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LIMNOLOGICAL STUDIES OF BABRIYA POND SEONI (M.P.)

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ABSTRACT:

Limnology is the study of the physical, chemical, geological and biological aspects of all naturally occurring fresh water. Freshwater habitats such as lakes, ponds, dams, reservoirs are known as lentic (still) while running water such as rivers, mountain streams are known as lotic (flowing). Physiochemical parameters and biological together can give better picture of any wetland ecosystem. The major objective of this study was to assess the water quality of Babriya Pond and its impact on structure and function of aquatic ecosystem. But this study was focused particularly on identification of the biological indicator of water pollution especially benthic macro-invertebrates along with physiochemical parameters. The water samples and bottom sediments were collected from upstream and downstream courses of Babriya pond from in June 2022 to May 2023 and analysed in the laboratory. The values of physiochemical parameters were significantly different except temperature between upstream and downstream courses of river. The water was found more polluted at various sampling station of Babriya Pond.



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KEYWORDS: *Limnology, discharge, Physiochemical parameters.*

INTRODUCTION:

Water quality monitoring is an important exercise, which helps in evaluating the nature and extent of pollution as well as effectiveness of pollution control measures. It also helps in determining the water quality trends and prioritizing pollution control effort. Water quality are those physical, chemical and biological factors that influence species composition, diversity, stability, production and physiological conditions of indigenous populations of a water body (Boyd 1982).

India is rich in water resources, being endowed with a network of rivers and blessed with snow cover in the Himalayan range that can meet a variety of water requirements of the country. However, with the rapid increase in the population of the country and the need to meet the increasing demands of irrigation, human and industrial consumption, the available water resources in many parts of the country are getting depleted and the water quality has deteriorated. Indian rivers are polluted due to the discharge of untreated sewage and industrial effluents (Bhardwaj 2005).

Water quality refers to the ability of our water resources to support human, animal, and plant life. Good water quality is necessary for providing us with drinking water that is safe and clean; for providing habitat for aquatic bugs, plants, and animals; for providing recreational opportunities like wading, swimming, and fishing; and for providing a place for us to connect with nature. The quality of water is of vital concern for mankind since it is directly linked with human welfare. In fact, pollution is the result of anthropogenic activities, which has adverse impact on mankind. Water is regarded as

polluted when it is changed in its quality or composition, directly or indirectly as a result of human activities. Consequently, it becomes less suitable for human consumption.

This study investigates the relation between physico-chemical parameters. Due to the role of stratification in pond function and decomposition to provide internal nutrient, vertical survey is also important in tropical reservoir. Therefore the objectives of this study are:

1. To determine physico-chemical parameters and their temporal and spatial fluctuation.
2. To study of physico-chemical parameters.
3. To determine the status of water quality of the pond based on physico-chemical parameters.

MATERIALS AND METHODS

Study Area

The Babriya pond in district Seoni. It is situated 22.08°N 79.53°E. It has an average elevation of 611 meters (2004 feet). The city is 2,043 ft. above sea-level, half-way between Nagpur and Jabalpur. It is bordered by Jabalpur, Narsinghpur and Mandla districts to the north, Balaghat to the east and Chhindwara to the west and the shares its southern boundary with Nagpur (Maharashtra). National Highway No. 7 connects the Kanyakumari-Banaras passes through the district from north to south. Fair weather roads connect the major towns in the district. The narrow-gauge Chhindwara- Nainpur Central Railway passes through Seoni connecting Jabalpur, Nagpur, Chhindwara, Balaghat, Katangi, Keolari and Nainpur Prateet.



A View of Babriya Talab Seoni M.P.

