

PHYSICO-CHEMICAL PARAMETERS AND ZOOPLANKTON DIVERSITY OF A TEMPLE POND IN VIRUDHUNAGAR, TAMIL NADU

¹Amsha Devi, V., ²Baskaran, S. and ³Suresh Kumar, R.

¹Department of Zoology, V.V. Vanniaperumal College for Women, Virudhunagar
Tamil Nadu, India - 626 001,

²PG and Research Department of Zoology, Ayya Nadar Janaki Ammal College, Sivakasi,
Tamil Nadu, India - 626124

³PG and Research Department of Zoology, R.D. Government Arts College, Sivagangai,
Tamil Nadu, India - 630561

E-mail: sridevi.amsha@gmail.com

Abstract: The plankton constitutes the basic food sources of any aquatic ecosystem, which supports fish and other aquatic animals. Zooplankton diversity is one of the most important ecological parameters in water quality assessment. Zooplankton is good indicator of the changes in water quality because they are strongly affected by environmental conditions and respond quickly to changes in water quality. They occupy an intermediate link between phytoplankton and fish. Hence qualitative and quantitative studies of zooplankton are of great importance. In the present paper, Zooplankton diversity in relation to physico-chemical parameters was studied. This investigation revealed that 17 species of zooplankton belonging to four major groups i.e. 10 species of Rotifera, three species each of Cladocera and Copepoda and one species of Ostracoda.

Keywords: Zooplankton, Bioindicator, water quality.

INTRODUCTION

Zooplankton are microscopic, free floating organisms occurred in all natural water bodies. They are a major mode of energy source between phytoplankton and other aquatic animals. They occupy an intermediate position in the aquatic food web (Altaff, 2004). Different environmental factors that determine the characteristics of water have great importance upon the growth and the abundance of zooplankton (Thirumala *et al.* 2007). The term water quality is defined as those physical, chemical, and biological characteristics by which the users evaluate the acceptability of water (Neelima and Kumar, 2005). Therefore the water quality is a major factor in determining the welfare of the society (Dwivedi and Pathak, 2000). It also plays a vital role in governing the production of planktonic biomass.

A regular monitoring of water bodies with required number of parameters, not only prevents outbreak of diseases and occurrence of other hazards but also checks the water from

further deterioration (Kakati and Sharma, 2003). The management of any aquatic ecosystem is a means of conservation of fresh water habitat with an aim to maintain the water quality or to rehabilitate the physico-chemical and biological settling of water (Ravi Kumar *et al.* 2005). Based on the above mentioned facts, it is suggested to make an inventory of the physico-chemical parameters and zooplankton diversity of temple pond, located in Virudhunagar.

STUDY AREA

The area selected for the present study is the temple pond which is a small aquatic body with a depth of about 40 feet. It has less human interference and is situated half a kilometer away from Virudhunagar town. They possess fishes such as common carp and murrels. The water is used for pooja purposes only.

MATERIAL AND METHODS

Field sampling

Surface water sample was collected from the pond once in a fortnight in the early hours of the day from October 2007 to April 2008. The water samples were collected using one litre container for the estimation of water quality parameters. The collected samples were immediately taken to the laboratory for analysis. The estimation was done by using the standard book of Kumar and Kakrani (2000).

Zooplankton sampling

Zooplankton samples were collected by filtering 200 litres 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 by using standard keys of Dhanapathi (2000) and Altaff (2004). The quantitative analysis of planktonic organisms was carried out using Sedgwick Rafter's plankton counting chamber.

