Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 5, Issue, 08, pp.2091-2094, August, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

DIVERSITY AND SEASONAL VARIATION OF ZOOPLANKTON IN UKKADAM LAKE, COIMBATORE, TAMIL NADU, INDIA

***[1]Ezhili, N., [2]Manikandan R. and [3]Ilangovan R.**

[1]Department of Zoology, PSGR Krishnammal College for Women, Peelamedu, Coimbatore -04, TN, India
[2]Department of Biotechnology, Periyar University, Salem-11, TN, India
[3]Quality Control Division, Water Resource Department, PWD, Coimbatore -01, TN, India

ARTICLE INFO

Article History:
Received 11th May, 2013
Received in revised form
25th June, 2013
Accepted 16th July, 2013
Published online 23rd August, 2013

Key words:
Zooplankton,
Rotifera, Copepoda,
Water quality and Eutrophication.

ABSTRACT

Zooplanktons are good indicators for changes of water quality, because they are strongly affected by environmental conditions and respond quickly for the changes in environmental quality. The present study was carried out to examine the diversity and density of zooplankton in Ukkadam lake, Coimbatore, Tamil Nadu, India, for the period of one year from May 2003 to April 2004. During the present study period, a total of 36 genera of zooplankton composed of 8 genera of protozoa, 6 genera of Rotifera, in which 7 genera belonged to Cladocera and 6 to Copepoda were recorded in all the three stations during the period of study. Rotifera were observed to be maximum during summer (March, April and May) and dominated other genera. Species Diversity Index calculated for zooplankton population varied from 1.74 to 3.63. Maximum numbers of zooplankton were recorded in the months of March and October. Dominance of Rotifers is indicated the eutrophic status of lake. The present study result was clearly indicating intensified eutrophication of lake.

INTRODUCTION

Natural water bodies both lotic and lentic are more important sources of water that sustain life. These resources need special attention for conservation, development and management for optimal and sustainable utilization. The micro and macro communities in a natural water body play an important role in keeping the water clean and acceptable for various purposes. Zooplankton plays a pivotal role in aquatic ecosystems. In the recent year globally most common problem is enrichment of water by a nutrient that increases the biological growth and renders the water bodies unfit for diverse uses (Ahmed *et al*., 2011). Eutrophication is a natural process in aquatic ecosystems and it was basically refers to a nutritional enrichment of water column (Esteves, 1988). Nutrients which are present in fertilizers, uncontrolled domestic and industrial waste water have been identified as main sources for eutrophication. The study of zooplankton abundance and diversity of fresh water ecosystems are good indicator for pollution of lake environments. Many studies have highlighted the significance of the torphic relationship between zooplankton and phytoplankton in aquatic ecosystems. Sabu and Azis (1998) reported that phytoplankton and zooplankton abundance in peppara reservoir in Kerala. Das *et al*., (2002) made some observations on zooplankton diversity of two fresh water and two brackish water wetlands of Goa and totally 42 species of zooplankton have been recorded. Rajaopal *et al*., (2010) reported that the presence of certain species like *Keratella, Moinodaphmia* and *Brachionus* are considered to be biological indicator for eutrophication. Coimbatore is an important industrial city of India, ranking 11th in terms of population. It is located in Tamil Nadu with a latitude of 10° 55' and 11°10'N, and longitude of 77°10' and 76° 50'E at an approximate altitude of 333 m. There are more than 30,000 small, medium and large industries including textile mills and foundries in the city employing about 40% of the population. The growing industrial sector and ensuring immigration of people pose heavy burden on the city infrastructure that did not grow in proportion. Till date no integrated sewage system is in operation in the city. The city also does not have facilities for treatment of industrial, municipal, domestic and hospital wastes. The prevailing drainage and sewage are of open type joining the lakes, wetlands and the river Noyyal without appropriate treatment. Little information is available about zooplankton in eutrophication of aquatic ecosystems. Hence, the present study was investigated the abundance and diversity of zooplankton community in ukkadam lake, Coimbatore, Tamil Nadu, India.