WATER ANALYSIS

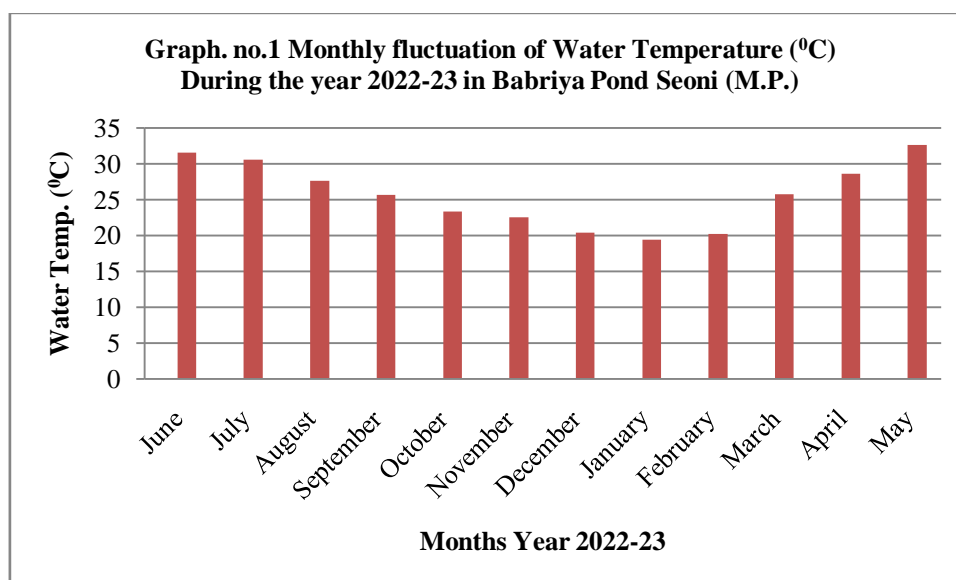
The water samples were collected from the four selected sampling stations viz., Sampling Station A, Sampling Station B, Sampling Station C, Sampling Station D and Sampling Station E in the Babriya Pond for the period of two year from May 2022 to June 2023. In the analysis of the physico-chemical properties of water, standard method prescribed in limnological literature were used. Temperature, pH, Transparency and Dissolved Oxygen were determined at the site while other parameters like Biochemical oxygen demand, Total Hardness, Alkalinity, Chloride, Nitrate and Phosphate were determined in the laboratory. The Physico- Chemical parameters were determined by standard methods of Golterman (1978), Welch (1998), APHA (2005). To analyse other physiochemical parameters, water samples were collected in clean plastic bottles. Details including sampling site, date and time of sample collection were written in sampling bottles.

RESULT AND DISCUSSION-

The results of the study are given in table1. 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.

