatti Lake during the study period is as follows – March > August > December. It is inversely connected to other zooplankton groups. *Copepoda* group among zooplankton community consists of 20% of the zooplankton population [Figure 2]. This group was dominated by *Diaptomus*, *Eyclops*, *Heliodiaptomus*, and *Paracyclops*. The presence of *Diaptomus* sp. indicates that the lake is toward organically polluted copepods.^[19] The polluted in Kosavampatti lake during the study period are as follow April > January > August. Karthika *et al.*^[1] have reported that the maximum density of *Ostracoda* in summer due to the availability of food, high values of temperature, and salinity. In the present study, *Ostracoda* group among zooplankton community consists of 3% and it represented very low population density when compared to other zooplankton groups [Figure 2]. This group was dominated by *Cyclopyris*, *Cypris*, and *Steno cypris*. The presence of *Cypris* sp. indicates that the lake is toward organically polluted.^[19] The density of *Ostracoda* in Kosavampatti Lake during the study period is as follows April > December > July.

CONCLUSION AND RECOMMENDATIONS

The present study of Kosavampatti lake water assessment shows the diverse fluctuation and

densities among zooplankton throughout the year. The results of the water quality clearly show that the most number of parameters was higher than the desirable limit. This investigation confirms that Kosavampatti Lake is polluted due to eutrophication and a various population of zooplanktons. Hence, the status of water quality of Kosavampatti Lake should be protected and conserved by raising the awareness of the local people and by reducing anthropogenic activities. The district administration and the Public Works Department should take immediate steps for the desilting and renovation of all the lakes in the district, especially Kosavampatti Lake to increase the water holding capacity. Referring to Kosavampatti Lake, the present study results urge the authorities to prevent the lake water from getting polluted with the mixing of sewage water. This will check the groundwater getting polluted. All the encroachments in the water spread area should be removed and steps should be taken for deepening the lake to increase its water holding capacity. The local people have also demanded Namakkal Municipality to take steps for the beautification of the lake and its bunds and convert it into a tourist attraction.

REFERENCES

1. Karthika M, Shabana S, Ramasubramanian V. Assessment of water quality and zooplankton diversity in the freshwater ecosystem (Lake)- In India. *Int Res J Env Sci* 2017;6:23-33.
2. Amsha Devi V, Baskaran S, Suresh Kumar R. Physico-chemical parameters and zooplankton diversity of a temple pond in Virudhunagar, Tamil Nadu. *Int J Sci Environ Technol* 2013;2:250-7.
3. Aman S, Sharma SK, Varun M, Ekta S. *Freshwater Zooplankton: An introduction and Their Role in Aquaculture*. Aquafind 2016.

4. Ochocka A, Pasztaleniec A. Sensitivity of plankton indices to lake trophic conditions. *Environ Monit Assess* 2016;188:622.
5. Gutierrez MF, Battauz Y, Caisso B. Disruption of the hatching dynamics of zooplankton egg banks due to glyphosate application. *Chemosphere* 2017;171:644-53.
6. Araujo M, Noriega C, Hounsou-Gbo GA, Veleda D, Araujo J, Bruto L, *et al.* A synoptic assessment of the amazon river-ocean continuum during boreal autumn: From physics to plankton communities and carbon flux. *Front Microbiol* 2017;8:1358.
7. Yin XH, Brock TC, Barone LE, Belgers JD, Boerwinkel MC, Buijse L, *et al.* Exposure and effects of sediment-spiked fludioxonil on macroinvertebrates and zooplankton in outdoor aquatic microcosms. *Sci Total Environ* 2018;610-611:1222-38.
8. Saravanan SP. Kosavampatti Lake in Poor Condition on; 2015. Available from: <https://www.thehindu.com/news/national/tamil-nadu/kosavampatti-lake-in-poor-condition/article7445724.ece>. [Last accessed on 2018 Jun 18].
9. Saqaf SM. Kosavampatti Lake Being Destroyed on; 2018. Available from: <https://www.thehindu.com/news/states/kosavampatti-lake-being-destroyed/article23149113.ece>. [Last accessed on 2018 Jun 18]
10. Kumar U, Kakrani B. *Water Environment and Pollution*. India: Agrobios; 2000. p. 1-258.
11. Dhanapathi MV. *Taxonomic Notes on the Rotifers from India*. Hyderabad: IAAB Publication; 2000. p. 175.
12. Altaff K. *A Manual of Zooplankton*. University Grants Commission. New Delhi: Daya Publishing House; 2004. p. 1-145.
13. America Public Health Association. *Standard Methods for the Examination of Water and Waste Water*. 20th ed. Washington: America Public Health Association, AWWA, WPCF; 1998.
14. Joshep B, Yamakanamardi MS. Monthly changes in the abundance and biomass of zooplankton and water quality parameters in kukkarahalli lake of Mysore. *J Environ Biol* 2011;32:551-7.
15. Malik DS, Shikha P. Zooplankton diversity, species richness, and their distribution pattern in Bhimtal lake of kumaun region, (Uttarakhand). *Hydrol Curr Res* 2015;7:1-7.
16. Jagadeeshwara CT, Mahender J, Kumar S, Rajashekhar AV. Zooplankton diversity, abundance and seasonal variation of Nagulakunta water tank, Vinjapally, Karimnagar dist, Telangana state, India. *Int J Sci Res* 2015;4:1651-4.
17. Sulata K, Devashish K. Zooplankton Diversity of a freshwater perennial pond in Silchar city of Assam, India. *Am Int J Res Form Appl Nat Sci* 2016;14:10-4.
18. Sharma KK, Aarti D, Sharma A, Antal N. Zooplankton diversity and physicochemical conditions of a temple pond in Birpur (J and K, India). *Int Res J Environ Sci* 2013;2:25-30.
19. Rajagopal T, Thangamani A, Sevarkodiyone SP, Sekar M, Archunan G. Zooplankton diversity and physicochemical conditions in three perennial ponds of Virudhunagar district, Tamilnadu. *J Environ Biol* 2010;31:265-72.