Corresponding author: Ezhili, N. Department of Zoology, PSGR Krishnammal College for Women, Peelamedu, Coimbatore -04, TN, India

MATERIALS AND METHODS

Study area

Coimbatore city is surrounded with a number of wetlands and they were the important sources of water for drinking and irrigation. These wetlands are presently deteriorated and cannot be used as a source of drinking water. The wetlands are fed by River Noyyal. The river, which is seasonal, originates from Vellingiri Hills of Western Ghats and meanders through Coimbatore and Tirupur before it confluences into the River Cauvery at Kodumud. The Ukkadam lake is situated between latitude of 100 59' 05.9", longitude of 760 57' 22. 1". Catchments free area is 10. 752 sq. km. Water spread area is 12. 95 sq. m. Number of slices are 4 and capacity is 1.970m. Lowest sill level is 10.64 m. Registered Ayacut area is 14.25 acres. Maximum flood discharge is 62.88m^3 / sec and the depth is 12.75 feet.

Sample collection

The study was continued for a period of one year from May, 2003 to April, 2004. The samples were taken from three stations, station I, Ukkadam, station II, 1 km from Ukkadam in the west direction (Karumbukadai road) and station III (1 km from Ukkadam in the south direction (Selvapuram road). The samples for plankton analysis were collected early in the morning before 6. 00 am by plankton net of silk bolting cloth size of 25 µ and preserved in Lugol's Iodine for phytoplankton and 4% formalin and glycerine for zooplankton analysis. Identification of the specimens was carried with the help of standard woks of Pennak (1978), Edmondson (1966) and Battish (1992).

Species Diversity Index

The Species Diversity Index was calculated by using the formula given by Menhinick (1964).

$$D = \frac{S}{\sqrt{N}}$$

Where, d = species diversity index, S = number of species in the sample, N = total number of individuals in the sample. Statistical analyses were done for zooplankton density at each sampling point and months as well as a correlation analyses (r-Pearson, $p < 0.05$).

RESULTS AND DISCUSIONS

Zooplankton comprised of 8 genera of protozoa, 6 genera of Rotifera, in which 7 genera belonged to Cladocera and 6 to Copepoda (Tables 1 to 3). All genera were identified in all the three stations during the period of study. Rotifers were observed to be maximum during summer (March, April and May) and dominated other genera. Species Diversity Index calculated for zooplankton population varied from 1.74 to 3.63, is shown in Table 4.

Maximum numbers of zooplankton were recorded in the months of March and October. Presence of numerous rotifers indicates the level of algal population and show insufficient oxygen to support the rotifers. Kudari *et al*. (2005) and Stich *et al*. (2005) studied that the zooplankton composition in some ponds of Haveri District, Karnataka and in some lakes of Constance, Germany and stated that Zooplanktons occupy an important position in the trophic structure and play a major role in energy transfer of an aquatic ecosystem. In the present study zooplankton population was found to be in a descending order of major dominant groups viz., Protozoa > Rotifera > Copepoda > Cladocera. Yusuf and Quadri (1980) and Sivakumar and Altaf (2004) stated that the rotifers and cladocerans depend upon the physical parameters such as temperature, pH and nutrient status. Zooplankton biomass directly reflects the prevailing conditions of aquatic environment and structure and function of biological systems which are affected by environmental changes (Manna *et al*., 2000); Pace and Orcutt (1981) and Keto and Tallberg (2000). The zooplanktons form a link between phytoplankton and macroinvertebrates which in turn provide food for fish. Abundance of *Brachionus* sp. and *Keratella* sp. are the determinants of high alkalinity and organically enriched conditions. A direct relationship with phytoplankton and zooplankton was observed in the present study which is in agreement with the findings of Peelan (1974), Rognerud (1984) and Hosmani (2002). The zooplanktonic fauna of this lake were abundant during summer season while minimum numbers were recorded during rainy season. This seasonal variation of zooplankton may be due to environmental changes. In the present study, the zooplankton showed distinct seasonal variations. They indicate their own maximal and minimal peaks as observed by Manzer *et al*. (2005). In any aquatic system, determination of primary productivity gives an information relating to the amount of energy available to support the bioactivity of the system. The high intensity of light may related to the maximum primary productivity of the lake as stated by Yadav *et al*. (1987), Goldman (1988), Saha and Pandit (1990) and Litinov and Roschupko (1993). In the present, study a well marked fluctuations in the primary productivity was recorded due to the high organic pollution and very low intensity of light.

