STUDIES ON THE DYNAMICS OF TEMPERATURE, TURBIDITYAND TDS IN THE WATER OF BHADRA RESERVOIR, KARNATAKA: A REVIEW

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Abstract

This review paper was intended to assess the quality of Bhadra reservoir water in Chikmagalur district, Karnataka, with respect to the dynamics of physical parameters including temperature, turbidity and TDS. The results were evaluated and compared with WHO and BIS water quality standards. From the data obtained, it is found that based on these physical characteristics 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 Temperature, turbidity and TDS values with in the permissible level. On the basis of the limnological analysis, it was found that, physical parameters showed seasonal fluctuations. It has been found that the water can be used for drinking, irrigation and fisheries.

Keywords: temperature, turbidity, TDS, Bhadra reservoir ,water quality.

Introduction

Man made reservoirs and lakes provide unique habitats for the fishery wealth of Karnataka. Reservoir ecosystems have been recognized for their great potential for fish production (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 urbanization.

Acquiring potable water is a day to day struggle for most of the people .The healthy aquatic ecosystem is depended on the physico-chemical and biological characteristics (Venkatesharaju, 2010; John Mohammad et al.,2015).

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 physical factors such as temperature, turbidity and TDS at Bhadra reservoir and to enable the formulation of suitable management measures towards a rational exploitation and management.

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).

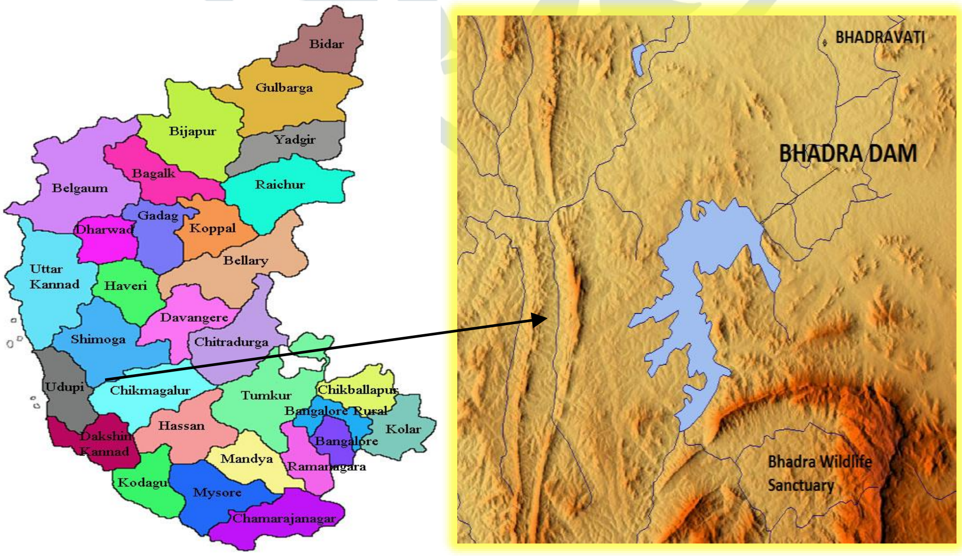

Figure 1: Location of Bhadra reservoir

(Source: https://en.wikipedia.org/wiki/Bhadra_Dam#/media/File:Bhadra_Dam.png; Onefivenine.com)

Method of water sampling

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

Water temperature at each station was recorded at a depth of 10-12 cm with the help of a mercury thermometer. Turbidity readings were obtained by using Nephelo turbidity meter–132 (Systronics).Total dissolved solids readings were obtained by using water analysis kit (Elico).

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 physical characteristics have been studied and discussed.

Water temperature (Fig.2)

Water temperature plays an important role in either decreasing or increasing the concentration of certain chemical characteristics of water. The occurrence of aquatic organisms of a given water body is also directly or indirectly linked with the variation in temperature ranges.

Temperature is basically important parameters and affects on the chemical and biological in the organisms of water (Trivedi and Goel, 1986).

In the present study, water temperature ranged from a minimum 23º C at station I during the month of January (1999) to a maximum of 30º C at station II during the month of May 1999. During 1999-2000, the water temperature varied from minimum of 25º C at station I in the month of December 1999 to a maximum of 29.4º C at station II during April 2000. If the seasonal variations are accounted for, it has been observed that water temperature reached its maximum at station II (29.07) in Pre-monsoon season (1999-2000) and the minimum value recorded at station I (25.0º C) in Post-monsoon season (1998-99). Above results clearly indicate that the water temperature vary from one station to another station and from season to season. David et al. (1969) recorded water temperature that varied between 23.1º C to 29.5º C in Tungabhadra reservoir. Similarly, Khatri (1985) recorded the water temperature that varied from a minimum of 21.8º C to 26.3º C in Idukki reservoir (Kerala state), which is almost similar to the observations made in the present investigation.