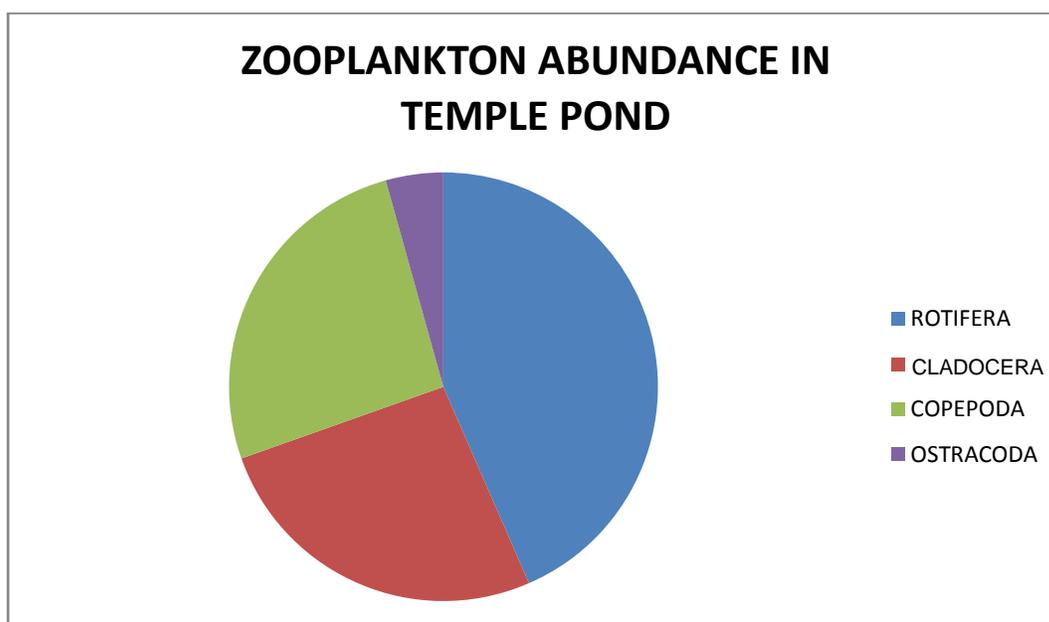
RESULTS AND DISCUSSION

The seasonal variations in water quality parameters of the pond have a marked influence on the numerical abundance of zooplankton. Jeppesen *et al.* (2002) has stated that the abundance and diversity of zooplankton vary according to limnological features and the trophic state of freshwater bodies.

BIOLOGICAL PARAMETERS**QUALITATIVE STUDY OF ZOOPLANKTON IN TEMPLE POND**

In a temple pond, a total of 17 species of zooplankton have been reported that belongs to 4 major groups. They were included as follows,

Rotifera	-	10 species
Cladocera	-	3 species
Copepoda	-	3 species
Ostracoda	-	1 species

**Systematic list of zooplankton in temple pond****Rotifera****Phylum: Rotifera****Class : Monogononta****Order : Ploimida****Family: Brachionidae**

1. *Brachionus calyciflorus* Pallas
2. *B. caudatus* Barrois and Daday
3. *B. diversicornis* Daday
4. *B. angularis* Gosse
5. *B. forficula* Wierzejski
6. *B. falcatus* Zacharias
7. *B. rubens* Ehrenberg

8. *Keratella tropica* Apstein

Family: Testudinellidae

9. *Testudinella parva* Ternetz

Family: Filinidae

10. *Filinia longiseta* Ehrenberg

Cladocera

Phylum: Arthropoda

Class :Crustacea

Order :Cladocera

Family :Sididae

11. *Diaphanasoma sarsi* Richard

12. *D. excisum* Sars

Family: Daphnidae

13. *Ceriodaphnia cornuta* Sars

Ostracoda

Class:Crustacea

Subclass:Ostracoda

Order:Podocopa

Family: Cypridae

14. *Stenocypris major*

Copepoda

Phylum: Arthropoda

Class :Crustacea

Order :Cyclopoida

Family: Cyclopoidae

15. *Mesocyclops aspericornis*

Order :Calanoida

Family: Calanoidae

16. *Heliodyptomus viduus*

17. *Diaptomus nauplius*

QUANTITATIVE STUDY OF ZOOPLANKTON IN TEMPLE POND

In the present investigation, *B. calyciflorus* was found to be more in number during the month of April 2008 and *B. forficula* in the month of February 2008 (3units/ml). The

other species were recorded in less number. *B. rubens* was observed only during April 2008. The abundance of rotifers and their community characteristics are used as effective indicators of environmental changes, such as, acidity, food level and humidity *etc.* (Attayde and Bozelli, 1998). The number of cladocerans recorded was minimum during the study period. *Ceriodaphnia cornuta* was recorded during the entire period of study. Their presence indicates the health of the ecosystem, as it forms the basic food item for fishes.

Mesocyclops aspericornis was observed maximum in the month of November and December 2007 (20 units/ml) and minimum in January and April 2008 (5 units/ml). Kumar (1999) reported that cyclops serve as the most suitable pollution tolerant indicator. *Heliodyptomus viduus* was found in range from 2 units/ml in October 2007 to 10 units/ml in December 2007. *Diaptomus nauplius* showed variations from 3 units/ml in December to 10 units/ml in February 2008. The ostracod was represented by only one species, *Stenocypris major* was observed in all the months (1 unit/ml) except November 2007.

