



Physico-chemical studies of Govindgarh Lake Rewa (M.P.) with special reference to Phytoplanktons

Dr. Manisha Shrivastava

Guest Faculty, Govt. T.R.S. College, Rewa, Madhya Pradesh, India

Abstract

Present investigations were carried out on the physicochemical studies of Govindgarh lake Rewa (M.P.) with special reference to phytoplanktons. Present investigation has been conducted on Govindgarh lake Rewa of Madhya Pradesh with special reference to its zooplankton diversity in relation physico-chemical characteristics. The maximum of total phytoplankton was recorded in winter (December) and summer (April) due to suitable range of temperature. The members of Bacillariophyceae dominated in phytoplankton population. Poor representation was made by the members of Euglenophyceae.

Keywords: water chemistry, phytoplanktons, govindgarhlake

1. Introduction

Inland water resources and their high productivity have a very important place in human civilization and therefore an adequate knowledge of their environments is indispensable. It has been estimated that the total area of fresh water of the world is 2.5 million sq. km. It makes about 0.5% of the total earth surface. In India the water spread into 1.37 million hectare in the form of lakes and reservoirs.

Lakes play an important role in the development programmes of country. They can serve as sources of drinking water and water for industries for agriculture power development and fisheries. Unfortunately domestic wastes from human settlements and industrial effluents pollute majorities of our lake systems. Water pollution severely affects the aquatic life. Massive fish killing and distraction of other aquatic life due to industrial pollutants have become a common feature in many lakes of our country.

The quality and quantity of water also have some valuable effects on the metabolic activities of organisms. Besides, it has been observed that the high specific heat of water permits it to resist the seasonal changes in water temperature. It is obvious that water is a poor thermal conductor and slight variation in temperature results in rapid change in its density. The surface tension and viscosity of water surface play a significant impact in shaping the characteristics of concerned planktonic communities and other micro-organisms.

Phytoplankton are free floating unicellular, microscopic and colonial autotrophic organisms that grow in aquatic environments whose movement is more or less dependent upon water currents (Millman *et al.*, 2005) ^[1]. Phytoplankton are considered as important component of aquatic flora, play a key role in maintaining equilibrium between abiotic and biotic components of aquatic ecosystem (Pandey *et al.*, 2004) ^[2]. Phytoplankton plays an important role in the biosynthesis of organic matter in aquatic ecosystems, which directly or indirectly serve all the living organisms of a waterbody as food. The clarity of the pond depends on the presence or absence of suspended materials such as microscopic clay particles and phytoplankton. In the absence of suspended

materials and phytoplankton, a tank will appear almost crystal clear. A number of researchers have studied the phytoplankton diversity of lentic water bodies (Pawar *et al.*, 2006; Tapashi and Mithra, 2011; Sayeswara *et al.*, 2011; Vasantha *et al.*, 2012) ^[3-6].

Phytoplankton are floating microscopic autotrophs and consist of mainly members of chlorophyceae, cyanophyceae and bacillariophyceae and algae like green flagellates. The studies on phytoplankton are the subject of great interest because of their role as primary producers in an aquatic ecosystem. The qualitative and quantitative studies of those species may provide good indices of water quality and capacity of water to sustain heterotrophic communities.

Thus, the present work aimed to assess the biodiversity of Phytoplankton and their Relation to the physico-chemical parameters of Govindgarh lake which is mainly used for irrigation purposes, commercial fishing practices and recreation.

2. Materials and Methods

Physico-chemical analysis of water samples were carried out following the standard methods as described by Adoni (1985) ^[7] and APHA (2005) ^[8]. For enumeration of phytoplankton population surface water samples (100 liters) were filtered with the help of plankton net made of bolting silk of mesh size of 20 µm and concentrated samples were preserved with 5% formaldehyde solution in 100 ml plastic vials. The concentrated samples were examined under the inverted microscope (Metzer made) and identification of plankton was done following the taxonomic references of Needham and Needham (1962) ^[9], Edmondson (1992) ^[10], Reddy (1994) ^[11], Sharma (1999) ^[12] and Dhanapathi (2003) ^[13].