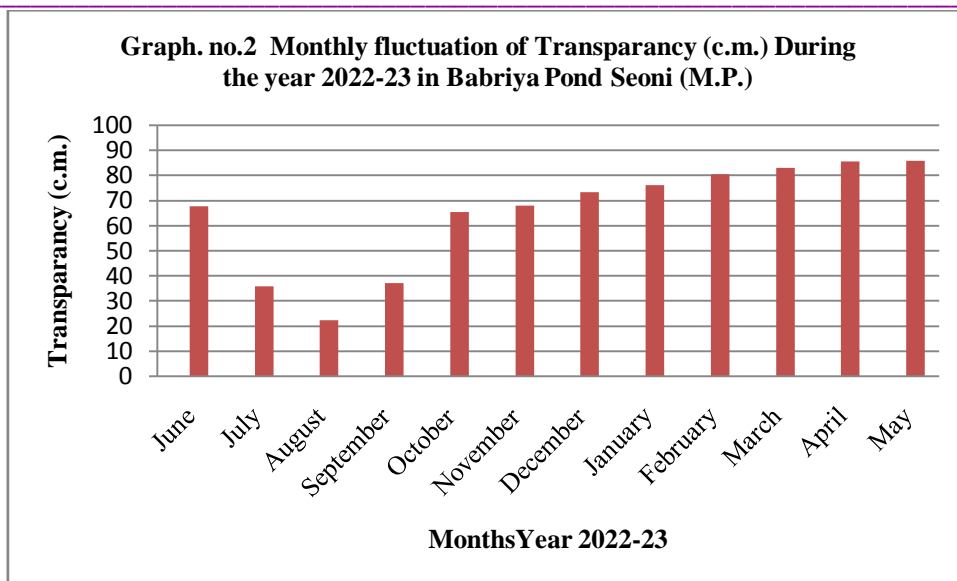
WATER TEMPERATURE

Water temperature is an important parameter because it not only influences the physical and chemical characteristics of water but also the biota in a water body by affecting activities such as behaviour, respiration and metabolism. The water temperature varied from $19.4\text{ }^{\circ}\text{C}\pm 0.16$ to $32.56\text{ }^{\circ}\text{C}\pm 0.11$, showing maximum range in summer and minimum in winter (Table no1 & graph 1. This variation of water temperature was directly related to atmospheric temperature having more effect directly or indirectly on all life processes (Welch, 1952). Almost similar results have also been reported by Narayana *et al.*, (2008), Jawale (2009) and Prakash *et al* (2015a). Jain and Sharma (2001), Baghel R.K.(2017), Yogesh and Pendse (2001) also reported the same type of fluctuation in various freshwater bodies. Based on the results it was noted that Jayalakshmi *et al.*, 2011 observe the temperature at Vijaywada Andhara padesh, fluctuated in between $22\text{ }^{\circ}\text{C}$ to $34\text{ }^{\circ}\text{C}$. Pir *et al.*, 2012 was obtained water temperature ranged from $20\text{ }^{\circ}\text{C}$ to $33\text{ }^{\circ}\text{C}$ on Narmada River. Efe Ogidiaka 2012 Temperature recorded of Ogunpa River at Bodija, Ibadan, and Oyo state mean value $20.95\text{ }^{\circ}\text{C}$ to $24.9\text{ }^{\circ}\text{C}$.



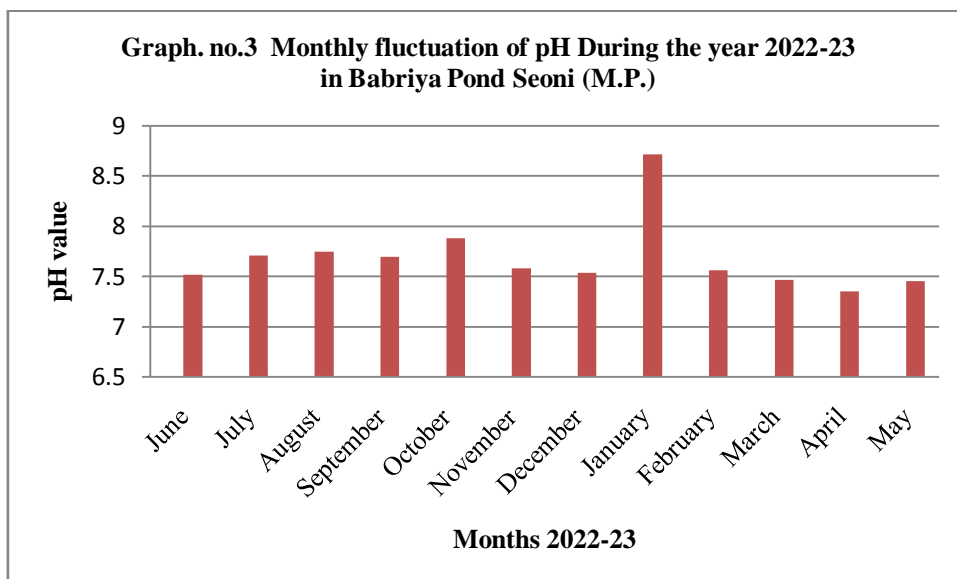
Transparency

Transparency is a characteristic of water that varies with the combined effect of colour and turbidity. It measures the depth to which light penetrates in the water body. Transparency of the surface water is often an important limiting factor in the development and distribution of plant and animal life in fresh waters. In the present study Transparency fluctuated from 22.26 ± 5.26 c.m. to 85.88 ± 1.49 c.m (table no.1 & graph 2). Similar results show Sharma *et al.*, 2008 in Ningland stream; Shittu *et al.*, 2008 in Abeouta Nigeria; Kudthalang and Thane (2010) in the upper part of the Chi Basin. This investigation is also close conformity with finding of Prakash *et al* (2015a). Sharma and Chowdhary (2011) observed transparency variation between 12.5 to 40.75 cm. in river Tawi of Jammu and Kashmir.



