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EFFECT OF FERTILIZER USE ON THE DISTRIBUTION AND SPECIES COMPOSITION OF MACROZOOBENTHOS IN DAL LAKE, KASHMIR

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ABSTRACT The distribution and species composition of macrozoobenthos in relation to the effect of fertilizer use was investigated for a period of one year. Based on the fertilizer use in the floating vegetable gardens and agricultural fields in the catchment area of the lake, the impact of fertilizers on the distribution and species composition of macrozoobenthos was carried out and the results of the fertilizer affected sites were compared with the fertilizer unaffected sites of the lake. During the study a total of 33 species of macrozoobenthic invertebrates were recorded. The study revealed a higher abundance of oligocheates and insects at fertilizer affected sites and the mollusks were predominant at fertilizer unaffected sites of the lake.

KEYWORDS : Fertilizers, Benthos, Species Composition, Effect, Dal Lake.

INTRODUCTION

The Dal Lake, situated in the North-East of Srinagar at an altitude of 1584m, is a multi basined water body having a large catchment area of about 315 km^2, where intensive agricultural activities are performed. Its area has also got shrinked as a result of encroachment of its shallow zone for the construction of floating gardens. These floating gardens (locally called Radhs) are made from decayed vegetation into the shape of long rectangular strips floating on the surface of water. The floating gardens are used by the people for the cultivation of different vegetables and several fertilizers are used on them in order to get more production. A significant quantity of these fertilizers from agricultural fields and floating gardens gets washed into surrounding water, thereby changing the ecology of the lake. (Figure 1 and 2). It was with this aim that the present investigation on the impact fertilizers on the distribution and species composition of macrozoobenthos in Dal lake was undertaken, which probably gives us an idea about the extent of the effect of fertilizers on the lake fauna.

FIGURE 1. A Floating garden in Dal lake

FIGURE 2. Entry of Telbal Nallah into Dal Lake

MATERIAL AND METHODS

The data on various physico-chemical parameters and macrozoobenthos were collected on monthly basis from three sampling stations differing in various environmental variables like depth, vegetation, and human interferences. Site 1: Close to the inlet of water from Telbal Nallah. Site 2: In the central deepest part of the lake virtually free from any pollution and Site 3: Near the floating vegetable gardens. Sampling from all the study sites was done at least once in a month. Water samples for physico-chemical characteristics were analyzed as per the standard methods given by [1,2].

For studying macrobenthic-invertebrate fauna, the collection of the bottom samples was made with the help of Ekmans's dredge having an area of 15.5 cm^2. The samples were sieved through 0.5 mm mesh, the organism were sorted out manually using forceps and preserved in 4% formalin for soft bodied animals while as 70% ethanol for hard bodied or shell type organisms.

The samples were taken to the laboratory for detailed examination. Identification of the various taxa was done with the help of standard taxonomic works of [3,4,5,6]. The density was calculated in terms of individuals/m^2.

RESULTS AND DISCUSSION

Physicochemical features of water

The mean values of various physicochemical features are presented in Table 1. Physico-chemical characteristics of water of an aquatic ecosystem reflect not only the quality of the system but also the type and density of its biota. Analysis of such parameters generates information regarding pollution pattern and magnitude of pollutant loading of aquatic ecosystem. The water temperature followed closely the air temperature showing only spatial difference. Transparency was very low near floating gardens. Dissolved oxygen varied from 5.2 mgl^{-1} to 10.2 mgl^{-1}. Low DO content was observed near floating gardens. The study did not show any marked difference in pH values and the water seems to be well buffered. Conductivity values were very high near floating gardens. The concentration of ammonical-N and nitrate-N was high particularly at site-3 near floating vegetable gardens. This is attributed to the too much use of nitrogen based fertilizers in the floating gardens and heavy anthropogenic pressure in the catchment area resulting in organic pollution, which in turn adds ammonia by undergoing bacterial decomposition of the organic matter. The nitrate-N and nitrite-N values ranged between 120 ugl^{-1} - 310 ugl^{-1} and 13.5 ugl^{-1} - 20.0 ugl^{-1} respectively. Similarly, total phosphorus concentration ranged from 9.5 ugl^{-1} to 35.5 ugl^{-1}. Higher concentration of N and P in the lake particularly at site 3 near floating gardens is attributed to the use of fertilizers and addition of domestic sewage from the adjacent human habitations. These findings are in consonance with the earlier findings of [7,8].