The Govindgarh lake is one of the unique water body in India and located in south of Rewa, district in Madhya Pradesh at a distance of 20 kms. from Rewa, with a longitude 24°20'25" and latitude 81°15'20". The lake is connected with all weather Rewa-Shahdol and Satna-Sidhi road. The lake 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. During the present investigation author has selected five study sites for Physico-chemical nature of water and phytoplankton of this Govindgarh lake Rewa region in particular. This historic geographical region provides a unique environment. So far no work on these aspects was attempted and hence the present problem was undertaken. For the convenient of the study 5 research sites Station A, Station B, Station C, Station D and Station E was established about 1/2 km. of distance each at ecologically significant areas.

3. Results and Discussion

Physicochemical analysis

The physico-chemical parameters as pH, Bulk density, True-density, water holding capacity, Electrical conductivity, Clay, Silt, Sand, Infiltration, were analysed from five research Stations observations given below. (Table 1).

pH

At five research stations (A, B, C, D and E) the pH value of soil samples were recorded respectively 7.0, at station A, 7.0 at station B, 7.0 at station C, 7.6 at station D, 7.5. While average pH of all five station was found 7.22.

Bulk Density

Bulk density is (gm/cc) measured at each research stations (A, B, C, D and E) in which 1.36 gm/cc was found at station A, 1.35 gm/cc at station B, 1.34 gm/cc at station C, 1.35 gm/cc at station D, 1.31 gm/cc and at site E. While average Bulk-density

was measured as 1.34 gm/cc for five stations.

True-density

True-density of soil had been measured in five research stations. In stations A and B true-density were found 2.63 gm/cc, site C, D and E the true-density observed 2.62 gm/cc. While the average true density for each station was found 2.62 gm/cc.

Sand %

The sand percentage of soil was measured in each stations (A, B, C, D and E). At site A sand % recorded 25.0%, 27.5% recorded at site B, 32.5% sand recorded at site C, 39.0% had been found at site D, 42.5% and 33.3% had been found at site E. While the average sand % was found to be 33.3%.

Silt %

The silt % of soil was measured at each stations (A, B, C, D and E). At station A silt % recorded 30.0%, At site B silt % recorded 27.5%, at site C silt % recorded 30.8%, 34.5% recorded as site D, 32.5% recorded at site E. While the average silt % was found 31.4%.

Clay %

The clay % of soil was measured at each station (A, B, C, D and E). At site A and B clay % recorded 45.0 % at site C was found 37.5%, 26.5% was found at site D, 25.0 % was recorded at site E. While the average clay % was found 35.8%.

Table 1: Physico-chemical condition of soil analysis of Govindgarh Lake at 5 research stations (2016)

Parameters	Station A	Station B	Station C	Station D	Station E	Average
pH	7.0	7.0	7.0	7.6	7.6	7.22
Bulk density gm ^o /cc	1.36	1.35	1.34	1.35	1.31	1.34
True density gm ^o /cc	2.63	2.63	2.62	2.62	2.62	2.62
Sand %	25.0	27.5	32.5	39.0	42.5	33.3
Silt%	30.0	27.5	30.8	34.5	32.5	31.4
Clay %	45.0	45.0	37.5	26.5	25.0	35.8
Electrical conductivity (dsm ⁻¹)	0.20	0.18	0.70	0.60	0.40	0.41
Water holding capacity	31.0	29.5	28.0	28.5	26.0	28.6
Infiltration mm/hr	6.0	6.5	7.0	6.82	6.0	6.46

Electrical Conductivity

The electrical conductivity of soil has been measured at five localities of research stations near the lake from site A the conductivity recorded 0.20 dsm⁻¹, 0.18 dsm⁻¹ conductivity

recorded at site B, and 0.70 dsm⁻¹, at site C, 0.60 dsm⁻¹ and 0.40 dsm⁻¹ conductivity were recorded at sites D and E. While the average electrical conductivity 0.41%.

