Journal of Research & Development, Vol 9. (2009) ISSN 0972-5407

Macrophytic Diversity in Anchar Lake, Kashmir

Nyla Ali and Ashok K. Pandit
P.G. Department of Environmental Science, The University of Kashmir, Srinagar-190 006, J&K, India

ABSTRACT

The present floristic survey focuses on the diversity of macrophytes in Anchar lake, Kashmir. A total of 41 macrophyte species were recorded during the growing season in 2005. The emergent macrophytes had the highest diversity (24 species), followed by rooted floating leaf- type (07), submergeds (07) and free floating (03). The maximum number of macrophyte species were recorded in the months of July and August (41) while a minimum of 32 species were recorded in the month of April. A comparison of present data with earlier ones reveals that there has been a considerable decline in the macrophytic diversity of Anchar lake. The lake which has been submitted to an increasing eutrophication for the past several years is overgrown mainly by the aggressive interlope`rs like *Typha* spp., *Phragmites australis*, *Sparganium ramosum* and *Scirpus* sp.

Key words : Macrophytes, diversity, eutrophication, Anchar lake.

INTRODUCTION

The role of macrophytes in freshwater aquatic systems has received increased attention over the last 10-15 years, primarily due to their widespread decline in many lakes as a result of sustained cultural eutrophication (Egertson *et al*., 2004). Macrophytes are excellent indicators of lake condition for many reasons including their relatively high levels of species richness, rapid growth rates, and direct response to environmental change. Individual species show differential tolerance to a wide array of stressors. Thus, as environmental conditions vary, community composition shifts in response. Aquatic plant communities have been shown to change in response to hydrologic alterations (Spence, 1982), nutrient enrichment (Craft and Richardson, 1998), sediment loading and turbidity (Sager *et al*., 1998), and metal and other pollutants. These patterns have been interpreted and used to diagnose lake impacts because they represent a diverse assemblage of species with different adaptations, ecological tolerances, and life history strategies. The composition of the plant community can thus, reflect (often with great sensitivity) the biological integrity of the aquatic ecosystems. The appreciation of the positive ecological values of macrophytes has led to a better understanding of their diversity and role in natural ecosystem for their scientific management. In Kashmir a few studies pertaining to macrophytes have been reported (e.g. Kaul and Zutshi, 1967; Kaul *et al*., 1978; Kak, 1987,89; Pandit, 1984,92,99,2001). Keeping in view the importance of macrophytes in aquatic ecosystems, the present study was undertaken to add some more information on their diversity in an eutrophic valley lake.

STUDY AREA

Anchar lake is a shallow basined valley lake, having fluviatile origin. The lake is situated to the north-west of Srinagar at a distance of about 14 km. It is fed by the cold water river, Sindh which enters the lake on its northern end, while the southern end receives water from Khushalsar lake. The lake has a number of small outlet channels that drain the lake water into the nearby Shalabough wetland.

MATERIAL AND METHODS

The lake was surveyed during the growing season of the macrophytes (April-October, 2005). The identification of macrophytes was done upto genus or/species level by adopting the standard works (Sculthorpe, 1967; Kak,1978; Cook, 1996).

RESULTS AND DISCUSSION

During the present survey of the lake, a total of 41 macrophyte species(excluding Bryophyta) belonging to 23 families and 33 genera were recorded (Table1). The maximum number of species were recorded in the months of July and August (41) and a minimum of 32 species were recorded in April. All the four ecological groups viz. emergents, rooted floating type, free floating and submergeds were recorded from the lake. The diversity of emergent species was highest (24 species) while comparatively low diversity was recorded for other three groups of macrophytes : rooted floating type (07 species), submerged (07 species) and free floating (03 species).. A comparison of present data with the earlier ones, such as Zutshi *et al.,* (1967) who reported 99 macrophytic species (including Bryophyta) from Anchar lake, reveals that there has been a considerable decline in the macrophytic diversity of Anchar lake.

Due to intensified anthropogenic activities, the depth of the lake has been reduced considerably and as such much of the lake has been converted to marsh land. The lake is intensely overgrown and the typical zonal distribution of the macrophytes is lacking, resulting in complex physiognomy of macrophytes.

.

