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Seasonal Variation in Water Quality of Kakund River at BandhBaretha Wildlife Sanctuary: A Case Study of BandhBaretha Dam, Bharatpur, Rajasthan

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ABSTRACT

An alarming rate of deterioration of water quality of fresh water resources like pond, lake and rivers etc is now a global problem. The present study was conducted to evaluate the seasonal variations in the physicochemical properties of Kakund river water at BandhBaretha dam which is an important bird area (IBA) and support the wildlife of BandhBaretha Wildlife Sanctuary. Water quality status was observed by different parameter viz. Temperature, pH, total hardness, total dissolved solids, Electrical Conductivity, dissolved oxygen, biological oxygen demand, free alkalinity, chloride, nitrate, phosphate and heavy metals. All parameter were found under the prescribed limit but rising trend in amount of nitrate, phosphate and biological oxygen demand indicate contamination in water due to agricultural runoff and other anthropogenic activities.

KEYWORDS: Important Bird Area (IBA), Wildlife Sanctuary, Anthropogenic, Habitat suitability.

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INTRODUCTION

Fresh water ecosystems have been critical to sustaining life and establishing civilizations throughout history. The world freshwater lakes are increasingly threatened by new pressure and the interaction among these new and old stresses. Pollution of water ways with toxic substances and excessive nutrient as well as destructive land use practices in areas surrounding freshwater ecosystem, lead to reduction in water quality¹. The increasing commercial activities have also contributed considerably to the water pollution.

The Physico-chemical quality of different water bodies has been widely investigated to assess the contamination and nutrient load in wetland all around the world. Water quality control is a top-priority policy agenda in many parts of the world. The objective of the present study is to provide information on the physicochemical characteristics of in order to appreciate the impact of unregulated waste discharge on the quality of Kakundriver to discuss its suitability for consumption.

The construction of the dam on Kakund River was started by Maharaj Jaswant Singh in 1866 AD and completed by Maharaj Ram Singh in 1897 AD for irrigation and drinking purpose. BandhBaretha also served aquatic habitat for wildlife of Bandhbaretha Sanctuary. Bird baretha also counted in Important Bird area (IBA). The Physico chemical Features greatly influence the habitat suitability in terms of primary productivity and growth of fishes.

MATERIAL AND METHOD

Study area

Bandhbaretha lies on BayanaBaseriroad, 57 km far from bharatpur city. The Morphometric feature is given in table 1. The BandhbarethDam is located on Kakund river which originates from hills of Karauli district and its water adjoin Yamuna river through a tributary Gambhiri. Study area experiences a subtropical climate with average rainfall 674 mm. The climate of Bharatpur can be divided into three distinct seasons, i.e., summer (Mar-Jun), rain (Jul-Oct) and winter (Nov-Feb).

TABLE-1: Morphometric details of the BandhBaretha Dam

Latitude	28 ^o 54' 0"
Longitude	77 ^o 20' 7"
Land Area	1.2 hectare
Catchment area	18130 hectare
Mean Annual Rainfall	674 mm
Maximum Depth	12 m

Laboratory analysis

For the present study water samples were collected from four selected sites seasonally for two years from January 2016 to December 2017. Seasonally water samples have been collected in plastic

cans after rising it properly. The average value of these four sampling stations was considered for each parameter. Temperature and pH were analyzed at sampling site and other parameter such as TDS, Alkalinity, hardness, DO, BOD, Nitrate, Phosphate etc analyzed in Laboratory. The water quality variables were analyzed as per standard methods given in American Public Health Association (APHA, 1989).

RESULTS

The results obtained for the analysis of water samples are represented in Table 2. The pH of aquatic system is an important indicator of the water quality and extent pollution. The Indian drinking water quality standards recommend the value of 6.5 to 8.5 for the pH. In year 2016 the pH value ranges from 7.2 to 8.1. With respect to season maximum pH value was observed during summer (8.1) followed by that of winter (7.5) and monsoon season (7.2). Conductivity is directly proportional to the amount of dissolved salts as such it is a good and rapid measure of the total dissolved salts². A value of 750 to 1000 $\mu\text{mhos/cm}$ of EC is considered as the safe limit in drinking water while the value of 2000 $\mu\text{mhos/cm}$ is considered as tolerable to some extent. In the year 2016 highest electrical conductivity was measured during summer (298 $\mu\text{mhos/cm}$) followed by monsoon (240 $\mu\text{mhos/cm}$) and winter (232 $\mu\text{mhos/cm}$). Similar trend was observed in the year 2017.

