

Macrophytic Distribution in Dal Lake, Kashmir During Summer

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ABSTRACT

The paper provides data on the distributional pattern of dominant macrophyte species of Dal Lake, Kashmir, as observed during the summer months of 2004. *Ceratophyllum demersum* was the most common macrophyte in all the four basins of the lake. *Azolla* sp., which has been a recent introduction in this water body, was found to be taking over the macrophytic community throughout the lake, except Lokut Dal basin, where it is being continuously skimmed off by the Government Agency responsible for the Conservation of Dal Lake.

Key words : Dal lake, macrophytes, *Azolla* sp.

INTRODUCTION

Macrophytes are an integral part of freshwater ecosystems and play a key role in determining the structure and function of the system. Being the ecological dominants, they provide the basic material for the food cycle by making energy and nutrients available for higher trophic levels (Ryszkowski, 1975). The Dal lake (34° 07' N, 74° 52' E; 1584m above MSL) is under great ecological stress due to human inhabitation around and within it, resulting in heavy mineral loading of the water body, which is chiefly responsible for recurrence of dense macrophytic growth. Mukherjee (1921, 1925, 1926), Kaul and Zutshi (1967), Zutshi (1968, 1975), Zutshi and Vass (1971, 1982) and Kaul *et al.* (1972, 1980) have discussed the macrophytic flora of the lake to a great extent. However, for the last twenty five years or so no attention has been given to the macrophytic community of the lake. It was, therefore, felt necessary to conduct a fresh study on the species composition and distribution pattern of the aquatic macrophytes in the lake and document the changes undergone in this important component of the biocenose of the lake. In the present communication the distributional pattern of the macrophytic community of the lake observed during the summer season of 2004 is discussed.

MATERIAL AND METHODS

The Dal Lake is a multi-basined water body spread over a water area of about 11 km². 15 sampling sites were selected in the lake for studying the distribution pattern of aquatic vegetation in the four basins. Five sites (H1, H2, H3, H4 and H5) were in the Hazratbal basin, three (N1, N2 and N3) in the Nigeen basin, four (L1, L2, L3 and L4) in the Lokut Dal basin and three (G1, G2 and G3)

in the Gagribal basin of the lake. The number of the sampling sites was fixed according to the size and the change in pattern of vegetation in a basin. The density of the aquatic macrophytes was assessed by quadrat method. The size of the quadrat was generally 25 × 25cm; however, at various sites its size varied according to the diversity of the community.

RESULTS AND DISCUSSION

Macrophytes are an important component of freshwater ecosystems and play a key role in determining the structure and function of the lakes, especially the shallow productive ones like the Dal lake in Kashmir. Mukerjee (1926) reported dominance of *Potamogeton*, *Hydrilla* and *Myriophyllum* besides the dense carpets of *Chara* species close to the bottom in the Dal Lake. The shallow water association was found by him to be dominated by *Typha*, *Sparganium* and *Carex* species. During the present study thirteen species of macrophytes (one emergent, five rooted floating, five submergeds and three free floating) were observed to be dominating the macrophyte community in the lake (Table 1). None of the species was dominant in all the four zones.

The present investigation revealed that the dominance pattern of the macrophytic community in the Dal showed significant changes with space (Fig. 2). The submerged macrophytes due to their aggressive capacity covered extensive areas occupying the deeper regions of the lake and were mainly dominated by *Ceratophyllum demersum*, *Myriophyllum spicatum* and *Potamogeton lucens*. The general changes in vegetation with varying water depth were well recognized. The emergents dominated in the shallower zones, while the floating leaf type species got established as the depth increased. The adaptive connection between deep waters and broad-leaf species has also been suggested by Spence (1967).

In the past Kaul (1971), Kaul *et al* (1978) and Zutshi and Vass (1982) have reported on the distribution pattern of macrophyte community of the Dal. According to Kaul (1971) lemniids were restricted in the Dal to water depth of less than 1.5m, while *Myriophyllum spicatum* covered large areas having 0.5 – 2.0m depth and *Nymphoides peltatum* areas in 0.1 – 2.5m depth zone. Zutshi and Vass (1982) estimated 0.5m as the maximum depth for colonization of emergent forms. The floating - leaf forms were reported by them to be distributed over depth range of 0.25 – 1.97m, while maximum amplitude of 0.4- 3.0m was recorded for the submerged communities of *Myriophyllum* and *Ceratophyllum*. Although these reports have not given any detailed distribution maps of the various species in the lake, still some broad comparisons with them are possible. A comparison of the data given by these early workers with the present situation in the lake with respect to macrophytic community reveals that there have been significant changes in the dominance pattern of different macrophyte species.

