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Assessment of aquatic Phytoplanktons and water quality of Govindgarh Lake in Rewa district, Madhya Pradesh, India

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Abstract
The present study was carried out to document the aquatic and wetland plants of Govindgarh lake in Rewa district of Madhya Pradesh, India. Floristic survey was carried out during 2018-2019. The mean annual density composition of Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae was recorded of 164.24, 174.67, 71.92 and 15.57 (org/L) during first year (2018) and 173.00, 185.25, 72.08 and 17.33 (org/L) during second year (2019) of study period respectively. Bacillariophyceae showed their dominance during both study years showing eutrophic nature of lake water. The collected water samples were analyzed for different Physico-chemical parameters *viz*. pH, electric conductivity, temperature, Odour, CO_2, chloride, Total hardness, calcium, magnesium, DO, BOD and COD. The study reveals that the Govindgarh Lake possesses appreciable quantum of Phytoplankton's, after physicochemical analysis the results were found that the sample of habited water is free from pollution and ecologically balanced. Potable water is safe enough to be consumed by humans and can be used for irrigation and Pisciculture.

Keywords: Phytoplankton, Govindgarh Lake, Physico-chemical

1. Introduction
In aquatic ecosystems, phytoplanktons are the important component which consists of primary producers with photosynthetic activity that constitute the first step in the carbon cycle of water body. Lakes serve as an important life support system by helping in recharging of aquifers and regulating hydrological regimes. Restoration and recharge water table is possible due to the lakes, so the lakes play an important role in our lives. Many workers have studied phytoplanktons of water bodies. Davis (1955) [1] studied the planktons and plankton production. Sharma and Bhatnagar (1977) [2] recorded seasons variations in planktons in Bhopal lake. The lakes also act as natural traps for sediments and nutrients, there by helps to regulate water quality and sedimentation of the river systems from the catchment area. The degradation of the lake is due to encroachment and eutrophication loads and silt (Khare and Jadha, 2008) [3]. Phytoplankton has long been used as indicator of water quality. They flourish both in highly eutrophic waters while a few others are very sensitive to organic and/or chemical wastes. Some species have also been associated with noxious blooms sometimes creating offensive tastes and odours or toxic conditions. They respond quickly to environmental changes, and hence the standing crop and species composition indicate the quality of the water mass in which they are found. Phytoplankton growth is dependent on sunlight and nutrient concentrations. Studies of the ecology of Lake Phytoplankton have provided a wealth of insight into the interactions between abiotic factors and biotic ones such as competition and predation. Growth of phytoplankton is influenced by the presence of limiting nutrient caused by the inflow of fresh water (Sabita, *et al.* 2018) [4]. Some notable studies on phytoplankton diversity have been made (Pandey *et al.* 2017 and Suresh, *et al.* 2013) [5-6]. The quality of water generally refers to the composition of water present at the optimum level for stable growth of plants and animals. Aquatic organisms need a healthy environment to live and adequate nutrients for their growth; the productivity depends on the physicochemical characteristics of the water body (Agbaire and Obi, 2009 and Verrma, *et al.* 2012) [7-8].

The reports on water quality assessment have been recorded (Patil, *et al.* 2012; Shukla, *et al.* 2013; Kumar and Khare, 2015; Pushkar and Gupta, 2019 and Patel & Dubey, 2019a) [9-13]. In the present study Govindgarh lake was surveyed for the phytoplankton for the assessment of biotic potential, which contributes to overall estimation of the basic nature and general economic potential of the water body. A long side analysis of water quality in relation to physicochemical parameters was performed.

2. Materials and Methods

2.1 Study Area: The Govindgarh lake is one of the unique water body in M.P. and located in south of Rewa district at a distance of 20 km. with a longitude 81°15'0" and latitude 24°20'25". It comes under the Rewa district and in Huzur tehsil. 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 1958.

