E-ISSN: 2706-8927
P-ISSN: 2706-8919
www.allstudyjournal.com
IJAAS 2022; 4(1): 276-279
Received: 25-11-2021
Accepted: 27-12-2021

Vinita R Kashyap
Associate Professor,
Department of Zoology,
Govt. Science College, Rewa,
Madhya Pradesh, India

Corresponding Author:
Vinita R Kashyap
Associate Professor,
Department of Zoology,
Govt. Science College, Rewa,
Madhya Pradesh, India

Limnological studies of the perennial waterbody, Govindgarh Lake district Rewa (M.P.)

Vinita R Kashyap

Abstract
This paper describes the physico-chemical profile of perennial lake of Govindgarh, Madhya Pradesh, where limnological studies were conducted during March 2020 to February 2022. Variables analysed from surface water of the tank were temperature, transparency, pH, electrical conductivity, dissolved oxygen, alkalinity, hardness, chlorides, nitrates and phosphate. The seasonal variations of these factors were studied and interrelationships existing between them are discussed. The pH of water was alkaline. Transparency, EC, hardness and alkalinity were tend to increase during summer and decrease in winter. Dissolved oxygen was maximum during winter and minimum during summer. Dissolved oxygen showed inverse relationship with temperature and EC. Nitrate and phosphate were higher in monsoon and post monsoon, fluctuated directly with dissolved oxygen.

Keywords: Alkalinity, pH, total dissolved solids, awareness, environment

1. Introductions
India has vast freshwater resources in the form of both lentic and lotic ecosystems. The lentic ecosystems include ponds, lakes, tanks and reservoirs. The perennial tanks play an important role as a valuable water resource for domestic, agriculture and aquaculture. The lentic ecosystems have long attracted the attention of ecologists, both for their importance as the source of drinking water and in the development of fisheries. To employ scientific methods for aquaculture, understanding of environmental conditions prevailing in the water body is essential. Increased attention is, therefore, be given to the physico-chemical factors, since they directly or indirectly affect fishes and other aquatic inhabitants.
The Govindgarh dam is one of the unique water body in India and located in south of Rewa, district in Madhya Pradesh at a distance of 20 km. from Rewa, with a longitude 24°20'25" and latitude 81°15'20". The dam is connected with all weather Rewa-Shahdol and Satna-Sidhi road. The dam was formed by impounding of small nalla originating from Kaimore hill. With a view to storing rain water, the Maharaja of Rewa at that time built a bandh across the nalla to form a tank in the year 1958. The shows that the lake is functioning as a carbon and nitrate removal system. Major untreated sewage influx is removed by the bio diversity of the lake.
Several limnological studies have been carried out in past few decades on lakes and tanks of this region, notable among those are of Kamat, 1965; Goel *et al.*, 1988; Bhosale *et al.*, 1994; Kashyap, 2016; Prajapati, 2016; Rana, 2015 & 2016; Shukla and Upadhyay, 2017; Khandayat and Singh, 2019a [7, 4, 3, 9, 17, 18, 19, 21, 13]. Most of the studies were carried out in water bodies situated in urban areas. The reports on water bodies from rural areas are meagre. Thus there is lack of baseline data on limnological characteristics of Govindgarh Lake, which is being used for pisciculture activities. Therefore the present study was undertaken.

2. Material and Methods
The samples of surface water were collected fortnightly from four sampling sites of the tank. A few tests particularly for dissolved oxygen and alkalinity were performed at the site. The water temperature was measured using mercury thermometer. The transparency of water was measured by using Secchi disc. The pH was determined by using pH meter. The water samples were transferred to the laboratory for further chemical analysis. Standard methods as described by APHA-AWWA-WPCF (1985) [1] and Trivedy *et al.* (1998) [26] were followed for various physico-chemical parameters. Statistical analysis was done to find out the interrelationship among physico-chemical factors.