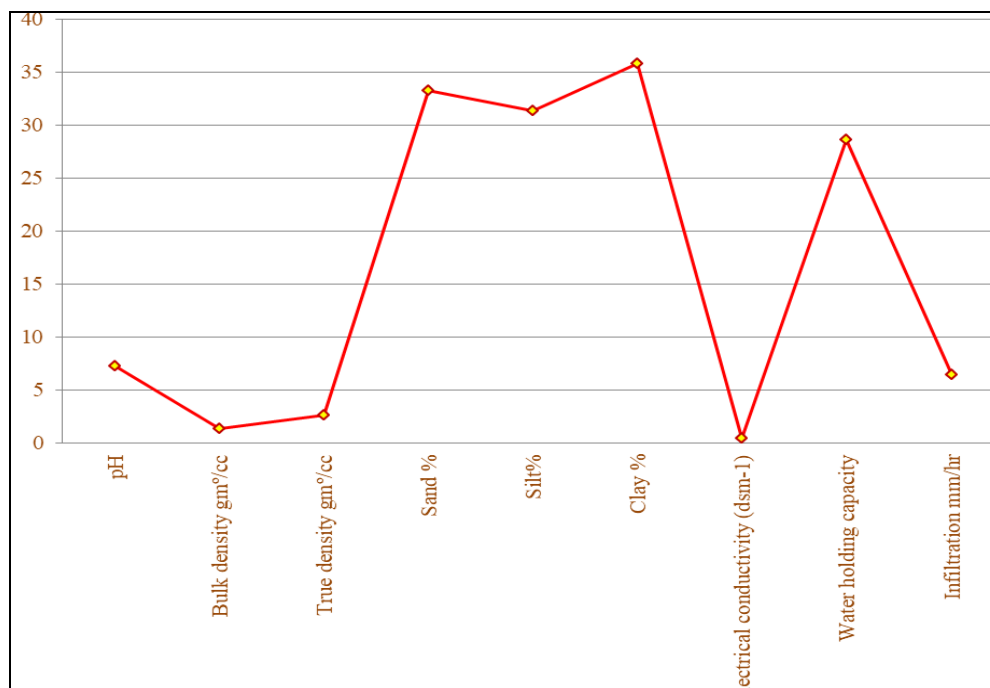


Fig 1: Graphics analysis of average physico-chemical condition of soil analysis of Govindgarh Lake at 5 research stations (2016)

Water Holding Capacity

Water holding capacity (Volumetric) has been measured at the five localities of the lake near research stations at site A 31.0, at site B 29.5, at site C 28.0 at site D 28.5 at site E 26.0, water holding capacity (Volumetric) were found while average W.H.C. 28.6 measured for five research stations.

Infiltration: (mm/hr). The research site of Govindgarh lake at five localities the infiltration of soil was recorded at site A and E 6.0 mm/hr, at site B 6.5 mm/hr, at site C 7.0 mm/hr at site

D, 6.82 mm/hr. Infiltration was found while average infiltration 6.46 mm/hr measured for five research stations.

Qualitative Analysis of Phytoplanktons

Biotic component of this lake includes various phytoplanktons, out of which Chlorophyceae, Bacillariophyceae and Myxophyceae were dominant population. 34 species including 25 genera have been recorded from Govindgarh Lake. The pattern of total phytoplankton and monthly fluctuations at five stations is given in Table 2.

Table 2: Average monthly data of the Phytoplanktons (Units/L) of Govindgarh Lake.

S. No.	Months	Station A	Station B	Station C	Station D	Station E
1.	Jan.	3433	3275	3265	3215	3245
2.	Feb.	4018	3770	3638	3758	3643
3.	Mar.	5228	5310	5328	5160	5325
4.	Apr.	8078	7133	7475	7315	7420
5.	May	3075	2940	2965	3048	3003
6.	Jun.	2963	2393	2567	2490	2438
7.	Jul.	2328	2230	2163	2133	2120
8.	Aug.	1518	1315	1370	1318	1347
9.	Sept.	2973	2945	2995	2900	2868
10.	Oct.	4550	4153	3863	3775	4125
11.	Nov.	7013	6815	6575	6618	6625
12.	Dec.	7290	6825	6438	6463	6555
	Max.	8078	7133	7475	7315	7420
	Min.	1518	1315	1370	1318	1347

