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Ecology of Macrozoobenthos in Nigeen lake

Humaira Qadri and A . R. Yousuf

P. G. Department of Environmental Science, University of Kashmir, Srinagar, J & K , India, 190006.

ABSTRACT

An ecological study of the summer macrozoobenthos of Nageen lake, which forms one of the basins of Dal lake, was undertaken during May-July,2002. The macrozoobenthic community was found to be influenced by the type of substrate, the organic matter, the abundance of macrophytes as well as the concentration of calcium. Annelids formed the most dominant group. All the taxa recorded were true representatives of eutrophic habitats.

Keywords: Dal lake, macrozoobenthos, eutrophic

INTRODUCTION

The Nigeen lake forms the Western part of the world famous Dal lake (34° 07'N, 74° 52'E, 1584 m above MSL). The lake is an important source of vegetables and fishes, an easy water transport system and a tourist attraction for aquatic sports. However, over the years it has fallen an easy prey to biotic interferences. It is the deepest basin of the lake having a maximum depth of 6m. It is connected to Anchar lake by Nallah Amir Khan via Khushalsar Lake. A large part of this waterbody is occupied by floating islands. A luxuriant growth of macrophytes, especially *Ceratophyllum demersum, Myriophyllum spicatum, Nymphaea alba, Nymphoides peltatum, Nelumbo nucifera, Phragmites communis, Typha angustata, Trapa natans* and *Salvinia natans*, is observed in the lake.

Although detailed studies have been conducted on the physico-chemical limnology, primary productivity and plankton of the various basins of the Dal Lake (Kaul and Zutshi, 1967; Kant and Kachroo, 1971; Kaul *et al.*, 1972; Zutshi and Vass, 1978; Vass and Zutshi, 1979; Zutshi *et al.*, 1980; Mir and Kachroo,1982; Yousuf and Parveen, 1990,1992), the benthic fauna of the Dal in general and Nigeen basin in particular has not received due attention. It was therefore felt necessary to conduct a brief study of the ecology of the benthic community of this water body.

STUDY SITES

During the present investigation three sites were selected for the collection of

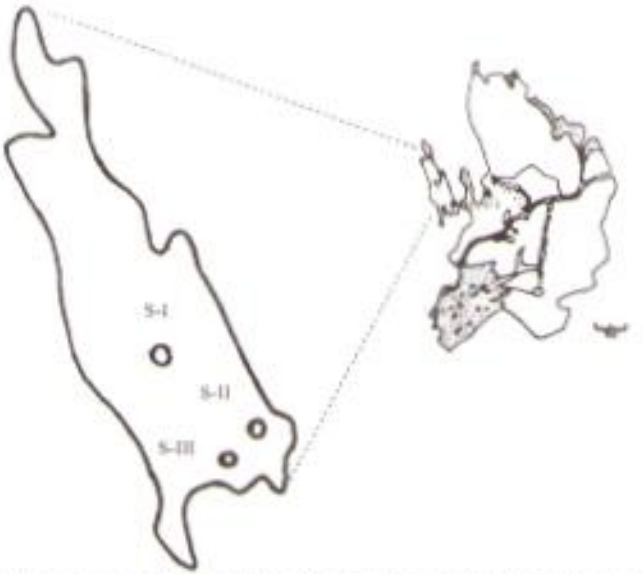

Fig. 1 : A map of Nigeen Lake showing various study sites

data(Fig. 1). Site-I was located in the middle in the deepest zone of the lake (depth 5 - 5.5m). This site was infested with *Ceratophyllum* sp. Site-II was located near Ashai Bagh bridge in the vicinity of the area having house boats (depth 2 -2.5m). The sewage of the house boats is directly discharged into the lake body. This site exhibits a rich macrophytic growth of both submergeds and emergents and also rich algal growth. Site-III was located in the shallow zone (depth 1 - 1.5m) of Zaildar Mohalla. At this site the lake receives maximum sewage from the house hold drains including all kinds of refuse. Only one free floating macrophyte, *Salvinia natans*, was present in this area.

MATERIAL AND METHODS

Water samples for the analysis of physico-chemical parameters, viz., pH, conductivity, free CO_2, carbonate, bicarbonate, chloride, calcium and magnesium, were collected in polyethylene bottles of 1.5*l* capacity, while that for dissolved oxygen was taken in separate glass bottles and fixed on the spot in accordance with Winkler's method. Free CO_2, hardness, alkalinity and chloride were determined by titrimetric methods (Mackereth,1963).

Benthos was collected by Ekman's dredge (15.5 cm × 15.5cm). The macrozoobenthic organisms were presereved in 4% formaline for qualitative and quantitative enumeration in the laboratory (Edmondson,1959; Pennak,1978). While the physico-chemical parameters were studied during April-September 2002, the

benthic samples were collected only for May-July 2002.