Table 1. Zooplankton population of Ukkadam Lake (Station I) for the period of one year from May, 2003 to April, 2004 (values expressed in units / l)

ZOOPLANKTON	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
PROTOZOA												
Didinum sp.	2	-	-	4	3	2	-	-	2	3	4	3
Vorticella globusa	-	-	3	-	-	4	6	-	-	-	-	-
Amoeba radiosa	1	-	-	-	-	-	-	-	-	-	-	-
Oxitricha sp.	5	4	3	4	3	-	-	-	2	4	3	4
Oxitricha fallax	1	2	5	3	1	-	-	-	-	-	-	-
Arcella discoidus	4	6	7	7	5	2	1	1	2	5	6	5
Arcella vulgaris	3	5	7	7	5	-	-	-	2	3	7	6
Condylostoma patens	2	3	3	2	-	-	-	-	-	2	3	2
ROTIFERA												
Brachionus calyciflorus	-	4	-	4	-	-	-	-	-	-	-	3
Brachionus budapestinensis	-	-	2	-	1	-	2	2	-	-	-	2
Brachionus patulus	-	-	-	-	2	2	2	-	-	-	-	-
Brachionus angularis	-	-	-	3	3	3	3	-	2	2	-	-
Brachionus diversicornis	3	3	3	-	-	-	-	-	-	-	-	-
Stenocypris malcomsoni	3	3	3	3	-	1	1	-	-	-	2	3
CLADOCERA												
Daphnia pulux	4	4	4	3	3	3	2	-	1	2	2	2
Moina comuta	-	3	-	-	-	-	-	1	-	-	4	-
Moina sp.	2	2	-	1	-	-	-	-	-	-	1	1
Moina brachiata	2	2	3	-	-	-	-	-	-	-	1	2
Chydorus parvus	3	-	1	2	2	2	-	-	-	-	-	-
Alona sp.	-	2	1	2	2	-	2	-	-	2	-	-
Bosomina longistris	-	2	2	3	-	-	-	-	-	2	-	-
COPEPODA												
Eucyclops sp.	4	4	4	5	-	-	-	-	2	2	3	3
Mesocyclops leuckartii.	5	4	3	-	4	5	3	3	3	2	4	4
Trophocyclops sp.	3	4	4	-	-	-	-	-	2	-	2	3
Ectocyclops sp.	2	-	1	2	-	-	1	-	-	2	-	-
Paradiaptomus greeni	4	4	3	3	-	-	-	-	-	-	2	2
Phyllodiaptomus blanci	2	2	2	2	-	-	-	-	-	-	2	2

Table 2. Zooplankton population of Ukkadam Lake (Station II) for the period of one year from May, 2003 to April, 2004 (values expressed in units / l)

