A COMPARATIVE STUDY OF MACROBENTHIC COMMUNITY IN DAL AND NILNAG LAKES OF KASHMIR HIMALAYA

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ABSTRACT

The present study was carried out during May-October 2004 to make a comparative assessment of benthic communities of two lakes of different trophic status. The studies revealed marked differences in the composition of benthic communities of the lakes (Dal and Nilnag). Although a few species (*Gammarus* sp., *Gerris* sp., *Lymnaea columella*, *Chironomus* sp., *Pentaneura* sp. and *Tubifex* sp.) were common to both the lakes yet others were restricted to only one of the aquatic biotopes. Insecta was the most dominant group in both the lakes with average population density of 245 individuals m^{-2} for Dal and 157 individuals m^{-2} for Nilnag. The oligochaetes with an average population density of 121individuals m^{-2} constituted second dominant group in Dal lake. The emergence of species like *Tubifex* sp. and *Chironomus* sp. in Nilnag lake is an indication that the lake is marching towards eutrophication.

***Key words*:** Freshwater, biomonitoring, benthic community, trophic status, Kashmir Himalaya

INTRODUCTION

Environmental biomonitoring is much talked about and a rapidly expanding field particularly in case of limnological studies. Biomonitoring gives us an aggregate of all the environmental stresses and is not fluctuated by intermittent disturbances, besides being a cost effective technique (Zajic, 1971). Among biological indicators of water quality like macrophytes, fishes, plankton and benthos, the last one serves as the best indicator of pollution. The species analysis of macrozoo-benthos enables the determination of trophic type of lakes and is, therefore, used as in important tool in the ecological classification of lakes (Thut, 1965; Seather and Mclean, 1972; Bazzanti, 1975. Richardson, 1921, 29). Liebmann (1942), Huet (1949), Pandit (1980) and Kaul and Pandit (1981) have also reported the importance of macroscopic benthic organisms as being true indicators of pollution. According to Jumppanen (1976) also the first signs of eutrophication and pollution in some Finish lakes are usually seen in the benthic fauna and flora as the suspended wastes immediately sink to the bottom to decompose and thus, cause a change in the benthic communities. In view of the importance of benthic organisms as important indicators of water pollution, the present study was carried out on two different lake ecosystem having different trophic status.

MATERIAL AND METHODS

The two lakes selected for the present investigation were Dal and Nilnag. Dal lake, being an typical urban valley lake with immense biotic interference, is situated towards the north east of Srinagar city at an altitude of 1584 m (a.s.1) and covers an area of about 10.5km^2. Nilnag lake, being a pine forest rural lake, is situated about 45 km to the south of Srinagar city at an altitude of 2180 m(a.s.1)with an overall surface area of 0.5km^{-2}.For studying macrobenthic – invertebrate fauna, the bottom sediment samples were collected with the help of Ekman's dredge having an area of 15.5cm^2. The samples were sieved through 0.5mm mesh. The organisms were sorted out manually using

forceps and preserved in 4% formalin for soft bodies animals and 70% ethanol for hard body or shell type organisms. The samples were taken to the laboratory for detailed examination. Identification of the various taxa was done with help of standard taxonomic works of Needham (1957), Edmondson (1989), Pennak (1978), APHA (1989), Engbolm and Lingdell (1999). The density was calculated in terms of individuals/m^2.

RESULTS AND DISCUSSION

The community composition of macrobenthic invertebrate fauna of a particular habitat reflectes the habitat characteristics. The presence of a particular population is governed by a specific set of ecological conditions prevailing at that period of time. In present study, altogether seven taxa of macrozoobenthos belonging to three main groups viz. Annelida, Arthropoda and Mollusca were recorded from both Dal and Nilnag lakes (Table1).

Table 1: Benthic composition of Dal and Nilnag lakes

Study sites	Annelida		Arthropoda		Mollusca
	Hirudinea	**Oligochaeta**	**Crustacea**	**Insecta**	**Gastropoda**
Dal lake		*Tubifex* sp. *Limnodrillus* sp. *Branchiura sowerbyi*	*Gammarus pulex*	*Macromia* sp. *Chaoborus* sp. (larvae) *Pentaneura* sp. (larvae) *Chironomus* sp. *Tendipes tentans.* *Gerris* sp. *Pseudochironomus* sp.	*Lymnaea columella* *L. auricularia* *Gyraulus circumstratus*
Nilnag lake	*Hirudo* sp.	*Tubifex* sp.	*Gammarus pulex*	*Pentaneura* sp. *(larvae)* *Chironomus* sp. *Gerris* sp. *Dysticus* sp. *Hydrophilus* sp. *Ablabesmyia* sp.	*Lymnaea columella,* *L. auricularia*

Table 2: Average population density (individuals/m^2) and relative density (percentage contribution) of macrozoobenthos in Dal and Nilnag lakes

