Diversity and Distribution of Emergent Macrophytes in Nilnag Lake, a Pine Forest Lake in Western Himalaya

Shahid A. Wani, Kawnsar- ul- Yaqoob and Ashok K. Pandit
Post Graduate Department of Environmental Science, University of Kashmir, Srinagar – 190 006 (J & K), India.

ABSTRACT

The present paper gives an account of the distribution of emergent vegetation growing in and around the Nilnag – a pine forest lake in Kashmir Himalaya. In all a total of 18 species, belonging to 11 families, were recorded from the lake. *Polygonum amphibium*, *Phragmites australis*, *Sparganium ramosum* and *Typha angustata* were the four most frequent species with the mean frequency values of 63.57, 40.71, 30.0 and 29.90 respectively. The maximum number of species was recorded in the summer months from June to August (16) as against the minimum of 06 in April. In general, lake depicted complex physiognomy of emergents and an adaptive relation between water level fluctuation and increasing atmospheric temperature was observed.

Key words: Nilnag lake, macrophytes, emergents, diversity, Kashmir Himalaya.

INTRODUCTION

Macrophytes are the most important constituents of the aquatic ecosystem (Pandit, 1984). They may contribute to these biotopes by way of their primary production (Adams and McCracken 1974; Dykyiova, 1971, 78), detritus formation (Wetzel *et al.,* 1972), as nutrient source (Carignan and Kalff, 1980) and serving as substrate for other organism such as periphytic algae, bacteria and macrofauna. The littoral zones which belong to the most productive biotopes on earth (Wetzel, 1975) play an important role in the metabolism of shallow lakes and consist of an intricate habitat which is affected by the lake's drainage basin as well as by its pelagic zone (Sculthorpe 1967; Bernatowiez, 1967).

Considerable knowledge exists on ecology, species composition and production of macrophytes on valley lakes of Kashmir (Kaul and Zutshi, 1967; Zutshi and Vass, 1971, 76; Kaul *et al*., 1978; Handoo and Kaul, 1982; Kaul, 1982; Pandit, 1984, 92, 99, 2001,02; Kak, 1987, 89; Zutshi and Gopal, 2000; Qadri and Yousuf, 2005; Rather and Pandit, 2005; Ravinder and Pandit, 2005,06). However, with regard to high attitude and pine forest lakes of the region, only a few studies (Zutshi *et al.*, 1972; Kaul et al., 1980) have been undertaken. It is in this context the present attempt has been made to analyze

emergent macrophyte vegetation of a pine forest lake, Nilnag, in Kashmir Himalaya, to have base line data for further studies.

STUDY AREA

Nilnag Lake is a pine forest rural lake, situated about 45 km in the south of Srinagar city, at an altitude of 2180 m (a.s.l.) and having an area of 0.5 km^2. The lake, believed to have formed as a result of tectonic movements (Zutshi *et a*l., 1972), lies amidst pine forest and is fed by an ephemeral stream, Soiepather Kul, on its south-western end in addition to a small channel from Ladden spring on its southern side. The lake is elliptical in shape with a wavy shore line (Fig.1). It remains snow covered for about 3 months from mid December to mid March and harbours emergents for about 6 months, emerging in late April. The hilly catchment of the lake is characterized by heavy agricultural practices on the north and north-western sides while as south and south-eastern sides are covered with pine forests.

