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Zooplankton Diversity in Dal Lake - A Comparative Study

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ABSTRACT

Comparison of Zooplankton at the selected sites of Dal Lake was carried out (Nov. 2002 to Oct. 2004 and May 2010 to Apr 2011) to find the changes in the water quality over the years. For physico-chemical analysis of water, sampling was done once in a month and samples were collected from surface of the Lake in polyethylene bottles of 1 L capacity from pre-selected sites with the help of Ruttner type water sampler. The water temperature in general ranged from 4-27˚C with usual trend maximum in summer and minimum in winter. The pH values fluctuated between 7.1 and 9.3 indicating the Lake to be on alkaline side. A total of 40 taxa of Zooplankton were recorded during both the periods of study. In the studies carried out from Nov. 2002 to Oct. 2004, a total of 27 rotifer and 13 crustaceans and from May 2010 to Apr 2011, 8 rotifer and 5 crustacean taxa were recorded respectively.

KEYWORDS : Zooplankton, Dal Lake, water quality, physico-chemical analysis, rotifer, crustaceans.

Introduction

Kashmir Valley situated in the northern part of India within the Himalayan region has a number of fresh water bodies. These water bodies have a great diversity due to their differences in origin and altitude. Increasing population on the other hand has been responsible for introducing many undesirable changes to these water bodies. Among these, the Dal Lake over the years, have been subjected to over exploitation for economic purposes. Open water areas of the Dal Lake have been converted into floating gardens to enhance agricultural production while lake peripheries have been encroached upon to construct residential houses and hotels. A large number of houseboats have encroached within the lake area. Household wastes and sewage are drained into the lake indiscriminately at several sites. Agricultural run-off from the surrounding fields, especially the fertilizer and pesticide wastes from the floating gardens enter into the lake water. The excessive load of nutrients in the Lake water has resulted into luxuriant growth of aquatic plants. A few STP's (Sewage treatment plants) on the periphery of the lake are treating the sewage before it enters the lake. However, due to multitude of problems the lake is heading towards its destruction. With this background, the present study was carried out at the selected sites of Dal Lake at two different periods of time to find out the changes in the water quality over the years and its impact on Zooplankton. The present study will also reveal the impact of de-weeding and the magnitude of threat imposed by discharges from urban human settlements to the ecology of the lake, so that possible conservative measures could be undertaken to restore the natural lake ecology. The present study would prove useful in understanding the conservative planning and management of polluting factors.

Materials and methods

Water sample: Water samples were collected from four sites of the Dal Lake for a period of two years extending from Nov. 2002 to Oct. 2004 and May 2010 to Apr 2011.

(Fig. 1a-c).
Fig. 1a. Dal Lake, Kashmir.



Fig. 1b. De-weeder in Dal Lake



Fig. 1c. Aquatic plants at the periphery after removal



Physico-chemical analysis: Sampling was done once in a month and samples were collected from surface of the Lake in polyethylene bottles of 1 L capacity from pre selected sites with the help of Ruttner type water sampler (Ruttner, 1968). Sampling was done between 10 am to 12 noon. For the physico-chemical analysis, standard methods as suggested by Welch (1948), Murphy and Riley (1962), Mackereth (1963), Golterman and Clymo (1969), Trivedy and Goel (1986) and APHA (1989) were followed.

Zooplankton sampling: Zooplankton sampling was carried out on monthly basis from Nov. 2002 to Oct. 2004 and from May 2010 to Apr 2011. However, the sampling from May 2010 to Apr 2011was done on seasonal basis (4 seasons) from the open water areas of the Lake