pH

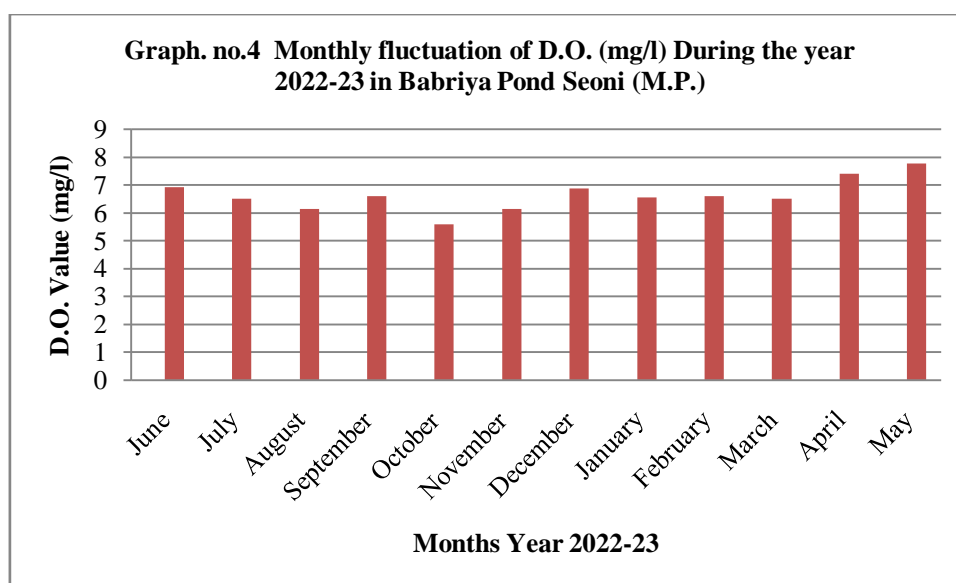
The pH is a measure of the acidity or alkalinity of an aqueous solution. Its different values at different areas in all the three seasons of the year were significant. The variation in pH is due to the presence or absence of free carbon dioxide, carbonate and planktonic density. The pH of the water ranged from 7.34 ± 0.19 to 8.71 ± 0.16 , showing alkaline nature (Table no.1 & Graph No.3). The alkaline pH is a usual feature of productive water bodies as reported earlier by Ayappaan and Gupta (1981). The pH of fresh water body is in accordance with the findings of Ghose and Sharma (1988) and Singh and Ray (1995). Sharma and Chowdhary (2011) observed pH variation between 6.8 to 9.4 mg/l in river Tawi of Jammu and Kashmir. Aweng *et al.*, (2011) observed pH variation between 5.48 to 7.49 mg/l. in Madak river Kluang Johor, Malaysia. Balachandran *et al.*, (2012) observed the value of pH ranged between 7.1 to to 9.05 in Banglore Lake at Karnataka.



Dissolved oxygen

Dissolved oxygen of water is an important test to study the quality of water. Its optimum value for good quality water has been 4 to 6 mg/l of DO which is able to maintain aquatic life in a water body.