3. Results and Discussion

The average minimum and maximum values of each parameter recorded in Govindgarh lake during March 2020 to February 2022 are given in Table 1. The values of correlation coefficient between physicochemical factors are given in Table 2. The monthly variations of these variables are depicted in Fig. 1.

The surface water temperature ranged between 23.4 and 31.8°C. It was recorded minimum during winter and maximum in summer (Fig. 1). The monthly variations showed that the water temperature followed the seasonal pattern and fluctuated according to the prevailing atmospheric temperature.

The transparency ranged from 25.4 cm to 68.46 cm. Maximum transparency was recorded in summer, and lowest during monsoon and postmonsoon (Fig. 1). The rainwater brought in a lot of dissolved and undissolved inorganic and organic materials that made the water turbid and caused lowest transparency in rainy months. These observations are in agreement with the findings of Timms & Midgley (1970) [25].

The pH of the tank water was always alkaline and ranged from 7.2 to 8.9. The variation in pH was not very wide. The waters having pH range of 6.5 to 9.0 are most suitable for aquaculture (Jhingran, 1982) [6]. The pH in Govindgarh lake was found suitable for pisciculture. Maximum pH was recorded during summer and minimum in monsoon (Fig. 1). The high pH in summer possibly results from increased photosynthesis; photosynthetic assimilation of dissolved inorganic carbon can increase pH (King 1970, Khandayat and Singh, 2019a) [14, 13]. The pH showed direct relationship with total alkalinity (Table 2). Such a relationship was also reported by Bharadwaj & Sharma (1999) [2].

The EC values ranged from 296.4 to 428.5 µmhos/cm, being maximum in summer and minimum in winter (Fig. 1). The EC showed direct relationship with water temperature, hardness and chlorides (Table 2). The relation of EC with temperature could be explained on the basis of the fact that solubility of minerals and other inorganic matter increases with increase in water temperature. Kataria *et al*. (1995) [10] have reported similar seasonal trend of EC, which supports our findings.

According to APHA (1985) [1] the lowest dissolved oxygen for maintaining fish in healthy condition is 5.0 mg/L and the critical value is 3.0 mg/L. In the Govindgarh lake average DO value recorded was 7.3 mg/L and 7.4 mg/L, indicating favourable condition for fish growth. Dissolved oxygen varied from 5.4 to 8.9 mg/L being minimum in summer and maximum in winter (Fig. 1). DO showed significant inverse relationship with water temperature. This might be attributed to two reasons, i.e., in summer at high temperature the rate of oxidation of organic matter increases and oxygen is consumed and secondly at high temperature oxygen holding capacity of water decreases (Welch 1952, Nair 1999, Kashyap, 2016) [27, 9].

The total alkalinity ranged from 97.7 to 166.6 mg/L. It was recorded maximum in summer during both the years of the study, and minimum during monsoon and winter during first and second year respectively. According to Jackson (1961) [5], alkalinity below 50 mg/L indicated low photosynthetic rate. The alkalinity in Govindgarh lake remained always high indicating high photosynthesis rate. Kaur *et al*. (1997) [12] observed higher alkalinity during summer and lower during monsoon. The high values of alkalinity in present study imply large reserve of total CO_2 which provide supply of inorganic carbon for the support of algal population as Sinada & Abdel Karim (1984) [22] have observed.

Hardness of Govindgarh lake varied from 65.2 to 130.2 mg/L. Kannan (1991) [8] has classified water with hardness values ranging from 60-180 mg/L as moderately hard to hard. By these criteria the water of Govindgarh Lake can be termed as moderately hard. The hardness showed seasonal variation, being maximum in summer and minimum in winter (Fig. 1). Rao & Mahmood (1995) [20] and Kashyap (2016) [9] have also recorded higher hardness in summer and lower in winter, which support our findings. Hardness showed direct relationship with temperature, EC and transparency (Table 2). Similar relationship was reported by Jhingran (1982) [6] and Kaur *et al*. (2000) [11]. Chloride values ranged between 24.2 and 45.7 mg/L. Slightly higher values of chloride were recorded during monsoon (Fig. 1).

