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Seasonal variation of Physico-chemical parameters of Pilandri Reservoir in District Bhandara, Maharashtra (India)

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Abstract

The current study's goal was to assess Pilandri Reservoir's water quality in District Bhandara, Maharashtra, India. The location of Pilandri Reservoir is 20°55'25.92" N latitude and 79º46'33.32" E longitude. The 12-month study period ran from April 2024 to March 2025. Temperature, pH, conductivity, transparency, total alkalinity, total solids, total hardness, free O_2, CO_2, BOD, COD, chloride, sulphate, phosphate, and nitrate were among the physico-chemical parameters that were tracked on a monthly and seasonal basis. All the parameters were within the acceptable ranges. The obtained results for the physico-chemical parameters show that the reservoir is clean and appropriate for usage in residential areas, farming, fishing, and wildlife drinking.

Key words : Water quality, physico-chemical parameters, Pilandri Reservoir, India.

Water has a special place on the planet because it supports life. It is ingrained in the fundamental fabric of life. Water is crucial for the survival and prosperity of all living species on Earth; because no life can live on their planet without water, it is known as "natural liquid gold." Water is one of the most important natural resources needed by all living beings. According to Singh[15], the demand on water resources is increasing as the world's population grows and living standards improve. According to Reece[13], the property of water is critical for aquatic life's survival. Water is essential for all living organisms, ecological systems, human health, food production, and economic development, according to Shafiq *et al.,*[14]. The majority of people get their drinking water from surface water. According to Brown and Barnwell[3], healthy lake ecology can help to preserve natural and social balance by contributing to the health of its surroundings. Because of the usage of contaminated water, the human population suffers from a variety of water-borne diseases, it is therefore vital to verify the quality of water at regular intervals.

Study Areas

The study area was the Pilandri Reservoir in Maharashtra, India's eastern region. Pilandri Reservoir is a tiny inland reservoir in Bhandara district, located around 51 kilometers south-east of Bhandara. Pilandri Reservoir is located at latitude 20°55'25.92" N, longitude 79º46' 33.32"E. The Length of reservoir is 1344 meter and total catchment area is 7.64 square kilometers, and its storage capacity is 1.723 million cubic meters. The water from Pilandri Reservoir is primarily used for wildlife drinking, commercial fishing, aquaculture, irrigation, and domestic purposes.

Figure 1. Satellite image of Pilandri Reservoir.

Sample Collection :

Monthly water samples were collected from designated places in the reservoir for the present study, which began in April 2024 and ends in March 2025. Monthly water samples were collected in plastic cans and monitored for temperature, pH, transparency, and conductivity between 7.30 a.m. and 10.30 a.m. Temperature, pH, and transparency were tested with a mercury thermometer and an EIPRODUCTS water analysis kit (MODEL-161-E). Standard techniques were employed to investigate physicochemical parameters by APHA [1, NEERI [11]], and Kodarkar[8].

1. ***Temperature :*** In present investigation the water temperature was highest reported 21.23 ± 04.50 °C in the summer and minimum during winter season, a minimum temperature 17.60 ±01.22 °C. The high water temperature was due to clear light and less volume of water.and low during winter might be attributed to a combination of low atmospheric temperature and high water level. Telkhade *et al.,*[18] noted that

minimum water temperature was 23.20 and maximum was 29.60 °C at Tadoba lake in district Chandrapur.

2. ***pH :*** pH is a key factor in determining water quality. In the current study, pH values were highest during the summer season (8.49 ± 0.29), and lowest during the winter season (7.41 ± 0.33). The pH of the water is affected by the geology of the watershed and the ability of the water to function as a buffer. Because of the high heat and low water levels this summer, pH fluctuated. Wankhede *et al.,*[19] reported similar observations, stating that the minimum was 7.7 in December and the maximum was 8.3 in May at Sawanga Lake, district Amrawati.

3. ***Conductivity :*** Conductivity is the best way for measuring the purity of water since it is affected by the ionization of the solute that dissolves in it. The monsoon season has the highest conductivity because to increased organic matter and residential effluents, whereas the winter season has the lowest conductivity (0.36 ± 0.03 µmhos cm^{-1}). Winter has the lowest conductivity due to lower levels of dissolved solid pollutants. Solanki[17] reported that the Pilandri Reservoir had a maximum conductivity of 0.48 ± 0.06 µmhos.

4. ***Transparency :*** Transparency indicates the concentration of suspended particulates; it also represents the light penetration capability of the water, which may be calculated using the weight technique. Summer had the highest transparency (39.69 ± 7.59 cm), while monsoons had the lowest (21.68 ± 2.81 cm). The monsoon season could have been created only by the injection of sewage, the inflow of rainwater from the catchment area, low light penetration, and high turbidity from suspended inert particulates.