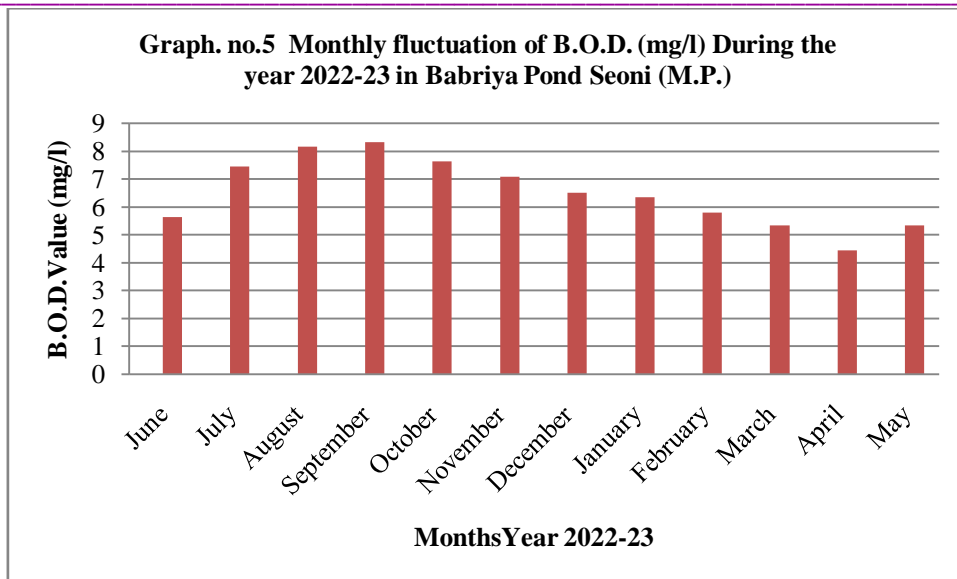
If DO values are somewhat lower than this value this indicates water pollution. Dissolved oxygen is an important parameter indicating all sorts of organic pollution and purity of water for intended use. In general, dissolved oxygen showed variation from 5.58 ± 0.25 to 7.76 ± 0.11 mg/l (Table no.1 & Graph 4). The seasonal variation of DO in water depends upon the temperature of the water body which influences the oxygen solubility in water. The dissolved oxygen (DO) is one of the most important and limiting parameter of water quality assessment, which maintains aquatic life. It regulates the metabolic process of aquatic organisms. The maximum dissolved oxygen was recorded in winter and minimum dissolved oxygen was recorded in the summer season. The highest dissolved oxygen in winter may be due to low temperature and minimum dissolved oxygen in summer may be due to high metabolic rate of organisms. This present result was in conformity with Mohan *et al.*, 2013 in River Tawi in vicinity of udhampur city (J & K) India.



Biological Oxygen Demand

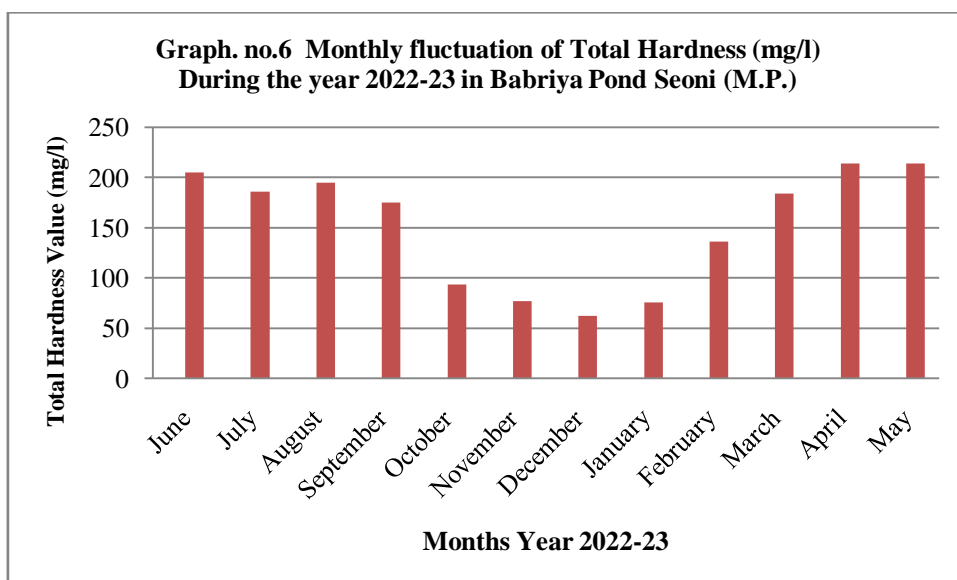
The biological oxygen demand, abbreviated as BOD, is a test for measuring the amount of biodegradable organic material present in a sample of water. Biological oxygen demand is the amount of oxygen utilized by microorganism in stabilizing the organic matter in aerobic condition. DO measurement forms the basis of BOD analysis. It gives an indication of load of biodegradable organic material present in the water body.

The level of BOD depends on temperature, during the present study Biological oxygen demand varied between 4.44 ± 0.3 to 8.32 ± 0.22 mg/l (Table no.1 & Graph 5). This present result was in conformity with Sisodiya and Moundiotiya (2006) in Kalakho Lake, Rajasthan; Balachandran *et al.*, (2012) in Bangalore Lake at Karnataka; Efe Ogidiaka 2012 recorded in Ogunpa River at Bodija, Ibadan, Oyo state and Prabhakar *et al.*, (2012) in Palar River, Vellore district Tamilnadu. This investigation is also close conformity with finding of Verma (2019b).



