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Comparative Assessment of Physicochemical Characteristics and Water Quality of Rangarayar Doddi and Honganuru Lakes, Ramanagara District, Karnataka, India

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ABSTRACT

Freshwater lakes are important aquatic ecosystems that support domestic, agricultural, ecological, and recreational activities. However, increasing anthropogenic activities, urbanisation, and agricultural runoff can adversely affect water quality, emphasising the need for systematic monitoring and sustainable management. The present study aimed to assess and compare the physicochemical characteristics of Rangarayar Doddi Lake and Honganuru Lake in Ramanagara District, Karnataka, India, and evaluate their water quality with reference to World Health Organisation (WHO) drinking-water guidelines. Water samples collected from both lakes were analysed using standard methods for temperature, pH, total dissolved solids (TDS), electrical conductivity (EC), dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), free carbon dioxide (CO_2), and phosphate. Rangarayar Doddi Lake recorded temperature of 21.15 ± 0.30°C, pH 8.35 ± 0.10, TDS 482.45 ± 0.80 mg/L, EC 112.03 ± 0.20 µS/cm, DO 6.52 ± 0.20 mg/L, BOD 1.61 ± 0.20 mg/L, COD 6.28 ± 0.60 mg/L, and phosphate 0.48 ± 0.06 mg/L. Honganuru Lake exhibited temperature of 20.75 ± 0.30°C, pH 8.30 ± 0.10, TDS 303.35 ± 0.80 mg/L, EC 103.19 ± 0.20 µS/cm, DO 7.49 ± 0.50 mg/L, BOD 2.55 ± 0.10 mg/L, COD 6.33 ± 0.40 mg/L, and phosphate 0.14 ± 0.01 mg/L. Free CO_2 was not detected in either lake. Overall, the observed parameters indicated relatively good water quality, with differences between the lakes reflecting variations in mineral and nutrient enrichment. Rangarayar Doddi Lake showed comparatively higher TDS, EC, and phosphate, whereas Honganuru Lake recorded higher DO. Continuous monitoring and effective watershed management are recommended for sustainable conservation of these freshwater ecosystems.

Keywords: *Freshwater lakes; Water quality; Physicochemical parameters; Dissolved oxygen; Biological oxygen demand; Ramanagara; Karnataka.*

1. Introduction

Freshwater ecosystems constitute one of the most valuable natural resources, supporting biodiversity, human health, agriculture, fisheries, and socioeconomic development. Water serves as an essential component of living organisms and functions as a universal solvent, facilitating numerous biological and ecological processes [3]. However, increasing industrialisation, urbanisation, agricultural intensification, and population growth have resulted in progressive deterioration of freshwater quality worldwide. Consequently, periodic assessment of water quality has become indispensable for ensuring environmental sustainability and public health [4].

Physicochemical characteristics such as temperature, pH, electrical conductivity, total dissolved solids, dissolved oxygen, biological oxygen demand, chemical oxygen demand, nutrients, and dissolved gases provide valuable information regarding the ecological status and functioning of aquatic ecosystems. These parameters regulate biological productivity, nutrient cycling, metabolic processes, and species diversity within freshwater habitats [5]. Variations in these characteristics often reflect both natural seasonal changes and anthropogenic disturbances occurring within the catchment.

Among freshwater ecosystems, lakes are particularly vulnerable because they receive pollutants through surface runoff, domestic wastewater, agricultural inputs, and atmospheric deposition. Excessive nutrient loading often accelerates eutrophication, resulting in algal blooms, oxygen depletion, biodiversity loss, and deterioration of water quality [6]. Continuous monitoring of physicochemical characteristics therefore provides an effective approach for evaluating lake health and developing appropriate conservation strategies.

Rangarayar Doddi Lake and Honganuru Lake are two important freshwater bodies located in Ramanagara District, Karnataka, providing essential ecosystem services and supporting the domestic and agricultural needs of the surrounding communities. Despite their ecological and socioeconomic significance, comprehensive scientific information on the physicochemical characteristics and overall water quality of these lakes remains limited. Therefore, the present study was undertaken to comparatively assess selected physicochemical parameters of Rangarayar Doddi Lake and Honganuru Lake and evaluate their water quality in relation to internationally recognized water-quality standards, particularly the World Health Organisation (WHO) [2] guidelines for drinking water.

The specific objectives of the study were:

1. To assess the physicochemical characteristics of water from Rangarayar Doddi Lake and Honganuru Lake.
2. To comparatively evaluate the water quality status of the two lakes based on selected physicochemical parameters.
3. To assess the suitability of the lake water for drinking purposes with reference to the WHO drinking-water quality guidelines.

