

Physico-Chemical Study of Dodital Lake in Uttarkashi District of Garhwal Himalaya

Harish Nautiyal, S. P. Bhandari, Ramesh C. Sharma

Abstract: Present investigations were carried out on the limnological aspects of Dodital Lake in district Uttarkashi (Garhwal Himalaya). Many of the parameters were found below the permissible limits for drinking water as suggested by WHO. A total of 11 parameters were analyzed and their seasonal variations in the year 2004-2005 were discussed.

Key words: Limnology, Dodital Lake

1. INTRODUCTION

The aquatic ecosystem is extremely important to mankind as they have various uses, including drinking water supply, irrigation, navigation, recreation etc. and are also source of organic productivity. During recent year there has been increasingly great concern for inland freshwater resources which are affected in different ways by all kinds of anthropogenic activities. Therefore the limnological investigations on water bodies are need of today. Several studies have been made on the limnology of fresh water bodies in India (Ganapathi, 1940; Alikunhi et al., 1948; Harshey, et al., 1982; Rao and Mahmood, 1995; Alfred and Thapa, 1996; Naganandini and Hosmani, 1998; Patel and Sinha, 1998; Pandey et al., 2000) but unfortunately very little information is available on the limnology of high altitude lakes of Garhwal Himalaya. Therefore, the present study was undertaken in Dodital lake. Dodital, the lake with a lot of mythological history is known to the birth place of Lord Ganesha. It is said to have witnessed the beheading of the deity by Lord Shiva. The origin of this Tal is from the natural springs and the source of river 'Asi Ganga'. Dodi Tal is situated at an elevation of 2950 m. The lake is sparkling and crystal clear, surrounded by forests. The famous Himalayan trout are found in abundance in the lake. The present investigation is an effort to present a comprehensive limnology of Dodital Lake in Garhwal Himalaya, Uttarakhand.

2. STUDY AREA

The Garhwal Himalaya, in addition to a complex network of fluvial ecosystem, is blessed with a large number of beautiful lakes, locally known as Tal or Kund, of these lakes Dodi Tal lakes is an important and one of the beautiful lakes of the region. The lake Dodi Tal located between latitude 30°47'15" N and longitude 78°29'40" E to north-east of Uttarkashi district. Dodi Tal is approx 850 m long and 350 m wide at its broadest points. The lake is bowl in the shape and medium in size. The water level increased in summer season due to melting of ice. The lake is located at 2950 m above msl. The surrounding floristic environment of this high altitude lake is mainly represented by temperate vegetation. The upper limits are dominated by some common tree species like *Quercus dilatata*, *Q. leucotrichophora*, *Rhododendron arboreum*, *Acer caesium* and *Myrica nagi*. The under story is dominated by the species like *Berberis aristata*, *Salix elegans* etc. along with some climbers *Clematis grata*, *Clematis gouriana* etc

3. MATERIAL AND METHODS

To study the water quality and its seasonal variations, the water samples are collected from the surface at a depth of 22 cm. from four different points, integrated and a representative sample was taken. Water samples were collected during morning hours in between 8.30 to 10.30 a.m. with one liter containers from the lake in three seasons i.e. during summer, monsoon and winter seasons from April 2004 to March 2005. Sampling was done at four sites. Some of the results were recorded at the sampling sites whereas the others were recorded in the laboratory. The parameters observed were air and water temperature, relative humidity, Dissolve Oxygen (DO), Total Dissolved Solid (TDS), Free CO₂, pH, Conductivity, and Hardness of the lake water. Samples of the water for physicochemical characteristics were analysed according to standard methods of APHA (1998).

4 RESULT AND DISCUSSION

The results of physicochemical analysis of three seasons are summarized in Table-1. The pH of the lake is 7.20, 6.60 and 6.53 during the summer, monsoon and winter seasons. No significant change was observed in the water pH and it was found within the permissible limits of 6.5 to 8.5(WHO). The highest value was noticed in summer season and lowest in winter season. Decline in pH during monsoon and winter seasons were attributed to the rains as it increase the amount

Harish Nautiyal*, S.P.Bhandari and Ramesh C. Sharma
Research Scholar, Department of Environmental Sciences,
Manav Bharti University, Solan (Himanchal Pradesh),
Forest Research Institute, Dehradun, Uttarakhand
*Corresponding Author: Tel. No :+91-9639622044,
Email : harishnt1629@gmail.com / hari629@rediffmail.com

of carbonic acid to the lake water (Khan and Chaudhary 1994, Kaushik *et al.* 1989). Hutchinson (1975) stated that if any aquatic system is neither higher alkaline nor highly acidic, the pH of the water is principally governed by the CO₂ bicarbonate- carbonate system.

