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A Review on the Dynamics of Electrical Conductivity and pH in the Water of Bhadra Reservoir, Karnataka

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ABSTRACT

This review study was designed to assess the quality of Bhadra reservoir water in Chikmagalur district, Karnataka, with respect to the dynamics of parameters including pH and EC (Electrical Conductivity). The results were evaluated and compared with WHO and BIS water quality standards. From the data obtained, it is found that based on the EC and pH the samples are falling under moderately oligotrophic category and hence suitable for domestic purposes. In most of the months the water samples at Bhadra reservoir were founds to have EC and pH values within the permissible level.

1. Introduction

Man made reservoirs and lakes provide unique habitats for the fishery wealth of Karnataka. Reservoir ecosystems have been recognised for their great potential for fish production. At the present level of management, the average fish yield of Indian reservoirs is only between 10-16 kg/ha/year (Jhingran, 1991). The small reservoirs have the potential to yield more than 100-200 kg/ha. Siltation in the rivers and reservoirs, apart from diminishing the quantum of water flow results in the destruction of breeding grounds of fishes, migration of fishes and overall productivity of the reservoir. Siltation also affects the benthic population and the natural recruitment of fishes in the impounded waters. Reservoirs, like rivers are inevitably being affected by industrialization and urbanisation.

However, India has 0.72 million hectare of cold water upland lakes, 3.0 million hectare of reservoirs, 2.0 million hectare of oxbow lakes and the 2.6 million hectare of estuaries and associated impoundments which are distinct habitats harbouring animals and plants exhibiting different tolerance limits to the physical and chemical features characterising these environment. The Indian fish fauna is an assemblage of about 2500 species depicting diverse characteristics, of which 930 belonging to 326 genera, inhabit the inland water (Talwar and Jhingran, 1991).

Less than 1% water is present in ponds, lakes, rivers, dams, etc., which is used by man for industrial, domestic and agricultural purposes. Ponds are useful in many ways and it is one of the methods of artificial infiltration of underground water. Water quality in an aquatic ecosystem is determined by many physical, chemical and biological factors (Sargaonkar and Deshpande, 2003). The term water quality was developed to give an indication of how suitable the water is for human consumption (Vaux, 2001; Sajitha and Smitha Asok Vijayamma, 2016).

The present study was aimed at enhancing the knowledge regarding the dynamics of electrical conductivity and pH at Bhadra reservoir and to enable the formulation of suitable management measures towards a rational exploitation and management.

2. Materials and Methods

Study area

Bhadra reservoir is situated at 13°42′0″N & 75°38′24″E. The Bhadra reservoir, which is located on the Bhadra River a tributary of Tungabhadra River. Bhadra dam is located in the border of Bhadravathi and Tarikere, in the western part of Karnataka in India. The benefits derived from the reservoir storage are irrigation with gross irrigation potential of 162,818 hectares (402,330 acres), hydro power generation of 39.2 MW (three powerhouses, located on the right and left bank main canals, drinking water supply and industrial use. The dam commissioned in 1965 is a composite earth cum masonry structure of 59.13 metres (194.0 ft) height with length of 1,708 metres (5,604 ft) at the crest level, which submerges a land area of 11,250.88 hectares (27,801.5 acres) (Bhadhra Reservoir Project,2011;Map of Bhadra River,Wikimapia, 2011; Srinivasa Raju & Nagesh Kumar,2011; Bhadra Dam Left Bank Power House,2011; Modernization Strategy for Irrigation Management: Bhadra Project,2011).

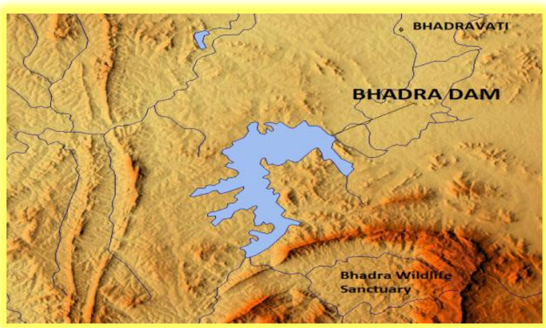

Figure 1: Location of Bhadra reservoir

(Source: https://en.wikipedia.org/wiki/Bhadra_Dam#/media/File:Bhadra_Dam.png

Method of water sampling

Water samples were collected for chemical analysis from each station at an interval of 30 days. Samples were collected in black plastic carbuoys of 2 litres capacity. In all the cases the final results were calculated by following at least 3 consecutive readings.

p^H was determined at the place of collection with the help of p^H pen and was confirmed by using p^H meter at the laboratory. Electrical conductivity readings were taken in the laboratory using direct reading conductivity meter – 304 (Systronics).