RESULTS AND DISCUSSION

The substrate differed considerably at the three sites. Site-I had a clayey substrate, Site-II a silty sand , while Site-III a muck substrate. The mean values for the various physico-chemical characteristics of the water are summarized in Table 1. The pH values recorded during the present study were indicative of the alkaline nature of the water body and fluctuated from 7.05 (Site-II) to 7.67 (Site-I).The conductivity values ranged from 168µs (Site-I) to 213µs (Site-III), while the free CO_2 fluctuated from 18.8 mg / l (Site-I) to 36.5 mg / l (Site-III).

The data on the dissolved oxygen concentration at the three sites revealed that the water was never anoxic, the range of fluctuations being 6.0 mg / l (Site-III) to 7.8 mg / l (Site-I).The total alkalinity of the waterbody was mainly due to bicarbonates which fluctuated from 81.2 mg / l (Site-I) to 93.1 mg / l (Site-III).The chloride concentration fluctuated between 11.9 mg / l (Site-II) and 13.0 mg / l (Site-III). Total hardness was predominantly contributed by calcium and magnesium. Calcium value ranged between 31.8 mg / l (Site-I) and 39.3 mg / l (site-III), while magnesium fluctuated in the range of 10.0 mg / l (Site-II) and 12.0 mg / l (Site-I).

Table 1. Mean values of important physico-chemical characteristics of water at various study sites in Nigeen lake

Parameters	Site I	Site II	Site III	Mean (Whole lake)
pH	7.67	7.05	7.09	7.27
Conductivity (µS cm^{-1})	168	195	213	192
FCO_2 (mg / l)	18.8	25	36.5	26.76
DO (mg / l)	7.8	6.5	6.0	6.76
Alkalinity (mg / l)	81.2	83.4	93.1	85.9
Chloride (mg / l)	12.3	11.9	13.0	12.4
Total Hardness (mg / l)	129.3	122.3	141.9	131.17
Calcium (mg / l)	31.8	32.6	39.3	34.6
Magnesium (mg / l)	12.0	10.0	11.0	11.0

Five macrozoobenthic taxa belonging to Annelida, Mollusca and Arthropoda were recorded during the survey. The monthly variations in population density (ind / m^2) of the various taxa is given in Table 2. Annelids were represented by two oligocheates, i.e., *Tubifex tubifex* and *Branchiura sowerbyi*. *Tubifex* has been designated as an indicator of pollution (Oliver, 1971; Milbrink, 1980 and Bazzanti, 1983). In the present lake *T. tubifex* was confined in its distribution to Site-II. *B. sowerbyi* was also mainly found at Site-II in June and July. However, in July it was

also recorded a few meters away from site-III. Both the taxa were restricted in their distribution to the shallower peripheral areas having silty sand bottom characterized by luxuriant growth of submergeds as well as emergents. Clayey as well as muck substrate was avoided by both the species. Molluscs were represented by *Lymnaea* sp., which occurred in May and July at Site-I and in June at Site-II. However, the species was altogether absent at Site-III. Chironomid larvae and *Gammarus* sp. represented class Insecta and Crustacea respectively. Chironomids are known to be pollution tolerant (Milbrink, 1980). Both the taxa contributed very little towards the total zoobenthic population, being present only at Site-II in June.

The Nigeen basin receives large amounts of biologically active nutrients from the catchment areas and from human settlements and house-boats within the lake, which is known to affect the distribution and abundance of benthic fauna (Marshall, 1971). Vegetation (Ball, 1948) and the amount of dissolved calcium (Asahina, 1943) have been suggested to influence the benthic communities. Molluscs have been mentioned by many investigators to be numerous in macrophyte infested areas (Soszka, 1975). The macrophytes provide a good habitat for molluscan population and may increase their density by structurally increasing the available benthic area, although not serving as food (Anderson and Sedell, 1979). These inferences seem to hold good for Nigeen lake as well, as the benthic population in the lake was mainly restricted to Site-II, where there is luxuriant growth of macrophytes and the calcium content is also relatively high.

Berg (1937) is of the opinion that the nature of bottom sediments is the main factor detertmining the spread of organisms. The abundance of macroinvertebrates at the various sites of Nigeen lake can also be related with the substrate characteristics. Site-I with a clayey substrate was preferred only by *Lymnaea*, whereas Site-II with a silty sand substrate, was the most preferred place for all the benthic organisms that were recorded. Site-III with a muck substrate was the least preferred area for the benthos.

It may be concluded that the macrozoobenthic organisms prefer the lake areas with silty sand substrate having rich macrophytic growth. The present results when compared with the earlier studies conducted on the lake (Jan, 1987 and Mir,1995) reflect a decline in the species diversity which indicates the advancement in the trophic conditions of the lake. This is substantiated by the fact that oligochaetes, which have been associated with the advancement in the trophic status of lakes (Howmiller and Beeton, 1971), dominated the benthic community of the present waterbody.

