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Dr. Phul Kunwar Singh Rana
Assistance Professor, Zoology,
V.R.D. Govt. College,
Marwahi, GPM, Chhattisgarh,
India

Seasonal variation in water quality of a Gagnai Dam, Marwahi Blcok, GPM (Chhattisgarh)

Dr. Phul Kunwar Singh Rana

Abstract

Physico-chemical analysis of water in Gagnai dam located in the Marwahi block of GPM (Chhattisgarh) was done in order to assess the suitability of water for irrigation. The seasonal monitoring was done that involved pre and post monsoon months. A total of eleven different parameters *viz.* Temperature, pH, DO, BOD, COD, Total Alkalinity, Total Chlorides, TDS, TSS, Turbidity and Hardness were considered for this study. Differences in the unit values of various parameters were seen in the two seasons.

Keywords: Seasonal, water analysis, Gagnai dam, water quality

1. Introduction

India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development. Water is a prime natural resource, a basic human need and a precious national asset and hence its use needs appropriate planning, development and management. However, studies related to ecology and environment are often perceived as 'anti-development and detrimental to the overall growth and welfare of human beings and are viewed with suspicion and generally considered as nuisance. The trophic status of a water body depends on the locality and its topography. Of all renewable resources of planet, water has the unique place. It is essential for sustaining all forms of life, food production, economic development and for general well-being. Due to tremendous development of industry and agriculture, the water ecosystem has become perceptibly altered in several respects in recent years and as such they are exposed to all local disturbances regardless of where they occur (Venkatesan, 2007) ^[1].

Water pollution is one of the major problems in India. Almost 70% of the available surface water and growing percentage of ground water are contaminated by biological, toxic, organic and inorganic pollutants Chandrasekhar and Kodarkar 1996 ^[2]. In many cases, sources are providing deteriorated quality of water which is unsafe for drinking and other purposes like irrigation Nigam *et al.* 2013 ^[3]. Fresh water lakes and rivers are fragile ecosystems that face the problem of water pollution. Assessment of biological properties along with physico-chemical properties provides a clear idea about trophic status and quality of water bodies. In India, several studies have been done on lentic and lotic limnology Kakvipure and Yeragi 2005 ^[4]; Parashar *et al.* 2007 ^[5]; Shinde *et al.* 2010 ^[6]; Jadhav *et al.* 2011 ^[1]; Waghmare *et al.* 2012 ^[7]; Naik *et al.* 2012 ^[8]; Bajpai 2012 ^[9] and Rana, 2016 ^[13].

In the current study, an effort was made to understand water quality of a lake that has been primarily used for irrigation of farms.

Study area

Gagnai dam located in the Marwahi block of GPM (Chhattisgarh). According to Census 2011 information the location code or village code of Bharridand village is 437574. Bharridand village is located in Marwahi tehsil of GPM (Chhattisgarh), India. It is situated 12km away from sub-district headquarter Marwahi (tehsildar office) and 123 Km away from district headquarter Bilaspur. As per 2009 stats, Bharridand village is also a gram panchayat. The total geographical area of village is 399.38 hectares. Bharridand has a total population of 2,118 peoples, out of which male population is 1,050 while female population is 1,068. Literacy rate of bharridand village is 66.29% out of which 74.95% males and 57.77% females are literate.

Corresponding Author:
Dr. Phul Kunwar Singh Rana
Assistance Professor, Zoology,
V.R.D. Govt. College,
Marwahi, GPM, Chhattisgarh,
India

There are about 595 houses in bharridand village. Pincode of bharridand village locality is 495118.

The present aquatic body "Gagnai dam" was constructed in the year 1972 on local nala of Gangnal nala of Pendra road

district GPM. It is situated 22°-54'-45" latitude and 82°-01'-36" longitude. The height of the dam is 14.65 mt. and length 330 mts. Mainly the water of this dam is used for irrigation and fish culturing.