Freshwater contains 8.3 mg of chlorides per litre, in general, (Swarnalatha & Rao 1998, Khandayat and Singh, 2019a)) [24, 13] but in present investigation the chloride concentration was observed higher indicating polluted nature of the lake. Munawar (1970) [15] and Kashyap (2016) [9] suggested that higher concentration of chloride in water is an index of pollution of animal origin. Higher chloride values during monsoon might be attributed to run off from the catchment area, which added dung and other agricultural wastes in the tank water. Chloride showed direct relationship with water temperature and EC.

Nitrates (NO_3^-N) were reported in lower concentration which might be due to biological destruction. The nitrate ranged from 0.04 to 0.22 mg/L. Though nitrate content of the tank water was lower, higher values were reported in monsoon than in winter and summer (Fig. 1). Highest values of nitrates in rainy season may be due to addition of nitrogen in the form of run off water. The nitrate showed direct correlation with DO, and such a direct relationship was also observed by Swarnalatha & Rao (1998) [24] and Rana (2016) [19].

Phosphate (PO_4^-P) content of tank water varied from 0.02 to 0.21 mg/L being higher in monsoon and postmonsoon and lower in summer (Fig. 1). Nair (2000) [16] has observed similar seasonal trend in phosphate concentration. Phosphate showed direct relationship with DO and nitrate, and negative correlation with water temperature, transparency, hardness and alkalinity (Table 2). Singh (1986) [23] and Khandayat and Singh, (2019a) [13] also reported such a relationship of phosphate with other parameters.

Table 1: Average values and (ranges in parantheses) of physical and chemical parameters recorded at Govindgarh Lake during March 2020 to February 2022

S. No.	Parameters	Mar. 2020-Feb.2021	Mar.2021-Feb. 2022
1.	Temp. (°C)	26.9 (23-32.6)	27.6 (23.4-33.8)
2.	Transparency (cm.)	51.8 (31.4-68.46)	49.4 (25.4-62.5)
3.	pH	8.46 (7.2-8.9)	8.37 (7.7-8.8)
4.	Electrical Conductivity (µmhos/cm)	358.5 (296.4-414.1)	386.4 (330-428.5)
5.	Dissolved oxygen (mg/L.)	7.3 (5.4-8.9)	7.4 (5.7-8.8)
6.	Hardness (mg/L.)	89.63 (65.2-117.2)	99.4 (71.8-130.2)
7.	Total alkalinity (mg/L.)	143.2 (98.28-166.6)	123.6 (97.7-156.4)
8.	Chlorides (mg/L.)	33.24 (24.2-45.7)	35.44 (28.7-41.9)
9.	Nitrate (mg/L.)	0.11 (0.05-0.22)	0.08 (0.04-0.19)
10.	Phosphate (mg/L.)	0.13 (0.02-0.21)	0.11 (0.036-0.2)