Table 2. Monthly variations in the population density (ind / m²) of aquatic macroinvertebrates

	Animal Kingdom	Site	May	June	July
I	**Annelida**				
(i)	Oligochaeta				
(a)	Tubifex tubifex	I	-	-	-
		II	42	83	62
		III	-	-	-
(b)	Branchiura sowerbyi	I	-	-	-
		II	-	42	62
		III	-	-	42
I	**Arthropoda**				
(i)	Insecta				
(a)	Chironomid larvae	I	-	-	-
		II	-	83	-
		III	-	-	-
(ii)	Crustacea				
(b)	Gammarus pulex	I	-	-	-
		II	-	42	-
		III	-	-	-
III	**Mollusca**				
(i)	Gastropoda				
(a)	Lymnaea sp.	I	42	-	42
		II	-	42	-
		III	-	-	-

- = absent

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REFERENCES

Anderson, N. H. and Sedell, J. R. 1979. Detritus processing by macroinvertebrates in stream ecosystems. *Ann. Rev. Entomol.* **24**: 315-377.

Asahina, E. 1943. Bottom fauna in the coastal lakes of Tokachi. 1. *Zool. Mag.* **55**: 137-154.

Ball, R. C. 1948. Relationship between available fish food, feeding habits of fish and total fish production in a Michigan lake. Mich. State.Univ. Agricult. Exp. Stat. *Tech. Bull.* **206**: 1-59

Bazzanti, M. 1983. Composition and diversity of the profundal macrobenthic community in the polluted lake Nemi (Central Italy), 1979-80. *Oecol Applic.* **4**(3): 211-220.

Berg, K. 1937. Contributions to the biology of Corethra (*Chaoborus lichtentein*). K. Danske Vidensk selsk. *Biol. Medd.* **13**(11) : 101.

Edmondson, W. T. 1959. *Freshwater Biology*. John Wiley, N.Y.

Howmiller, R. P. and Beeton, A. M. 1971. Biological evaluation of environment quality, Green Bay, Lake Michigan. *J. Water Poll. Control Fed.* **43**:123-133

Jan, Ulfat. 1987. *Studies on Macrozoobenthos of Dal Lake, Kashmir (India)*. Ph.D Thesis. University of Kashmir. India.

Kant, S. and Kachroo, P. 1971. Phytoplankton population dynamics and distribution in two adjoining lakes in Srinagar.1. Macroflora in relation to phytoplankton. *Proc. Natn. Acad. Sci. India* **37**: 163-188.

Kaul, V. and Zutshi, D. P. 1967. A study of aquatic and Marshland vegetation of Srinagar, *Proc. Nat. Inst. Sci. India.* **33** (3 & 4):111-127.

Kaul, V., Zutshi, D. P. and Vass, K. K. 1972. Biomass production of some macrophytes of Srinagar lake. In : *Tropical Ecology Emphasizing Organic Production*. (P.M. Golley and F.B. Golley, eds.). Athens. pp. 295-311.

Mackereth, F.J.H. 1963. *Some Methods of Water Analysis for Limnologists*. Freshwat. Biol. Assoc. Sci. Publ. No. **21**.

Marshall. B. E. 1971. *Ecology of the Bottom Fauna of Lake Mc Illwiane, Rhodesia*. M.Phil. Thesis, Univ. of London.

Millbrink, G. 1980. Oligochaete communities in population biology: the European situation with special reference to lakes in Scandinavia. In: *Aquatic Oligochaeta Biology* (R..D.

Brinkhurst and D.G. Cook, eds.). Plenum Press, N.Y and London, pp. 433-455.

Mir, A. M. and Kachroo, P. 1982. Limnology of Kashmir lakes VII. The Ecology of Bacillariophyceae. *Proc. Int. Natn. Sci. Acad, B.* **48** : 378-390

Mir, M. F. 1995. *Ecological Studies on Zoobenthic Community of Dal Lake.* Ph.D Thesis. University of Kashmir, India.

Oliver, D. R. 1971.Life History of the Chironomidae. *Ann. Rev. Ent.*, **16**: 211-230.

Pennak, R. W. 1978. *Fresh Water Invertebrates of United States*, John Wiley, N.Y.

Soszka, G. J. 1975. The invertebrates on submerged macrophytes in three Masurian lakes. *Ekol. Pol.* **23**: 371-391.

Vass, K. K. and Zutshi, D. P. 1979. Limnological Studies on Dal lake Kashmir, India : Morphometry and physical features. *J. Inland Fish. Soc. Ind.* **11** (1) : 12-21.

Yousuf, A. R. and Parveen, M. 1990.Phytplankton dynamics in Dal lake, Kashmir. In: *Contribution to the fisheries of Inland open water systems in India*, Part I (Jhingran, Unnith and Ghosh, eds.). Inland Fish Soc. India, pp. 58-67.

Yousuf, A. R. and Parveen, M. 1992 Ecology of polluted waters of Kashmir : Brari Nambal basin of Dal Lake. In: *Current Trends in Fish and Fishery Biology and Aquatic Ecology* (A.R. Yousuf, M.K. Raina and M.Y. Qadri, eds.). pp. 255-264.

Zutshi, D.P. and Vass, K.K. 1978. Limnological studies on Dal Lake chemical features, *Ind. J. Ecol.* **5** (1) : 90-97.

Zutshi, D.P., Subla, B.A., Khan, M.A. and Wanganeo, A. 1980. Comparative limnology of nine lakes of Jammu and Kashmir Himalayas. *Hydrobiologia* **80** : 101-112.