In Govindgarh lake the study sites are (Fig. 1):

1. Station A (Fort at East of the lake)
2. Station B (Khakhari Kothi South)
3. Station C (Gopal Bag at Centre)
4. Station D (Anandgarh Ghat at Centre)

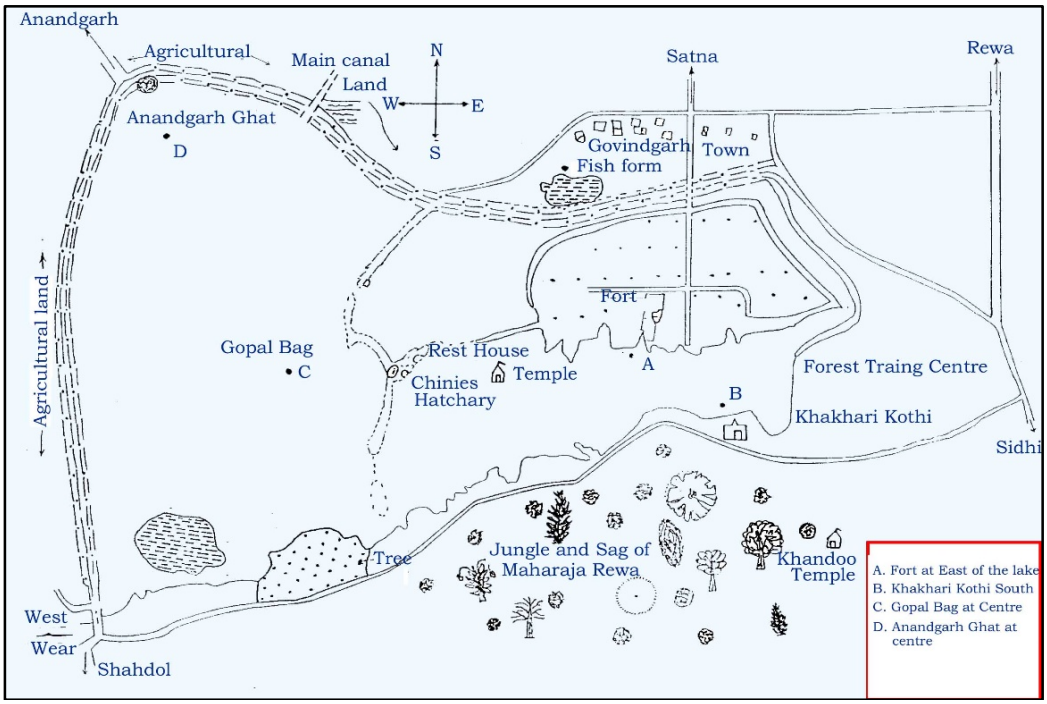

Fig 1: Map of Govindgarh Lake, Rewa (M.P.) showing the different study sites.

2.2 Collection of Water Sample for Phytoplankton Analysis: Plankton samples were collected between 10 am to 12 pm. Collection of phytoplankton samples was made by sieving 25 liters of habitat water from approximately 10-12 cm below the surface level. Four sampling stations were selected to collecting of water sample. Plankton samples were examined under a high-power microscope and identification up to genus and species level was done with the help of standard books and monographs (Kumar and Khare, 2015) [11].

2.3 Collection of Water Sample for Physico-Chemical Analysis: During water quality investigation, 4 sampling sites were outlined and samples were collected in the morning hours between 9 am to 11am. For lake water sample collection, the closed bottle was dipped in the lake at the depth of 0.7 to 0.9 m, and then a bottle was opened inside and was closed again to bring it out at the surface. The samples collected from 4 different points were mixed together to prepare an integrated sample (Mishra, *et al.* 2017) [14]. Chemical parameters were determined by using standard methods immediately after taking them into laboratory (Nagamani, *et al.* 2015) [15]. The collected water samples were analyzed for different physico-chemical parameters (Table 1) *viz.* pH, electric conductivity, temperature, odour CO_2, chloride, Total hardness, calcium, magnesium, DO, BOD, COD, by following the standard protocols (Taylor, *et al.* 2007) [16]. All the above analyses were performed in triplicate.

2.4 Statistical Analysis: The results of the physicochemical evaluation (n=3) were expressed as mean ± standard error mean (SEM).