5. ***Alkalinity :*** Water is alkaline because it contains weak acid salts and strong bases. The sum of hydroxides, carbonates, and bicarbonates is known as total alkalinity. The total alkalinity was maximum during the summer season, 263.69 ± 16.76 mg/l, and lowest during the winter season, 193.00 ± 25.96 mg/l. When CO_2 is released, organic breakdown rates accelerate, resulting in higher overall alkalinity levels. Manjare *et al.,*[10] found similar results, reporting an alkalinity value ranging from 121.25 mg/l in January to 200 mg/l in May.

6. ***Total Hardness :*** Total hardness refers to the combined hardness of magnesium and calcium. Water content typically dissolves magnesium and calcium bicarbonate, substantial amounts of sulfate chloride, and trace amounts of different cations and anion, all of which add to the water's hardness. Seasonally, the highest measured hardness value was 287.00 ± 9.13 mg/l in summer and the lowest was 94.57 ± 9.32 mg/l in winter.

7. ***Calcium and Magnesium hardness :*** Calcium is not only an essential element for algae, but it also plays an important role in the exoskeletons of arthropods and shellfish. Ca-hardness values ranged from 61.28 ± 5.11 mg/l in the winter to 161.00 ± 6.08 mg/l in the summer. The lowest values recorded in the winter may be due to dilution and increased water levels, whilst the highest values recorded in the summer may

be due to the release of effluents and untreated wastes. Magnesium hardness ranged from 33.29 ± 4.21 mg/l in winter to 126.00 ± 3.05 mg/l in the summer. Salve and Hiware[16] found that calcium hardness was higher in the winter. moderate in monsoon and lower in summer, Wanaparkalpa reservoir, Nagpur.

8. ***Total solids, TSS and TDS :*** Total solids measurement is a very useful instrument for determining the chemical composition of water. The study found that total solids peaked at 371.65 ± 31.82 mg/l during the monsoon season and dropped to 262.09 ± 14.75 mg/l during the summer. The lake's monsoon surface mud and sand influx have high TS values, as does the large watershed precipitation. In the current investigation, the highest total suspended solids (TSS) concentration was 261.13 ± 23.47 mg/L. The minimum was 216.00 ± 14.43 mg/l during the summer season, and the smaller range found in summer compared to winter could be attributed to water evaporation. During the monsoon season, the maximum Total Dissolved Solids were measured at 110.52 ± 08.35 mg/l and the minimum was recorded at 44.09 ± 0.32 mg/l in the summer. Elevated TDS levels in degradation, heavy precipitation, and monsoon surface input. Similar findings were noted by, Kadam *et al.,*[7] found that total suspended solids were lowest in the winter and highest.

9. ***Dissolved oxygen :*** Oxygen dissolves when it diffuses from the air into water. The photosynthetic activity of aquatic autotrophs and inflowing streams provides additional dissolved oxygen. Summer values were lowest due to the organisms' high metabolic rate, whilst winter values were highest due to low temperatures and strong photosynthetic activity. Munawar[9] observed a similar tendency, noting that the low air temperature of Hyderabad's freshwater lake resulted in the highest amount of soluble oxygen being detected during the winter.

10. ***Free Carbon dioxide :*** Aquatic species' respiration and breakdown are the principal sources of free CO_2 in water basins. During the monsoon season, the maximum free CO_2 concentration was 5.21 ± 0.41 mg/L. During winter, CO_2 levels were at their lowest (3.39 ± 0.40 mg/l). The greatest results during the monsoon season may be attributable to increased biological oxidation of organic molecules. However, low amounts of free CO_2 in the winter may be due to lower water temperatures and greater algal blooms, which maximize CO_2 use. Similar values were found by Salve and Hiware[16].

11. ***Biological oxygen demand :*** According to Kistan *et al.*[6], it is a measure of the amount of oxygen required by microbes for organic matter breakdown and chemical oxidation of inorganic substances. The summer season produced a seasonally high BOD level of 14.06 ± 2.29 mg/l. The BOD value was higher in the summer due to increased microbial activity of diverse aerobic and aerobic bacteria, which increased as the water temperature rose. Winter saw a minimum BOD value of 7.91 ± 0.79 mg/l. [16]

12. ***Chemical oxygen demand :*** The highest seasonal COD values were 47.09 ± 5.13 mg/l in the summer and the lowest were 21.17 ± 1.47 mg/l in the winter. Gayathri *et al.,*[4] recorded minimum COD levels of

4.45 ± 0.95 mg/l in the winter and maximum COD levels of 8.85 ± 0.95 mg/l in the summer.

13. *Chloride :* All naturally occurring surface waters contain different levels of chlorine. Seasonal chloride readings were 60.73 ± 3.51 mg/l at maximum in summer and 59.62 ± 5.88 mg/l at minimum in winter. Because to lake water evaporation, the highest chloride value was recorded in the summer, while the lowest value was found in the winter due to dilution. Manjare *et al*. reported similar results[10].