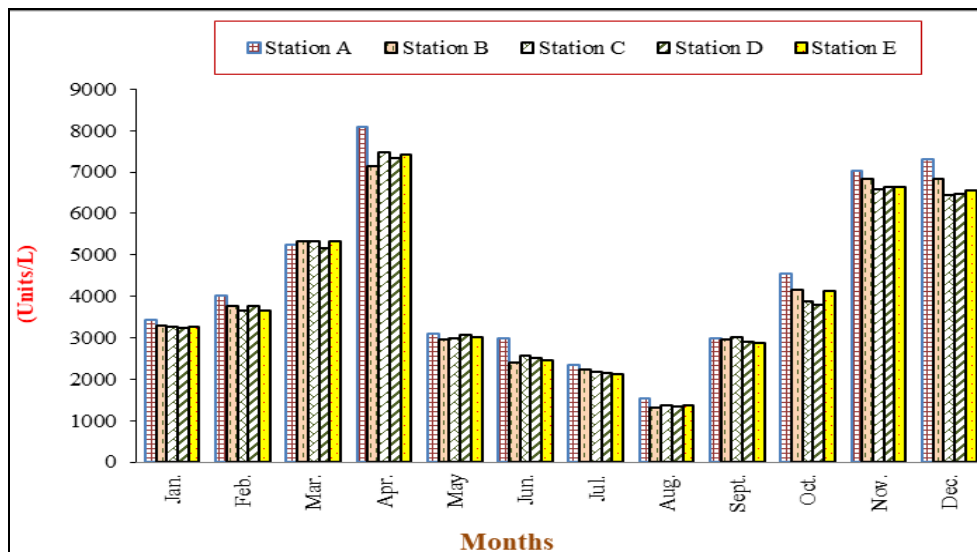


Fig 1: Graphics analysis of average monthly date of the Phytoplanktons (Units/L) of govindgarh Lank.

Maximum density of phytoplanktons (8078 units/L) station A was observed in April in 2016 and minimum (1315 units/L) station B was observed in Aug. 2016 at the surface level. The maximum density of phytoplankton was 8078 units/L (Apr.), 7133 units/L (Apr.), 7475 units/L (Apr.), 7315 units/L (Apr.) and 7420 units/L (Apr.) at the station A, station B, station C, station D and Station E. The minimum density of phytoplankton was 1518 units/L (August), 1315 units/L (August), 1370 units/L (August), 1318 units/L and 1347 units/L (August) at the station A, station B, station C, station D and Station E.

During present investigation it was noted that the total number of phytoplankton was low in summer and monsoon months. This may be attributed to the reason that during summer high (water) temperature, turbidity, fluctuating water level and low nutrient concentration along with consumption of phytoplankton by zooplankton and fishes, resulted in the reduction of phytoplankton population. Low plankton production during monsoon period seems to be due to wavy action of currents, an increase in turbidity and influx of rain water which act as limiting factor for plankton population. Reports of Bhatnagar and Sharma (1977) [14]; Chacko and Krishnamurthy (1954) [15]; Chakraborty, *et al.* (1959) [16]; Goel, *et al.* (1988) [17]; King and Davidson (1933) [18]; Pearsall (1932) [19] and Saran and Adoni (1985) [20] support the above contention.

Table 3: Family wise numerical of genus and species of different phytoplankton are summarised below:

S. No.	Family	Genus	Species
1.	Chlorophyceae	12	12
2.	Desmidiaceae	03	03
3.	Bacillariophyceae	08	08
4.	Euglenophyceae	04	04
5.	Myxophyceae	05	05
Total	05	33	33

A bimodal pattern of phytoplankton fluctuations was observed. Minimum in rainy season may be caused by the

dilution of the nutrients and an increase in turbidity. While the minimum in summers may be due to high temperature.

4. Acknowledgement

The author is greatly indebted to Principal of Govt. Girls P.G. College, Rewa (M.P.) who permitted to carry out this work at the centre.