3. Results and Discussion

The study of physico-chemical parameters of the water is an important aspect in assessing the quality of water for various uses. The chemistry of surface water has been discussed by Gibbs (1970). The problem of water pollution is world-wide and it could draw the attention of scientists only when it became hazardous for human health. During the present investigation the following physico-chemical characteristics have been studied and discussed.

p^H (Fig. 3)

pH is most important in determining the corrosive nature of water. Lower the pH value higher is the corrosive nature of water. The reduced rate of photosynthetic activity and the assimilation of carbon dioxide and bicarbonates are ultimately responsible for increased pH the low oxygen values coincided with high temperature during the summer month. Various factors bring about changes in the pH of water. The higher pH values observed suggests that carbon dioxide, carbonate–bicarbonate equilibrium is affected more due to change in physico-chemical condition (Rachna Bhateria and Disha Jain,2016)

The p^H values ranged from 6.7 in station II during April 2000 to 7.9 at station I during the month of December (1998), January (1999) and July (1999). Alkaline p^H was recorded in all the months in station I and II except in summer months (April, May and June) during which acidic p^H was observed in station II. When seasonal and yearly averages are accounted for, the water is alkaline in both the stations. A similar observation has been made by Devaraj et al. (1987) in Hemavathy Reservoir. Sarkar et al. (1977) and Anon (1989b) have also made similar observation in respect of Gobind Sagar Reservoir (M.P). Similarly, Pal et al. (1986), Khare and Unni (1986), Singh and Singh (1990), Venkateshwarlu (1986), Swarnalatha and Narsingh rao (1993), Namboodiri and Sankaran (1995) and Unni (1996) have recorded alkaline p^H in the riverine systems that they have investigated.

The reason for acidic p^H at station II during summer season is due to the discharge of industrial effluent containing acidic wastes. Birsal et al. (1987), Rao et al. (1990), Shukla et al. (1992), Venkateshwarlu (1986), Rana (1995) noted acidic p^H in the riverine system during their investigations and they concluded that the effluent containing acidic wastes is responsible for the decrease in p^H of water. This observation is very much true in case of station II of the present investigation.

Electrical conductivity (Fig. 2)

In the present work, the value of electrical conductivity ranged from 32 µmhos/cm (station I) to 378 µmhos/cm (station II). It reached its maximum value at station II (228 µmhos/cm) during summer season (Table 1) and minimum value (59.38 µmhos/cm) during winter at station I (Table 1). Nevertheless, the average value of two years is considered, it has been observed that station I showed minimum value (64.06 µmhos/cm) and maximum of it was recorded at station II (210.23 µmhos/cm).

Anon (1980) working on water quality of Vallabhsagar reservoir (Gujarat) noted that the value of electrical conductance ranged from 41 to 585µmhos/cm. Similarly, Natarajan (1983) working on Nagarjunasagar reservoir recorded electrical conductivity which ranged between 172.53 and 1114.7 µmhos/cm. He opined that lotic sector of the reservoir showed maximum value of conductivity. Which is true in the present investigation also particularly at station II.

4. Conclusion

The data generated clearly revels that the reservoir is basically productive and moderately oligotrophic as compared to the downstream stretch of the Bhadra river course. Therefore, it is suggested that the status quo. of the reservoir should be maintained by enforcing the environmental protection acts. The catchment area of the reservoir should be protected from the adverse effects of human activities.