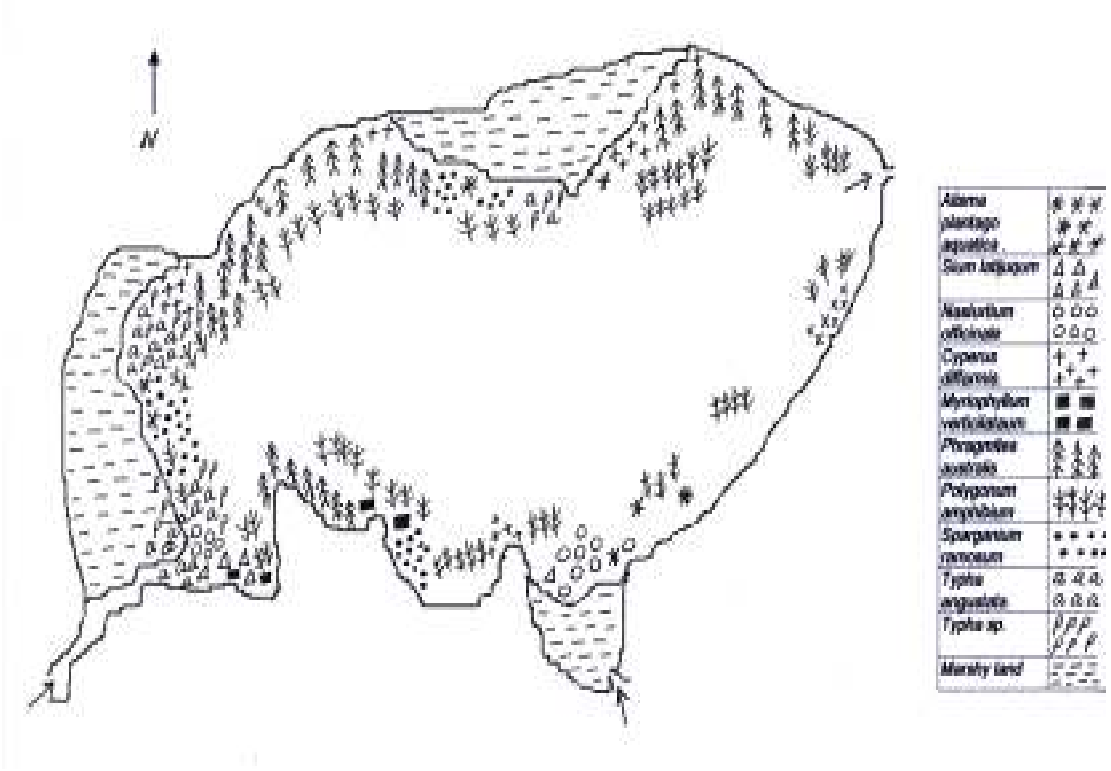

Fig.1 Location map of Nilnag lake showing the distribution of emergent vegetation.

MATERIAL AND METHOD

The present study was conducted on monthly basis from April to October 2004 during the growing period of macrophytes. The quardrat method (Misra, 1968) was followed for studying various structural features of macrophytic community. Quardrats of definite size ($1m^2$) were laid randomly at and around the various study sites and the macrophytes occurring in each quardrat were listed species-wise. The individuals of each species were counted to work out the quantitative community features – frequency and relative frequency

RESULTS AND DISCUSSION

The present study revealed the presence of 16 species belonging to 11 families of emergent macrophytes in the lake (Table 1). The maximum number of 16 species was recorded during summer months (June – August) as against the minimum of 6 species recorded in April. In general, the species depicting highest mean frequency were *Polygonum amphibium* (63.57), *Phragmites australis* (40.71), *Sparganium ramosum* (30.00) and *Typha angustata* (29.20). Although most of the species depicted significant mean frequency values, the lower values were obtained for *Lycopus europus* (3.57), *Sagittaria sagitifolia (*5.00) and *Ranunculus secleratus* (5.71). On the other hand, the species depicting significant values for relative frequency were *Phragmites australis, Polygonum amphibium, Tyhpa angustata, Sparganium ramo*sum and *Cyperus defformis* (Fig. 2).

In Nilnag Lake a distinct littoral zone can be demarcated. The shallowest part, extending from shore line to about 1.5m depth, is occupied mostly by emergent vegetation. *P. australis* predominates towards the shore line in north, north-east and north-west, in addition to a small patch in southwest, where as *P. amphibium* makes the maximum coverage inner to reed (*P. australis*) zone. Dense strands of *S. ramosum, T. angustata, Typha* sp.and *C. defformis* were recorded in west, north-west and south-west areas of the lake. The lake is almost devoid of emergent vegetation in south and south-east regions where only *P. amphibium* is found besides a small patch of *C. defformis.*

The present study shows a noticeable increase in the coverage of emergent macrophytes in the lake littorals. The species like *P. australis, T. angustata*, *S. lacustris* and *S. ramosum* were present in a very small but narrow belt along the shore line (Kaul *et.al*., I980), whereas at present these species have been found to encroach upon large areas along the periphery of the lake. The gradual increase in the emergent vegetation cover in the lake littorals is attributed mainly to the shallowing of the lake basin by siltation through allochthonous deposits from the hilly catchment.

