

Limnological Features of Freshwaters of Uri, Kashmir

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ABSTRACT

The present investigation was undertaken during the month of November, 2000 and deals with the physico-chemical characteristics of water of seven freshwater bodies including streams and springs passing through Tehsil Uri of District Baramulla, Kashmir. The water depth ranged from a minimum of 9 cm in Nallah Chunda to a maximum of 150 cm in Chandanwari Nallah and the speed of water varied from a minimum of 0.50 m/sec in Krishan Nag to a maximum of 1.42 m/sec in Chandanwari Nallah. The cation sequence, Ca>Mg>Na>K, is in confirmatory to the well known progression for freshwater bodies. The present study sites showed higher values of transparency, dissolved oxygen and pH. On the basis of hydrochemistry most of these waterbodies are pollution free and crystal clear.

Keywords: Freshwaters, hydrochemistry, pollution, Uri, Kashmir.

INTRODUCTION

Clean water is one of nature's greatest gift to mankind. Water is one of the most important and precious natural resources. Unfortunately clear water resources are not only shrinking in size but are also getting more and more polluted; so becoming less suitable for drinking, domestic, agricultural and other purposes. The high altitude valley of Kashmir, embedded in the midst of Himalayan mountains, is well known for its innumerable but varied freshwater bodies which are of great ecological and economic interest in that they provide food, fodder, hydroelectricity, irrigation, tourist recreation besides potable water. The freshwaters of Uri are mainly utilized for the purposes of drinking, irrigation, bathing and washing. Fortunately, the industries do not exist in the valley which could generate thermal pollution and toxic wastes to pollute the waterbodies but nevertheless these waterbodies are gradually getting degraded due to growing anthropogenic pressures. Though some literature on

limnological aspects of Kashmir freshwaters have been published (Qadri and Yousuf, 1979; Yousuf and Shah, 1988; Pandit, 1996, 1999), yet there is hardly any information available on some waterbodies belonging to the remote areas. The present investigation, therefore, is an attempt to provide a preliminary but baseline information on various types of freshwater bodies of Uri, a hilly area (altitude of Uri 1490 m.a.s.l.) bordering Pakistan.

STUDY SITES

For the present investigation two types of waterbodies selected are streams and springs (Fig.1). The streams include : (1) Boniyar stream, passing through a village Boniyar which is comprising a population of 1300-1500, (2) Hapatkhi-Nallah passing through a village Bela Salamabad, (3) Chandanwari Nallah, being the fastest flowing, (4) Nallah Chunda, passing amidst the village, Gantamulla Balla, (5) Nilnag, draining its water from high snow-peaked mountains

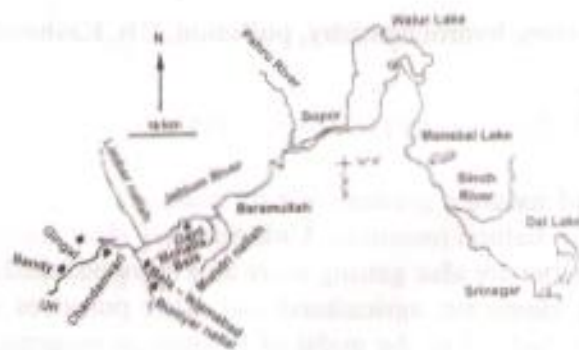


Fig.1. Location map of study sites

of Qazinag and in its course splitting into three side channels irrigating the adjoining paddy fields of the village Gingal. The springs include Chandanwari and Krishan Nag. The former lies in the foothills of Chandanwari mountains and is of a temporary type and stops flowing during winter months of December and January. The spring water flows and mixes with Chandanwari stream. The latter one is a permanent type and is a well protected spring flowing from high mountain areas of village, Bandy.

MATERIAL AND METHODS

The water samples were collected during November 2000 at different altitudes ranging between 1490 to 1650 (m.a.s.l.). Sampling was done between 11.00 and 17.00 hours from seven sampling stations, one at each study site in one litre polyethylene bottles. Some of the parameters, including temperature, pH, conductivity and dissolved oxygen, were analysed at the sampling sites, while the other chemical parameters were determined in the laboratory within 48 hours. The analysis was done according to the standard methods given in Mackereth (1963), Golterman and Clymo(1969) and APHA(1998).