Fig 1: Showing map Gagnai dam, Marwahi block, GPM (Chhattisgarh)

2. Materials and Method

Water samples were collected into plastic or glass bottles as per the need. The samples were placed into thermocol box and were transported to lab within 2 hours from collection time. Samples were collected for 8 months out of which 4 months (February-May) were designated as pre monsoon and 4 months (October- January) were considered as post

monsoon months. At every month, samples were collected at specific time of a day to minimize the error.

A total of 10 parameters were considered for analysis. Details of methods used for every parameter are given in the table 1. The observations were interpreted by using standard provided by Bureau of Indian Standards (BIS). In case where BIS standards were not available, WHO/CPCB standards were considered for interpretation.

Table 1: Parameters Analysed

Parameter	Method used	Reference
Temperature	Thermometer	APHA 2005 ^[10]
pH	Digital pH meter	
DO	Wrinkler's method, Microbiological titration	
BOD	5 day incubation, Wrinker's method, Microbiological titration	
COD	Open reflux	
Alkalinity	Volumetric Titration	IS 3025 (Part 23): 1986 ^[11]
Chlorides	Volumetric Titration	APHA 2005 ^[10]
TDS	Gravimetric Analysis	Howard 1933 ^[12]
TSS	Gravimetric Analysis	Howard 1933 ^[12]
Turbidity	Nephelometric using Digital turbidity meter	APHA 2005 ^[10]
Hardness	Volumetric Titration	

Table 2: Acceptable limit by BIS, CPCB and WHO

SN	Parameter	Unit	BIS		CPCB	WHO
			Desirable	Permissible		
			6.5 to 8.5	-	6.5 to 8.5	-
1	pH		6.5 to 8.5	-	6.5 to 8.5	-
2	Dissolved oxygen	mg/lit	4	6	6 or more	-
3	BOD	mg/lit	-	-	5 day 2 or less	5
4	COD	mg/lit	-	-	-	10
5	Total alkalinity	mg/lit	200	600	-	-
6	Total solid	mg/lit	-	-	-	-
8	TDS	mg/lit	500	2100	-	1000
9	Turbidity	NTU	1	5	-	-
10	Total hardness	mg/lit	200	600	-	-
11	Chlorides	mg/lit	250	600	-	-
12	Temperature	°C	-	-	-	15-35

3. Results and Discussion

During post monsoon season, temperature at Gagnai dam varied from 19.4 °C to 23.6 °C while in pre monsoon season

there was an average raise by nearly 5 °C. pH of water was in between 7.2 to 8.3 throughout the monitoring period. The value of pH was towards higher end during the pre-monsoon

season. The amount of dissolved oxygen in Gagnai dam was found to be in desirable amounts. It was seen that as the temperature increased in pre monsoon season the amount of dissolved oxygen in water also increased showing positive

correlation. The biological oxygen demand was high during post monsoon season while it decreased in pre monsoon season. The chemical oxygen demand ranged in between 5.6 to 8.1.

Table 3: Details of water parameters analysed during pre and post monsoon at Gagnai dam, Marwahi block, GPM (Chhattisgarh)

Parameter	Post Monsoon				Pre Monsoon				Max.	Min.	Mean	SD.
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May				
Temperature	23.6	20.3	19.4	21.3	22.3	26.3	28.3	29.7	29.7	19.4	23.9	3.81
pH	7.3	7.5	7.2	7.4	7.6	8.2	8.3	8.1	8.3	7.2	7.7	0.43
DO	6.9	7.4	7.3	6.5	6.2	6.3	4.2	3.5	7.4	3.5	6.0375	1.43
BOD	4.3	3.4	2.4	3.1	2.3	2	2.1	3	4.3	2	2.825	0.78
COD	6.4	5.6	6.7	6.2	7.2	7.5	8.1	8	8.1	5.6	6.9625	0.89
Alkalinity	161	135	165	146	143	120	123	102	165	102	136.875	21.35
Chlorides	163	178	164	175	135	154	145	100	178	100	151.75	25.40
TDS	256	168	137	236	253	361	396	469	469	137	284.5	114.52
TSS	166	205	201	216	235	308	369	435	435	166	266.9	94.37
Turbidity	1	1	1	1	1	2	2	2	2	1	1.375	0.52
Hardness	161	166	168	178	197	196	199	201	201	161	183.25	16.77

