ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 8.4
IJAR 2023; 9(1): 37-40
www.allresearchjournal.com
Received: 18-10-2022
Accepted: 20-12-2022

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Limnological studies of Bansagar dam of Vindhya region (M.P.) in relation to planktons

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Abstract
Limnological study is one of the most important parameter to assess the water quality of a water body. In this study authors tried to assess the seasonal variations in physico-chemical properties of water and plankton diversity during one year (July, 2020 - June, 2021) of a perennial dam of Bansagar of Madhya Pradesh. A significant level of variation was found in respect to these parameters throughout the study period. The planktonic populations in the pond indicates that the water of this dam is not yet seriously polluted since it contains freshwater algae *Chara* and *Nitella* and phytoplankton *Volvex* in the central region of dam. During the present study, presence of *Chlorella, Oscillatoria, Anacystis, Scenedesmus, Branchionus, Keratella* and *Cyclops* is considered as indicator of organic pollution, because all these genera were collected from polluted marginal water.

Keywords: Water quality, plankton, Bansagar dam

Introduction
Phytoplankton forms the vital source of energy in the aquatic environment. They initiate the food chain, by serving as food to primary consumers, which include zooplankton, fish and others. Phytoplankton is the primary producers and constitutes the first level in aquatic food chain for all aquatic animals. Aquatic ecosystem harbours a variety of communities, which constitute the functioning of the ecosystem in terms of maintaining production and food chain. The density and diversity of phytoplankton also help to determine the trophic status and water quality of a fresh water body. The seasonal variation of phytoplankton in water body has been studied by different scientists including Prakash *et al*., (2015a) [1] and Verma *et al*., (2016a) [2]. Numbers of studies have been carried out on limnological condition of freshwater bodies in various regions of India including Prakash *et al*., (2015b) [3], Verma (2016a and 2019a) [2, 4], Mishra (2022b) [5].

Dam water is beneficial for agriculture since but the unsustainable farming has multiple effects (Verma, 2017a) [6] and disturbs the ecological balance (Verma 2018a) [7]. Aquatic ecosystem maintains the ecological, social and economic functions that interconnect the organisms including humans. It is helpful in maintaining the biodiversity. The biodiversity has values (Verma 2016b) [8] and explored at three levels namely: ecosystem diversity, species diversity and genetic diversity. The genetic diversity acts as a buffer for biodiversity (Verma, 2017b) [9]. The biodiversity helps to maintain the ecological balance. There is a necessity of ecological balance for widespread biodiversity (Verma 2017c) [10] and the biodiversity loss has ecological impact (Kumar Ajay *et al*., 2017) [11]. The ecological balance is must for human survival (Mishra and Singh, 2022a) [12]. The climate change has a huge impact on biodiversity (Shukla & Shukla, 2022) [13] and farmers' practices (Mandal *et al*., 2020) [14].

The Bansagar Dam is one of the biggest and longest Dams, district Shahdol in Central India, covers three different states like Madhya Pradesh, Uttar Pradesh and Bihar. Bansagar or Ban Sagar Dam is a multipurpose river valley built on Sone River situated in the Basin of Ganges in Madhya Pradesh, India envisaging irrigation, fisheries and hydroelectric power generation. The Bansagar Dam built across the Sone River has been constructed at village Deolond in Shahdol district on the Rewa – Shahdol road, at a distance of 51.4 KM away from Rewa. The project has been started with named as 'Bansagar" after Bana Bhatt, the renowned Sanskrit Scholar of 7th Century, who is believed to have hailed from this region in India. Bansagar Dam is located with Latitude 24-11-30 N and Longitude 81-17-15E.

The present study is an effective attempt to assess the seasonal variations in physico-chemical properties of water and plankton diversity during one year (July, 2020 - June, 2021) of a perennial dam of Bansagar of Vindhya region of Madhya Pradesh.