However, during the present investigation, the water temperature tends to increase in downstream stations during the Pre-monsoon months. A similar observation has also been made by Khare and Unni

(1986) on Pollar river. The record of relatively high temperature at downstream station of the river stretch (Station II) is due to the discharge of industrial effluents from Mysore Paper Mills Ltd., and Visveswaraya Iron and Steel Ltd. factories located on the bank of the Bhadra river near Bhadravathi town. Unni et al. (1992) have pointed out that the river systems receiving industrial effluents record relatively high temperature as compared to river stretch not receiving any kind of effluents.

Turbidity (Fig. 4)

The turbidity values ranged between 1.2 NTU to 30 NTU. The lowest value (1.2 NTU) of turbidity was observed at station I and the highest value (30 NTU) of turbidity at station II. Season wise, station I showed lower values (4.15 NTU) of turbidity during Pre-monsoon (Table 1) while, station II showed higher values (23.4 NTU) of turbidity during Monsoon season (Table 1). However, the average values of two years is considered, it has been observed that station I showed lowest value (7.56 NTU) of turbidity and the highest value (20.08 NTU) of turbidity was recorded at station II.

David et al. (1969) recorded highest average range of turbidity (184-284.5 mg/l) from Tungabhadra reservoir. Vaishya and Adoni (1992) opined that the turbidity values increase due to the inflow of rainwater carrying suspended particles and the discharge of industrial effluents. In the present study, the reason for the highest value of turbidity at station II is due to the discharge of industrial effluents and domestic sewage.

Total dissolved solids (Fig. 5)

A large number of workers (Sastry et al. 1970; Dakshini and Gupta,1974; Swarnalatha and Narasinga rao, 1993) have recorded that the content of total dissolved solids which ranged between 69 mg/l to 1500 mg/l in their studies. The values recorded during the present investigation fall under the range between 27.61 mg/l at station I and 195.5 mg/l at station II. If the seasonal variations are accounted for, it has been observed that the total dissolved solids reached its maximum at station II (125.99 mg/l) in Pre-monsoon season and the minimum value at station I (36.44 mg/l) during Post-monsoon season. Prasad and Saxena (1980) and Manikya Reddy (1984) have correlated the richness of total dissolved solids to the surface run-off during Monsoon season and concluded that Monsoon water adds more solids to the water. In the present investigation also, the station I showed maximum value of total dissolved solids during Monsoon season indicating that the rain water through run-off increases the total dissolved solids in the water bodies. Further, Rajkumar (1984) and Balakrista Reddy (1989) are of the opinion that the polluted water bodies contain more of total dissolved solids when compared to unpolluted water. Which is also very much true in respect of station II.

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. Based on the results of the present study it can be stated that, the reservoir can be improved, if the physical parameters of the water body are maintained at required levels. This will help in uplifting of the economic condition of the natives. However,further study is required for the improvement of the water quality and fish productivity in the reservoir.

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Table 1:Seasonal fluctuations in water temperature, Turbidity and TDS of Bhadra reservoir (Station I) and Downstream stretch of Bhadra river (Station II)

Sl. No.	Parameters	Station I			Station II		
		Monsoon	Post-monsoon	Pre-monsoon	Monsoon	Post-monsoon	Pre-monsoon
1	Water temperature (°C)	26.12	25.0	28.90	26.03	25.73	29.07
2	Turbidity (NTU)	6.00	7.33	4.15	23.4	19.41	16.70
3	TDS (mg/l)	42.88	36.44	39.03	121.25	126.05	125.99