2. Materials and Methods

2.1 Study Area

The present investigation was conducted on two freshwater lakes located in Ramanagara District, Karnataka, India: Rangarayar Doddi Lake (Fig. 1) and Honganuru Lake (Fig. 2). Ramanagara, popularly known as the "Silk City", is situated in the southern part of Karnataka. The selected lakes serve as important freshwater resources for domestic activities and agricultural irrigation. Rangarayar Doddi Lake is one of the largest lakes in Ramanagara Taluk and is located at Bolappanahalli village. The lake has undergone recent developmental activities and functions as an important freshwater resource for nearby communities. Honganuru Lake is situated in Channapatna Taluk of Ramanagara District and is surrounded by agricultural landscapes, making it vulnerable to catchment runoff and other anthropogenic influences.

Fig.1: Rangarayar Doddi lake

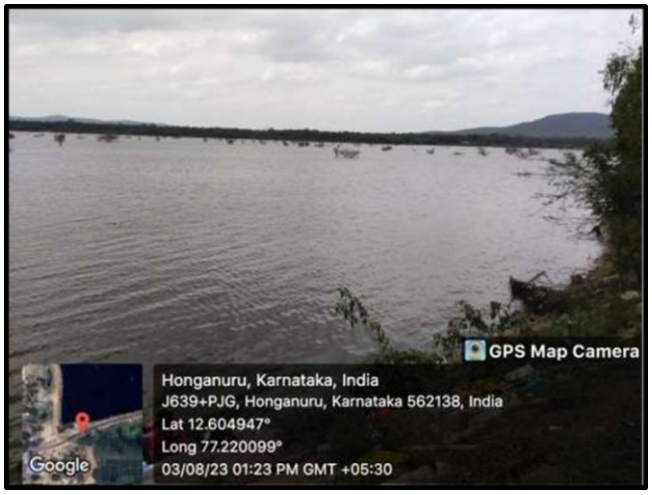

Fig.2: Honganuru lake

2.2 Water Sample Collection

Water samples were collected from both lakes during the morning hours (09:00–11:00 AM) using clean 2-L polyethene bottles. Sampling was performed carefully to avoid contamination. Immediately after collection, temperature, pH, and total dissolved solids (TDS) were measured in the field, whereas the remaining physicochemical parameters were analysed under laboratory conditions.

2.3 Physicochemical Analysis

The physicochemical characteristics of lake water were analysed following standard laboratory procedures as described in APHA [1].

The following parameters were determined:

Parameter	Method/Instrument
Temperature	Digital thermometer
pH	pH paper
Total Dissolved Solids (TDS)	Digital TDS meter
Electrical Conductivity (EC)	Conductivity meter
Dissolved Oxygen (DO)	Winkler's iodometric method
Biological Oxygen Demand (BOD)	Five-day incubation method
Chemical Oxygen Demand (COD)	Potassium dichromate titrimetric method
Free Carbon Dioxide	Sodium hydroxide titration
Phosphate	Spectrophotometric method (690 nm)

The analytical procedures were carried out according to standard water quality assessment protocols using appropriate reagents and laboratory instruments.

2.4 Statistical Analysis

The experimental data obtained from all physicochemical analyses were statistically analysed using SPSS software. Results are presented as mean ± standard error (SE). Statistical significance was evaluated using Student's *t*-test, and differences were considered significant at $P < 0.01$.

3.0 Results

The physicochemical characteristics of Rangarayar Doddi Lake and Honganuru Lake are summarized in Table 1. Both lakes exhibited slightly alkaline conditions with pH values above 8.0. Rangarayar Doddi Lake recorded comparatively higher TDS and electrical conductivity, whereas Honganuru Lake exhibited higher dissolved oxygen concentrations. Free carbon dioxide was absent in both lakes.

Table 1. Comparison of physicochemical parameters of the two lakes

Parameter	Rangarayar Doddi Lake	Honganuru Lake
Temperature (°C)	21.15 ± 0.30	20.75 ± 0.30
pH	8.35 ± 0.10	8.30 ± 0.10
TDS (mg/L)	482.45 ± 0.80	303.35 ± 0.80
EC (µS/cm)	112.03 ± 0.20	103.19 ± 0.20
DO (mg/L)	6.52 ± 0.20	7.49 ± 0.50
BOD (mg/L)	1.61 ± 0.20	2.55 ± 0.10
COD (mg/L)	6.28 ± 0.60	6.33 ± 0.40
Phosphate (mg/L)	0.48 ± 0.06	0.14 ± 0.01
Free CO_2	Not detected	Not detected

3.1 Physical Parameters

Water temperature varied only slightly between the two lakes. Rangarayar Doddi Lake exhibited a mean temperature of 21.15 ± 0.30°C, whereas Honganuru Lake recorded 20.75 ± 0.30°C. The pH values of both lakes indicated slightly alkaline conditions, measuring 8.35 ± 0.10 and 8.30 ± 0.10, respectively.