Materials and Methods

Monthly sampling of water of the dam was done from July, 2020 to June, 2021. Observations were made for water temperature and pH at the site, while for rest of the parameters analysis was made in the laboratory as per standard procedures of APHA (2005)[15]. Planktonic flora and fauna were collected from marginal and center of dam using plankton net following standard procedures, and later identified in the laboratory. Plankton were identified with the help of a book entitled "A guide to the study of fresh water biology" written by Needham & Needham (1962) [16] and other standard literature.

Results and Discussion

The results of the study are given in table 1 and 2. It is a well-known fact that physico-chemical characteristics of the water play an important role in determining the status of the aquatic ecosystems. Climatic conditions of the area also influence these parameters to great extent.

Table 1: Seasonal Variation of physico-chemical parameters of Pond water and comparison with acceptable range of BD (Bhatnagar and Devi, 2013) [17].

Parameters	Summer	Rainy	Winter	Acceptable Range BD
Temperature (°C)	29.2-35.4	33.5-28.4	19.6-23.5	15-35
pH	7.7-8.1	7.2-7.7	7.5-7.9	7.0-9.5
Dissolved Oxygen (mg/l)	2.5-4.9	3.8-6.4	3.8-5.7	3.0-5.0
Free CO_2 (mg/l)	40.2-52.4	35.4-40.0	33.2-34.4	-
Total Alkalinity (mg/l)	125-155	120-150	122-175	50-200
Chloride (mg/l)	75-150	58-105	54-95	0-100
Phosphate (mg/l)	3.0-4.0	2.5-3.9	2.5-3.8	0.03-2.0
Nitrate (mg/l)	1.8-3.0	1.7-3.2	1.8-2.8	0-100

The water temperature varied from 19.6 to 35.4 ºC, showing maximum range in summer and minimum in winter. This variation of water temperature was directly related to atmospheric temperature having more effect directly or indirectly on all life processes (Welch, 1952) [18]. The pH of the water ranged from 7.2 to 8.6, showing alkaline nature. The alkaline pH is a usual feature of productive water bodies as reported earlier by Ayappaan and Gupta (1981) [19] and Tiwari and Sandya (2022b) [20].

Dissolved oxygen of any water body is an important parameter because it is an indicator biological productivity of taal. The oxygen concentration in water body is a function of the temperature as well as the photosynthesis and community respiration. Dissolved oxygen concentration showed variation between 2.5 mg/L and 6.4mg/L, the higher values being noted in post winter months due to high photosynthetic activity (Alam, 2001 and Kashyap, 2016) [21-22].

Free carbon dioxide in a water body is generally derived from the atmospheric sources, biotic respiration and decomposition of organic matter by saprophytes. The free carbon dioxide was ranged from 33.2-52.4 mg/L with maximum value in summer and minimum in winter season. The present finding is similar to that of Mishra and Singh (2022b) [5].

Carbonate alkalinity of the pond was absent throughout the study period. The total alkalinity was mainly due to bicarbonates which varied from 120.0mg/L to 175.0mg/L, showing minimum range in post monsoon and maximum in summer months. The present finding of high alkalinity value is due to influx of domestic sewage rich in alkalinity causing chemicals such as soap and detergents and also due to presence of bicarbonate system and high value of pH in alkaline side (David *et al*., 1969, Rana, 2016) [23-24] showing that the pond is of productive nature.

The level of chlorides varied from 54.0-150.0 mg/L. As reported by Bhaskaran (1977) [25] this chloride level is harmful to aquatic life. Singh (1983) [26] suggested that high chloride content of water is an indication of pollution of animal origin.

Phosphate is considered as the most critical nutrient substance in the maintenance of aquatic productivity. They are essential for the growth of organisms and a nutrient that limits the primary productivity of the water body. The level of phosphate varied from 2.5-4.0 mg/L with maximum value in summer and minimum in winter season. Low phosphate contents during winter months and high during summer or post monsoon months may be due to low decomposition of organic matters during summer seasons (Kashyap, 2016 and Rana, 2016) [22, 24].