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TABLES & FIGURES

Table 1:Seasonal variations of pH & EC of Backwater of Bhadra reservoir (Station I) and Downstream stretch of Bhadra river (Station II)

Sl. No.	Parameters	Station I (1998-2000)			Station II		
		Rainy	Winter	Summer	Rainy	Winter	Summer
1	Water temperature (°C)	26.12	26.10	28.90	26.03	25.73	28.99
2	P^H	7.65	7.47	7.34	7.59	7.40	7.08
3	Turbidity (NTU)	6.00	7.33	6.70	19.86	19.41	16.70
4	Electrical conductivity (μm hos/cm)	71.60	59.38	71.57	192.18	188.02	228.23

Table 2: Drinking water quality standards

Parameter	Permissible limit	
	World Health Organization (WHO, 1994)	Bureau of Indian Standards (BIS 10500:1991)
Colour, Hazen unit, max	Nil	5.0
Turbidity, NTU	5.0	5.0
Odour	Nil	Unobjectionable
Dissolved solids	500	500
Total hardness	100	300

Calcum hardness	75	75
Magnesium hardeness	30	30
Alkalinity	200	200
Dissolved oxygen	4-6	4-6
Chloride	250	250
Nitrate	45	45
Iron	0.3	0.3
pH	6.5-8.5	-
BOD	5	-

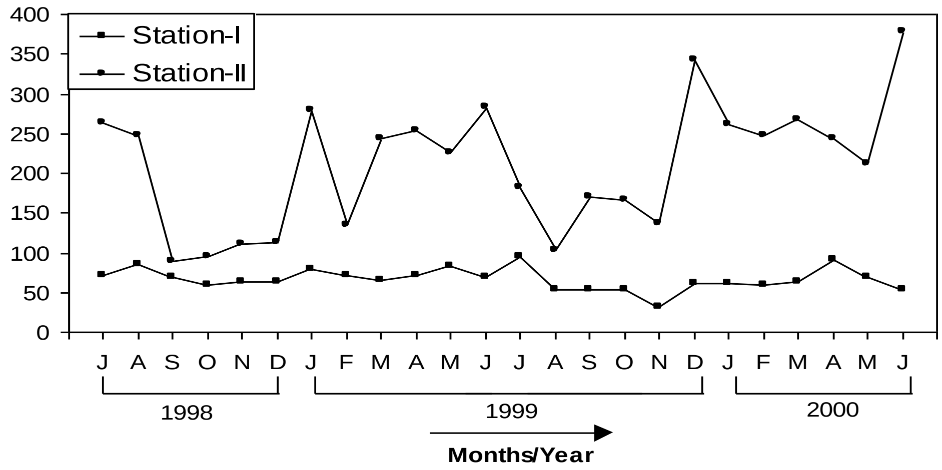

Figure 2: Monthly variations in Electrical conductivity

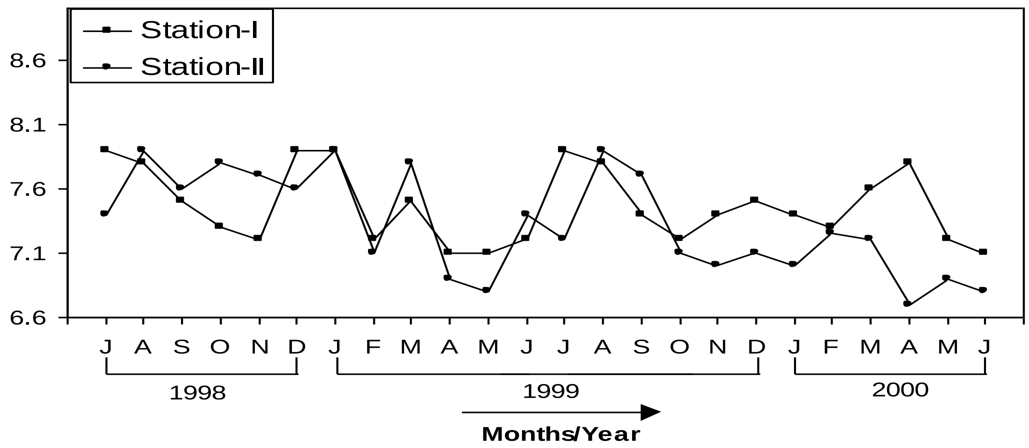

Figure 3: Monthly variations in pH