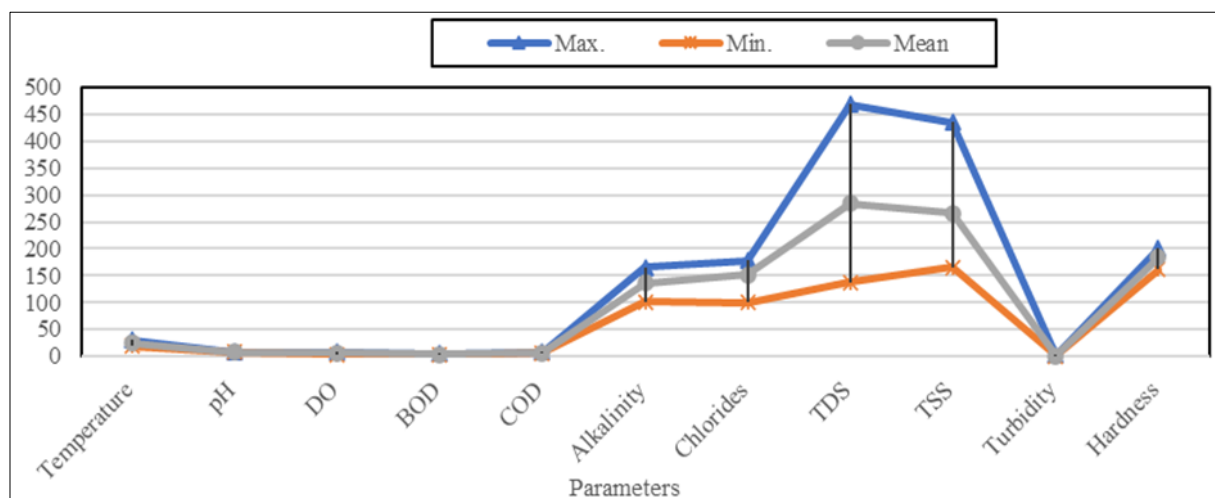


Fig 2: Graph analysis of water parameters (maximum, minimum and mean) at Gagnai dam

In pre monsoon season chemical oxygen call for of water became extra. Alkalinity of the water was inside limits for all of the eight months, but in the course of put up monsoon season alkalinity changed into distinctly high. Comparable fashion of observation changed into visible for the chlorides. value of general dissolved and total suspended solids inside the water was quite excessive during pre-monsoon season as compared to put up monsoon season. In phrases of turbidity water of Gagnai dam become clear however, little turbidity changed into visible in the pre monsoon season especially because of high amounts of total solids. Hardness of water changed into inside limits for both seasons, however during pre-monsoon season the values of hardness almost reached suitable restriction. To have higher understanding of common version and deviation in month-to-month values; mean, general deviation of each parameter have been assessed. To understand the array of fluctuations maximum and minimum reading were noted. It was seen that, mean temperature of water was around 23.9 °C while maximum and minimum temperatures noted were 29.7 °C and 19.4 °C respectively. The average pH was little alkaline with a standard deviation of 0.43. DO and COD levels in the water varied considerably during two different seasons while BOD values were more or less stable. Very high deviation of values was seen for five parameters viz. Alkalinity,

Chlorides, TDS, TSS and Hardness, though values in each month were within acceptable ranges.

All parameters at Gagnai dam had been inside proper ranges for most of the period of monitoring. Only high TSS turned into seen in few months specially because of human activities like swimming that causes disturbance in water. Other herbal elements like wind too contributed in high TSS. Human hobby near lake was much less in post monsoon length especially because of difficulties in accessibility as the road attaining the lake is not well built. Additionally, the want for water from the lake in immediate post monsoon length is quite much less. Water for irrigation is needed simplest after September month that's provided by way of local Panchayat through pipe lines. Though, anthropogenic strain on the lake is fantastically much less, in Pre monsoon season the lake attracts many humans especially for entertainment motive. it can be concluded that the, Gagnai dam has an awesome excellent of water that is appropriate for irrigation.

4. Acknowledgement

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