The most chemically stable available form of nitrogen is nitrate. High nitrate concentration is responsible for algal blooms in water body. Surface runoff, decayed vegetations and animal matter are the main sources of nitrates in water body. The level of nitrate varied from 1.7-3.2 mg/L with maximum value in summer and minimum in winter season. The result is supported by the findings of Khan *et al.* (1986) [27]. In the present study except chloride, all the physico-chemical parameters were optimum for fish productivity as reported by Bhatnagar and Devi (2013) [17] and Kashyap (2016) [22].

Table 2: Seasonal Variation of Phytoplankton in the dam studied.

S. No.	Phytoplankton	Summer	Rainy	Winter
A	**Chlorophyceae**			
1	*Chlamydomonas* sp.	-	-	+
2	*Pandoria* sp.	+	+	+
3	*Gonium* sp.	+	+	+
4	*Volvox* sp.	+	+	+
5	*Oedogonium* sp.	+	+	+
6	*Chlorococcum* sp.	+	+	-
7	*Sirogyra* sp.	-	-	+
8	*Closterium* sp.	+	+	+
9	*Chara* sp.	+	-	+
10	*Nitella* sp	+	-	+
B	**Cyanophyceae**			
11	*Microcystis* sp.	+	+	_
12	*Scytonems* sp.	+	+	+
13	*Oscillatoria* sp.	+	+	+
14.	*Spirulina* sp.	+	-	-
15.	*Gloecapsa* sp.	-	+	-
16	*Anacystis* sp.	+	+	-
C	**Euglenophyceae**			
17	*Euglena* sp.	+	-	+
18	*Phacus* sp.	+	-	+
D	**Bacillariophyceae**			
19	*Diatoma* sp.	+	+	-
20	*Cymbella* sp.	-	-	+
21	*Frustulia* sp.	-	-	+
22	*Navicula* sp.	-	-	+
23	*Nitzschiasp*.sp.	+	-	+
24	*Fragilaria* sp.	-	-	+
25.	*Synedra ulna*	+	-	+

In the present study, twenty five genera of phytoplankton were found. Of these 10 belong to Chlorophyceae (*Chlamydomonas, Pandoria, Gonium, Volvox, Oedogonium Chlorococcum, Sirogyra, Closterium, Chara and Nitella sp*); 6 to Cyanophyceae (*Microcystis, Scytonems, Oscillatoria, Spirulina, Gloecapsa* and *Anacystis sp*); 2 to Euglenophyceae (*Euglena* and *Phacus*) and 7 to Bacillariophyceae (*Diatoma, Cymbella, Frustulia, Navicula, Nitzschiasp, Fragilaria* and *Synedra*).

The results for phytoplankton populations in the dam indicates that the water of this dam is not yet seriously polluted since it contains freshwater algae *Chara* and *Nitella* and phytoplankton *Volvex* in the central region of dam. Most other plankton also comprised of non-indicator organisms. During the present study, presence of *Chlorella, Oscillatoria, Anacystis, Scenedesmus, Branchionus, Keratella* and *Cyclops* is considered as indicator of organic pollution, because all these genera were collected from polluted marginal water.

During the field survey various type of macrophytes, *e.g.* emergent (*Ipomoea* sp.), rooted submerged (*Hydrilla* sp.), free submerged (*Ceratophylum* sp.) and free floating (*Eichhornia* sp., *Lemna* sp., *Pistia* sp., and *Azolla* sp.), have been observed. Maximum macrophytes were found in the margin of the pond due to efficient and adequate nutrients coming from different sources. The presence of *Lemna sp*. and *Eichhornia sp*. also indicates the pollution load in dam.

Acknowledgement

Authors are thankful to the authority of Govt. Girls P.G. College, Rewa (M.P.) to carryout to this work.