Table 1: Distribution pattern of macrophytes in Nilnag Lake

S No	Emergent Species	Apr		May		Jun		Jul		Aug		Sep		Oct		Mean monthly frequency
		F	RF	F	RF	F	FR	F	RF	F	RF	F	RF	F	RF	
1	*Alisma plantago aquatica* L. (Alismataceae)	0	0	5	1.78	10	3.03	15	3.79	15	4.16	10	3.33	5	2.17	8.57
2	*Sagittaria sagittifolia* L. (Alismataceae)	0	0	0	0	5	1.51	10	2.53	15	4.16	5	1.66	0	0	5
3	*Sium latijugum* Clarke (Apiacae)	0	0	5	1.78	5	1.51	15	3.79	15	4.16	10	3.33	10	4.34	8.57
4	*Nasturtium officinale* Barbus (Brassicaceae)	10	12.5	20	7.14	20	6.06	25	6.32	20	5.55	15	5	15	6.52	15
5	*Carex* sp. (Cyperaceae)	0	0	15	5.35	15	4.54	15	3.79	15	4.16	10	3.33	0	0	10
6	*Cyperus defformis* L. (Cyperaceae)	0	0	30	10.7	30	9.09	35	8.86	35	9.72	35	11.66	30	13.04	27.85
7	*Scirpus lacustris* L. (Cyperaceae)	0	0	10	3.57	10	3.03	10	2.53	10	2.77	10	3.33	10	4.34	8.57
8	*Myriophyllum verticillatum* L. (Haloragaceae).	0	0	0	0	5	1.51	10	2.53	10	2.77	10	3.33	10	4.34	6.42
9	*Lycopeus europus* L. (Lamiaceae)	0	0	0	0	5	1.51	5	1.26	5	1.38	5	1.66	5	2.17	3.75
10	*Phragmites australis* Trin. (Poaceae)	30	37.5	35	12.5	40	12.1	45	11.4	50	13.88	45	15	40	17.39	40.71
11	*Polygonum amphibium* Gray (Polygonaceae)	15	18.75	60	21.4	65	19.7	80	20.3	70	19.44	60	20	35	15.21	63.57
12	*Polygonum hydropiper* Spach (Polygonaceae)	0	0	20	17.1	25	7.57	20	5.06	10	2.77	5	1.66	5	2.17	12.14
13	*Ranunculus secleratus* (Ranunculaceae)	0	0	10	3.57	10	3.03	15	3.79	5	1.38	0	0	0	0	5.71
14	*Sparganium ramosum* Huds. (Sparginaceae)	10	12.5	30	10.7	35	10.6	40	10.1	35	9.72	30	10	30	13.04	30
15	*Typha angustata* Bory & Chaub. (Typhaceae)	10	12.5	30	10.7	35	10.6	35	8.86	35	9.72	35	11.66	25	10.86	29.2
16	*Typha* sp. (Typhaceae)	5	6.25	10	3.57	15	4.54	20	5.06	15	4.16	15	5	10	4.34	12.85

F = Frequency RF = Relative frequency

The distribution of the emergent vegetation within the lake is highly uneven as north and north-west parts have greater coverage of emergent vegetation in the extended littoral region, owing to the presence of inlet channel from this side which brings in heavy silt load from the adjoing agricultural fields and denuded forests. The less coverage of emergent vegetation from south to south- east areas of the lake is mainly attributed to interception of solar radiation by dense canopy of pine trees.

Emergents, being the most productive communities of macrophytes (Westlake, 1963; Wetzel, 1973 and Kaul *et al.*, 1978;), show an increase in number as well as coverage per unit area in the lake and hence it can be inferred that the lake is evolving at a rapid pace, pointing towards increasing productivity of the lake ecosystem.

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