Total dissolved solids (TDS) were considerably higher in Rangarayar Doddi Lake (482.45 ± 0.80 mg/L) than in Honganuru Lake (303.35 ± 0.80 mg/L). Similarly, electrical conductivity was higher in Rangarayar Doddi Lake (112.03 ± 0.20 µS/cm) than in Honganuru Lake (103.19 ± 0.20 µS/cm). Statistical analysis indicated that these physical parameters were significantly different ($P < 0.01$).

3.2 Chemical Parameters

The dissolved oxygen concentration was higher in Honganuru Lake (7.49 ± 0.50 mg/L) compared with Rangarayar Doddi Lake (6.52 ± 0.20 mg/L). Biological oxygen demand was 1.61 ± 0.20 mg/L in Rangarayar Doddi Lake and 2.55 ± 0.10 mg/L in Honganuru Lake. Chemical oxygen demand values were similar in both lakes (6.28 ± 0.60 and 6.33 ± 0.40 mg/L, respectively). Phosphate concentration showed noticeable variation, with Rangarayar Doddi Lake recording 0.48 ± 0.06 mg/L, while Honganuru Lake recorded only 0.14 ± 0.01 mg/L. Free carbon dioxide was absent in both lakes throughout the study period. All chemical parameters exhibited statistically significant differences ($P < 0.01$).

4.0 Discussion

Physicochemical characteristics are fundamental indicators of freshwater ecosystem health because they directly influence biological productivity, nutrient cycling, and aquatic biodiversity. The present comparative assessment demonstrated that Rangarayar Doddi Lake and Honganuru Lake exhibited generally good water quality, with most physicochemical parameters falling within the permissible limits recommended by the World Health Organisation [2]. Nevertheless, variations in individual parameters between the two lakes reflect differences in local environmental conditions, watershed characteristics, and anthropogenic influences.

Water temperature is a primary environmental variable that regulates the metabolic activity of aquatic organisms, dissolved oxygen solubility, and nutrient cycling. The temperatures recorded in Rangarayar Doddi Lake (21.15 ± 0.30°C) and Honganuru Lake (20.75 ± 0.30°C) indicate favourable thermal conditions for freshwater biota. [5] reported that water temperature controls several physical, chemical, and biological processes within aquatic ecosystems. Similarly, [10] observed comparable temperatures in Karanji Lake, while [11] reported seasonal fluctuations between 21 and 30°C in Triveni Lake. The close agreement between the present findings and previous investigations suggests that both lakes maintain a relatively stable thermal regime suitable for sustaining aquatic biodiversity.

The pH values of both lakes (8.30–8.35) indicate slightly alkaline conditions, which are characteristic of productive freshwater ecosystems. Aquatic organisms generally thrive within a pH range of 6.5–8.5, beyond which physiological stress and reduced biodiversity may occur. The present findings agree with those reported for Kukkarahalli Lake [10], Killa Lake [12], and Chandlodia Lake [13], where slightly alkaline conditions were also observed. The alkaline nature of both lakes may be attributed to bicarbonate buffering, carbonate-rich geological formations, and photosynthetic removal of dissolved carbon dioxide. These conditions indicate that the lakes possess adequate buffering capacity and are not presently affected by acidification.

Total dissolved solids and electrical conductivity are widely recognized as indicators of ionic composition and mineralisation of water. Rangarayar Doddi Lake exhibited significantly higher TDS (482.45 mg/L) and EC (112.03 µS/cm) than Honganuru Lake, indicating greater concentrations of dissolved inorganic constituents. Although these values remain within acceptable drinking water limits, they may reflect greater contributions from catchment runoff, weathering of surrounding rocks, agricultural activities, and domestic inputs. Similar observations have been reported by [14] and [15], who associated increased TDS and conductivity with agricultural runoff and anthropogenic disturbances. In contrast, the substantially higher EC reported for Kukkarahalli Lake and Karanji Lake suggests that the two Ramanagara lakes currently experience comparatively lower ionic pollution.