In the Hazratbal basin Kaul *et al* (1978) reported thick stands of emergents comprising of

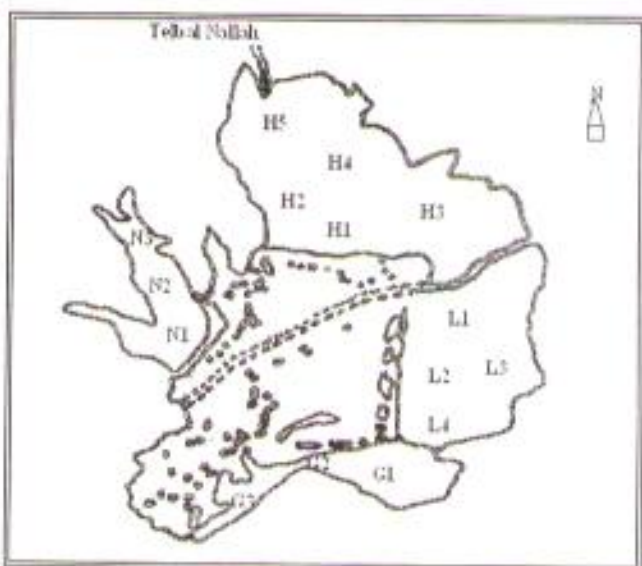
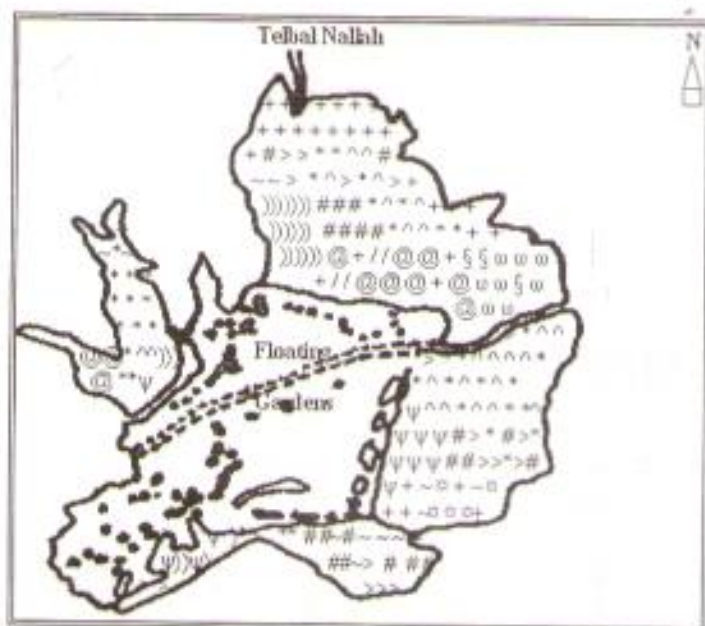


Fig.1: Map of the Dal Lake showing study sites



) = *Azolla* Sp., § = *Salvinia natans*, + = *N. peltatum*
 # = *P. lucens*, > = *P. natans*, * = *C. demersum*, ^ = *M. verticillatum*
 @ = *Trapa natans*, @ = *N. nucifera*, ψ = *H. verticillata*, ○ = *H. dubia*
 ~ = *N. alba*, / = *T. angustata*