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	-

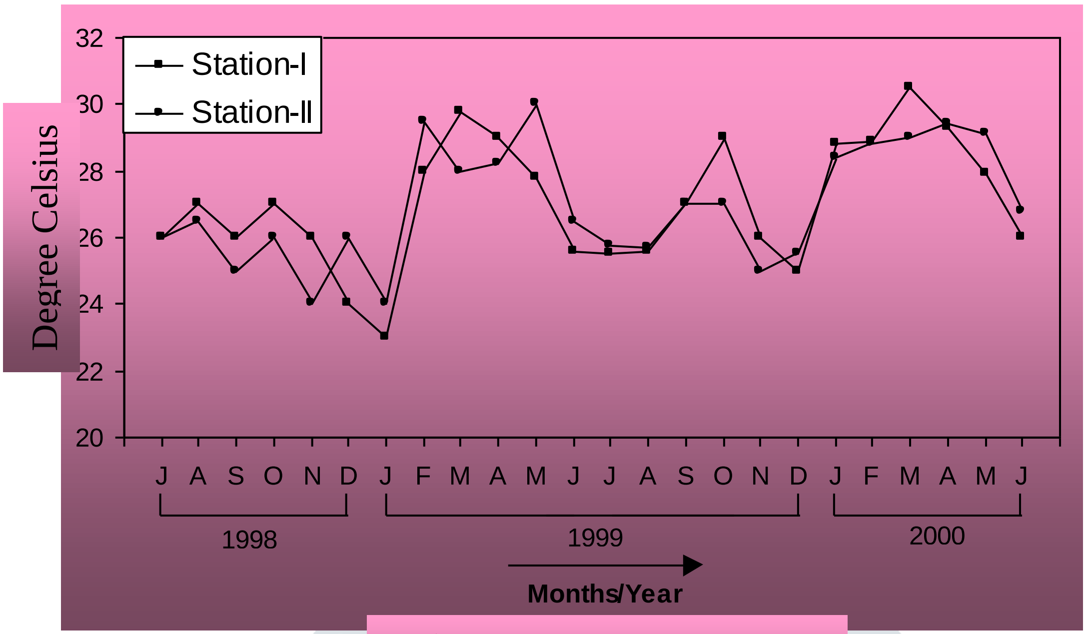

Fig.2: Water Temperature

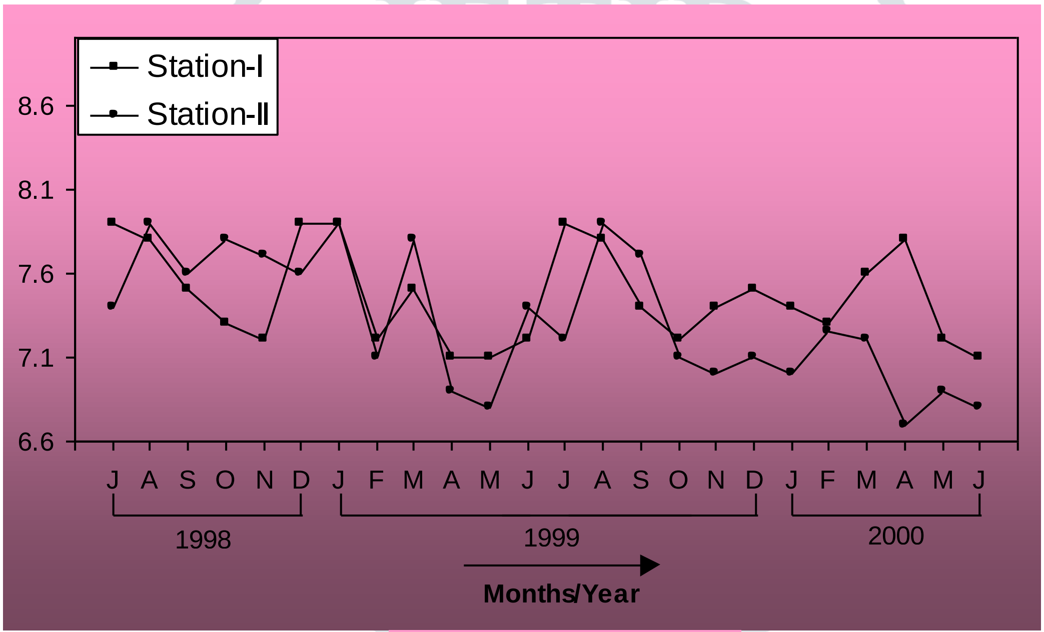

Fig.3: pH