Total Hardness:

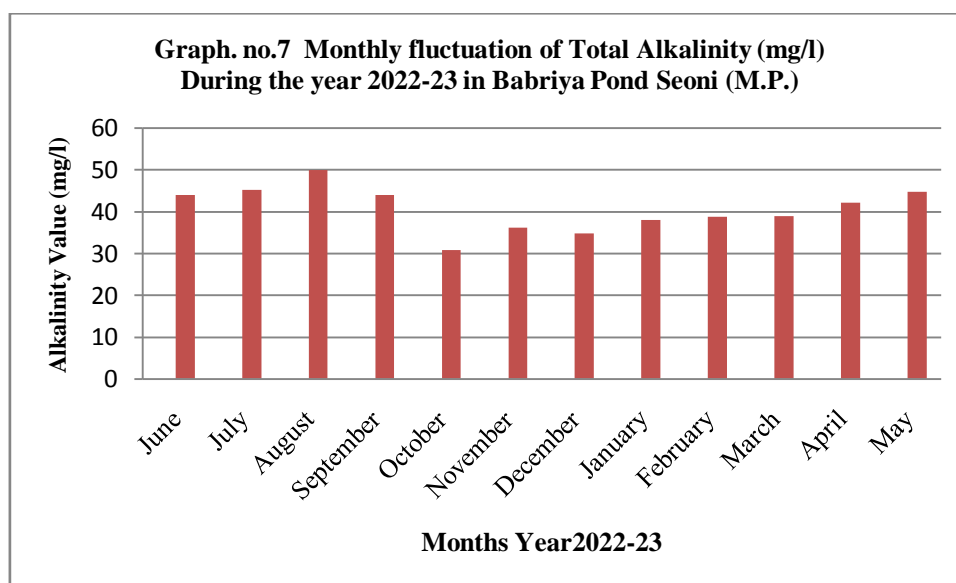
Hardness is a natural characteristic of water which can enhance its palatability and consumer acceptability for drinking purposes. Health studies in several countries in recent years indicate that mortality rates from heart diseases are lower in areas with hard water. Total hardness is the parameter of water quality used to describe the effect of dissolved minerals (mostly Ca and Mg), determining suitability of water for domestic, industrial and drinking purposes. During the present study, Total hardness varied between 62 ± 3.87 to 213.8 ± 2.77 mg/l (Table no.1 & Graph 6). Bhatt *et al.*, 2011 was recorded the range of hardness 5-72 mg/l. as CaCO_3 with $\text{Mean} \pm \text{SD}$ 42.2 ± 25.606 which showed that the hardness of the Bhotekoshi River reduced from upstream to the downstream. Same results were also reported by Sharma *et al.*, 2012.



Alkalinity

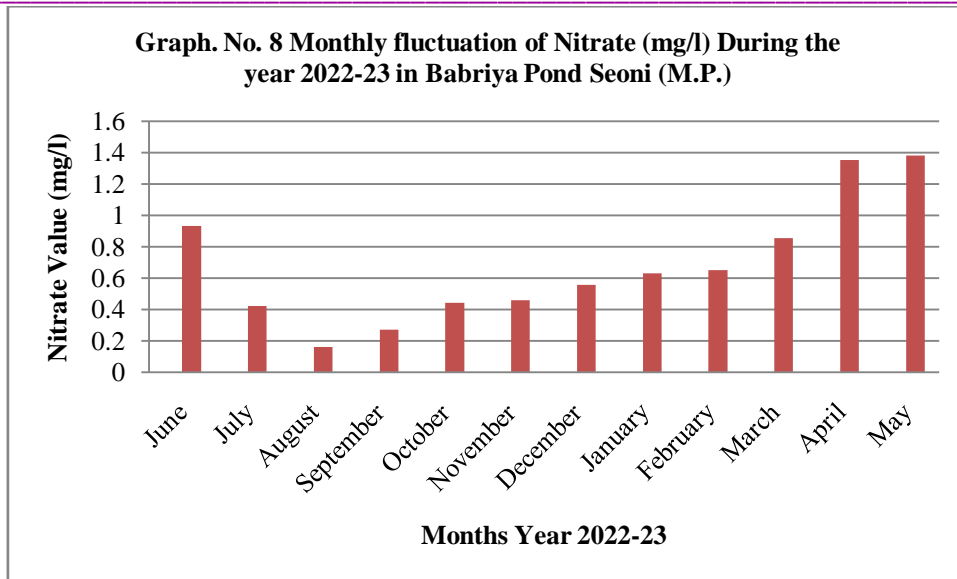
Alkalinity of water is usually interpreted as the quality and kind of compounds (such as bicarbonate, carbonates and hydroxides present, which collectively shift the pH to the alkanlinic side of neutrality. In the present study the value of Alkalinity varied from 30.8 ± 1.92 to 50 ± 1.58 mg/l (Table

