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(RESEARCH ARTICLE)



Seasonal variation in water quality parameters of Loni dam Rewa, Madhya Pradesh

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Abstract

The present study shows the seasonal and spatial changes of certain physicochemical parameters namely water transparency, temperature, dissolved oxygen, pH, free CO₂, Alkalinity, total hardness, magnesium, calcium and sulphate hardness, nitrates and inorganic phosphates. All parameters were documented in every months of July to June in 2017-18 and 2018-19. It was found that no significant differences in the variability of physicochemical factors between surface and bottom water. The present water body was noted to have alkaline water throughout the year at all sites and seasons.

Keywords: Variability; Physicochemical factors; Surface and bottom water

1. Introduction

Lony dam is constructed by impounding flowing water of river to form a large lake. It has high socioeconomic status and contributes the basic means to provide hydroelectric power, irrigation, and flood control, production for fish food and space for sewage and water disposal. The lony dam water also provides drinking water for animals and a means of recreation to the villagers. It is necessary to examine the physicochemical condition of water, soil, existing fauna and flora in order to the most suitable and compatible species for a reservoir. The integrated fish culture is closely related with physicochemical and biological condition of the water body. The water bodies give good results by using scientific technologies with continuous hydro biological investigations. The physicochemical parameters play a vital role in determining the distribution pattern and quantitative abundance of organisms inhabiting particular aquatic ecosystems (Kumar et al. 2009). Water has the ability to dissolve solids and to absorb gases and other liquids .Because of this solvent power, all natural water contains minerals and other substance which have been picked up from the air , soil and rock over which it passes and any change in water quality will affects aquatic life (Pawar and Pandarkar 2011). Therefore, the continuous and periodical monitoring of water bodies for water quality is necessary. Hence in the present study efforts have been made to analyze the physico-chemical parameters of loni dam from July2017 to June2019 (two years).

2. Material and methods

The present study was carried out on Lony dam which is situated at the junction of Allahabad and Rewa district in Uttar Pradesh and Madhya Pradesh border. The experiment was conducted from July 2017 to June 2019. The samples were collected from surface and bottom water between 10.00 AM to 12:00 AM. A number of four sampling sites were selected. The two sites A, B from littoral and C, D from limnetic zones. Only clean and dried sample bottles were selected for sampling work (table-1). The transparency and temperature of water was recorded by Secchi disc and Celsius thermometer respectively. Hanna instrument is used for the measurement of pH, temperature and total dissolved solids. This instrument was immersed in a thoroughly shaken water sample and readings were noted in °C. For measurement of pH, the pH meter was calibrated with buffer solution and the instrument was immersed in well mixed samples and readings were noted. To analyze the Dissolved Oxygen content an automatic oxygen analyzer was used.Total alkalinity

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was measured by adding 3-5 drops of methyl orange to the sample when yellow colour occurred it is titrated against 0.02N sulphuric acid until the colour changed to orange. The volume of sulphuric acid was noted. Calcium hardness of water was calculated by oxalate method and calcium + magnesium by titrating with ethylene diamine tetraacetate (E.D.T.A.). Magnesium was obtained by the subtraction of calcium from calcium+magnesium. Measurement of nitrates, sulphates and phosphates was done by Spectrophotometer. The physicochemical conditions of water depend on the Meteorological condition of the area (table-2). The physical factors affect the chemical factors and responsible for the qualitative and quantitative variations in the micro and macro organisms, planktons and water quality of the system. A quantitative study of the plankton and physicochemical condition of the river Yamuna at Allahabad was supported by Chakraborty R., D.P. Roy and S.B. Singh (1959). To estimate the quantitative value of physicochemical parameters the water samples were taken to the laboratory and were analyzed by applying the standard method (Shivkumar et.al), (APHA 2008).

Table 1 Showing Names, Depth ranges and Site types

Sampling sites	Depth range (meters)	Site types
A	1.5-4.0	Littoral
B	1.0-3.0	Littoral
C	3.5-6.5	Limnetic
D	4.5-8.0	Limnetic

Table 2 Meteorological data of Rewa district for 2017-18 and 2018-19

Sl. No.	Month	Minimum temp. °C		Maximum temp. °C		Rainfall (mm)		Maximum % humidity		Minimum % humidity	
		2017-2018	2018-2019	2017-2018	2018-2019	2017-2018	2018-2019	2017-2018	2018-2019	2017-2018	2018-2019
1	July	25.0	24.6	34.0	32.8	226.2	462.0	82	86	65	74
2	August	25.7	25.8	31.8	32.0	225.5	115.5	90	88	75	70
3	September	22.5	24.8	32.5	31.5	175.2	100.2	92	90	62	65
4	October	20.5	19.0	31.2	31.8	28.0	Trace	94	92	54	64
5	November	12.6	10.2	27.5	28.9	0.5	0.0	85	85	40	65
6	December	7.5	8.2	25.0	24.5	0.0	2.5	84	84	46	58
7	January	5.6	7.2	23.0	24.0	32.2	0.0	87	83	55	48
8	February	9.5	10.8	26.0	28.5	8.0	0.0	84	83	38	42
9	March	16.0	12.0	32.0	32.5	18.2	15.5	85	84	45	34
10	April	18.5	17.5	38.0	37.4	4.5	35.8	82	83	34	30
11	May	22.6	26.0	42.0	40.5	3.5	27.5	72	78	36	32
12	June	26.0	28.0	40.0	42.8	196.0	65.0	75	65	54	38

