Evaluation of Lakes Water Quality of Mysore City, India

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Abstract-Numerous water bodies in and around Mysore are vulnerable to numerous environmental degradations as a result of the population boom, the exponential growth of industry, and the urbanisation of the region, among other factors. This results in phytoplankton aggregations, macroalgae, and sporadically colourless heterotrophic protists that can discolour the water and cause foam. As a result, there is a decrease in the level of dissolved oxygen, which ultimately affects the lake's ecological balance and causes eutrophication in water bodies. The Kukkarahalli Lake, Karanji Lake, and Dalvoy Lake located in various parts of Mysore, India, have been chosen for the studies to assess their physico-chemical water quality parameters. This result describes the current state of the water quality in all three of the aforementioned lakes, and it makes recommendations for environmental remediation techniques to improve the quality of the lake water.

Keywords: Physico-chemical, DO, Nitrate, Faecal Coliform, COD, TDS.

INTRODUCTION

Water is one of nature's most abundant resources and a vital component for life. Therefore, both the quality and quantity of water must be available to support life. Water is becoming more and more in demand throughout the residential, agricultural, and industrial sectors as a result of modern civilization's fast industrialization, urbanisation, and population growth. Surface water is made up of two types of freshwater systems: flowing systems (lotic), like rivers, streams, and canals, and static systems (lentic), like ponds, lakes, and reservoirs, etc. Rivers are described as a reasonably substantial volume of water travelling inside a visible channel, including subsurface water moving in the same direction, the related flood plain, and the associated riparian vegetation. Rivers garnered additional attention by providing water for large-scale activities. In terms of ecological systems, rivers and streams both demonstrate high degrees of connectedness between systems on a longitudinal, lateral, and vertical scale (N. Athira *et al.*,2014). One of the most productive ecosystems is made up of lakes. Environments found in lakes are made up of the physical, chemical, and organic elements found there. Freshwater is essential for the survival of many species, and humans frequently rely on lakes to provide them with a wide range of "goods and services," including drinking water, waste management, fisheries, agricultural irrigation, industrial activity, and recreation.

The analysis of the water parameters in a lake habitat is crucial for figuring out the biological output. The alterations in these aquatic environment variables had a major impact on biotic diversity as well. Therefore, it is important for limiting pollution that the physico-chemical variables in the lake ecosystem have a correct evolution. (Rama Kumari *et al.*,2018) By aiding in the replenishment of aquifers and controlling hydrological regimes, lakes serve as a crucial component of the world's life support system. Lakes are essential to human life because they allow for water table restoration and recharge (K C Khare *et al.*,2008). Lakes are a dynamic ecosystem that reflect the peculiarities of the individual lake basins, climatic fluctuations, and biological components. Important factors to consider include the size of the lake basin, its depth and volume, and the quantity and quality of water entering the lake. On the basis of this knowledge, lake management initiatives are put into action, such as surface use restrictions, aeration, and native and exotic aquatic plant management. The biological productivity of a lake (trophic condition) depends on the water chemistry profiles, regional water quality comparisons, nutrient concentrations, and water transparency.

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fluctuations, and biological components. Important factors to consider include the size of the lake basin, its depth and volume, and the quantity and quality of water entering the lake. Based on this knowledge, lake management initiatives are put into action, such as surface use restrictions, aeration, and native and exotic aquatic plant management. The biological productivity of a lake (trophic condition), water chemistry profiles, regional water quality comparisons, nutrient concentrations, and water transparency are all significant water quality issues (Ravinder Kumar.*et al.*,2018).

DESCRIPTION OF STUDY AREA

The city of Mysore is situated between latitudes of 12° 18' 26" north and longitudes of 76° 38' 59" east. It is situated 2,427 feet above sea level. There are 6,268 square kilometres of it, and the temperature ranges from 14 to 35 degrees Celsius. Mysore experiences beautiful weather all year long. The Deccan Plateau's southernmost region is where Mysore City is situated. There are numerous major and small bodies of water in Mysore. Kukkarahalli Lake, Lingambudi Lake, Devanoor Lake, Dalvoy Lake, and Karanji Lake are a few of the larger lakes. Mysore, a history city that has evolved into a contemporary city, nonetheless moves at a calm, slow, and leisurely pace. The city includes some lakes and a good amount of greenery, which enhance its beauty and tranquilly.