Fig. 2: Dominance pattern of macrophytes in the Dal Lake, Kashmir

Table 1: Distribution pattern of dominant macrophytes in Dal Lake, Kashmir

S. No.	Collection Site	Hazratbal basin					Nigeen basin					Lokut Dal basin					Gagribal basin		
		H1	H2	H3	H4	H5	N1	N2	N3	L1	L2	L3	L4	L5	L6	G1	G2	G3	
Emergent																			
1.	<i>Typha angustata</i>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rooted floating																			
2.	<i>Nelumbo nucifera</i>	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
3.	<i>Nymphoides peltatum</i>	+	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	-	-
4.	<i>Trapa natans</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	<i>Nymphaea alba</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.	<i>Hydrocharis dubia</i>	-	-	-	-	-	-	-	-	-	-	+	-	-	+	-	-	-	-
Submergeds																			
7.	<i>Potamogeton lucens</i>	-	-	-	+	-	-	-	-	-	-	-	-	-	+	-	-	+	-
8.	<i>Potamogeton natans</i>	-	-	-	+	-	-	-	-	-	-	+	-	-	+	-	-	-	+
9.	<i>Ceratophyllum demersum</i>	-	-	-	+	-	-	-	-	-	-	+	-	-	+	-	-	-	+
10.	<i>Myriophyllum spicatum</i>	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-	-	-
11.	<i>Hydrilla verticillata</i>	-	-	-	-	-	+	-	-	-	-	-	-	+	-	-	-	-	-
Free Floating																			
12.	<i>Azolla</i> sp.	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	+
13.	<i>Salvinia natans</i>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Typha angustata, *Phragmites communis* and *Myriophyllum verticillatum* towards the littorals, forming large associations with the rooted floating leaf types and the submergeds, mostly *Nymphoides peltatum*, *Nelumbo nucifera* and *Hydrocharis morsusraeae*, with increased density of *Potamogeton lucens*, *Hydrilla verticillata* and *Ceratophyllum demersum* towards the centre. Zutshi and Vass (1982) reported *Salvinia natans* and *C. demersum* as co-dominants in this basin. These were reported to be followed in dominance by *T. angustata*, *P. australis*, *N. nucifera*, *M. spicatum*, *H. verticillata*, *Lemna* sp., *N. alba* and *H. dubia*. During the present survey the macrophyte community of the basin was dominated by *Trapa natans*, *N. peltatum*, *P. lucens*, *P. natans*, *C. demersum* and *M. spicatum*. All these species covered large areas close to the banks and some (*P. lucens*, *P. natans*, *C. demersum* and *M. spicatum*) extended right up to the centre of the basin, especially where water was shallow. *N. nucifera* was abundant along the southern side of Hazratbal basin (H1).

Dense patches of *Azolla* sp. were observed along the western banks of Hazratbal basin (H2). *Trapa* - *Salvinia* community was extensively present along Nishat Bund site of Hazratbal basin (H3). Emergents comprising *T. angustata*, *P. communis*, *Sparganium erectum* and *M. verticillatum* were the chief occupants of the littoral zone and extended all along the eastern and southern side of the basin.

Heterogeneous stands of *N. peltatum*, *P. pectinatus*, *P. lucens* and *H. verticillata* were observed by Kaul *et al* (1978) in the littorals as well as the central part of Nigeen basin. The present study revealed *C. demersum* as the most dominant species forming monospecific meadows, particularly in the central part of this basin. These observations are very much similar to the ones made by Zutshi and Vass (1982) who observed large areas extensively occupied by *C. demersum*. *N. nucifera* was present extensively towards the southern side of the basin. Large patches of *Nymphaea alba* were present along the northern side of Nigeen basin (N3). The emergent vegetation composed of *T. angustata* and *P. communis* formed large stands in the form of floating gardens on the northern and extensively on the southern side. Patches of *Azolla* sp. were observed near and around the Ashai Bagh bridge of the Nigeen basin (N1).

Kaul *et al* (1978) observed thick stands of *T. angustata* and *P. communis* on the north-western side of the Lokut Dal basin with maximum area occupied by *N. peltatum* among the rooted floating types and *C. demersum*, *P. lucens* and *M. spicatum* among the submerged hydrophytes. However, Zutshi and Vass (1982) observed *N. nucifera* to be the most dominant community followed by *N. alba* and *M. spicatum*. The present study revealed that *C. demersum* - *M. spicatum* combine was the most dominant association in Lokut Dal basin and covered extensive water areas. *H. verticillata* formed monospecific stands along the western side of Lokut Dal basin (L2). *N. peltatum* and *H. dubia* covered large areas along the southern shores of the basin (L4). Other species present were *P. lucens*, *P. natans* and *N. alba*. Skimming of *Azolla* patches was being done continuously in this basin by the Lakes and Waterways Development Authority, the Government Agency which is

managing the Dal Lake.

N. alba was observed to form pure isolated stands of its own in Gagribal basin with dominant associations of *P. crispus*, *P. pectinatus*, *P. lucens*, *H. verticillata* and *C. demersum* (Kaul et al. 1978). Zutshi and Vass observed *M. spicatum* covering extensive areas followed by *N. nucifera* and *N. alba*. However, the present study revealed *P. lucens* - *C. demersum* complex as the dominant association covering large water areas in the Gagribal. Extensive cover of *Azolla* sp. was observed near and around Dal lock gate with *H. verticillata* underneath.

On the whole a number of phytosocial associations were observed in the lake. The main associations were between *Ceratophyllum* - *Myriophyllum*, *Nelumbo* - *Nymphoides*, *Ceratophyllum* - *Myriophyllum* - *P. lucens* - *P. natans*, *Ceratophyllum* - *Hydrilla* and *Trapa* - *Salvinia*. *Azolla* sp., which has made its appearance in the lake very recently, is distributed in sheltered pockets throughout the lake and is encroaching upon the open water areas. Since it forms dense patches, it limits the penetration of light, thus hindering the growth of other aquatic plants. On the other hand it is impeding navigation, fishing and also degrading the aesthetic quality of the lake.

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