Table 1. List of macrophyte species recorded from Anchar lake during 2005

S.No.	EMERGENTS
1.	*Alism plantago-aquatica* Linn.
2.	*Bidens cirnua*
3.	*Carex* sp.
4.	*Cyperus* sp.
5.	*Eleocharis palustris* Linn.
6.	*Gallium* sp.
7.	*Hippuris vulgaris* Linn.
8.	*Lycopus europus* Linn.
9.	*Menyanthese trifoliate* Linn.
10.	*Myriophyllum verticillatum* Linn.
11.	*Nasturtium officinale* R.B.r.
12.	*Paspalum paspaloides* (Michx)
13.	*Phragmites australis* Trin.
14.	*Polygonum amphibium* Linn.
15.	*Polygonum hydropiper* Linn.
16.	*Ranunculus lingua* Linn.
17.	*Ranunculus scleratus* Linn.
18.	*Sagittaria sagittifolia* Linn.
19.	*Scirpus* sp.
20.	*Sium latijugum* C.B.C.L.
21.	*Sparganium ramosum* Huds.
22.	*Typha angustata* Bory & Chaub.
23.	*Typha latifolia*
24.	*Veronica* sp.
	ROOTED FLOATING-LEAF TYPE
25.	*Hydrocharis dubia* (Blume) Bacquer
26.	*Marsilea quadrifolia* Linn.
27.	*Nelumbo nucifera*
28.	*Nymphaea alba* Linn.
29.	*Nymphoides peltatum* (Gmel) Kuntze
30.	*Potamogeton natans* Linn.
31.	*Trapa natans* Linn.

SUBMERGEDS

32. *Ceratophyllum demersum* Linn.
33. *Hydrilla verticillata* (L.f.)Royle.
34. *Myriophyllum spicatum* Linn.
35. *Potamogeton crispus* Linn.
36. *Potamogeton lucens* Linn.
37. *Potamogeton pusillus* Roxb.
38. *Potamogeton pectinatus*

FREE –FLOATING TYPE

39. *Azolla pinnata*
40. *Lemna* spp.
41. *Salvinia natans* Linn.

At present, the overriding influence on this lake is eutrophication caused by the human activities in its catchment. The nutrient loading is high and derived mainly from sewage and agricultural land. The changes in vegetation caused by eutrophication have been well documented (Ozimek,1978). Excessive nutrient loadings can affect the plant communities in a variety of ways (Weisner,1990), shifting the species composition away from species that take up nutrients slowly, to those that are able to exploit nutrient pulses more rapidly or which have high nutrient requirements (Wetzel and Van der Valk, 1998). The present survey revealed that emergent species were the most common and overgrown growth forms in Anchar lake. Growth of emergent aquatics can become very dense with eutrophication (Moss, 1979). Emergents like *Phragmites australis*, *Sparganium ramosum*, *Scirpus* sp. and *Typha* spp. which are the known aggressive interlopers, form continuous or at some places patchy mixed or monospecific stands, and thus colonize large areas of Anchar lake. Nutrient enrichment often results in growth of species tolerant to high nutrient loadings e.g. *Typha*, *Phragmites* (Galatowitsch *et al*., 1999). The emergent vegetation has expanded rapidly across the lake, presumably as a response to lake shallowing caused by enhanced infilling of the lake, mainly due to the eroded soil and silt carried by the River Sindh.

Among the three free floating macrophytes recorded from Anchar lake, *Lemna* spp. and *Azolla pinnata* were found to have an explosive growth in the open waters of the lake. *Lemna* spp. often increases in density and coverage epecially during late spring and early June, in response to increased nutrients (Pandit *et. al.,* 1978; Vaithiyanathan and Richardson, 1999).Later invasive plants, especially non-native invaders, such as *Azolla*, usually form a solid cover which creates compact, thick, floating mats, that shade the water column below them, restricting the submerged growth and thus altering the species composition of the lake . Their explosive expansion, thus, pose a great threat to the lake ecosystem.

The present floristic survey revealed that the number of floating leaved species was less as compared to the emergent species. This may be because in high alkalinity lakes, the floating leaved species are replaced by emergent macrophytes (Makela *et al*., 2004).

The low species diversity of submergeds encountered during the present study, may be attributed to the high water turbidity of the lake. This is in accordance with the results of other studies (Sand-Jensen *et al*.,2000). Turbidity (i.e. decreased water clarity) almost by definition means decreased availability of light to submerged aquatic vegetation, killing many species. Conversely, increased water clarity may result in increased cover of submerged aquatics (Scheffer *et al*., 1993). During this study, *Ceratophyllum demersum* was the most common submerged macrophyte encountered in the lake. *Ceratopyllum* is known to grow well in organically polluted waters (Kulshreshtha, 1982). Similarly, *Potamogeton pectinatus*, recorded during the present survey, is known to be tolerant to murky waters (Nichols and Lathrop, 1994). The declining of submerged vegetation may be considered to be one of the symptoms of advanced eutrophication of Anchar lake as also reported by Phillips *et al*., (1970) for other lakes. Similar observations have been made by Pandit (1992) while working on takes and wetlands of Kashmir.

REFERENCES

Cook, C.D.K. 1996. *Aquatic and Wetland Plants of India*. Oxford University Press. New York.

Craft, C.B. and Richardson, C.J. 1998. Recent and long-term organic soil accretion and nutrient accumulation in the Everglades. *Soil Sci. Soc. Am. J*., **62**: 834-843.