Table 1: Parameters and methods employed in the chemical examination of water samples

S. No.	Parameters of water analysis	Methods
1.	BOD	Bottle incubation for 3-days at 30°C
2.	Calcium	EDTA Titrimetric
3.	Chloride	Argentometric Titration
4.	CO_2	Titrimetric
5.	COD	Open Reflux
6.	DO	Winkler azide modification titrimetric
7.	Electric conductivity	Conductivity cell potentiometric
8.	Magnesium	Calculation from total hardness and calcium
9.	Odor	Qualitative human receptor
10.	pH	Potentiometric
11.	Temperature	Centigrade thermometer
12.	Total hardness	EDTA Titrimetric

3. Results and Discussion

3.1 Phytoplankton Diversity in Govindgarh Lake

The Phytoplankton community in which, whole populations depends were largely influenced by the seasons. Monthly sampling of phytoplanktons was done at four stations of Govindgarh Lake for two years (2018-2019). Average diversity of each phytoplankton species was determined for winter (November, December, January and February). Summer (March, April, May and June) and rainy (July, August, September and October) seasons from the basic data. In total thirty two species of phytoplankton belonging to four groups were identified, composing 13 species of Chlorophyceae, 11 species of Bacillariophyceae, 6 species of Cyanophyceae and 2 species of Euglenophyceae as given below:

Group 1 Chlorophyceae: *Ankistrodesmus sp., Chlorella vulgaris, Cosmarium sp., Closterium moniferum, Coelastrum sp., Cladophora sp., Crucigenia crucifera, Mougeotia sp., Spirogyra sp., Scenedesmus armatus, Ulothrix sp., Volvox sp., Zygnema sp.*

Group 2 Bacillariophyceae: *Achanthes sp., Cymbella sp., Coconies placentula, Cyclotella sp., Fragillaria sp., Gomphonema sp., Gyrosigma sp., Meridium sp., Nitzschia sp., Synendra ulna, Tabellaria sp.*

Group 3 Cyanophyceae: *Anabaena sp., Merismopedia sp., Microcystis aeruginosa, Nostoc sp., Oscillatoria sp., Spirulina gigantia.*

Group 4 Euglenophyceae: *Euglena sp., Phacus sp.*

Table 2: Number of species and percentage composition of phytoplankton of Govindgarh Lake.

S. No.	Groups	Number of species	Percentage
1.	Chlorophyceae	13	40.6
2.	Bacillariophyceae	11	34.4
3.	Cyanophyceae	6	18.7
4.	Euglenophyceae	2	6.3
	Total	32	100.00

It is evident from the above table that Chlorophyceae forms 40.6%, Bacillariophyceae 34.4%, Cyanophyceae 18.7% and Euglenophyceae 6.3% composition of species during study period.

Table 3 records the mean annual density of phytoplankton observed during study period. Phytoplankton density was slightly higher during second year 2019 (447.76 org/l) in comparison to first year 2018 (427.00 org/l).

Table 3: Mean annual density (org/l) of different phytoplanktonic groups of Govindgarh Lake.

S. No.	Taxonomic group	First year (2018)				
		Winter season	Summer season	Rainy season	Mean annual density	%
1.	Chlorophyceae	197.71	164.0	131.0	164.24	38.50
2.	Bacillariophyceae	203.25	177.50	143.25	174.67	40.95
3.	Cyanophyceae	91.75	68.25	55.75	71.92	16.86
4.	Euglenophyceae	18.75	16.0	12.50	15.75	3.69
	Total	**511.46**	**425.75**	**342.50**	**426.57**	**100.00**
Second year (2019)						
1.	Chlorophyceae	203.00	177.00	139.00	173.00	38.64
2.	Bacillariophyceae	211.25	188.50	156.00	185.25	41.38
3.	Cyanophyceae	86.25	74.25	55.75	72.08	16.11
4.	Euglenophyceae	22.00	18.00	12.00	17.33	3.87
	Total	**522.50**	**457.75**	**362.75**	**447.67**	**100.00**