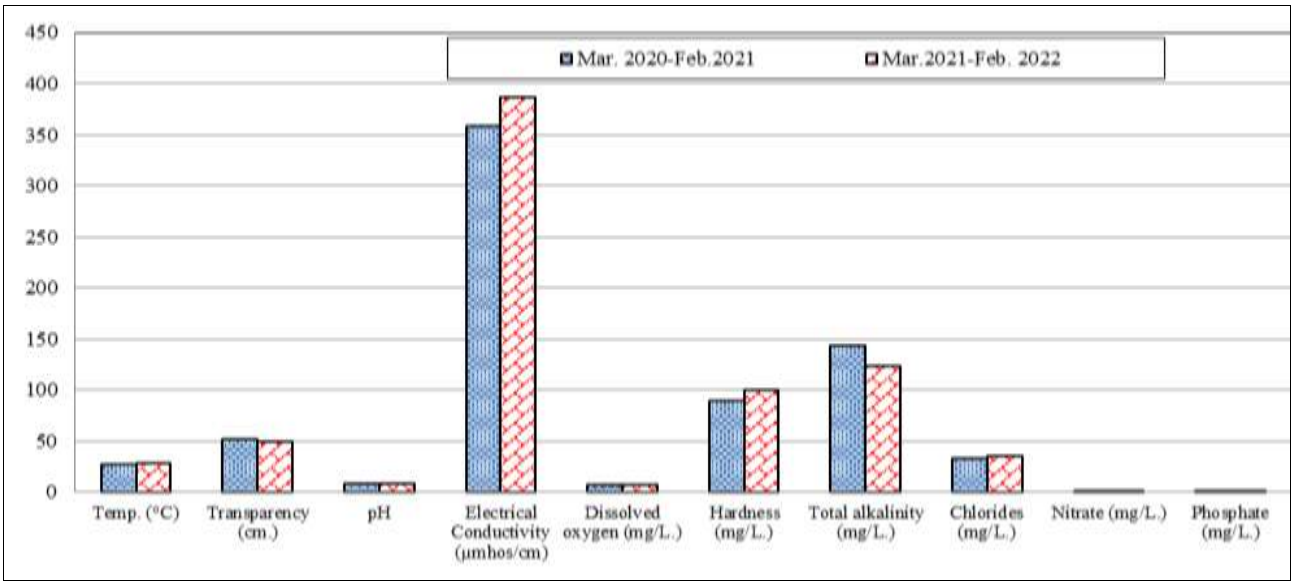

Fig 1: Graphics analysis of Average values and (ranges in parantheses) of physical and chemical parameters recorded at Govindgarh lake during March 2020 to February 2022

Table 2: Correlation matrix of physico-chemical characteristics of Govindgarh lake

	Temp.	Transparency	pH	Electrical conductivity	Dissolved oxygen	Hardness	Total alkalinity	Chloride	Nitrate	Phosphate
Temp.	1									
Transparency	0.26	1								
pH	-0.13	0.66**	1							
Elect. Conductivity	0.77*	0.12	-0.39	1						
Dissolved oxygen	-0.91*	-0.38	0.27	-0.79*	1					
Hardness	-0.04	0.77*	0.49**	0.36	-0.04	1				
Total alkalinity	0.80*	0.54**	0.04	0.68*	-0.91*	0.17	1			
Chlorides	0.67*	-0.15	-0.66*	0.78*	-0.71*	-0.43**	0.40	1		
Nitrate	-0.43**	-0.51**	-0.35	-0.08	0.57**	-0.35	-0.57**	0.06	1	
Phosphate	-0.47**	-0.71*	-0.28	0.29	0.59**	-0.45**	-0.743*	-0.01	0.65*	1

* = $P < 0.01$; ** = $P < 0.05$

4. Conclusion

The objective of this research work was to find the quality of Govindgarh lake, water w.r.t drinking purpose. From the experimental results of water quality analysis of Govindgarh lake, it can be concluded that the water quality is good and most of the parameters are within the limits set by organizations like WHO and Bureau of Indian Standard (BIS). From the above study, it may conclude that except little variation, all the physico-chemical parameters were in permissible limit at the study site of the Govndgarh lake. It is suggested that proper measures are necessary to avoid contamination as water is used for drinking purpose. At present the river is suitable for irrigation and fishery purpose.

5. Acknowledgement

Author is very thankful to authority of Govt. Science P.G. College, Rewa (M.P.) for given permission to carry out this work.

6. References

1. APHA-AWWA-WPCF. Standard Methods for Examination of Water and Wastewater, 20th edition, American Public Health Association, Washington D.C, 1985.
2. Bharadwaj K, Sharma LL. Study of some physico-chemical characteristics of a sewage fertilized seasonal pond of Udaipur (Rajasthan). J Env. Poll. 1989;6(4):255-260.