no.1 & Graph 7). Sisodiya and Moundiotiya (2006) observed total alkalinity values fluctuated between 98 to 276 mg/l, indicating that the water is hard. 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) during monsoon and 114.8 to 115.8 mg/l. during winter. Sharma *et al.*, (2008) recorded total alkalinity between 68.4 to 91.4 mg/l in Ningland stream, India. Kudthlang and Thanee (2010) observed the mean of total alkalinity varied from 22.9 ± 2.5 to 29.2 ± 3.0 mg/l in the upper part of the Chi Basin. Balachandran *et al.*, (2012) observed the value of total alkalinity fluctuated between 19.28 mg/l. to to 346.8 mg/l. in Bangalore Lake at Karnataka.



Nitrates:

Nitrates are the most oxidized forms of nitrogen and the end product of the aerobic decomposition of organic nitrogenous matter. In the present study, the Nitrate showed variation from 0.16 ± 0.02 to 1.38 ± 0.02 mg/l (Table no.1 & Graph 8). Mohan *et al.*, 2013 observe the Nitrate in River Tawi in vicinity of udhampur city (J & K) India fluctuated in between 0.109 mg/l to 0.300 mg/l. The most important source of nitrate is the biological oxidation of organic nitrogenous substances. Also nitrate in Babriya Pond may result from point and non-point sources such as sewage disposal systems, faulty septic tanks, soil erosion, livestock wading, bathing and washing clothes in river banks.



Phosphate

Phosphorus is one of the most important nutrients limiting the growth of autotrophs and biological productivity of the system. High Phosphorus content causes increased algal growth, often as blooms, till nitrogen becomes limiting. Phosphorus comes from several sources like human and animal wastes, industrial wastes, agricultural runoff, and exposed soil erosion. In the present study the value of Phosphate showed variation from 0.13 ± 0.02 to 1.268 ± 0.03 mg/l (Table no.1 & Graph 9). Adeyemo *et al.*, (2008) observed the value of Phosphate ranged between 0.35 mg/l. to 16.2 mg/l. in Ibadan River at Ibadan city, Nigeria. Kudthalang and Thane (2010) observed the mean of phosphate varied from 0.01 ± 0.0 to 0.20 ± 0.1 mg/l in the upper part of the Chi Basin. Efi Ogidiaka 2012 recorded Phosphate of Ogunpa River at Bodija, Ibadan, Oyo state mean value 0.28 to 1.32.