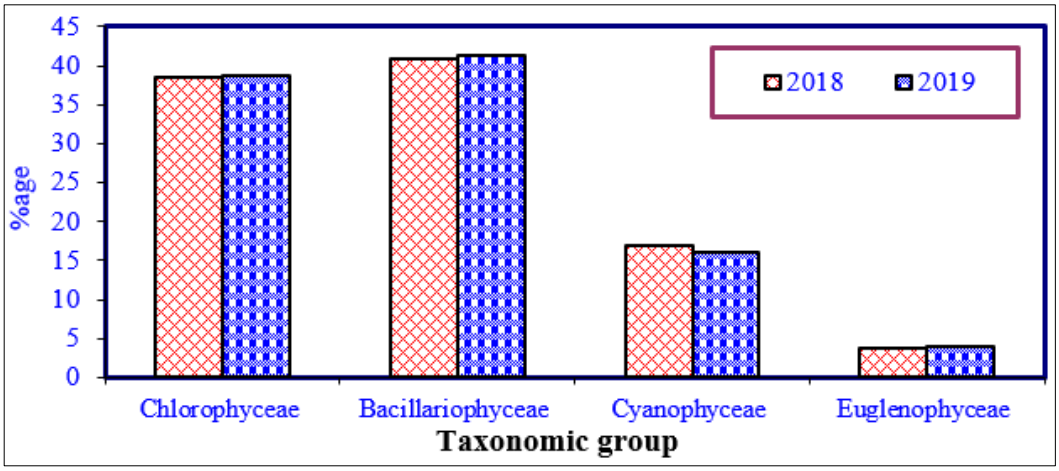

Fig 2: Mean annual density (%) of different phytoplanktonic groups of Govindgarh Lake

The percentage composition of Chlorophyceae, Bacillariophyceae, Cyanophyceae and Euglenophyceae was recorded of 38.50%, 40.95%, 16.86% and 3.69% during first year (2018) and 38.64%, 41.38%, 16.11% and 3.87% during second year (2019) of study period respectively (Fig. 2). Bacillariophyceae showed their dominance during both study years showing eutrophic nature of lake water Several researchers have proposed temperature as a vital factor responsible for the growth of algae (Ramkrishnaiah and Sarkar, 1982; Verma and Datta 1987; Bohra and Kumar, 1999 and Patel and Dubey, 2019a) [17-19, 13].

3.2 Physico-Chemical Analysis of Water Samples

The temperature of the water samples was taken on the spot in January, 2019. Among the samples taken from the different place's temperature ranged from 28.1 ± 1.11°C. The pH value of the water samples was tested in the laboratory using electric pH meter (EQ 610), in which pH was recorded to be 8.5 ± 2.07, slightly acidic. Physical parameters like odour test, were agreeable in Govindgarh lake. The electric conductivity of the water samples was tested in the laboratory using electric conductivity meter (EQ 664A). The results reflect that the mean conductivity was 325± 0.14 µhos/cm. Inorganic Chemical parameters like Calcium, Magnesium, total hardness, chlorides showed 144.6±2.06 mg/L, 27.4± 2.33 mg/L, 171.8± 2.06mg/L, 27.3±1.55mg/L respectively. Organic nutrients like Carbon dioxide (CO_2), Dissolved oxygen (DO), Biological oxygen demand (BOD), Chemical oxygen demand (COD) showed 3.26±1.09 mg/L, 9.6± 1.53mg/L, 8.2 ± 1.26mg/L and 21.4±3.07mg/L respectively (Table 4).

Table 4: Physico-chemical parameters of water samples in the Govindgarh lake of Rewa district of Madhya Pradesh, India

S. No.	Parameters of water analysis	Results
1.	BOD	8.2±1.26 mg/L
2.	Calcium	144.6±2.04 mg/L
3.	Chloride	27.3±1.55 mg/L
4.	CO_2	3.26±1.09 mg/L
5.	COD	21.4±3.07 mg/L
6.	DO	9.6±1.53 mg/L
7.	Electric conductivity	325±0.14 µhos/cm
8.	Magnesium	27.4±2.33 mg/L
9.	Odour	Agreeable
10.	pH	8.5±2.07
11.	Temperature	28.1±1.11 °C
12.	Total hardness	171.8±2.06 mg/L

The presence of phytoplankton in freshwater bodies is a widely accepted indicator of water quality. Identification of the algal species, the knowledge of the algal cell number, or the physiological state of cells may also be important in providing a true picture of the water quality or trophic state (Sudeep, *et al.* 2008) [20]. Physico-chemical parameter study is very important to get exact idea about the quality of water and we have compared results of different physico-chemical parameter values with standard values (Patil, *et al.* 2012) [9]. Some physical test was performed for testing of its physical appearance such as temperature, color, odour, pH, turbidity, TDS etc., while chemical tests were performed for its BOD, COD, dissolved oxygen, hardness and other characters. Studies on the bionomics of freshwaters in India, I seasonal changes in the physical and chemical conditions of water of the tank in Indian Museum compound Purthy (1933) [21].

4. Conclusion

Data provided in the study may be helpful for the preparation of comprehensive flora of the Rewa district and can also contribute to the floristic documentation of the district. Efforts to conserve biodiversity and preserve traditional food systems need to be combined and enhanced. As the results obtained during the study of water analysis was compared with ISI standards. Potable water is safe enough to be consumed by humans or used with low risk of immediate or long-term harm. Habited water is generally used by animals, birds and aquatic life. The disturbance in this biological system and ecological system may affect health of living organisms.