TABLE 1. Average values of physico-chemical parameters recorded in Dal Lake.

PARAMETER	SITE I	SITE II	SITE III
Water temperature (c°)	18.5°c	15.8	19.0
Transparency (m)	2.0	0.98	2.5
Conductivity($uscm^{-1}$)	150	172	390
Dissolved oxygen (mgl^{-1})	9.1	10.2	7.2
Free co_2(mgl^{-1})	8.8	7.5	8.0
Alkalinity(mgl^{-1})	80.0	76.1	110.0
Calcium(mgl^{-1})	25.5	15.0	36.5
Chloride(mgl^{-1})	25.0	16.0	27.5
Silicate(mgl^{-1})	2.2	1.2	2.6
Ammonical nitrogen(ugl^{-1})	230	225	625
Nitrate nitrogen(ugl^{-1})	201	120	310
Nitrate nitrogen(ugl^{-1})	13.5	15.5	20

Orthophosphorus (ugl^{-1})	32.2	9.5	35.5
Total phosphorus(ugl^{-1})	152	132.5	215
Potassium(mgl^{-1})	5.0	2.0	7.0
Sodium(mgl^{-1})	9.0	7.5	12.0

Biological features

From the physico-chemical parameters of water it was found that site near floating vegetable gardens was the most polluted site of the lake. A total of 33 species of macrozoobenthic-invertebrates were recorded out of which 14 belonged to Annelida, 13 to Arthopoda and 6 to Mollusca. Quantitatively the most dominant class was Oligocheata followed by Insecta & Mollusca during the investigation.

Species composition of macrozoobenthos of Dal Lake

	Phylum: Annelida Order: Plesiopora Family: Tubificidae
1	*Aulodrilus sp*
2	*Limnodrilus hofffmeisteri*
3	*Tubifex tubifex*
	Family: Aeolosomatidae
4	*Aeolosoma hemprichi*
	Family: Naididae
5	*Nais communis*
6	*N. elinguis*
7	*Chaetogaster sp*
8	*Dero sp*
9	*Aulophorus sp*
10	*Pristina longisetta*
11	*Stephenosoniana sp*
12	*Stylaria sp*
13	*Allonais sp*
	Class: Hirundinae Order: Arhynchobdellida Family: Hirudidae
14	*Hirudo sp*
	Phylum: Arthropoda Class: Crustacea Sub class: Malacostraca Order: Decapoda
1	*Gamarus sp*
	Class: Insecta Order Ephemeroptera
2	*Ephemerella sp*
	Order: Odonata
3	*Anax sp*
4	*Macromia sp*
5	*Libellula sp*
6	*Coenagrion sp*
	Family: Gerridae
7	*Gerris sp*
	Family: Notonectidaea
8	*Notonecta undulate*
	Family: Napidae
9	*Nepa sp*
	Order: Coeloptera Family: dystiscidae
10	*Cybister sp*
	Family Hydrophylidae
11	*Hydrophylus sp*
	Family: chironomidae
12	*Tendipes tentans*
13	*Chironomus sp*
	Phylum: Mollusca Class: Gastropoda Order: Pulmonata Family: Lymneaidae
1	*Lymnaea auricularia*
2	*L.stagnalis*
3	*L.columella*
	Family: Planorbidae
4	*Gyrulus parvus*
5	*Planorbis sp-*
	Family: Arnicolidae
6	*Arnicola limosa*

TABLE 2: Percentage contribution of macrozoobenthos groups in Dal Lake

Groups	%age
Annelida	52.5
Arthropoda	43.5
Mollusca	4

The present study revealed a higher abundance of annelids at fertilizers affected sites than at unaffected sites (Table 2). The abundance and density of annelids was higher at site 3 and lower at site 2. [9]suggested that the higher concentration of oligocheates can be attributed to increased amount of high domestic & agricultural pollution of the habitat. [10]stated that oligocheates mostly *Tubifex* and *Chironomous* are indicative of tropic pollution.

Arthopoda had higher density and abundance at fertilizer affected site of the lake. Insecta was the most dominant group and its percentage contribution was second after the oligocheats. The number & density of pollution tolerant species was maximum which were represented by *chironomous spps., chaoborus spps and tendipes tenants*. Chironomids are invariably the inhabitants of polluted waters with low oxygen content and high organic nutrients. Similar results have been obtained by [11,12]. Mollusks were higher in the cleaner waters in the deepest central part of the lake.[13,14] also found predominance of mollusks in cleaner waters.

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