TABLE – 2: Physico-Chemical Parameter of BandhBaretha Dam

Parameter	Year 2016			Year 2017		
	Winter	Summer	Monsoon	Winter	Summer	Monsoon
Temperature	18	25	22	17.6	24.8	22.1
pH	7.5	8.1	7.2	7.6	8.3	7.2
Electrical Conductivity($\mu\text{S/cm}$)	232	298	240	224	302	248
TDS (PPM)	107	142	108	158	160	112
Transpirancy (CM)	24.2	28.4	14.5	23.8	28.0	15.6
Salinity	0.34	0.38	0.28	0.36	0.39	0.25
Chloride	21.2	29.8	24.8	28.6	34.8	22.8
Total alkalinity	120	174	112	126	180	120
Total Hardness	78	80	70	80	94	74
Dissolved oxygen	8.4	5.2	6.1	8.2	5.0	5.8
BOD	0.6	3.8	0.9	0.7	1.8	1.1
Nitrate	1.2	1.8	2.16	1.9	2.1	3.8
Phosphate	0.6	0.9	1.8	2.6	2.8	3.1
TOC	1.85	2.14	0.58	1.47	2.08	0.48
Zn (ppm)	BDL	0.03	BDL	BDL	BDL	BDL
Cd(ppm)	BDL	BDL	BDL	BDL	BDL	BDL
Pb (ppm)	BDL	BDL	BDL	BDL	BDL	BDL

All other parameter except temperature ($^{\circ}\text{C}$), pH, electrical conductivity, Zn/Cd/Pb (ppm) are expressed in mg/l.

The higher concentration of TDS is undesirable for drinking and industrial uses. The highest concentration of TDS obtained 160mg/l due to nutrient enrichment from fertilizers and wastes, it also increases electrical conductivity as directly related to total dissolved solids³. In year 2016 and 2017 maximum concentration of dissolved solid was observed during summer season followed by

winter season and monsoon season. Transparency was observed highest (28.4) during summer season and lowest (14.5) during monsoon season.

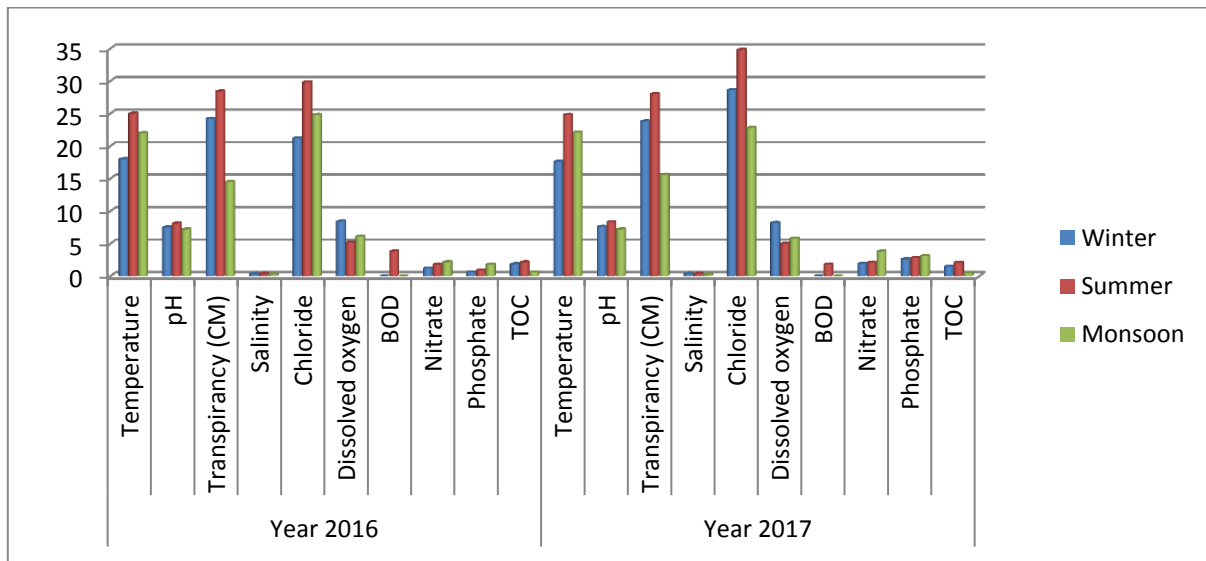


Fig.1: Seasonal Variation in Temperature, pH, Transparency, Salinity, Chloride, DO, BOD, Nitrate, Phosphate, TOC of Kakund River Water.

The present investigation reveals that the chloride concentration is distributed and varies at low 21.2 mg/l (winter season) to high at 29.8 mg/l (summer season) in the year 2016. For the year 2017 the lowest value was recorded during monsoon season 22.8 mg/l and highest value during summer season 34.8 mg/l. In the year 2017 salinity ranges from 0.25 to 0.39.