SAMPLING AND ANALYSIS

The sampling sites were selected by keeping in mind the locations of inflow and outflow. To determine possible changes in properties between surface and bottom waters, water samples were taken from the surface and a few metres below the surface using a specially built airtight sampler and clean, sterile polythene bottles.

EXPERIMENTAL FINDINGS AND DISCUSSION

Table 1 lists the findings for the physico-chemical and biological parameters of the lake water. Additionally, the trends of some of the key parameters, such as pH, DO, BOD, COD, faecal and total coliforms in various months, are shown.

The physical state of water has a significant impact on the chemical and biological processes that occur in the body of water (Athira *et al.*,2014). The other water parameters may be affected by the sampling stations' depth. During the analyses, the mean depths of Kukkarahalli Lake, Dalvoy Lake, and Karanji Lake were determined to be 0.5 m, 0.5 m, and 0.4 m, respectively. The hydrochemistry and biological processes of the organisms in surface and ground waters are also impacted by temperature. During the study period, the water body's temperature ranged from 24^0 C to 32^0 C.

The presence of various chemicals and atmospheric precipitation both significantly influence the pH of surface waters. The interaction of different compounds in water and solutions results in pH, which is regarded as an ecological component that also affects a variety of biological phenomena. The pH levels at Kukkarahalli Lake, Karanji Lake, and Dalvoy Lake were discovered to be 7.4-7.6.

A measure of the total concentration of salts is the electrical conductivity (EC). High electrical conductivity levels are a sign of both aquatic body toxicity and pollution. In Kukkarahalli Lake, the EC value found to be 640µS, in Karanji Lake, 738µS and in Dalvoy Lake, 610µS. Total solids have a direct impact on conductivity's value. The number of ions in water will increase as the value of dissolved solids rises. The turbidity of the Kukkarahalli Lake, Karanji Lake and that of the Dalvoy Lake ranges between from 6.6 NTU – 10.2 NTU.

Due to the salts in lake water, the alkalinity values in the current study demonstrate gradual increases of 216 mg/L as CaCO3 in Kukkarahalli Lake, 210 mg/L in Karanji Lake, and 250 mg/L in Dalvoy Lake, which is high compared to standards. All three lakes had high levels of total dissolved solids (TDS) and total suspended solids (TSS), with Kukkarahalli Lake having the highest levels at 680 mg/L and 36 mg/L, Karanji Lake having the levels at 620 mg/L and 44 mg/L, and Dalvoy Lake having 690mg/lt and 38mg/L, respectively.

The biological functions of the aquatic ecosystem can be impacted by the oxygen that is dissolved in water. Diffusion from the air and photosynthetic activity inside the water are the two main sources of oxygen in water. The dissolved oxygen level varies in different lakes based on the pollutant. 6.5 mg/L in Kukkarahalli Lake, 6.8 mg/L in Karanji Lake, and 4.5 mg/L in

Dalvoy Lake, which is due to an increase in temperature or the addition of some organic matter to the sediments. Dissolved ammonia can also contribute to the nitrification process, which results in oxygen depletion.

Kukkarahalli Lake, Karanji Lake, and Dalvoy Lake all had sodium concentrations that varied from 76.3 mg/L, 71.6 mg/L, and 76.4 mg/L, respectively. In lake waters, sodium is present in relatively lower proportions than calcium and magnesium and enters the water through rock weathering. In Kukkarahalli Lake, Karanji Lake and Dalvoy Lake the potassium concentration ranged from 8.8 mg/l to 13mg/l.

The concentrations of total hardness (calcium + magnesium) varied between the lake's ranges from 246 mg/l in Kukkarahalli lake, 210mg/l in Karanji lake and 280 mg/l in Dalvoy lake. The lake water gets evaporated rapidly devoid of the dissolved cations and anions in the water and contributes to hardness.