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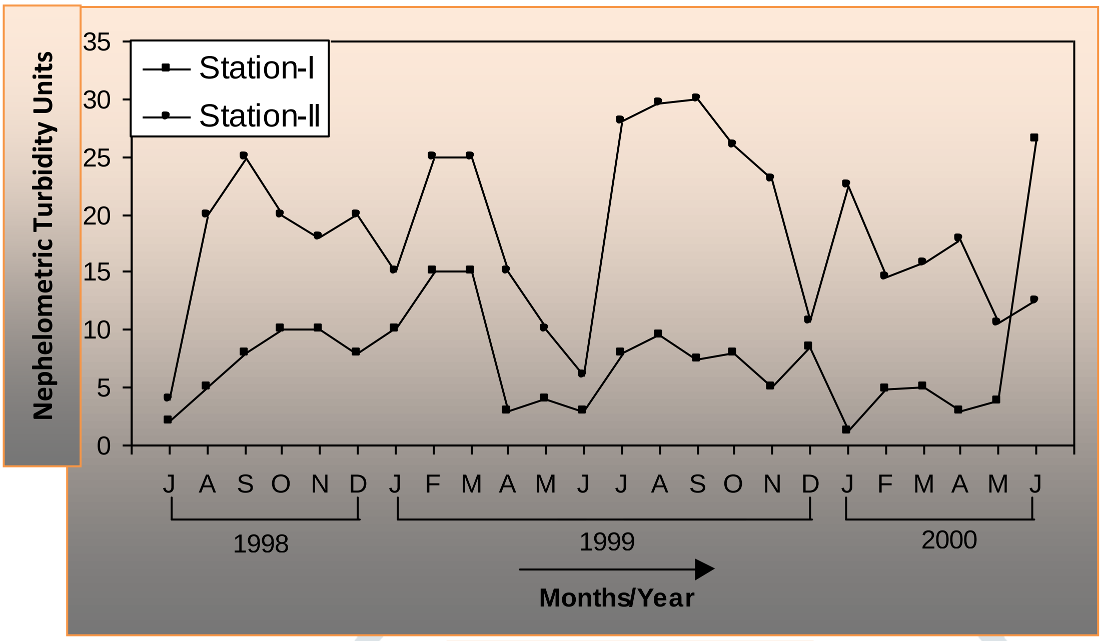

Fig.4: Turbidity

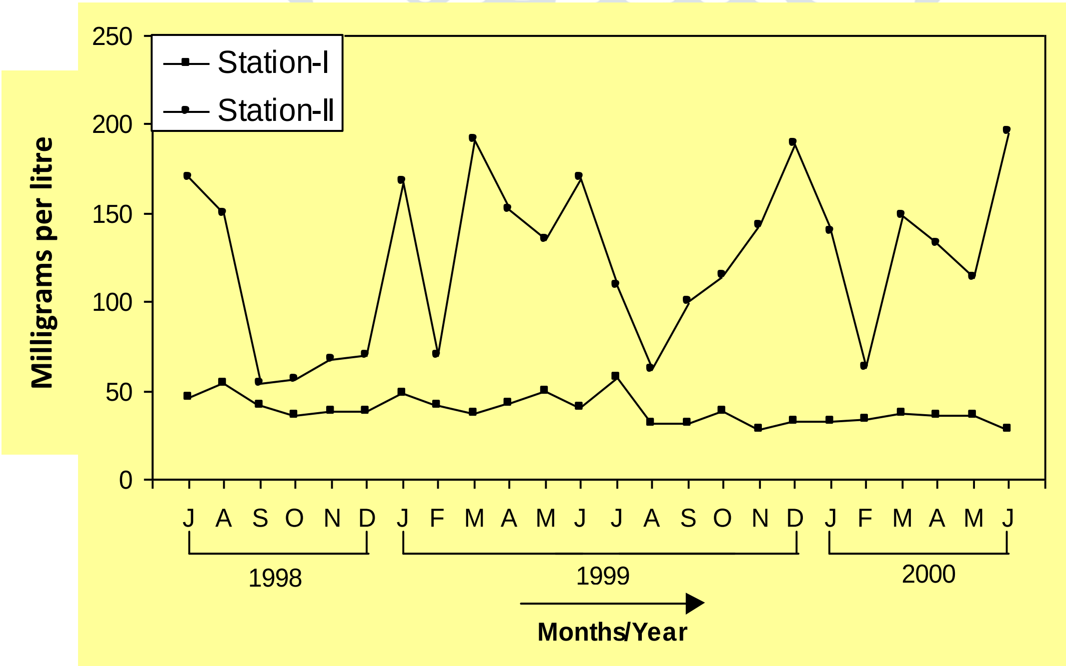

Fig. 5 : Total dissolved solids