Table: 1 Monthly Variations in the Physico-chemical parameters of the Temple Pond

Parameter	October 2007	November 2007	December 2007	January 2008	February 2008	March 2008	April 2008
Temperature (°C) Air water	29	29	27	29	31	29	31
	28	27	25	28	27	28	29
pH	7.3	7.5	7.6	7.8	7.8	7.8	8.0
Total Hardness (ppm)	161.60	139.77	127.50	81.50	52.00	98.50	99.00
Dissolved Oxygen (mg/l)	4.33	6.99	6.33	6.42	6.55	6.99	7.40
Free carbon dioxide (mg/l)	4.48	4.11	3.95	2.79	1.24	1.79	5.16
Total Alkalinity (ppm)	255.00	215.00	167.50	92.50	142.50	115.00	120.50
Salinity (ppm)	247.43	230.36	196.22	162.11	140.79	153.58	168.94
Chlorinity (ppm)	137.06	127.60	108.69	89.79	77.98	85.07	93.58
Phosphate (mg/l)	0.03	0.06	0.05	0.02	0.05	0.02	0.04

PHYSICO-CHEMICAL PARAMETERS OF TEMPLE POND

In the present investigation, the air temperature ranged from 27 to 32°C and water temperature from 25 to 29° C. Kumar and Kakrani (2000) opined that the rise in temperature of water elevates the metabolic activity of an organisms. It also influences the growth and

distribution of plankton. Welch (1952) has observed that smaller the water body, more quickly to react the changes in atmospheric temperature. The pH of the water body showed alkaline in nature i.e. 7.4 to 8.5. This range is good for growth of aquatic organisms (Lendhe and Yeragi, 2004). Bell (1971) has stated the pH ranges between 6.5 to 9.0 provides an adequate protection to the life of fresh water organisms. Jhingran (1991) reported that pH ranges between 6.0 to 8.5 indicates medium productivity, more than 8.5 highly productive and less than 6.0 low productive nature of water body. Total hardness ranged between 52 ppm in February 2008 and 161.60 ppm in October 2007. Fishes have been found to susceptible to diseases when hardness is below 20 ppm. If it ranged more than 300 ppm, it affects fish production due to more pH as reported by Das (1996).

Dissolved oxygen content in the water sample ranged from 4.0 to 10.66 mg/l. Mustafa and Ahmad (1985) opined the partial of O₂ dissolved in water depends upon the partial pressure of gas in the air close to water, rate of photosynthesis and oxygen holding capacity of water. Tarzwell (1957) reported that for supporting life, minimum of 3mg/l DO is required. Free CO₂ ranged from 3.0 to 5.5 mg/l during the study period. In morning sample, there is an accumulation of free CO₂ due to overnight community respiration. Salasker and Yeragi (2003) noted that slightly increased CO₂ in winter season. Free CO₂ is essential for photosynthesis and its concentration affects the aquatic fauna and its productivity. The total alkalinity was ranged from 92.5 to 255 ppm. In the water body, the alkalinity is imparted by number of bases viz., carbonates, bicarbonates, hydroxides, phosphates, nitrates, silicates, borates *etc.*, (Kumar and Kakrani, 2000). Baskaran *et al.* (1988) observed a decreasing trend of total alkalinity from 115 ppm to 80 ppm.

The salinity of the water sample showed fluctuations during the period of study. It has been found to be maximum of 247.43 ppm in October 2007 and minimum of 140.79 ppm in February 2008. The fluctuation in salinity is probably due to fluctuation in total solids (Boyd and Tucker, 1998). The minimum value of chlorides (77.98 ppm) was found in the month of February 2008 and the maximum value of 137.06 ppm during the month of October 2007 was noted. Chloride content above 250 ppm makes water salty in taste; however a level upto 1000 ppm is safe for human consumption (Kumar and Kakrani, 2000). The phosphate content of water sample showed 0 to 0.9 mg/l. It is an essential nutrient, play a vital role in biological activities of aquatic organisms. Lendhe and Yeragi (2004) reported the range of phosphates from 1.20 mg/l to 3.70mg/l in Phirange kharbav lake.

CONCLUSION

Water quality regulates biotic diversity and trophic level of an ecosystem. The present investigation involves the analysis of physico-chemical and biological parameters which reflect an abiotic status of an ecosystem. This in turn, helps in planning exploitation, antipollution or conservation strategies.

