Water Quality of Hokarsar, a Typical Wetland of Kashmir

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ABSTRACT

The present limnological study on Hokarsar wetland was undertaken during 2000. The water depth ranged between 13 and 65 cm. The pH of water was on alkaline side and the wetland depicted the usual cation progression: Ca>Mg>Na>K known for freshwaters. The concentration of various nutrients indicated the eutrophic nature of the wetland which could be attributed to the heavy population pressure in the catchment of the wetland.

Keywords: Limnology, eutrophic, wetland, Kashmir.

INTRODUCTION

The valley of Kashmir, embedded in the midst of the Himalayan mountains, abounds in a large number of extensive marshes called wetlands namely Nowgam, Mirgund, Malgam, Haigam, Malangpora, Tullamulla, Narkura, Hokarsar etc. which are spread in the floodplains of River Jhelum. Among these Hokarsar wetland occupies a special status as it is maintained by the State Government as the biggest bird sanctuary in Kashmir. Hokarsar alone harbours about 80-90% of the total population of migratory birds that visit the valley during winter from the palaearetic region, extending from Central Asia to North Europe.

The wetland is facing a serious threat of encroachment due to anthropogenic pressures resulting in its gradual eutrophication and degradation. Though some information on the various ecological aspects of Hokarsar wetland is available upto 1980's (Handoo, 1978; Kaul and Pandit, 1980; Pandit and Kaul, 1981) hardly any limnological investigation has been conducted on this wetland since then. The aim of the present paper, therefore, is to provide current trophic status of the wetland based on its water chemistry.

STUDY AREA

Hokarsar is a permanent and deep wetland, situated 10 km to the west of Srinagar on Srinagar- Baramulla Highway at an altitude of 1,584m (a.s.l.). The actual area of the wetland is 13.75 km^2 and is fed by a perennial stream, Doodganga. Hokarsar is a well protected Game Reserve which harbours thousands of migratory birds during winter besides providing breeding ground to a host of resident birds and non-resident summer visitors from Indian plains. The wetland is surrounded by a number of villages. The total population of these villages is about 61,300 while the total cattle population has been estimated to be about 20,433. The high anthropogenic pressures (agricultural, horticultural and cattle grazing), unregulated silt-ladden water of Doodganga Nallah and encroachment has adversely affected this wetland (Table 1) and as a result it has shrunk more than 50% restricting the wetland to about 5 km^2 (Pandit,1998).

Table 1. Anthropogenic pressures and land-use patterns in Hokarsar Wetland.

Bordering village	Human population	Cattle population	Intensity of land use under		
			Agriculture	Horticulture	Grazing
Zainakot	15,000	4,015	L	N	L
Narbal	13,000	40,200	M	N	L
Soibogh	9,500	3,015	H	N	H
Sozelith	6,000	2,050	H	N	M
Lawripora	5,500	1,878	H	L	M
Dharmuna	4,500	1,822	M	N	M
Hajibagh	4,000	1,692	H	N	H
Gotapora	1,600	853	M	L	M
Khosipora	1,500	662	H	N	M
Choripora	700	426	H	N	M

H=High; M= Moderate; L= Less; N=Nil

MATERIAL AND METHODS

During 2000, the water samples were collected on monthly basis in 1 litre polyethylene bottles between 11.00 and 15.00 hr from a number of sampling stations differing in water depth, vegetation, biotic set up etc. Some of the parameters including temperature, pH, dissolved oxygen and conductivity were analysed at the sampling stations while the other parameters were determined in

the laboratory within 24 hours. The analysis was done according to Standard Methods (Mackeeth, 1963; Golterman and Clymo, 1969 and APHA, 1986).