ZOOPLANKTON	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
PROTOZOA												
Didinum sp.	-	-	-	-	-	-	-	-	-	-	-	-
Vorticella globusa	-	-	3	-	-	3	5	-	1	-	-	-
Amoeba radiosa	-	-	-	-	-	-	-	-	1	-	-	-
Oxitricha sp.	-	-	-	-	-	-	-	-	1	-	-	-
Oxitricha fallax	-	-	-	-	-	-	-	-	1	-	-	-
Arcella discoidus	2	2	3	4	3	2	3	3	2	1	-	-
Arcella vulgaris	2	2	2	1	-	-	2	2	2	1	-	-
Condylostoma patens	3	3	4	3	-	-	-	-	-	2	3	3
ROTIFERA												
Brachionus calyciflorus	4	-	4	-	4	-	-	-	-	-	-	4
Brachionus budapestinensis	-	-	3	1	1	-	2	2	-	-	-	2
Brachionus patulus	-	-	-	-	3	3	3	-	-	-	-	-
Brachionus angularis	-	-	-	3	3	4	3	-	3	3	-	-
Brachionus diversicornis	3	4	4	-	-	-	-	-	-	-	-	-
Stenocypris malcomsoni	3	3	4	4	-	2	2	-	-	-	3	3
CLADOCERA												
Daphnia pulux	5	5	5	3	3	3	3	-	1	2	2	2
Moina comuta	-	3	3	-	-	-	-	1	-	-	3	-
Moina sp.	2	2	-	2	-	-	-	-	-	-	2	2
Moina brachiata	3	3	3	-	-	-	-	-	-	-	2	2
Chydorus parvus	4	-	2	2	3	2	-	-	-	-	-	-
Alona sp.	-	3	2	2	2	-	2	-	-	2	2	-
Bosomina longistris	-	3	3	3	3	-	2	-	-	1	2	-
COPEPODA												
Eucyclops sp.	5	5	5	5	-	-	-	-	3	3	3	3
Mesocyclops leuckartii.	5	5	4	-	5	5	4	4	4	3	4	4
Trophocyclops sp.	4	4	4	-	-	-	-	-	3	3	3	-
Ectocyclops sp.	3	-	2	2	-	-	2	-	-	2	-	-
Paradiaptomus greeni	4	4	4	3	-	-	-	-	-	-	3	3
Phyllodiaptomus blanci	3	3	3	3	-	-	-	-	-	2	3	3

Table 3. Zooplankton population of Ukkadam lake (Station III) for the period of one year from May, 2003 to April, 2004 (values expressed in units / l)

ZOOPLANKTON	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
PROTOZOA												
Didinum sp.	3	-	-	-	4	3	3	-	2	3	3	3
Vorticella globusa	2	-	3	-	-	4	5	-	-	-	-	-
Amoeba radiosa	2	-	-	-	-	--	-	-	-	-	-	2
Oxitricha sp.	4	4	4	4	3	-	-	-	3	3	3	4
Oxitricha fallax	2	2	4	2	1	-	-	-	-	-	-	3
Arcella discoidus	5	4	6	6	4	2	1	1	3	4	5	5
Arcella vulgaris	4	3	5	5	6	7	-	-	2	3	7	5
Condylostoma patens	2	3	3	3	-	-	-	-	-	3	3	3
ROTIFERA												
Brachionus calyciflorus	4	4	-	4	-	-	-	-	-	-	-	4
Brachionus budapestinensis	-	-	2	-	1	-	-	2	2	-	-	2
Brachionus patulus	-	-	-	-	2	3	3	-	-	-	-	-
Brachionus angularis	-	-	-	4	4	4	4	-	3	3	-	-
Brachionus diversicornis	3	3	3	-	-	-	-	-	-	-	-	-
Stenocypris malcomsoni	3	3	3	-	1	1	-	-	-	2	3	-
CLADOCERA												
Moina comuta	3	3	3	4	3	4	2	2	1	1	1	1
Moina sp.	3	2	-	-	-	-	2	-	-	3	-	-
Moina brachiata	2	2	-	2	-	-	-	-	-	-	2	2
Chydorus parvus	3	-	1	3	3	3	3	-	-	-	-	-
Alona sp.	-	2	2	2	2	2	-	-	-	-	-	-
Bosomina longistris	-	2	2	3	-	-	-	-	-	2	2	-
COPEPODA												
Eucyclops sp.	4	3	3	4	-	-	-	-	3	3	3	3
Mesocyclops leuckartii.	5	5	4	3	-	5	4	3	3	3	3	3
Trophocyclops sp.	3	2	2	-	-	-	-	-	2	-	2	2
Ectocyclops sp.	3	-	2	2	-	-	2	-	-	3	-	-
Paradiaptomus greeni	4	3	3	3	-	-	-	-	-	-	3	3
Phyllodiaptomus blanci	2	2	3	3	-	-	-	-	-	-	2	3

Table 4. Species Diversity Index values of Zooplankton in Ukkadam Lake for the period of one year from May, 2003 to April, 2004

