

Pollution Status of Lake Budha Pushkar of Central Aravalli near Ajmer, Rajasthan

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ABSTRACT: In the present investigation it is focussed on the determination of water quality such as temperature, pH, free CO₂, electrical conductivity, total hardness, total alkalinity, D.O., phosphate, chloride, calcium, magnesium, sodium, potassium, and nitrate of water samples from this water body. The study revealed that this lake is slightly alkaline pH (7.4-8.6), EC (0.95-1.65 mmhos/cm), free CO₂ (4.4-52.6 ppm), total hardness (195-395 ppm), total alkalinity (295-750 ppm), Ca hardness (88.2-252), Mg hardness (61-169), TDS (1160-4600 ppm), Chlorides (31.24-96.0 ppm), D.O. (1.6-7.8 ppm), Sodium (13.5-64.5 ppm), Potassium (6.0-18.5 ppm), Phosphate (1.23-2.66 ppm) and Nitrate (0.85-1.32 ppm). The biological components like Oscillatoria, Microcystis, Fragillaria, Nitzschia, Spirogyra, Scenedesmus, and Lyngbya were present in this lake during the course of study. The result revealed that this lake is highly eutrophic and going for further degradation.

INTRODUCTION

Water is a vital natural resource for sustaining all forms of life and environment. The available water resources are under pressure due to increased demands with an ever increasing population, rapid industrialization and loss through evaporation is continuous. Surface water are polluted by different sources such as human activities, agricultural-runoff and the quality of water is seriously degraded. Water quality management is concerned with the control of pollution problem. The water quality is affected by natural factors such as geomorphology, mineral contents of the watershed area, and the climate of the region. It is essential to restore and maintain the chemical, physical and biological quality, which ensures protection, and maintain the water quality and provide a scientific basis of sound ecosystem management of water resources in arid and semi-arid regions of the state.

This paper is an attempt to take an overview of present status of water quality of lake Budha Pushkar and formulate a strategy to restored it with sound ecosystem management.

STUDY AREA

The study was carried out for a holy lake Budha Pushkar situated at 13 kms NW to Ajmer, Rajasthan (26°25'-26°35' N Latitude and 74°37'-74°42' E Longitude, 502 m msl). The total capacity of the lake is more than 150 million cubic feet. However, the

surface spread is 4.5 hectare. It is interesting to note that the ground water source is about 10 feet deep from the surface. The climate of Budha Pushkar is semi arid type so the temperature of this area is very high in summer (May-June) and reaching at 44°C-46°C. Evaporation and transpiration rate is comparatively higher than the South Eastern part of Rajasthan. The Lake is surrounded by varying heights of sand dunes. The relative contribution of sand fall in the lake is more during the summer period when wind velocity is about 40-60 km per hour. The Budha Pushkar was the main source of water supply for Railway Department till 2004.

MATERIALS AND METHODS

In order to get comprehensive data of the conditions throughout the lake, samples were taken on monthly basis in midst of each month between 9-10 A.M. Surface water samples were collected in acid washed bottles and in polyethylene bags of two litre capacity. The temperature, pH, electrical conductivity and D.O. were analysed immediately at the site of the lake. The various physico-chemical parameters viz., dissolved oxygen, Ca and Mg-hardness, Total hardness, Total alkalinity, Free CO₂, Chlorides, TDS, Nitrate, Phosphate, Sodium and Potassium were done following standard methods of (APHA, 1992), (Trivedi *et al.*, 1998) and (Maiti, 2001).

Algal samples were preserved in 1% Lugol's solution immediately after collection and were identified upto

species level with the help of standard references (APHA, 1992), (Prescott, 1969) and (West, 1984).

Table 1: Range and Mean Values of Physico-Chemical Parameters of Lake Budha Pushkar during 2005–2006

Sl. No.	Parameter	Range	Mean
1.	Air Temperature (°C)	21.6–39.6	30.6
2.	Water Temperature (°C)	18.4–36.5	27.45
3.	p ^H	7.40–8.60	8.00
4.	Electrical Conductance (mmhos/cm)	0.95–1.65	1.30
5.	Dissolved Oxygen	1.60–7.60	4.6
6.	TDS	1160–4600	2880
7.	Total Alkalinity	295.0–750.0	522.5
8.	Total Hardness	195.0–395.0	295.0
9.	Ca Hardness	88.2–252.0	170.1
10.	Mg Hardness	106.8–143.0	124.9
11.	Chlorides	31.24–96.0	63.62
12.	Free CO ₂	4.40–52.60	28.5
13.	Sodium	13.50–64.50	39.0
14.	Potassium	6.00–18.50	12.25
15.	Phosphate	1.23–2.66	1.94
16.	Nitrate	0.85–1.32	1.08

Note: All values except Temp., pH, EC are given in ppm.

RESULT AND DISCUSSIONS

During the present investigation results showed some interesting ecological findings.

Physico-Chemical Status: The monthly variations have been computed in Table 1.

Biological Status: The seasonal variations in biological components at lake have been discussed below. The Physico-chemical environment of water functions in one or more ways in exerting the influence of its biotic components.

The minimum temperature noted in present study is 21.6°C and maximum temperature recorded is 39.6°C. During the present investigation maximum value of water temperature recorded in summer and minimum in winter months. The low water temperature in winter seasons can be explained on the basis of high water level where as higher temperature in summer was on account of low water level. The water temperature varied from 18.4–36.5°C.