Alkalinity in itself is not harmful to human being. Still the water supplies with less than 200 mg/l are desirable for domestic use. In the year present study total alkalinity of water samples shows wide variation. In the year 2016 value ranges from 112 mg/l (monsoon season) to 174 mg/l (summer season). Similarly in the year 2017 alkalinity ranges from 120 mg/l (monsoon season) to 180 mg/l (summer season).

The water containing excess hardness is not desirable for the drinking purpose as the intake of hard water can produce health problems like urolithiosis, cardio-vascular disorder, kidney problems, cancer, etc.^{3, 4,5}. The total hardness of natural water depends mainly on the presence of dissolved ions of calcium and magnesium salts^{6,7}. In the year 2016 total hardness of water samples from Kakund river was maximum during summer (80) and in the year 2017 value was maximum value 94 during summer.

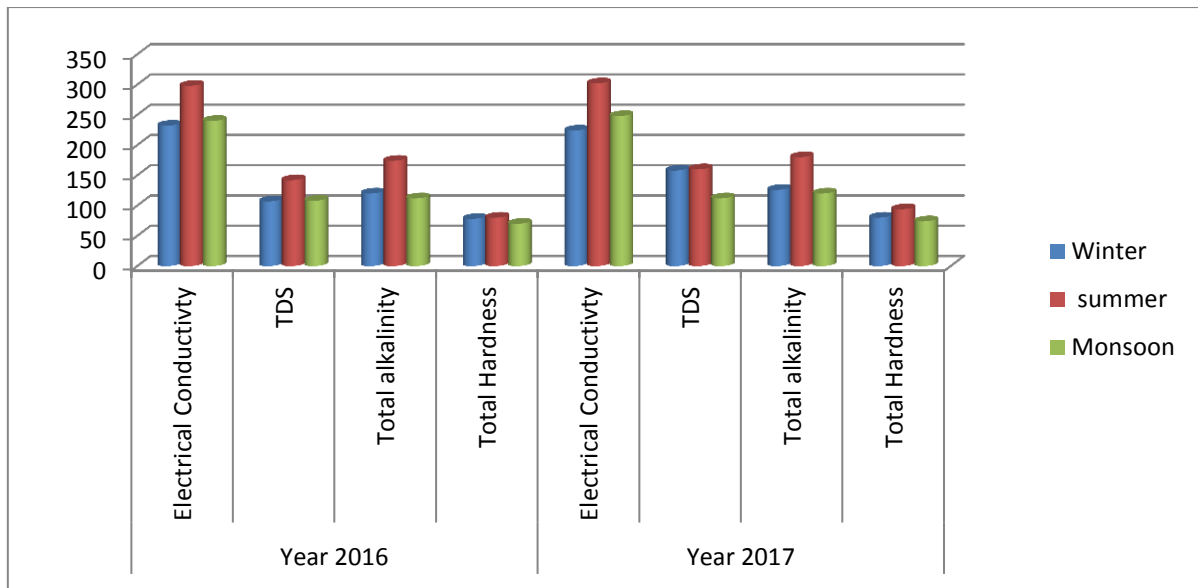


Fig.2: Seasonal Variation in Electrical Conductivity, TDS, Alkalinity and Total Hardness of Kakund River water.

Oxygen is the most fundamental parameter of water body indicating trophic status. It is essential for metabolism of aquatic organisms. Dissolved oxygen varies with the physico-chemical and biological activities of the system. According to the WHO standards the dissolve oxygen value should not be less than 6 mg/l. Amount of dissolved oxygen was low during summer season (5.2 mg/l in year 2016 and 5.0 mg/l in year 2017) due to presence of algal bloom on water surface. Biological oxygen demand values were detected only in summer season of both the year. Minimum value may be due to retarded microbial activity and higher value is attributed to high organic decomposition and enhanced pollution load.

The most important source of nitrate is biological oxidation of organic nitrogenous substance which comes in sewage and industrial effluent. The higher concentration of nitrate can cause methaemoglobinemia and cancer⁸. In the present study result shows that water body received very low amount of sewage and industrial effluent but there are increase in nitrate concentration was monitored during the study period.

The higher concentration of phosphate is an indicator of pollution. Phosphate as such is not harmful to organisms but its prime concerns lies in the ability to increase the growth of nuisance algae and eutrophication. Phosphate concentration was observed maximum (3.1 mg/l) in monsoon season of year 2017 because water body receives water from agriculture runoff during rainy season. In the present investigation Zinc, Cadmium and Lead were below detection limit.

CONCLUSION

It is concluded that growing anthropogenic activities around this water reservoir is likely degrading water quality. The values of water quality parameters such as pH, conductivity, turbidity, TDS, and TSS from all samples collected from different areas of BandhBaretha Dam were found to

be within the recommended limits of WHO and CPCB. This result shows that regular monitoring is necessary to addressing the wide range of sustainability and conservation planning for habitat suitability.

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