Months	Station I	Station II	Station III
May,2003 to April, 2004			
May	3.11	2.84	2.93
Jun	3.10	2.76	2.71
July	3.05	2.10	2.43
Aug.	2.94	1.91	1.97
Sep.	2.39	1.99	1.89
Oct.	3.22	2.13	2.68
Nov.	3.16	2.57	2.69
Dec.	3.25	2.50	2.87
Jan.	3.12	2.57	2.78
Feb.	2.87	2.83	2.54
Mar.	2.88	2.37	1.99
Apr.	2.78	2.09	1.91

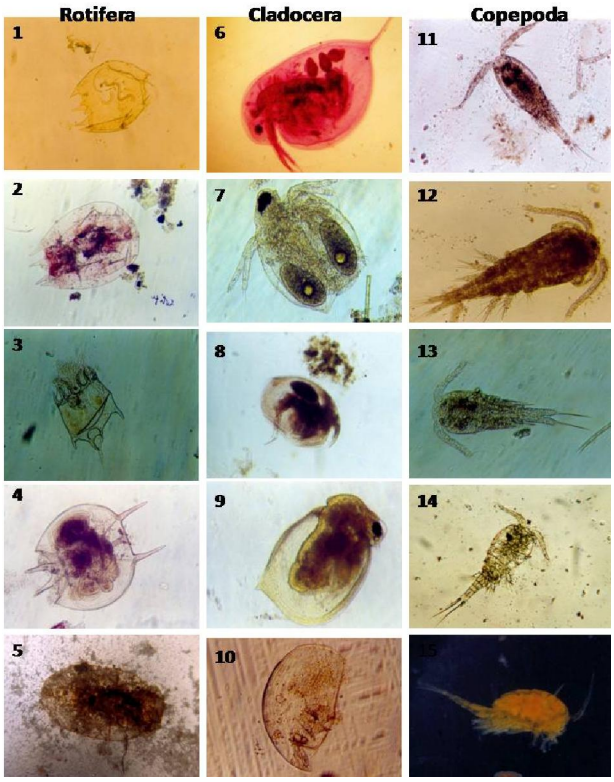

Fig.1. Zooplankton photos of Ukkadam Lake for the period of one year from May, 2003 to April, 2004. 1. Brachionus calyciflorus, 2. Brachionus budapestinensis, 3. Brachionus patulus, 4.Brachionus quadricomis, 5. Stenocypris malcomsoni, 6. Daphnia pulux, 7. Moina comuta, 8. Chydorus parvus, 9. Alona sp., 10. Bosomina longistris, 11. Eucyclops sp., 12. Mesocyclops leuckartii. 13. Trophocyclops sp., 14. Ectocyclops sp., 15. Phyllodiaptomus blanci

Conclusion

In the present study was investigated to Zooplankton diversity comprised of Protozoa, Rotifera, Cladocerans and Copepoda. Protozoans were found to be maximum in the lake. There was a fluctuation in the species composition during all the months of study depending upon the nature of the water in which they inhabit. Pollution indicator species such as *Didinium sp., Oxitricha sp., Alona sp.,* were maximum in the lake. *Brachionus sp* and *Keratela sp* indicate the high alkalinity conditions prevailing in the lake. The results reveal the need for essential regular monitoring in order to safeguard the health of the lake. If alternate disposal systems are not adopted in near future, the pollution load will jeopardize the ecological balance completely.

REFERENCES

Ahmad, U., Parveen, S., Khan, A.A., Kabir, H.A., Mola, H.R.A. and Ganai, A.H, 2011. Zooplankton population in relation to physicochemical factors of a sewage fed pond of Aligarh (UP), India. Biology and Medicine., 3: 336-341

Battsih, S.K. 1992. Fresh water zooplankton of india. Oxford and IBH publishing Co. Pvt.Ltd., New Delhi.

Das, A.C., B.K. Baruah and S. Sengupta. 2002. Study on wetlands of Guwahati city. Water quality of ponds and beels. Poll. Res., 21. (4) : 511 – 513

Edmondson, W.T. 1966. Fresh water biology. 2nd Edn. John wiley and Sons. Inc. New York and London. P. 1248.

Eestevea, F.A. 1998. Fundamentos de limnologia. Interciencia, Rio de Janeiro. 575p.