RESULTS

The annual ranges for various physico-chemical characteristics of water are depicted in Table 2. The depth of the water showed large fluctuations being

Table 2. Physico-chemical characteristics of freshwaters of Hokarsar wetland

Parameter	Unit	Range
Depth.	cm	13-65
Transparency	cm	11-55
Temperature	°C	4.6-29.2
Dissolved oxygen	mg l^{-1}	2.6-15.20
pH	mg l^{-1}	7.43-9.03
Conductivity	mg l^{-1}	224-532
Calcium	mg l^{-1}	26.45-54.30
Magnesium	mg l^{-1}	7.05-16.74
Sodium	mg l^{-1}	2.15-8.00
Potassium	mg l^{-1}	0.52-2.65
Alkalinity	mg l^{-1}	50-415
Chloride	mg l^{-1}	08-70
Silicate	mg l^{-1}	1.40-8.42
NH_3-N	µg l^{-1}	65-425
NO_3-N	µg l^{-1}	150 –520
OPP	µg l^{-1}	40-255
TPP	µg l^{-1}	115 - 535

maximum (65 cm) during the rainy month of April and minimum (13 cm) during hot summer month of July. The water transparency also varied largely and was maximum (55 cm) in winter and minimum (11 cm) in summer. The water temperature in this wetland ranged between 4.60° C in January and 29.20° C in July. The pH of the water was always in an alkaline range and fluctuated from 7.43 to 9.03. The amplitude of the dissolved oxygen was great (2.60 and 15.20 mg l^{-1}). The maximum dissolved oxygen content was, however, registered during winter and minimum during summer. Total alkalinity of water in different months fluctuated greatly from 50 to 415 mg l^{-1}. Hardness of water for all the months was almost high. Calcium values ranged between 26.45 and 54.30 mg l^{-1} , the maximum being recorded in September. Magnesium followed a trend similar to that of calcium and fluctuated from 7.05 to 16.74 mg l^{-1}. The range of sodium (2.15 – 8.00 mg l^{-1}) was comparatively higher as compared to potassium (0.52 –

2.65 mg l^{-1}) . The lowest values for both the ions was noted during winter. The conductivity values fluctuated from 224 to 532 µS cm^{-1}, the highest being observed during spring and the lowest in winter. The chloride content fluctuated from 8-79 mg l^{-1}, being high in April and low in September. The maximum (8.42 mg l^{-1}) silicate level was obtained in July as against the minimum (1.40 mg l^{-1}) in January. Ammonical nitrogen, in general, is present in lower quantities as compared to nitrate nitrogen which is the main source of nitrogen in aquatic bodies, the values being 150 – 520 µg l^{-1} for NO_3 –N and 65 – 425 µg l^{-1} for NH3-N respectively. The concentration of orthophosphate phosphorus was quite low (40 and 255 µg l^{-1}) as compared to total phosphate phosphorus (115 and 535 µg l^{-1}).

DISCUSSION

The wetland is a small sized waterbody with a little water depth and the transparency is greatly reduced in most of the months due to silt loaded inflow from Doodganga Nallah feeding in the wetland. The surface water temperature showed a close relation with the atmospheric temperature and as such wetland waters are warmer which is attributed to its narrow depth and little water volume (Pandit, 1980). In general, the oxygen level is low in this wetland. However, the high dissolved oxygen during winter is due to low biological activity and low temperature. The high conductivity values, an indication of the total salt concentration, places this wetland in β-meso-area type of Olson (1950). The alkalinity of the water is principally due to bicarbonates of calcium and magnesium. Ionic composition of the waterbody reveals the predominance of calcium and bicarbonates over the other ions and, therefore, the usual progression ($HCO^-_3 > Ca^{++} > Cl^- > Mg^{++} > Na^+ > K^+$) brings it close to the sequence well known for global freshwaters (Rodhe, 1949). The wetland according to Ohle (1934) is calcium-rich which owes its origin to the lacustrine deposits in the valley (Pandit, 1999). The high chloride content of the wetland may be attributed to the presence of large amounts of organic matter of both allochthonous and autochthonous origin (Pandit, 1999). Thresh *et al.* (1944) related it to organic pollution of animal origin.

The comparatively higher levels of nitrogen and phosphorus as obtained during the present investigation can be attributed to the heavy anthropogenic pressures in the catchment area. Forsyth and McColl (1975) attributed the high phosphorus and nitrogen values to the use of fertilizers in paddy fields bordering the wetland. The values of nitrogen and phosphorus according to Strem (1930), place the Hokarsar wetland in modoerate eutrophic category.

In conclusion, the heavy anthropogenic pressure, siltation and encroachment have contributed to the nutrient enrichment during recent years and, therefore, the wetland is undergoing racing eutrophication.

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