Table 1. Physiochemical Parameter of Dodital Lake, Uttarkashi

S. No	Parameters	Season		
		Summer	Monsoon	Winter
1.	Temperature of air (°C)	8	5	6
2.	Temperature of water (°C)	5	3	2
3.	Colour	Colourless	Colourless	Colourless
4.	pH	7.20	6.53	6.60
5.	TDS mg l ⁻¹	0.20	0.10	0.08
6.	Hardness mg l ⁻¹	16.00	13.00	15.00
7.	Chloride mg l ⁻¹	14.40	24.70	4.30
8.	Total phosphate mg l ⁻¹	0.09	0.06	0.04
9.	DO mg l ⁻¹	8.32	9.81	10.90
10.	Free CO ₂ mg l ⁻¹	5.23	3.61	4.84
11.	Alkalinity mg l ⁻¹	38.00	35.00	33.00

The variation was observed in the water temperatures in three seasons whereas a well marked seasonal variation in air temperature was recorded. Water temperature fluctuated with the air temperature, at all the sampling sites and both air and water temperature were correlated positively ($r = 1.10419$) in the present study. The temperature remained comparatively low throughout the study, which may be due to the presence of thick forest around it. Martin (1972) stated that the clarity of water, presence of vegetation etc. are the factors mainly responsible for the daily fluctuations in water temperature. The alkalinity varied from 33 mg l⁻¹ to 38 mg l⁻¹ in three seasons, during which minimum value (33 mg l⁻¹) was observed in winter season and the maximum (38 mg l⁻¹) in summer season. This may be due to the liberation of CO₂ in the process of decomposition of bottom sediments with resultant conversion of carbonates to bicarbonates. The alkalinity of water is usually caused by the presence of carbonates, bicarbonates and hydroxyl ions and less frequently by borates, silicates and phosphates (APHA 1998). Total dissolved solids of the lake were 0.10 mg l⁻¹ in summer, which is the highest value and the lowest values 0.08 mg l⁻¹ was noticed in winter. Total hardness value of the lake was 13 to 16 mg l⁻¹ of which higher value was in summer while the lowest in monsoon season. The maximum permissible limit for this parameter for drinking water standards is 500 mg l⁻¹. The total dissolved solids remained constantly low in the lake and ranged between 0.13±0.0262 to

0.13±0.0548 mg l⁻¹ these low values reflect the low mineral contents of the lake water. Chloride values were found ranging between 4.30 to 24.70 mg l⁻¹ of which maximum value was noticed in monsoon and the lowest value in winter may be due to dilution effect in post monsoon period. Chourasia and Adoni (1985) also found similar behaviour of chlorides in their studies on Sagar lake with summer maxima and winter minima. The concentration of dissolved oxygen was recorded high during winter season (10.90 mg l⁻¹). This may be due to that the oxygen concentration in the lake water increased by the reduction in water temperature. Free Carbon dioxide is one of the essential constituents of an aquatic ecosystem. The abundance of carbon dioxide exerts certain specific effects on aquatic bioata. The lake exhibited maximum carbon dioxide as 5.23 mg l⁻¹ during summer whereas the lowest concentration of carbon dioxide 3.61 mg l⁻¹ was recorded during monsoon season. Cole (1975) noted that free CO₂ supply rarely limits the growth of phytoplankton. It is evident from the present study that the phosphate concentration was higher during summer and lower in winter season. It was quite opposite in relation to dissolved oxygen and phytoplankton population. Many earlier workers have also reported similar findings (Marshall and Falconer, 1973; Meckenzie and Gillespie, 1986; Ghavzan *et al.*, 2006).

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