Sulphate concentrations in the lakes Kukkarahalli, Karanji, and Dalvoy ranged from 14mg/L to 27. mg/L. In addition to biological oxidation of reduced sulphur species, domestic sewage and industrial effluents may increase the sulphate level of water. In Kukkarahalli Lake, the phosphate concentration is 0.6 mg/L, while in Karanji Lake, it is 0.48 mg/L, 0.34 mg/L in Dalvoy Lake. High phosphate concentration in lakes is a result of fertiliser use, agricultural runoff, and domestic waste disposal. Large amounts of phosphates found in lake water are a sign of sewage and industrial waste pollution.

In Kukkarahalli Lake, nitrate concentration is observed at 0.4mg/L, Karanji Lake at 0.5mg/L and Dalvoy Lake 0.8 mg/L. The oxidised form of nitrogen is found in water as nitrites and nitrates. The biological oxidation of nitrogenous organic matter, fertilisers, animal waste, sewage from public facilities, and plant debris make up its main source. Less than 1 mg/L are naturally present in water; larger concentrations signify contamination.

The total coliforms varied from 5400 MPN in 100 ml to 7000 MPN in 100 ml and faecal coliforms ranged from 1300 MPN in 100 ml to 1700 MPN in 100 ml in sampling lakes of Mysore city. The coliform bacteria are expelled from the human intestine, and their presence suggests that harmful organisms may also be present. The Escherichia, Citrobacter, Enterobacter, and Klebsilla genera are among the coliform bacteria. This finding indicates that the lake water is bacteriologically impure and unfit for bathing and other recreational uses.

Table 1: Physico-Chemical and Biological quality of Kukkarahalli Lake, Karanji Lake and Dalvoy Lake Water

		Kukkarahalli Lake	Karanji Lake	Dalvoy lake
pH	--	7.6	7.4	7.6
Dissolved Oxygen	mg/L	6.5	6.8	4.8
BOD	mg/L	4.6	5.2	8
Conductivity	µs/cm	640	738	610
Nitrate as N	mg/L	0.4	0.6	0.8
Fecal Coliform	MPN/100ml	1300	1700	1700
Total Coliform	MPN/100ml	5800	5400	7000
COD	mg/L	128	144	138
Turbidity	NTU	8.6	10.2	6.6
Hardness	mg/L	246	210	280
Calcium	mg/L	88	90	108
Magnesium	mg/L	158	110	172
Chlorides	mg/L	102	124	158
Sodium	mg/L	76.3	71.6	76.4
Potassium	mg/L	13	8.8	9.8
Sulphate	mg/L	18	27	14
Phosphate	mg/L	0.6	0.48	0.34
Alkalinity	mg/L	216	210	250
TSS	mg/L	36	44	38
TDS	mg/L	680	620	690