Egertson, C.J., Koposka, J.A. and Downing, J.A. 2004. A century of change in macrophytic abundance and composition in response to agricultural eutrophication. *Hydrobiologia*, **524**: 145-156.

Galatowitsch, S.M., Anderson, N.O. and Ascher, P.D. 1999. Invasiveness in wetland plants in temperate North America. *Wetlands*, **19**: 733-755.

Kak, A.M. 1978. *Taxonomic Studies of Aquatic Angiosperms of Kashmir*. Ph.D Thesis, Kashmir University, Srinagar.

Kak, A.M. 1987. Ecological vegetation of the Kashmir wetlands. *J. Econ. Tax. Bot*., **10**(2): 361-364.

Kak, A.M. 1989. Aquatic and marsh plants of Kashmir valley. *Kashmir University Res. J*., **3**: 31-42.

Kaul, V. and Zutshi, D.P. 1967. A study of aquatic and marshland vegetation of Srinagar. *Proc. Nat. Inst. Sci.* India, **33**: 111-127.

Kaul, V., Trisal, C.L. and Handoo, J.K. 1978. Distribution and production of macrophytes in some waterbodies of Kashmir. p. 313-334. In: *Glimpses of Ecology* (J.S. Singh and B. Gopal, EDS.). International Scientific Publications, Jaipur, India.

Kulshreshtha, M. 1982. Comparative ecological studies on two species of *Ceratophyllum*. *Proc. 6th EWRS Int. Symp. Aquatic Weeds*, Novi Sad, p. 29-36.

Makela, S., Haitu, E. and Arvola, L. 2004. Spatial patterns in aquatic vegetation composition and environmental covariates along chains of lakes in Kokemaenjoki watershed (S. Finland). *Aquatic Botany*, **80**:253-269.

Moss, B. 1979. Algal and other fossil evidence for major changes in Strumpshaw Broad, Norfolk, England in the last two centuries. *Br. Phycol. J.* **14**: 253-283.

Nichols, S.A. and Lathrop, R.C. 1994. Cultural impacts on macrophytes in the Yahara lakes since the late 1800s. *Aquatic Botany*, **47:** 225-247.

Ozimek, T. 1978. Effects of municipal sewage on the submerged macrophytes of a lake littoral. *Ekol. Pol.*, **26**: 3-39.

Pandit, A.K. 1984. Role of macrophytes in aquatic ecosystems and management of freshwater resources. *J. Environ. Manage.*, **18**: 73-88.

Pandit, A.K. 1992. Macrophytes as a component of Dal lake ecosystem. p.45-67. In: *Aquatic Ecology*. (S.R. Misra and D.N. saksena, eds.). Ashish Publishing House, Delhi-110026.

Pandit, A.K. 1999. *Freshwater Ecosystems of the Himalaya*. Parthenon Publishing, New York, London.

Pandit, A.K. 2001. Plant diversity of freshwater ecosystems of North-West Himalaya. *J.Res.Dev.*, **1**: 1-21.

Pandit. A.K, Kaul, V. and Fotedar, D. N. 1978 A preliminary study of duck weed ecology and its natural control. *Int. J. Ecol. Environ Sci.*, **4**:107-115.

Philips, G.L., Eminson, D. and Moss, B. 1970. A mechanism to account for macrophyte decline in progressively eutrophicated freshwater. *Aquatic Botany*, **4:** 103-126.

Sager, E.P.S., Whillans, T.H. and Fox, M.G. 1998. Factors influencing the recovery of submersed macrophytes in four coastal marshes of Lake Ontario. *Wetlands*, **18**: 256- 265.

Sand-Jenson, K., Riis, T., Vestergaard, O. and Larsen, S. 2000. Macrophyte decline in Danish lakes and streams over the past 100 years. *J. Ecol*., **88**:1030-1040.

Scheffer, M., Hosper, S.H., Meijer, M.L., Moss, B. and Jeppensen, E. 1993. Alternative equilibria in shallow lakes. *Trends in Ecology and Evolution*, **8**: 275-279.

Sculthrope, C.D. 1967. *The Biology of Aquatic Vascular Plants*. Arnold, London.

Spence, D.H.N. 1982. The zonation of plants in freshwater lakes. *Adv. Ecol. Res*., **12**: 37- 125.

Vaithiyanathan, P., Richardson, C.J. 1999. Macrophyte species changes in the Everglades. Examination along a eutrophication gradient. *J. Environ. Qual*., **28**: 1347-1358.

Weisner, S.E.B. 1990. *Emergent Vegetation in Eutrophic Lakes: Distributional Patterns and Ecophysiological constraints.* Sweden, Grahns Boktry Ckeri.

Wetzel, P.R. and van der Valk, A.G. 1998. Effects of nutrient and soil moisture on competition between *Carex stricta, Phalaris arundinacea* and *Typha latifolia*. *Plant Ecology*, **138**: 179-190.