Dissolved oxygen is considered one of the most important indicators of ecological integrity because it determines the survival and distribution of aquatic organisms. Honganuru Lake exhibited a higher DO concentration (7.49 mg/L) than Rangarayar Doddi Lake (6.52 mg/L), indicating better aeration and ecological conditions. According to [6], adequate dissolved oxygen supports microbial diversity and maintains ecosystem functioning, whereas low oxygen concentrations adversely affect fish populations and benthic organisms. The present observations are comparable with those reported for Triveni Lake [11] and Errarajan Lake [16], but considerably higher than those observed in Safilguda Lake [17], where severe organic pollution resulted in oxygen depletion. The relatively high dissolved oxygen concentrations observed in both lakes therefore indicate limited organic contamination and favourable conditions for aquatic life.

Biological oxygen demand reflects the amount of biodegradable organic matter present in aquatic systems. The BOD values recorded in the present investigation (1.61–2.55 mg/L) were considerably lower than the WHO permissible limit and indicate minimal organic pollution. Similar BOD values have been reported for Varuna Lake [18] and Bibi Lake [13], suggesting that these freshwater ecosystems are relatively free from excessive organic waste. Conversely, higher BOD values observed in Karanji Lake and Thally Lake have been attributed to domestic sewage inflow and anthropogenic disturbances. Therefore, the comparatively low BOD observed in both study lakes reflects good ecological status and efficient natural self-purification processes. Chemical oxygen demand provides an estimate of both biodegradable and non-biodegradable oxidizable substances present in water. The COD values of approximately 6.3 mg/L in both lakes were substantially lower than those reported for Pulicat Lake, Kukkarahalli Lake, Safilguda Lake, and Varuna Lake. Such low COD values indicate that the concentration of chemically oxidizable pollutants is relatively insignificant, suggesting limited industrial or domestic contamination. Similar interpretations have been reported by [9], who concluded that low COD values generally represent healthier aquatic ecosystems with reduced anthropogenic impacts. Phosphorus is one of the principal nutrients regulating primary productivity and eutrophication in freshwater ecosystems. Rangarayar Doddi Lake exhibited higher phosphate concentration (0.48 mg/L) than Honganuru Lake (0.14 mg/L), although both remained within acceptable limits. According to [7] and [8], increasing phosphorus inputs can accelerate eutrophication by promoting excessive phytoplankton growth, reducing water transparency, and ultimately causing oxygen depletion.

The comparatively higher phosphate concentration in Rangarayar Doddi Lake may indicate greater nutrient input from surrounding agricultural fields or domestic runoff. Although eutrophication does not currently appear to be severe, continuous nutrient monitoring is recommended to prevent future ecological deterioration [9].

Free carbon dioxide was absent in both lakes during the study period. The absence of detectable free CO_2 may be attributed to active photosynthetic uptake by phytoplankton and aquatic macrophytes during daylight hours, resulting in rapid utilisation of dissolved carbon dioxide. Similar observations have been reported in Hadinaru Lake by [19], suggesting that productive freshwater ecosystems often exhibit low daytime carbon dioxide concentrations due to active primary production.

Overall, the comparative assessment indicates that both Rangarayar Doddi Lake and Honganuru Lake currently maintain satisfactory physicochemical conditions capable of supporting aquatic life and meeting domestic and agricultural requirements. Nevertheless, increasing urbanisation, agricultural intensification, and changing land-use patterns in the catchment may alter water quality in the future. Therefore, continuous monitoring, effective watershed management, and strict regulation of anthropogenic activities are essential for ensuring the long-term ecological sustainability of these freshwater ecosystems.

5. Conclusion

The present study provides a comprehensive comparative evaluation of the physicochemical characteristics of Rangarayar Doddi Lake and Honganuru Lake in Ramanagara District, Karnataka. Both lakes exhibited generally good water quality, with temperature, pH, dissolved oxygen, biological oxygen demand, chemical oxygen demand, electrical conductivity, total dissolved solids, and phosphate concentrations remaining within or close to the permissible limits recommended by the World Health Organisation [2]. Although Rangarayar Doddi Lake showed comparatively higher total dissolved solids, electrical conductivity, and phosphate concentrations, Honganuru Lake exhibited higher dissolved oxygen levels, indicating comparatively better ecological conditions.