5. References

1. Millman MC, Cherrier C, Ramstack J. The seasonal succession of the phytoplankton community in Ada Hyden lake, North Basin, Ames, Iowa, Limnology Laboratory, Iowa State University, Ames, Iowa, 2005.
2. Pandey BN, Hussain S, Ambasta OP, Podar SK. Phytoplankton and its correlation with certain physico-chemical parameter of Ramjan river of krishaganj, Bihar, Environment & Ecology. 2004; 22:804-809.
3. Pawar SK, Pulle JS, Shendge KM. The study on Phytoplankton on Pethwaj Dam, Taluda Kankhar, District, Nandenda, Maharashtra, Journal of Aquatic Biology. 2006; 21(1):16-22.
4. Tapashi Guptha, Mithra Day. Plankton composition and water quality in a pond of Lunding, Nagaon, Assam, India, Ecology Environment & Conservation. 2011; 17(3):581-583.
5. Sayeswara HA, Mahesh Anand Goudar, Manjunatha R. Water quality evaluation and Phytoplankton diversity of Hosahalli pond, Shivamogga, Karnataka, India, International Journal of Chemical Sciences. 2011; 9(2):805-815.
6. Vasantha Naik, Nafeesa Begum, Sayeswara HA. Phytoplankton diversity of Ganikere tank, Anandapura, Sagara, Karnataka, India, Asian Journal of Microbiology, Biotechnology and Environmental Science. 2012; 14(3):435-438.
7. Adoni AD. Work book on limnology. Pratibha Publishers, Sagar, 1985, 1-126.
8. APHA. Standard Method for the Examination of Water and Waste Water. 21st Edn., Washington DC, 2005.

9. Needham JG, Needham PR. A guide to the study of fresh water biology. Publishers-Holden-Day, Inc., San Francisco, USA. 1962, 107.
10. Edmondson WT. Freshwater biology. 2nd Ed. John Wiley & Sons, New York, USA, 1992.
11. Reddy YR. Copepoda: Calanoda: Diaptomidae: Guide to the identification of the micro-invertebrates of the continental waters of the world. SPB Publishers, The Hague, Netherland, 1994, 5.
12. Sharma BK. Freshwater Rotifers (Rotifera: Eurotatoria) Zoological Survey of India. State Fauna Series 3, Fauna of West Bengal. 1999; 11:341-468.
13. Dhanapathi MVSSS. Rotifers from Andhra Pradesh, India- III. *Hydrobiologia*. 2003; 48(1):9-16.
14. Bhatnagar GP, Sharma. Primary organic production by phytoplankton community in relation to environmental factors in the sewage polluted lower lake Bhopal. All India Symp. on Envir. Biol. Kerala, 1977.
15. Chacko PI, Krishnamurthy B. On the plankton of three fresh water fish pond in the Madras city (India). Symp. Mar. and Fresh water plankton Indo-pacific Com., Bangkok UNESCO: 1957, 103-107.
16. Chakraborty RD, Ray P, Singh SB. A quantitative study of the plankton and the physico-chemical conditions of the river Jamuna at Allahabad in 1954-55. *Indian J Fish*. 1959; 6(1):186-203.
17. Goel PK, Kulkarni AV, Khatavkar SD. Species diversity in phytoplankton communities in a few freshwater bodies in South-Western Maharashtra. *Geobios*. 1988; 15:150-156.
18. King EJ, Davidson V. The Biochemistry of silicic acid. IV. the relation of silica to the growth of phytoplankton. *Biochem. J*. 1933; 27:1015-1021.
19. Pearsall WH. Phytoplankton in the English lake.II. The composition of the phytoplankton in relation to dissolved substances. *J Ecol*. 1932; 20:241-262.
20. Saran HM, Adoni AD. Limnological studies on seasonal variation in Phytoplanktonic primary productivity. *Proc. Nat. Symp. pure and Appl. Limnology* (ed) Adoni, A.D. *Bull. Bot. Soc, Sagar*. 1985; 32:71-76.