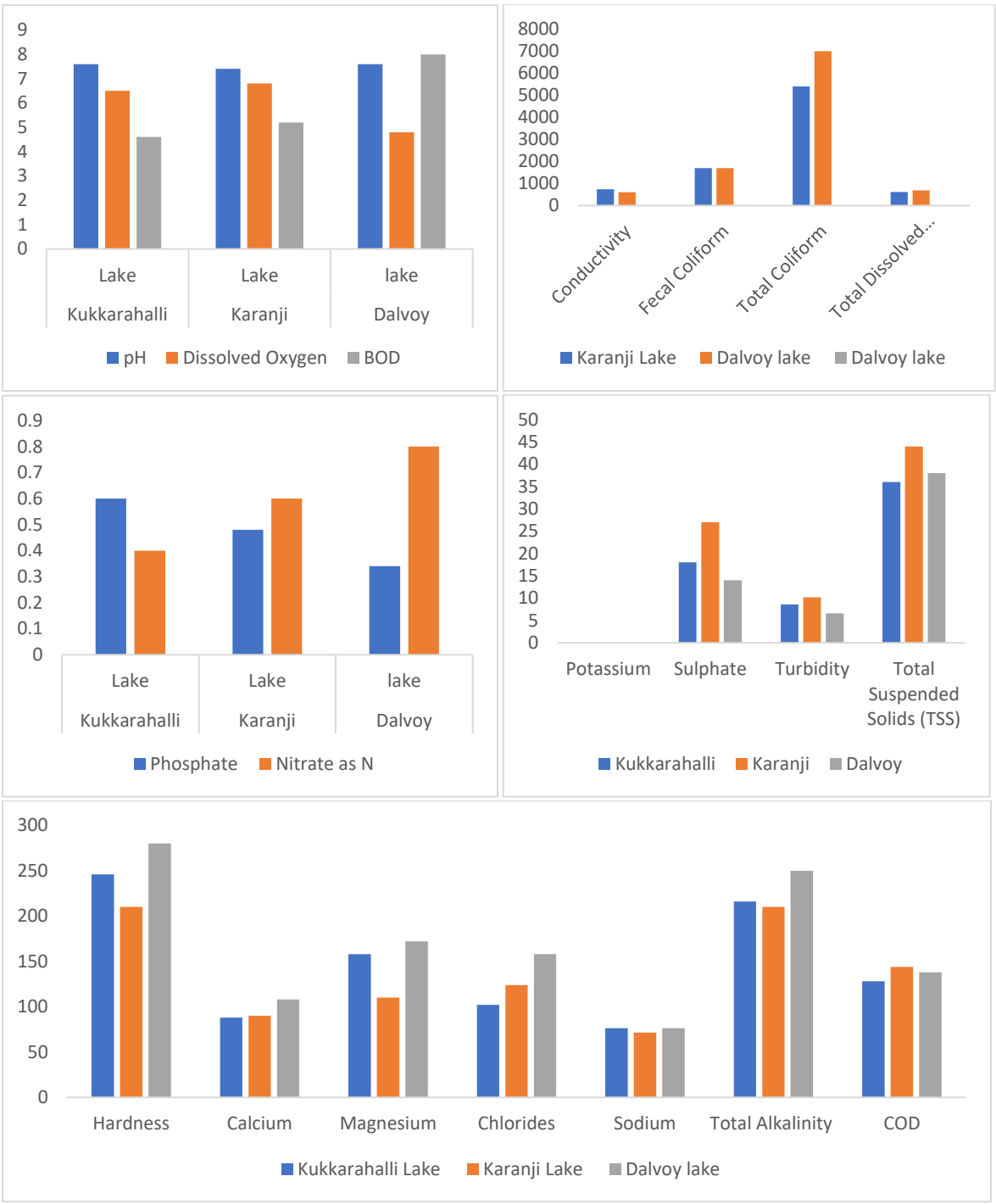

Figure 1: Graphical representation of assessed parameters

CONCLUSION

The following findings have been reached based on the examination of the experimental results.

- The lake is eutrophic, as evidenced by the quantity of nitrate and phosphate.
- The pH, COD, and BOD levels in the lake's water are within ranges that support aquatic growth.
- The DO level at lakes is found to be minimum, it can be inferred that the lakes are not suitable for aquaculture. Aquatic plants like water hyacinth and lavancha are seen in abundance in the lake,

which helps in absorbing nutrients, thereby reducing the pollutant concentration and aiding in Lake Self-purification.

- It can be inferred that the lake water is best suitable for agricultural purposes based on the sufficiency of nutrients. Due to their high nutritional value, weeds can be used as domestic animal feed.

PREVENTIVE ACTIONS

- Regular weed removal from the lake and disposal of them.
- Periodic de-silting of the lake in the targeted locations.
- Building silt traps and artificial wetlands where incoming drains and sewage enter the area.
- Bund formation and bolstering.
- Removing pollutant loads entering the lake by intercepting, rerouting, and treating pollution loads from point sources.
- Lakefront and catchment area treatment Bunding, fencing, and shoreline development are examples of eco-development, as are the establishment of public spaces for recreation and entertainment (Children's Park, boating, etc.).
- Public engagement and awareness through the creation of local community committees.

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