RESULTS

The physico-chemical features of water are summarized in Table 1.

Water Level: There are large fluctuations in the depth of waterbodies. Among the surveyed systems Chandanwari Nallah was deepest with a mean depth of 150 cm. All these water bodies exhibited high degree of transparency and as such their substrates were almost visible.

Temperature: The behavior of the surface water temperature at the study sites showed a very less relationship with that of atmospheric temperature. The temperature was recorded to be minimum in Nallah Chanda (7.6°C). Hapatkhi Nallah also recorded a very low temperature (7.9°C). The maximum temperature of 13.3°C was, however, recorded in slow moving Nilnag stream.

Oxygen: Under the natural conditions, the flowing waters typically contain relatively high concentration of dissolved oxygen. The dissolved oxygen value was maximum

Table 1. Physico-chemical characteristics of freshwaters of Uri, Kashmir.

Parameters	Streams				Springs		
	Boniyar Nallah	Hapatkhi Nallah	Chandanwari Nallah	Nallah Chandu	Nilag Nallah	Chandanwari spring	Krishan spring
Depth (cm.)	110	125	150	09	15	45	20
Breadth (cm.)	950	900	1050	100	150	-	-
Transparency (cm)	110	125	150	09	15	45	20
Speed (m/sec)	1.25	1.25	1.43	0.77	0.62	0.62	-
Tem ($^{\circ}$ C)	8.9	7.90	9.70	7.60	13.30	12.50	10.30
D.O (mg l^{-1})	10.20	13.20	12.00	9.20	9.10	6.60	7.00
pH	9.00	8.50	8.92	8.79	8.70	7.62	7.28
Conductivity ($\mu\text{S cm}^{-1}$)	135	88	170	144	272	207	203
Ca^{++} (mg l^{-1})	51.51	48.96	56.37	50.78	58.32	47.76	44.75
Mg^{++} (mg l^{-1})	13.85	14.58	18.44	16.28	15.30	12.81	14.09
Na^+ (mg l^{-1})	3.75	1.60	2.00	3.25	5.50	3.00	3.50
K^+ (mg l^{-1})	2.05	0.65	0.75	1.15	2.25	1.15	1.20
Alkalinity (mg l^{-1})	112	84	164	128	100	120	180
Cl (mg l^{-1})	12.00	8.00	8.00	14.00	10.50	8.00	10.00
Silicate (mg l^{-1})	2.44	2.80	3.25	2.80	4.50	5.50	5.90
$\text{NH}_3\text{-N}$ ($\mu\text{g l}^{-1}$)	11.00	Tr.	Tr.	Tr.	21.00	12.00	15.00
$\text{NO}_3\text{-N}$ ($\mu\text{g l}^{-1}$)	18.00	15.00	20.00	17.00	30.00	23.00	22.00
TPP ($\mu\text{g l}^{-1}$)	10.00	Tr.	Tr.	Tr.	18.00	14.00	12.00
TOPP ($\mu\text{g l}^{-1}$)	Tr.	Tr.	Tr.	Tr.	10.00	Tr.	Tr.

Tr = Traces

(13.20 mg l^{-1}) in fast flowing Hapatkhi Nallah and minimum (6.60 mg l^{-1}) in Krishan Nag spring.

pH: The pH of water was in an alkaline range at all the study sites, ranging between 7.28 and 9.00. The minimum pH was recorded at Krishan Nag and a maximum at Boniyar Nallah.

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nearly small(almost negligible) population pressure in Uri plays a significant role in keeping water bodies of the area at lower levels of pollution. The lower nutrient levels in such water bodies are also due to the lesser biological activity (Yousuf and Shah, 1988). Vass *et al.*(1977), Kaul and Handoo(1980) and Wanganeo *et al.*(1984) further believed that the low nutrient concentrations are maintained by the continuous replenishment of water.