3. Results and discussion

The physicochemical conditions of water depend on the meteorological conditions of the area. The physical parameters such as temperature, turbidity play an important role in the dam productivity. The quality of the dam water was decided by the levels of the chemical parameters including dissolved minerals, gases and pH. According to Sreenivasan (1969) the deep and big dams usually appeared only during initial fertility phase. The silt carried by inflowing river gets deposited every year and the magnitude of river current shows down gradually. Most of the big dams have as vast open surface water area without any macro vegetation. It is important to note that no significant differences in the variability

of physicochemical factors were found between surface and bottom water therefore the values of surface water taken into account to discuss the facts of the study. The value of transparency was noted to be moderate in lony dam; its high value appeared in summer and moderate in monsoon and winter. The reason of high transparency in summer was that of low depth of water, high intensity of sunlight and precipitation of turbidity. The transparency of lony dam ranged from 61.05 to 71.00 in 2017-18 and 55.4 to 71.2 in 2018-19. The transparency affects the photosynthesis, growth and primary productivity of the system.

The temperature has an important role in deciding the biotic features of the water body. The mean value of ambient water temperature at lony dam varied from 14.5°C to 36.5°C. The water temperature was shown variation with seasons and sites. Dissolved oxygen is the most popular and significant parameter. APHA (1985) has considered this parameter as the key test to understand water pollution and degree of eutrafication. The mean value of Dissolved Oxygen in present water body varied from 5.3mg/l to 9.4mg/l in 2017-18 and 4.32 to 12.0mg/l in 2018-19. The pH value of lony dam varied between 7.1 to 8.6mg/l in 2017-18. It was shown that the lony dam had alkaline water throughout the study period. This water is suitable for aquaculture. The high pH in summer and low pH in winter were recorded in present study. The average free carbon dioxide at lony dam varied from 5.2 to 6.4 mg/l. The highest value was noted in summer and lowest in winter. According to Wetgel (2006) the change in pH value are brought by the loss of carbon dioxide in photosynthesis and addition of carbon dioxide from respiration of aquatic organisms. The functional relationship and productivity of inland waters becomes affected significantly with the changes occurred in physicochemical and biological parameters. The present water body was found to have high range of total alkalinity. It is varied from 130.0 to 284mg/l. Its maximum value was recorded from September to February. The high range of alkalinity might be found due to greater dissociation of carbonic acid at high temperature. The total hardness in lony dam was recorded with a wide range of 217 to 275mg/l in 2017-18 and 2018-19 respectively. It indicated that water had high hardness throughout the year. The magnesium, calcium and sulphate hardness was recorded a moderate to high range during the study period. In natural waters, the main source of magnesium is sewage (Kumari and Rani 2008). The seasonal changes of Ca, Mg and sulphate hardness were also recorded. The nitrogen content of present water body varied from 0.2 to 0.4mg/l. Its maximum value in summer, moderate in monsoon and low in winter were observed. Higher values of hardness were observed during summer, which may be due to low water level and high rate of decomposition and evaporation that concentrating the salts (Dubey and Ujjania 2013). It was found that the source of nitrates is fertilizers, decayed vegetables and animal matter. The range of phosphate recorded from the present water body was 0.2 to 0.4mg/l during the study. The phosphate fertility in the lony dam indicates as an index of aquatic productivity (Ahmad Siddique 1996, Shivkumar et al. 2011) (table-3).

Table 3 Seasonal value of physicochemical parameters during 2017-18 and 2018-19

Sl. No.	Parameters	Rainy season		Winter season		Summer season	
		2017-2018	2018-2019	2017-2018	2018-2019	2017-2018	2018-2019
1	Transparency	65.5	58.1	58.6	66.4	66.5	69.6
2	Temperature	25.50	18.40	29.50	28.1	20.7	30.6
3	D/O	5.6	5.2	5.2	10.8	9.2	5.0
4	pH	7.8	7.8	7.5	7.9	8.2	8.2
5	Carbon dioxide	6.4	6.4	6.0	5.4	6.2	5.2
6	Alkalinity	130.4	131.2	284.6	266.2	132.5	135.2
7	Total hardness	223.0	260.7	217.9	233.7	224.6	275.3
8	Magnesium	21.2	20.5	17.5	21.7	20.6	19.6
9	Nitrates	0.2	0.4	0.2	0.3	0.2	0.4
10	Sulphates	17.9	20.6	20.1	22.9	23.2	15.8
11	Phosphates	0.2	0.4	0.2	0.3	0.2	0.4
12	Calcium hardness	86.3	83.9	82.6	85.1	86.4	87.1

4. Conclusion

The present study confirmed that no significant differences in the variability of physicochemical factors were found between surface and bottom water. The transparency is very high in summer. It was due to low depth of water, high intensity of sunlight and precipitation of turbidity. The water temperature was shown variation with seasons and sites. The present water body was found to have high range of total alkalinity. The study indicated that water had high hardness throughout the year. The magnesium, calcium and sulfate hardness was recorded a moderate to high range during the study period. The phosphate fertility indicates as an index of aquatic productivity. The physicochemical and biological condition of present water body is closely related with integrated fish culture. The importance of present study is to help fish farmers to chalk out strategies for fish culture enhancement programs.

Compliance with ethical standards

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