ACKNOWLEDGMENTS

The authors wish to thank the managing board members and the Faculties of Department of Zoology, Ayya Nadar Janaki Ammal College, Sivakasi, for their encouragement and timely help to complete the project work with grand success.

References

- [1] Altaff, K, 2004, A manual of Zooplankton. University grants commission, New Delhi, Pp 1-145.
- [2] Attayade, J.L. and Boryelli, R.L, 1998, Assessing the indicator properties of zooplankton assemblages to disturbance gradients by canonical correspondence analysis. *Can. J. fish. Aquat. Sci.*, **55**: 1789-1797.
- [3] Baskaran, S., Isaiarasu, L. and Thangamani, A, 1988, Observations on Diurnal variations in physical, chemical, and zooplanktonic components of a pond in Sivakasi. *Oikoassay*, **5** (2): 51-55.
- [4] Boyd, C.E. and Tucker, C.S, 1998, Pond aquaculture water quality management. Kluwer academic publisher, London.
- [5] Das, R.K, 1996, Monitoring of water quality, its importance in disease control, paper presented in Nat. Workshop on fish and prawn disease, epizootics and quarantine adaptation in India. CICFRI: 51-55.
- [6] Dhanapathi, M.V.S.S.S, 2000. Taxonomic notes on the Rotifers from India-IAAB publication, Hyderabad: 175.
- [7] Dwivedi, S.L. and Pathak, V, 2000, Studies of water quality of Mandakini rules in Chikrakoot for irrigation purpose. *Indian J. Env. Prot.*, **27** (8): 751-754.
- [8] Jeppesen, E., Jensen, J.P. and Sondergard, M, 2002, Response of phytoplankton, zooplankton and fish to re. oligotrophication : an 11. year study of 23 Danish lakes. *Aquatic ecosystems health and management*, **5**: 31-43.
- [9] Jhingran, V.G, 1974, *Fish and fisheries of India*. Hindustan publishing corporation, New Delhi

- [10] Kakati, S.S. and Sharma, H.P, 2003, Studies on water quality index of drinking water of Lakhimpur District, *Indian J. Env. Prot*, **27** (5): 425-428.
- [11] Kumar, A, (1999), Impact of Industrial effluents on the ecology of river Ganga in Bihar “Ecology of polluted waters and Toxicology” (Ed. K.D.Mishra) *Technoscience Publ.Jaipur*, Pp.87-102.
- [12] Kumar, U. and Bhanu Kakrani, 2000, Water environment and pollution. Agrobios, India. Pp 1-258.
- [13] Lendhe, R.S. and Yeragi, S.G, 2004, Physico-chemical parameters and zooplankton Diversity of Phirange Kharbav lake. Dist. Thane, Maharashtra. *J.Aqua. Biol*, **19** (1); 49-54.
- [14] Mustafa, S. and Ahmad, Z, 1985, Environmental factor and planktonic communities of Baigul and Nanaksagar reservoir, Nainital, *BNHS*, **82**: 13-23.
- [15] Neelima, R. and Kumar, 2005, *Water: Characteristics and properties*. A.P.H. Publishing corporation, New Delhi. Pp 1-346.
- [16] Ravikumar, M., Manjappa, S, Kiran, B.R., Puttaiah, E.T. and Ramesh,I, 2005. Hydrography of Begali tank near Harapanahali, Devangere District, *Indian J. Environmental Prot*, **27** (5): 454-458.
- [17] Salaskar, P.B. and Yeragi, S.G, 2003, Seasonal fluctuations of plankton population correlated with physico-chemical factors in Powai Lake, Mumbai, Maharashtra. *J. Aqua. Biol*, **18** (1): 19-22.
- [18] Tarzwell, C.M, 1957, Water quality criteria for aquatic life. In Biological problems in water pollution, (ed). O.S. Dept of Health education and welfare, P.H.S. 246-272.
- [19] Thirumala, S., Kiran, B.R., Puttaiah,T., Vijaya, K. and Harish Babu, K, 2007, Zooplankton diversity and its relationship with physico-chemical parameters of in Ayyanakere Lake Western Ghats, India. *J. Zool*, **27** (2): 203-207.
- [20] Welch, P.S, 1952, *Limnology*. II. Ed. McGraw Hill Book Co. Inc. New York.