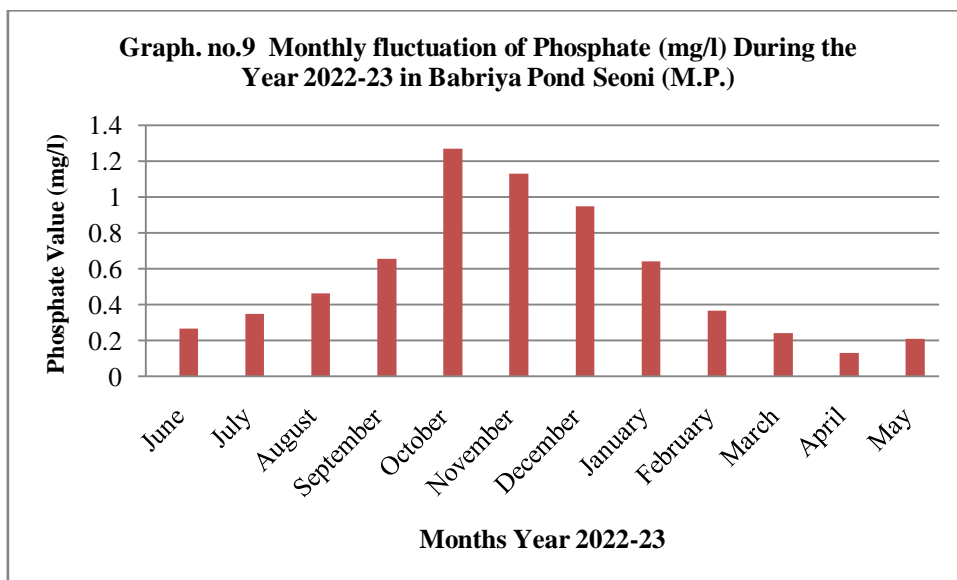


Table No. 1- Monthly Variation of Physico-chemical parameters of water samples of Babriya Talab Seoni (M.P.)

Months 2022-2023	Temp °C	Transparency (C.m.)	pH	D.O. (mg/l)	Hardness (mg/l)	Alkalinity (mg/l)	B.O.D. (mg/l)	Phosphate (mg/l)	Nitrate (mg/l)	
June	31.54±0.11	67.84±5.40	7.516±0.06	6.9±0.22	204.6±3.05	44±1.58	5.62±0.3	0.266±0.06	0.932±0.04	
July	30.5±0.16	35.92±4.58	7.71±0.08	6.5±0.21	185.6±4.51	45.2±2.17	7.44±0.29	0.348±0.03	0.42±0.08	
August	27.6±0.16	22.26±5.26	7.748±0.04	6.14±0.51	194.8±1.48	50±1.58	8.14±0.27	0.46±0.02	0.16±0.02	
September	25.66±0.11	37.14±2.83	7.698±0.08	6.6±0.25	174.8±1.3	44±1.58	8.32±0.22	0.654±0.03	0.27±0.02	
October	23.32±0.24	65.40±2.99	7.878±0.06	5.58±0.25	93.4±2.41	30.8±1.92	7.62±0.28	1.268±0.03	0.44±0.02	
November	22.5±0.16	68.10±5.56	7.58±0.06	6.12±0.34	76.8±4.15	36.2±1.79	7.08±0.19	1.128±0.02	0.458±0.04	
December	20.4±0.16	73.42±2.32	7.534±0.05	6.86±0.18	62±3.87	34.8±1.92	6.5±0.22	0.946±0.04	0.554±0.03	
January	19.4±0.25	76.20±1.98	8.718±0.04	6.54±0.23	75.4±6.73	38±1.58	6.34±0.3	0.64±0.03	0.628±0.03	
February	20.28±0.13	80.50±0.79	7.564±0.04	6.6±0.29	135.6±4.62	38.8±1.92	5.78±0.33	0.364±0.03	0.65±0.04	
March	25.68±0.13	83.12±0.75	7.466±0.03	6.5±0.43	183.4±3.85	39±1.58	5.32±0.36	0.238±0.03	0.852±0.03	
April	28.54±0.11	85.72±0.74	7.348±0.04	7.4±0.27	213.8±3.71	42.2±1.92	4.44±0.3	0.13±0.02	1.35±0.02	
May	32.56±0.21	85.88±1.49	7.452±0.03	7.76±0.11	213.8±2.77	44.8±1.92	5.32±0.24	0.208±0.02	1.38±0.02	
Range	Min	19.4±0.16	22.26±5.26	7.34±0.19	5.58±0.25	62±3.87	30.8±1.92	4.44±0.3	0.13±0.02	0.16±0.02
	Max	32.56±0.11	85.88±1.49	8.71±0.16	7.76±0.11	213.8±2.77	50±1.58	8.32±0.22	1.268±0.03	1.38±0.02

CONCLUSION

The present limnological studies of Babriya pond suggest its nutrient rich status and because of big size it could be gainfully used for fish culture. Authors suggest appropriate care of this pond in order to maintain the proper water level of surrounding areas. Thus based on the findings it can be concluded that the pond water was not suitable for bathing and drinking but it can be used for fish culture.

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