almost devoid of aquatic plants. The study of zooplankton was divided into two parts, viz., qualitative and quantitative analysis. For Qualitative analysis, standard planktonic net (64 nm pore dia) was hauled through vertical and horizontal planes of the lake at selected sites. The plankton collected in the 50 mL polyethylene bottle connected at the lower end of the net was preserved in 5% formalin. Then, 1 mL of this sample was taken at a time in a Sedgwick Rafter chamber and studied under the phase contrast inverted microscope (Nikon) and simple microscope. The identification was done with the help of keys given by Ward and Whipple (1959), Mellanby (1963), Pennak (1978) and Tonapi (1980). To collect sample for quantitative analysis of zooplankton population, 10 L of water was filtered through the plankton net and the water was allowed to filter through the net, the planktons were concentrated in the 50 mL polyethylene bottle connected at the lower end of the net. The sample thus, obtained was preserved in 5% formalin and further reduced in volume to 5 mL by centrifugation. About 1 mL of concentrated preserved sample was taken at a time in a Sedgwick Rafter Chamber (Whipple *et al.,* 1927) and counting was done for each zooplankton taxon. The entire 5 mL of the concentrated sample was studied under phase contrast inverted microscope (Nikon) and other microscope. The results are expressed as individuals per litre.

Table 1. Physico-chemical characteristics of Dal Lake.

Parameters	Range
Temperature (˚C)	4-27
pH	7.1-9.3
Conductivity (µS/cm)	100-530
Dissolved oxygen (mg/L)	0.8-11.4
Calcium (mg/L)	17.6-55.3
Magnesium (mg/L)	2.4-20.4
Total alkalinity (mg/L)	42-188
Chloride (mg/L)	14.2-85
Nitrate-nitrogen (µg/L)	113-910
Total phosphorus (µg/L)	120-580

Results and discussion

The physico-chemical features of water are summarized in Table 1. The water temperature in general ranged from 4-27˚C with usual trend with maximum in summer and minimum in winter. The pH values fluctuated between 7.1 and 9.3 indicating the Lake to be on alkaline side. The conductivity values put the Lake water under β-mesotrophic. The calcium and magnesium values follow the progression as Ca>Mg. The total alkalinity showing that the water is moderately hard. The rich chloride contents in the Lake water indicate the presence of organic pollution. Overall, the Dal Lake water is alkaline, moderately hard and nutrient rich in NO_3-N and P-PO_4. Zooplankton in the Dal Lake is represented by rotifers and crustacean (Jeelani *et al.,* 2005). A total of 40 taxa of Zooplankton were recorded during both the periods of study. In the studies carried out from Sep 2000 to Aug 2002, a total of 27 rotifer and 13 crustaceans and from May 2010 to Apr 2011, 8 rotifer and 5 crustacean taxa were recorded respectively (Table 2 and 3; Fig. 2). The rotifer fauna shows single peak in population density during summer at all the sites in both the studies. The site-I is open water area of the Lake which does not receive domestic water directly. The site-II is shallow and densely vegetated with macrophytes and at this site, species diversity and population was highest of all the sites. Both site-III and site-IV receive direct discharge of domestic sewages. The species composition has been found to be almost similar except *Brachionus angularis* Pallus which is found at site-IV. However, over a period of one decade, there has been a decline in the number of taxa of rotifer in the Lake evident from the studies carried out from May 2010 to Apr 2011 in which only 8 rotifer taxa were recorded. Crustacean population in both the periods of study increased during summer with a single peak. In all, 13 crustaceans belonging to cladocera and copepod were recorded during Nov. 2002 to Oct. 2004. Out of these, 12 were present at site-I and 13 each at all other sites of the Lake. However, during the studied period from May 2010 to Apr 2011, the crustacean diversity has shown a considerable decrease over aperiod of time.

Table 2. List of Rotifer Taxa recorded at the investigated sites of the Dal Lake.

Rotifer Taxa	Nov.2002 to Oct.2004				May 2010 to April 2011
	Site 1	Site 2	Site 3	Site 4	Random sampling at different sites
Asplanchna sp.	+	+	+	+	_
Anuraeopsis fissa Lauterborn	+	+	+	+	+
Brachionus angularis Pallus	_	+	_	+	+
Brachionus calycifloris Pallus	_	+	+	+	+
Cephalodella sp.	+	+	+	+	_
Epiphanes sp.	+	+	_	_	_
Gastropus sp.	+	+	_	_	_
Keratella cochlearis Bory de St. Vincent	+	+	+	+	+
Keratella quadrata Bory de St. Vincent	+	+	+	+	_
Lecane luna Nitzsch	+	+	+	+	_
Monostyla bulla Ehrenberg	+	+	+	+	_
Mytilina sp.	+	+	+	+	_
Philodina sp.	+	+	+	+	_
Polyarthra vulgaris Ehrenberg	+	+	+	+	_
Synchaeta sp.	+	+	+	+	_
Trichocerca sp.	_	+	+	+	_

Table 3. List of Crustacean Taxa recorded at the investigated sites of the Dal Lake.