Goldman, C.R., 1988. Primary productivity, nutrients and transparency during the early onset of eutrophication in ultra oligotrophic lake Tahoe, California, Nevada. Limnol. *Oceanogr*., 33:1321-1333.

Hosmani, S.P. 2002. Phytoplankton and Zooplankton relationship in four freshwater bodies of Dharwar. Indian J.Environ. Ecoplan.,6(1):23– 28.

Keto, J. and P. Tallberg. 2000. The recovery of Vesiyarvi, a lake in Southern Finland; water quality and phytoplankton interpretations. Boreal Environ. Res., 5: 15 – 26.

Kudari, V.A., G.G. Kadadevaru and R.D. Kanamadi, 2005. Zooplankton composition in some ponds of Haveri District, Karnataka. Zoos' Print Journal. 20(12): 2094 – 2099.

Lampert, W., Sommer, U. 1997. Limnoecology: The Ecology of Lakes and Streams. Oxford University Press, New York.

Litinov, A.S. and Roschupko, V.F. 1993. Hydrological conditions in the Rybinsk reservoir ecosystem. Hydrometeoizdat, Sankt-Peterburg. (Eds. Liebermann, T.D. and D.K. Mueller). pp. 3-19.

Manna, M.K, S. Banerice and Bhowmik, M.L. 2000. Plankton as index of water quality with reference to sewage pollution. Asian Jr. Microbiol. Biotech. and Env. Sci., 2(3-4):145-149.

Manzer, M.B.H., M. Nehal, M. Rahmathullah and Bazmi. 2005. A comparative study of population kinetics and seasonal fluctuation of zooplankton in two diverse ponds of North Bihar. Nat. Environ. and Poll. Tech. vol. 4(1): pp.23-26.

Menhinick, E.F. 1964. Comparison of some species diversity indices applied to samples of field insects. Ecol., 45: 858 – 861.

Pace, M.L. and Orcutt, J. D. 1981. The relative important of protozoans, rotifers and crustaccans in a fresh water zooplankton community. Limnol. Occanogr., 26: 822 – 830.

Peelan, R. 1974. Data on oxygen, temperature, sediment and transparency of the Netherland waters, 1961 – 1962. Hydrobiol., 45: 115 – 118.

Pennak, R.W. 1978. Freshwater invertebrates of United States. 2nd Edn. John wiley and So pejler, B. (1946). Regional ecological studies of Swedish fresh water zooplankton. Zool. Bidrag. Uppsala. 36: 407-515.

Rajagopal, T., Thangamani, A., Seavarkodiyone, S.P., Sekar, M., Archunan. 2010. Zooplankton diversity and physic-chemical conditions in three perennial ponds of Virudhunagar district, Tamil Nadu. J. Eenviron. Biol. 3: 265-272.

Rogneurd, S. and Kjellberg. 1984. Relationship between phytoplankton and Zooplankton biomass in large lakes. Ver. Int. Ver. Limnol., 22: 666 – 671.

Sabu Thomas and Abdul azis, P.K. 1999. Zooplankton community characteristics in the pappara reservoir, Kerela. Poll. Res.18:257-260.

Saha, L.C. and Pandit, B. 1990. Dynamics of primary productivity between lentic and lotic system in relation to abiotic factors. J. Indian Bot. Soc., 69:213-217.

Sivakumar, K. and Altaff, K. 2004. Ecological indices of freshwater copepods and cladocerans from Dharmapuri District, Tamil Nadu, India, Zoosprint, 19(5): 1466-1468.

Stich, N, B. Pfeiffer and Maier, G. 2005. Zoopalnkton communities in a large prealpine lake, Lake Conatance: comparison between the upper and lower lake. J. Limnol., 64(2): 129 -138.

Yadav, Y.S., Singh, R.K., Choudhry, M. and Kotcher, V. 1987. Limnology and productivity of Dighari Beed, Assam. Trop. Ecol., 28: 137-146.

Yousurf, A.R., Musthafa Shah, G.M. and Qadri, Y. 1986. Limnological aspects of Miragund wetland. Geobios. 5:116 – 120.

****