References

1. Prakash S, Verma AK, Prakash S. Seasonal variation of Zooplankton and Zoobenthos Population in Alwara lake of District Kaushambi (UP) India. The Journal of Zoology Studies. 2015a;2(5):13-16.
2. Verma AK. Hydrobiological Studies of Muntjibpur Pond of Allahabad (U.P.). International Journal on Agricultural Sciences. 2016a;7(2):164-166.
3. Prakash S, Verma AK, Prakash S. Limnological Studies of Alwara Lake of Kaushambi (U.P.). International Journal on Biological Sciences. 2015b;6(2):141-144.
4. Verma AK. Studies of Hydrobiological Properties of Balapur Pond of Prayagraj (U.P.). Hortflora Research Spectrum. 2019a;8(1):9-11.
5. Mishra, Reenu, Singh, Neeta. Assessment of water quality status of major aquatic bodies of Vindhyan region (M.P.) India, International Journal of Advanced Academic Studies. 2022b;4(3):18-22.
6. Verma AK. Multiple effects of Unsustainable Agriculture. International Journal on Agricultural Sciences. 2017a;8(1):24-26.
7. Verma AK. Unsustainable Agriculture, Environmental Ethics and Ecological Balance. Hort Flora Research Spectrum. 2018a;7(3):239-241.
8. Verma AK. Biodiversity: Its Different Levels and Values. International Journal on Environmental Sciences. 2016b;7(2):143-145.
9. Verma AK. Genetic Diversity as Buffer in Biodiversity. Indian Journal of Biology. 2017b;4(1):61-63.
10. Verma AK. Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 2017c;4(2):158-160.
11. Kumar, Ajay, Verma AK. Biodiversity loss and its Ecological impact in India. International Journal on Biological Sciences. 2017;8(2):156-160.
12. Mishra, Reenu, Singh, Neeta. Hydrophytic plant diversity of aquatic body of Govindgarh lake in Rewa district (M.P.) India, International Journal of Applied Research. 2022a;8(7):08-11.
13. Shukla, Bramhanand, Shukla, Nidhi. Physicochemical analysis of Mohan Ram Talab of Shahdol (M.P.), International Journal of Advanced Academic Studies. 2022;4(3):189-191.
14. Mandal AC, Singh OP. Climate Change and Practices of Farmers' to maintain rice yield: A case study. International Journal of Biological Innovations. 2020;2(1):42-51.
15. APHA Standard methods for Examination of water and waste water. American Public Health Association 21st Ed. APHA, New York; c2005.
16. Needham JJ, Needham PR. A Guide to the study of freshwater Biology, Charles Cthomas Publisher, USA; c1962.
17. Bhatnagar A, Devi P. Water quality Guidance for the management of Pond fish culture. Int. J Environ. Sci. 2013;3(6):1980-1993.
18. Welch PS. Limnology. McGraw Hill Book Co., N.Y; c1952. p. 538.
19. Ayappan S, Gupta TRC. Limnology of Ramasamudra Tank-Hydrograph, Mysore. J Aqric. Sc. 1981;15:305-312.
20. Tiwari, Supriya, Sandya, Kumud. Water quality assessment of Ghunghuta Dam, Surguja (CG), India, International Journal of Advanced Academic Studies. 2022b;4(3):105-108.
21. Alam MN. Studies on variations in the physic-chemical parameters of a pond at Hathwa (Bihar). Journal of Environment & Pollution. 2001;8(2):179-181.

22. 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.
23. David A, Rao GNS, Rahman FA. Limnology and Fisheries of Tungbhadra Reservoir. Bull. Central Inland Fisheries Research Institute, Barrakpore, Mimeo. 1969;13:188.
24. Rana, Phul Kunwar Singh. Physico-chemical study of Mohan Ram Lake Shahdol (M.P.). International Journal of Applied Research. 2016;2(1):239-241.
25. Bhaskaran RR. Treatment and disposal of tannery effluents. Geo Miller and Co. Pvt Ltd. New Delhi; c1977.
26. Singh SR. Observations on the seasonal variation in the water quality of Dah Lake (Ballia). Proc. Nat. Acad. Sci. India. 1983;53(B):142-149.
27. Khan E, Kaiser UM, Habib MAB, Hasan MR. Interrelations and interrelations and interrelations of some water characteristics of a farm pond and meteorological factor. Bangladesh, J Agric. 1986;11(4):35-40.