Rotifer Taxa	Nov.2002 to Oct.2004				May 2010 to April 2011
	Site 1	Site 2	Site 3	Site 4	Random sampling at different sites
Acroperus harpae Baird	+	+	+	+	_
Alona sp.	+	+	+	+	+
Alonella exigua Leydig	+	+	+	+	+
Bosmina longirostris Muller	+	+	+	+	+
Chydorus sp..	+	+	+	+	+
Cyclops scutifer Sars	+	+	+	+	_
Cyclops sp.	+	+	+	+	_
Daphnia sp.	+	+	+	+	_
Diaptomas sp.	+	+	+	+	_
Eucyclops agills	+	+	+	+	+
Moinodaphnia sp.	_	+	+	+	_
Moina sp.	+	+	+	+	+
Sida sp.	+	+	+	+	_

The excessive load of nutrients in the Lake has resulted into excessive growth of aquatic vegetation. In the recent past, a large scale me-

chanical de-weeding in the Lake has resulted into loss of crustacean as the aquatic vegetation provides food and shelter to them.

Conclusion

Several measures are being taken to restore the pristine glory of the Dal Lake back. However, few measures adversely affect the Lake ecology in general. The machines in place for the removal of nutrient rich sediments and aquatic plants from the Lake resulted into loss of biodiversity as is evident from this study. The use of mechanical de-weeder has also resulted into the loss of species diversity of Zooplankton in the Lake over a period of time. The entry of untreated sewage, agricultural run-off from the floating gardens and solid waste within and outside into the Lake water has resulted in nutrient enrichment of the water that has led to luxuriant growth of aquatic plants. In the recent past reduction/erratic precipitation levels has led to decrease of fresh water entry into the Lake. At present, there is a very little control over point and non-point source of pollution and the lack of public participation have also resulted into deterioration of the Dal Lake waters.

REFERENCES

1. APHA. 1989. Standard methods for the examination of water and wastewater. 17th Edn., Washington. | 2. Golterman, H.L. and Clymo, R.S. 1969. Methods for chemical analysis for freshwater. IBP. Hand book No. 8, Blackwell Scientific Publications, Oxford. | 3. Jeelani, M., Kaur, H. and Sarwar, S.G. 2005. Distribution of Rotifers in the Dal Lake, Kashmir, India. Poll. Res. 24(1): 79-82. | 4. Mackereth, F.J.H. 1963. Some methods of water analysis for limnologistics. Sci. Publ. Freshwater Biol.Assoc. England. | 5. Mellanby, H. 1963. Animal life in fresh water' 6th edn. Chapman and Hall Ltd. London. | 6. Murphy, J. and Riley, J. 1962. A modified single solution method for the determination of phosphate in natural waters. Anal. Chim. Acta. 27: 31. | 7. Pennak, R.W. 1978. Freshwater invertebrates of the U.S. 2nd John Wiley and sons Inc, New York. | 8. Ruttner, F. 1968. Fundamentals of Limnology, Toronto, University of Toronto Press. | 9. Tonopi, G.T. 1980. Fresh water animals of India–An ecological approach. Oxford and IBH Publishing Co.,New Delhi. | 10. Trivedy, R.K. and Goel, P.K. 1986. Chemical and biological methods for water pollution studies. Environ.Publ. karad. | 11. Ward H.B. and Whipple, G.C. 1959. Fresh water biology, 2nd Edn., John Wiley and Sons, New York, USA. | 12. Welch, P.S. 1948. Limnological methods. The Blaskiston Company, Philadelphia. p.381. | 13. Whipple, G.C., Fair, G.M. and Whipple, M.C. 1927. The microscopy of drinking water. John. Wiley & Sons, New York, N.Y. |