The pH values were found to be on slightly alkaline throughout the period of study, ranging from 7.4 to 8.6. Its low value was observed in winter and rainy

season and high value in summer. (Patil and Kumar, 1982, 1995a) also observed that the maximum value of pH in summer months. The rise in pH might be due to increased temperature.

Electrical conductivity of the lake water ranged from 0.95 m mhos to 1.65 m mhos. The EC which represents the total ionic load of waterbody. Mean and range of variations are shown in Table 1.

Total alkalinity fluctuated between 295 mg/l to 750 mg/l. (Phillipose, 1960) suggested that a water body with alkalinity value higher than 100 mg/l is considered to be rich in nutritive contents. Carbonate alkalinity were totally absent throughout the period of study.

Total hardness fluctuated between 195.0 mg/l to 395.0 mg/l. The total hardness of the lake B.P. was found to be high during summer season that may be due to the evaporation of water and increasing the concentration of calcium and magnesium salts (Bagde & Verma, 1985).

Calcium hardness was recorded in the range 88.2 mg/l to 252.0 mg/l. (Zafar, Singh & Swarup, 1964, 1979) reported that the higher concentration of calcium also promotes the growth of diatoms. Magnesium hardness of water varied from 106.80 mg/l to 143.0 mg/l. The lowest value of Mg-hardness was recorded in the month of August and highest in June.

The dissolved oxygen concentration varied from a minimum 1.6 mg/l to a maximum of 7.6 mg/l. The mean monthly value ranged from 4.6 mg/l at lake B.P. The present study showed higher value of dissolved oxygen content was in winter due to the fact that the solubility of oxygen increases with the decreasing in temperature (Agarwal *et al.* and Hannan, 1976, 1979).

It is also to be noted that free CO₂ was noted in ranged 4.4 mg/l to 52.6 mg/l. The concentration of carbon dioxide in water depends upon the temperature to a great extent and controls pH and alkalinity in an aquatic system. According to (Welch, 1952) the sources of carbon dioxide in water are directly from atmosphere, inorganic matter and respiration by aquatic biota and chemicals present in the system.

The chloride concentration was found to vary from a minimum 31.24 mg/l to 96.0 mg/l. The mean monthly values in lake were 63.62 mg/l. The high concentration of chloride is considered to be an indication of pollution due to high organic waste of animal origin (Munawar, 1970).

Sodium and Potassium are important for ion transport and exchange. Maximum Sodium concentration during summer followed a decreasing order by monsoon and

winter (13.5–64.5 mg/l). While Potassium concentration was found to be maximum during summer followed by a decreasing order in monsoon and winter (6.0–18.5 mg/l).

The phosphate concentration of the lake ranged from 1.23–2.66 mg/l. Whereas nitrate recorded 0.85–1.32 mg/l. Phosphate concentration is seems to be very high due to offering religious materials and also addition of funeral ash to be the source of pollution of this waterbody. Due to decomposition and decay, these phosphorus releases into the water column and makes it enriched. Nitrogen and Phosphorus also comes from nearby agricultural fields. Agricultural activity in the catchments adds sizeable amount of nutrients into the lakes and resulting increases their productivity (Tamot and Bhatnagar, 1988).

BIOTIC STATUS

A total of 22 genera belonging to four major groups viz. Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae were collected during the course of investigation. Cyanophyceae was the most dominant group followed by Bacillariophyceae, Chlorophyceae and Euglenophyceae. The highest phytoplankton density was recorded in summer and lowest in winter. Similar observations have been made by (Zafar and Patil, 1967, 1982).

In the present investigation, it was found that Blue-green algae were dominant followed by diatoms and green-algae. Euglenoids showed comparatively less uniformity in their abundance. (Mishra and Saksena, 1993) designated that temperature has found to play a key role in the periodicity of Cyanophyceae group. In the present study most of the pollution indicator algae were found such as *Anabaena*, *Microcystis aeruginosa*, *Oscillatoria*, *Scenedesmus quadricauda*, *Pediastrum*, *Nitzschia palea*, *Navicula*, *Melosira* and *Fragillaria*. Seasonal pattern of different algal groups were found in following order of abundance-

Summer = Cynophyceae > Bacillariophyceae >
Chlorophyceae > Euglenophyceae
Monsoon = Bacillariophyceae > Cynophyceae >
Chlorophyceae > Euglenophyceae
Winter = Bacillariophyceae > Cynophyceae >
Chlorophyceae > Euglenophyceae

CONCLUSIONS

The present study reveals that the lake Budha Pushkar which is a perennial freshwater body situated in central Aravalli near Ajmer has going for further degradation.

The lake is facing various problems viz. declining of water level, eutrophication, sedimentation or siltation through nearby sand dunes, agricultural run-off containing nutrients adds to the water body. The physico-chemical and biological analysis of water samples showed that the water is within the alkaline range, while other parameters also shows pollution of water. Because of over-exploitation, the water is confined to a small area. Nutrient loading may result in eutrophication. Multifold pressure of both natural and manmade activities the lake is threatened. The present study forms a preliminary data base on the basis of above result and discussion it can be concluded that the present environment of lake is facing threats discussed as above.

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