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6. References

1. Davis GL. The marine and fresh water plankton in Michigan state university press, East Lansing 1955.
2. Sharma GP, Bhatnagar GP. Seasonal variations in plankton biomass or organic matter in Bhopal lake. India J Zool. Soc. Ind 1977;29:31-44.
3. Khare KC, Jadha MS. Water quality assessment of Katraj lake, Pune (Maharashtra, India): A case study. The 12th world lake conference 2008, 292-299.
4. Sabita KP, Gayathri S, Ramachandra MM. Phytoplankton diversity in Bangalore lakes, importance of climate change and nature's benefits to people. Journal of ecology and natural resources 2018;2(1):1-7.
5. Pandey LK, Bergey EA, Lyu J, Park J, Choi S, Lee H *et al*. The use of diatoms in ecotoxicology and bioassessment: Insights, advances and challenges. Water research 2017;118(1):39-58.
6. Suresh B, Manjappa S, Puttaiah ET. Dynamics of phytoplankton succession in Tungabhadra river near Harihar, Karnataka, India. Journal of microbiology and antimicrobials 2013;5(7):65-71.
7. Agbaire PO, Obi CG. Seasonal Variation of some physico-chemical properties of River Ethiope water in Abraka, Nigeria. Journal of Applied Sciences and Environmental Management 2009;13:55-57.
8. Verma P, Chandawat D, Gupta U, Solanki HA. Water quality analysis of an organically polluted lake by investigating different physical and chemical parameters. International Journal of Research in Chemistry and Environment 2012;2:105-112.
9. Patil PN, Sawant DV, Deshmukh RN. Physico-chemical parameters for testing of water – A review. International Journal of Environmental Sciences 2012;3(3):1194-1207.
10. Shukla D, Bhadresha K, Jain NK, Modi HA. Physicochemical analysis of water from various sources and their comparative studies. IOSR Journal of environmental science, toxicology and food technology 2013;5(3):89-92.
11. Kumar M, Khare PK. Diversity of plankton and their seasonal variation of density in the Yamuna River at Kalpi, district Jalaun (U.P.) India. Journal of global bioscience 2015;4(7):2720-2729.
12. Pushkar, Virendra Kumar, Gupta, Shobha. Physico-chemical analysis of drinking water around Mauganj blocks of Rewa district (M.P.) (India), International Journal of Humanities and Social Science Research 2019;5(3):75-78.
13. Patel, Karuna, Dubey, Sanjeev. Physico chemical analysis and role of Phytoplanktons in Govindgarh Lake, European Journal of Biotechnology and Bioscience 2019a;7(2):79-81.
14. Mishra GS, James A, Paliwal HB, Kumar H. Physico-chemical, biological properties and biodiversity of

aquatic plant species in Macferson lake Allahabad, U.P. India. Current world environment 2017;12(3):630-634.
15. Nagamani C, Saraswathidevi C, Shalini A. Physico-chemical analysis of water samples. International journal of scientific and engineering research 2015;6(1):2149-2155.
16. Taylor JC, Harding WR, Archibald CGM. An illustrated guide to some common diatom species from South Africa. Water research commission project 2007, 1-224.
17. Ramkrishnaiah M, Sarkar SK. Plankton productivity in relation to certain hydrological factor in Konar reservoir (Bihar) J Inland Fish Soc. India 1982;14:58-68.
18. Verma PK, Datta JS, Munshi. Plankton community structure of Bandra reservoir, Bhagalpur, Tropic Ecol 1987;28:200-207.
19. Bohra C, Kumar A. Comparative studies of phytoplankton in two ecologically different lentic freshwater ecosystem. Modern trend in environmental pollution and eco-planning (Ed. A. Kumar) ABP Publisher, Jaipur 1999, 220-242.
20. Sudeep BM, Srikantaswamy S, Hosmani SP. The Study of Phytoplankton Dynamics in Two Lakes of Mysore, Karnataka State, India. Nature Environment and Pollution Technology 2008;7(4):697-702.
21. Purthy HS. Studies on the bionomics of freshwaters in India, I seasonal changes in the physical and chemical conditions of water of the tank in Indian Museum compound. Int. Rev. Hydrobiol 1933;28:46-67.