3. Bhosale LJ, Sabale AB, Mulik NG. Survey and Status Report on Some Wetlands of Maharashtra. Final report submitted to Shivaji University, Kolhapur. India, 1994, 60.
4. Goel PK, Kulkarni AY, Khatavkar SD. Species diversity in phytoplankton communities in a few freshwater bodies in south Western Maharashtra. Geobios. 1988;15:150-156.
5. Jackson DF. Comparative studies on phytoplankton photosynthesis in relation to total alkalinity. Verh. Int. ver. Limnol, 1961;14:125-133.
6. Jhingran VG. Fish and Fisheries of India. Hindustan Publishing Corp. (India), Delhi, 1982.
7. Kamat MD. Ecological notes on Kolhapur. J Biol. Sci. 1965;8:47-54.
8. Kannan K. Fundamentals of Environmental Pollution. S. Chand and Company Ltd., New Delhi, 1991.
9. Kashyap Vinita R. Physico-chemical analysis of various water samples of Rewa district (M.P.) India. International Journal of Applied Research. 2016;2(1):311-313.
10. Kataria HC, Iqbal SA, Shandilya AK. Limno-chemical studies of Tawa reservoir. I.J.E.P. 1995;16(11):841-846.
11. Kaur H, Bath KS, Mander G, Jerath N. Physico-chemical status of Kanjli wetland (Punjab-India). J Env. Poll. 2000;7(1):39-42.
12. Kaur HS, Dhillon S, Bath KS, Mander G. Interrelationships between physico-chemical factors at Harike wetland (Punjab-India) J Env. Poll. 1997;4(3):237-240.
13. Khandayat Poornima, Singh Bharat Sharan. Physico-chemical parameter and fish diversity of Gangulpara dam in Balaghat (M.P.), India, International Journal of Advanced Science and Research. 2019a March;4(2):06-08.
14. King DL. The role of carbon in eutrophication. Ecology. 1970;42:2035-2051.
15. Munawar M. Limnological studies on freshwater ponds of Hydrabad, India. I. The biotope. Hydrobiologia. 1970;35(1):127-162.
16. Nair MS, Rajendran. Seasonal variation of physico-chemical factors and its impact on the ecology of a village pond at Imala (Vidisha). J Ecobiol. 2000;12(1):21-27.
17. Prajapati Roopshah. Water quality index assessment of Sarfa Dam, Shahdol district (M.P.) India. International Journal of Applied Research. 2016;2(2):638-642.
18. Rana, Phul Kunwar Singh. Physicochemical Study of Ground Water of Shahdol City (Madhya Pradesh) With Special Reference to Status of WQI. IJRASET. 2015;3(11):458-461.
19. Rana, Phul Kunwar Singh. Physico-chemical study of Mohan Ram Lake Shahdol (M.P.). International Journal of Applied Research. 2016;2(1):239-241.
20. Rao Narendar V, Mahmood SK. Nutrient status and biological characteristics of Hubsiguda pond. J Env. Poll. 1995;2(1):31-34.
21. Shukla Bramhanand, Upadhyay Nidhi. Studies of physicochemical and bacteriological characteristics of Bansagar Lake Shahdol (M.P.). International Journal of Biology Research. 2017;2(2):45-50.
22. Sinada F, Abdel Karim AG. Physical and chemical characteristics of the Blue Nile and the White Nile at Khartoum. Hydrobiologia. 1984;110:21-32.
23. Singh RK. Fluctuations in the compositation of zooplankton population in relation to hydrobiological conditions of a reservoir. J Hydrobiology. 1986;2(3):37-42.
24. Swarnalatha N, Rao AN. Ecological studies of Banjara lake with reference to water pollution. J Env. Biol. 1998;19(2):179-186.
25. Timms BV, Midgly SH. The limnology of Borumba dam, Queenland. Proceedings Royal Socity of South Africa. 1970;3(2):37-41.
26. Trivedy RK, Goel PK, Trishal CL. Practical Methods in Ecology and Environmental Science. Enviromedia Publication, Karad, 1998.
27. Welch PS. Limnology. McGraw Hill Book Co., N.Y, 1952.