Comparison with previous limnological investigations conducted in other Indian freshwater ecosystems demonstrates that the water quality of both lakes is comparable to or better than many urban and peri-urban lakes reported in the literature. The relatively low biological oxygen demand and chemical oxygen demand values indicate limited organic pollution, while the absence of free carbon dioxide suggests active photosynthetic utilisation and balanced ecosystem metabolism. Nevertheless, the comparatively elevated phosphate concentration observed in Rangarayar Doddi Lake highlights the need for continuous nutrient monitoring to minimise the risk of eutrophication [20].

The findings of this investigation provide valuable baseline information for long-term limnological monitoring and freshwater conservation programmes in Ramanagara District. Regular physicochemical assessment, integrated watershed management, control of domestic and agricultural runoff, and community participation in lake conservation are recommended to preserve the ecological integrity and sustainable utilisation of these important freshwater resources.

Future investigations incorporating seasonal variations, biological indicators, heavy metal analysis, and water quality index (WQI) assessments would provide a more comprehensive understanding of ecosystem health and support evidence-based lake management strategies [16].

The authors declare that there is no conflict of interest.

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

References

1. APHA, AWWA, WEF. *Standard Methods for the Examination of Water and Wastewater*. 23rd ed. Washington, DC: American Public Health Association; 2017.
2. World Health Organisation. *Guidelines for Drinking-water Quality*. 4th ed. Geneva: World Health Organisation; 2017.
3. Wetzel RG. *Limnology: Lake and River Ecosystems*. 3rd ed. San Diego: Academic Press; 2001.
4. Chapman D, editor. *Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water in Environmental Monitoring*. 2nd ed. London: E & FN Spon; 1996.
5. Dallas HF, Day JA. *The Effect of Water Quality Variables on Aquatic Ecosystems: A Review*. Pretoria: Water Research Commission; 2004.
6. Middelburg JJ, Levin LA. Coastal hypoxia and sediment biogeochemistry. *Biogeosciences*. 2009;6:1273–1293.
7. Moss B, Kosten S, Meerhoff M, Battarbee RW, Jeppesen E, Mazzeo N, et al. Allied attack: climate change and eutrophication. *Inland Waters*. 2011;1(2):101–105.
8. Sinha E, Michalak AM, Balaji V. Eutrophication will increase during the 21st century as a result of precipitation changes. *Science*. 2017;357(6349):405–408.
9. Ferreira ARL, Sanches Fernandes LF, Cortes RMV, Pacheco FAL. Assessing anthropogenic impacts on riverine ecosystems using water quality indicators. *Science of the Total Environment*. 2017;584–585:685–700.
10. Upadhyay K, Chandrakala M. Assessment of physicochemical characteristics of Karanji Lake, Mysuru, Karnataka. *International Journal of Scientific Research*. 2016;5(8):120–124.
11. Rafiullah Khan M, Prasad SM, Kumar A. Seasonal variation in physicochemical characteristics of Triveni Lake, Karnataka. *International Journal of Environmental Sciences*. 2012;3(2):734–742.
12. Nagraj N, Patil HS. Physicochemical analysis of Killa Lake, Belagavi, Karnataka. *Journal of Environmental Biology*. 2008;29(5):673–678.
13. Qureshimatva UM, Solanki HA. Physicochemical assessment of Bibi Lake, Gujarat, India. *International Journal of Environmental Sciences*. 2015;6(2):225–233.
14. Bhat S, Mahesh MK, Ramachandra TV. Seasonal variation in physicochemical characteristics of Hebbal Lake, Bengaluru. *Journal of Environmental Biology*. 2019;40(3):437–445.
15. Sharma P, Chhipa RC. Assessment of physicochemical characteristics of freshwater lakes in Rajasthan. *International Journal of Current Microbiology and Applied Sciences*. 2016;5(9):461–470.
16. Yogitha M, Ramachandra TV. Water quality assessment of Errarajan Lake using physicochemical parameters. *Environmental Monitoring and Assessment*. 2018;190:456.
17. Rohini P, Manikya Reddy P. Assessment of physicochemical characteristics of Safilguda Lake, Telangana. *Journal of Water and Health*. 2021;19(2):335–346.
18. Abhilash S, Mahadevaswamy M. Seasonal assessment of physicochemical characteristics of Varuna Lake, Mysuru. *International Journal of Environmental Science and Technology*. 2022;19:10235–10246.
19. Shashank S, Mahadevaswamy M, Kumar HN. Physicochemical assessment of Hadinaru Lake, Mysuru District, Karnataka. *Journal of Environmental Biology*. 2022;43(5):921–929.
20. Jeppesen E, Søndergaard M, Søndergaard M, Christoffersen K, editors. *The Structuring Role of Submerged Macrophytes in Lakes*. New York: Springer; 1998.