Comparing the data on water temperature, the surface water shows a very less relation between water temperature (7.60-13.30°C) and the atmospheric temperature (15.40-23.65°C) as streams and springs, flowing from high snow-peaked mountains, are in uniform motion. High dissolved oxygen values are due to continuous replenishment of water and low biological activity, a fact also corroborated by the earlier studies of Vass *et al.* (1977) and Qadri *et al.*(1981). Comparatively lower dissolved oxygen values were recorded for springs which is possibly due to the underground sources of water and low photosynthesis in these waters. The high pH of stream waters corresponds with low temperature values. Comparatively springs showed pH below 8.0.

Specific conductivity, principally a function of alkalinity and dominant calcium ions, has been used as one of the important nutrient standards for assessing the trophic evolution of water bodies. The conductivity values fluctuated between 88 and 272 $\mu\text{S cm}^{-1}$, indicating lower levels of ionic concentration.

The alkalinity of water is principally due to bicarbonates of Ca^{++} and Mg^{++} . According to Ohle(1934) the waters are calcium rich and the observed alkalinity values place them in hard water type of Moyle(1945). The concentration of Ca^{++} and Mg^{++} is very high and the usual cation progression is $\text{Ca}^{++} > \text{Mg}^{++} > \text{Na}^+ > \text{K}^+$. The chloride concentration is lower presumably due to the lower anthropogenic pressure on the water bodies. However, the higher values of silica were recorded for two springs. The major source of silica for aquatic systems is the weathering of aluminosilicate in the catchment area.

Another feature of these water bodies is the prevalence of low values of nitrogen and phosphorus. The lower value of nitrogen and phosphorus is in consonance with the least activity in the catchment area, a fact also revealed by Kaul and Handoo (1980). In conclusion, the waters of Uri showed low nutrient level, which, therefore, justifies their placement in pollution free types.

Conductivity: The content of the total electrolytes is closely related to the type of waterbodies. In general, conductivity values were of low magnitude and ranged between 88 and 272 $\mu\text{S cm}^{-1}$. The lowest conductivity value was recorded in Hapatkhi Nallah and the maximum at Nilnag.

Alkalinity: Alkalinity is mainly due to the bicarbonate which is the most dominant form among the inorganic components. The values ranged between 84 and 180 mg l^{-1} .

Ca⁺⁺ and Mg⁺⁺: The waters in general are calcium rich. Ca⁺⁺ values fluctuated between 44.75 and 58.32 mg l^{-1} . The maximum Ca⁺⁺ content was recorded at Nilnag. Mg⁺⁺ followed a trend similar to that of Ca⁺⁺.

Na⁺ and K⁺: In general, the content of sodium and potassium was lower, the minimum (1.60 mg l^{-1}) being obtained at Hapat-Khi Nallah and the maximum (5.50 mg l^{-1}) being recorded at Nilnag.

Chloride and Silicate: In general, these waterbodies depicted low values of chloride, fluctuating from 8 to 14 mg l^{-1} . The silicate values were also recorded in the range of 2.44 to 5.90, the minimum being recorded at Boniyar Nallah and maximum at Krishan Nag spring.

Nitrogen (NO₃-N and NH₃-N): NH₃-N is present in low quantities as compared to NO₃-N which is the main source of nitrogen in aquatic bodies. In general, low values of NO₃-N and NH₃-N were recorded for all the waterbodies. The values of nitrogen fluctuated between 17 and 30.4 $\mu\text{g l}^{-1}$.

Phosphorus (TPP and TOPP): Quantities of phosphorus in waterbodies in general is very low. The values of TOPP in almost all the waterbodies was found to be in traces while the values of TPP registered for some water bodies fluctuated between 10 to 18 $\mu\text{g l}^{-1}$. The highest phosphorus values were, however, recorded for Nilnag Nallah.

DISCUSSION

In Kashmir most of the water bodies originate from high snow peaked mountains and, therefore, the streams and springs located at different altitudes, having little of human habitation, show lower concentration of many nutrients. A

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