Group/Taxa		Dal lake		Nilnag lake	
		Average population density (ind/m^2)	%age contribution	Average Population density (ind/m^2)	%age contribution
I.	**Annelida**	**121**	**22.79**	**42**	**16.15**
(i)	Hirudinea	-	-	11	4.23
	Hirudo sp			11	
(ii)	Oilgochaeta	121	22.79	31	
	*Tubifex*sp.	60		31	11.92
	Limnodrillus sp.	21		-	
	Branhiura sowerbyi	38			
II.	**Arthopoda**	**280**	**52.73**	**172**	**66.15**
(i)	Crustacea	35	6.59	15	5.77
	Gammarus pulex	35		15	
(ii)	Insecta	245	46.14	151	60.38
	Macromia sp.	18		-	
	Chaoborus sp. (larvae)	45		-	
	Pentaneura sp. (larvae)	33		25	
	Chironomus sp.	74		28	
	Tendipes tentans	20		-	
	Gerris sp.	40		48	
	Pseudochironomus sp.	15		-	
	Dysticus sp.			23	
	Hydrophilus sp.			21	
	Ablabesmyia sp.			12	
III.	**Mollusca**	**130**	**24.48**	**46**	**17.70**
	Lymnaea columella,	55		31	
	Lymnaea auricularia	25		15	
	Gyraulus circumtratus	50			

The Insecta was the most dominant group in both the waterbodies as their population densities averaged 245 individuals/m^2 for Dal and 151 individuals/m^2 for Nilnag. The dominant class made up 46.14 and 60.38 % of the total population for the two lakes respectively (Table 2). The zoocenosis of Dal lake revealed the existence of maximum number of pollution tolerant species represented by *Chironomus* sp., *Pseudochironomus* sp. *Chaoborus* sp., *Pentaneura* sp. and *Tendipes tenans*. In contrast, Nilnag lake harboured only two such genera namely *Chironomus* sp. and *Pentaneura* sp. Chironomids are invariably the inhabitants of polluted waters with low oxygen content and high organic matter (Pandit, 1980). The degree of eutrophication is further indicated by the population size of this known bioindicator and as such Dal lake harbours more population than the Nilnag lake (Table 2) indicating that the former lake is subjected to high influx of nutrients from its catchments (Hilsenhoff, 1966; Kaushik *et al*., 1991; Pandit, 1992 and Bay *et al.,*1996). A comparison of species composition further showed few species like *Gammarus* sp., *Gerris* sp., *Lymnaea columella, Chironomus* sp., *Pentaneura* sp. and

Tubifex sp. occurring in both the water bodies indicate the general eutrophy of lakes. Many others were restricted to only one or the other of the two aquatic biotopes. Among annelids *Hirudo* sp. with average population density of 11 individuals/m^2 and relative density of 4.23 was recorded only from Nilnag lake (Table 2). Their occurrence may be attributed to low salinity and high dissolved oxygen content of lake water, a fact already revealed by Wolff (1971). Oligochaetes have also been used to assess organic pollution and trophic status in waterbodies by many authors (Millbrink, 1994 and Sarkka, 1994). In the present study oligochaetes were the major contributors of benthos though their densities and relative contribution were very high, being 129 individuals/m^2 and 22.79 percent of the total population in Dal lake as against 31 individuals/m^2 and 11.92 percent for the group recorded respectively for Nilnag lake. The noteworthy feature of the present study was the presence of *Tubifex* sp. in Nilnag lake which is an indication of changing trophic status of the lake. Wilham and Dorros (1968) and Adholia *et al.* (1990) reported that oligochaetes particularly *Tubifex* sp. are the common inhabitant of mud enriched with organic matter. In the present study the oligochaete species richness in Dal lake confirms that the lake is receiving higher load of organic matter in contrast to the Nilnag lake. Bais *et al*. (1992) further emphasized that oligochaetes occur in large number when the bottom water at mud water interface contains low in dissolved oxygen content. *Gammarus pulex*, which was the single representative of Crustacea in two lakes, with density of 35 individuals/m^2 and relative density 6.59 percent for Dal and 15 individuals/m^2 and relative density 5.77 % for Nilnag again shows the degree of eutrophication in terms of influx of organic load into the waterbodies as the species develop as soon as the organic load makes its way into the aquatic body. Molluscs generally are known to prefer clean water with sandy/silty bottom. In the present investigation the representative species viz. *Lymnaea columella, Gyraulus circumstratus* and *Lymnaea auricularia,* with average population densities of 55 individuals/m^2, 50 individuals/m^2 and 25 individuals/m^2 respectively were mainly restricted to the Nigeen basin of Dal lake, depicting healthier condition of the basin.

From the above findings it can be concluded that the Dal lake, being an urban valley lake, is highly polluted as depicted by its high population density of 531 individuals/ m^2as well as the prevalence of pollution indicator species like *Chironomus, Pentaneura, Tendipes tentans, Tubifex, Chaoborus* etc. whereas Nilnag lake, being a rural valley lake and sustaining low population density of 260 individuals/ m^2, is not polluted to such an extent. However, presence of some indicator species like *Chironomus,*sp. *Pentaneura* sp. and *Gammarus* sp. from the lake is indicative of the fact that the lake is undergoing trophic evolution, though it is at present at the lowest ebb of eutrophication.

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