14. *Sulphate :* In the current study, the highest concentration of Sulphate was 20.22 ± 0.59 mg/l, while the lowest was 13.76 ± 0.31 mg/l during the winter season. The winter minimum may be produced by high water levels and an excess of phytoplankton. Similar to the patterns seen by Yeole *et al.,*[20], sulfate concentrations in the Jagtunga Samudra reservoir ranged from 0.08 to 0.33 mg/ltr.

15. *Phosphate :* Phosphate levels were lowest (0.34 ± 0.52 mg/l) in winter and greatest (0.84 ± 0.46 mg/l) during the monsoon. High water levels and an abundance of phyto-plankton may be responsible for the winter phosphate monimun readings. Higher phosphate concentrations during the monsoon season may be caused by phosphate intake from the catchment region as well as the discharge of domestic garbage. Similar findings were reported by Yeole *et al.,*[21] in Yedshi Lake.

16. *Nitrate :* Nitrate levels were highest during the monsoon season (01.13 ± 0.07 mg/l) and lowest in the winter season (0.80 ± 0.26 mg/l). Nitrate levels are lowest in winter because growing plankton consumes them. Munawar[9] verified similar trends, demonstrating that nitrate levels increased during the monsoon.

The findings of the current study will be valuable in future management of the Pilandri Reservoir, and it can be concluded that the majority of the physicochemical parameters were determined to be within the allowed limits of ISI, ICMR, and WHO. Pilandri Reservoir may become contaminated over time as human activity increases, and eutrophication impacts aquatic life, diminishing lake depth through excessive silting. As a result, Reservoir implements conservation measures based on scientific principles to safeguard reservoir quality. Based on the values of the obtained physicochemical characteristics, it is possible to conclude that reservoir water is unsafe for drinking but beneficial for wildlife, domestic use, agriculture, and fishery.

References :

1. APHA. (2005). Standard methods for the examination of water and waste water. 21st Edition, American Public Health Association, Washington D.C, 1368 pp.
2. Anita, S. M., S. S. Hatti and S. Majagi (2018). *Res. J. Life Sci. Bioinfo. Pharma. and Chem. Sci. 4*(6): pp.-525-530.
3. Brown, C. and T. Barnwell (1987). Enhanced stream quality model Qual2E and documentation and user manual. Athens, Georgia. Environ. Research Lab. Offi. of Rese. And Devlopment. U. S.
4. Gayathri, S., N. Latha and R. Mohan (2013). *J. Academia and Indus. Rese. 2:*

362-368.

5. Jhingran,V. G. (1982). Fish and Fishes of India Hindustan Publishing Corporation, India. Delhi. pp. 954.
6. Kistan, A., V. Kanchana and A. Ansari (2013). *Inter. J. Sci. and rese. 4*(5): 944-947.
7. Kadam, M.S., D. V. Pampatwar and R.P. Mali (2007). *J. Aqua. Biol. 22*(1): 110-112.
8. Kodarkar, M. S. (1992). Methodology for water analysis, physico-chemical biological and microbiological, Indian association of aquatic biologist, Hyderabad, Publi. (2): pp.-50.
9. Munawar, M. (1970). *Hydrobiology, 36:* 105-128.
10. Manjare, S. A., S. A. Vhanalkar and D.V. Mulay (2010). *Inter. J. of Adv. Biotech. and rese. 1 :* 115-119.
11. NEERI (1988). Mannual of water and wastewater analysis, NEERI, Nagpur, (M. S.).
12. Pulugandi, C. (2014). *Rese. J. of Recent Sci. 3 :* 242-247.
13. Reece, J. B. (2013). Campbell Biology, 10th ed. pp.- 44.
14. Shafiq, A. A. A., U. Ihteram, N. Nadia, A. Ammar and A. Nawab (2013). *Inter. J. of Advance.Rese.and Tech. 2*(7): pp.-452-460.
15. Singh, B.K. and N.N. Jha (2000). Monthaly variation in the physico-chemical properties of sediment of Kawarlake of North Bihar, India, *Ind. J. Envir. and Ecoplan. 3 :* 725-728.
16. Salve, B. S. and C. J. Hiware (2006). *J. Aqua. Biol., 21*(2): 113-117.
17. Solanki, V., Md. Hussain and Sabita Raj (2015). *Envi. Monit. Assess. 163 :* 411-419.
18. Telkhade, P.M., N. R. Dahegaonkar, S.B. Zade, P.J. Khinchi and P.N. Charde (2012). *BIONANO FRONTIER. 5*(2-1): 193-195.
19. Wankhede, V., N. Manwar and A. Malu (2012). *Inter. J. of Scie.and Rese. 2 :* 1-10.
20. Yeole, S.M. and G. P. Patil (2005). *Sci. J. Ecol. 21*(1): 64-66.
21. Yeole, S.M. and G.P. Patil (2005). *J. Aqua. Biol. 20*(1): 41-44.