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"A STUDY ON THE SEASONAL VARIATION IN WATER QUALITY OF SHANTIGRAMA LAKE IN HASSAN DISTRICT, KARNATAKA"

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Abstract - *In this study we are analyzing the water quality of Shantigrama lake, Hassan District, Karnataka. The physio-chemical characteristics of the lake will be studied and analyzed from November 2022 to April 2023 for a period of Six months. Water samples will be collected on a monthly basis from four different sample stations i.e., S1, S2, S3 and S4. The analysis was carried out for the parameters like Turbidity, Total Dissolved Solids, pH, Total Hardness, Alkalinity, Acidity, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD) which gives a better understanding of the prevailing condition of the lake with respect to water quality variation w.r.t seasons. We have used Water Quality Index method given by Horton which was helpful in studying the variation of quality of water. From the observed values it can be concluded that the water quality of the Shantigrama Lake is good and with some degree of primary water treatment it can be utilized for consumptive use as well.*

Key Words: Shantigrama, Lake, Physico-chemical parameters, Seasonal, Water analysis, Water quality index

1.INTRODUCTION

Water is a one-of-a-kind natural component that is essential to many life processes. Water is essential to the growth and survival of all living things. Due to the limited availability of water resources, water bodies are extremely valuable. The most significant factor in shaping the land and regulating the climate is water. The primary reason that natural water bodies' water quality has deteriorated is rapid industrialization and population growth.

In future, there could be a shortage of fresh water because of impromptu and unreasonable double-dealing. There is expanding need for freshwater assets like compact water for local locations, water system water for farming, water for modern use in enterprises and water for hydroponics. With their irreplaceable ecological functions, social benefits, and economic value, lakes are an important inland water ecosystem.

Water quality weakening in lakes has involved extraordinary worry because of its adverse consequences on friendly monetary and well-being viewpoints and has been perceived as a difficult issue at neighborhood provincial and worldwide levels. Any ecosystem's water quality tells a lot about the ecosystem's resources for life support and whether or not they are suitable for human use.

Natural and anthropogenic processes, such as rainfall, erosion, hydrological features, and industrial and agricultural activities, control the quality of surface water. Physiological and chemical factors determine the water quality in rivers, lakes, and reservoirs.

1.1 Objective

- To investigate the physical and chemical features of the Shantigrama Lake.
- to ascertain the state of Shantigrama Lake's water quality.
- To determine whether water is suitable for irrigation uses.

1.2 Study Area

Shantigrama Lake is situated in Hassan district of Karnataka state India (Fig. 1.1). It is surrounded by 3 villages and located along Bangalore-Mangalore NH-75. The area of the lake is 189 hectares. The water storing capacity of Shantigrama lake is 67.10 MCFT (Million Cubic Feet). The lake is mainly used for irrigation, fishing and washing purposes.

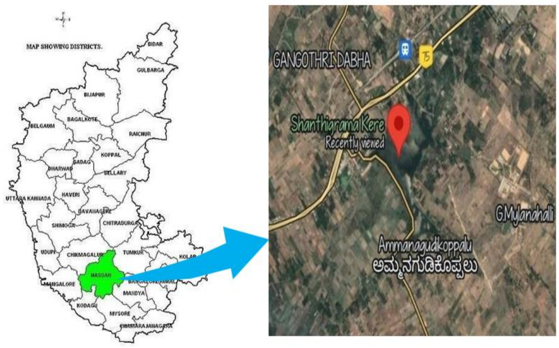

Fig 1.1: Study Area

2. LITERATURE SURVEY

- **Igbokwe SO, Ogueri C & Ajima MNO**

From April 2014 to March 2015, the physiochemical characteristics of Agulu Lake in Southeastern Nigeria changed seasonally. Thirteen Physicochemical properties of the lake were resolved keeping the guideline techniques. The lake's physical and chemical properties were found at sampling stations within acceptable limits, indicating that the lake's water may be safe for human consumption and beneficial to aquatic life.

- **Sudarshan P., Mahesh M. K. & Ramachandra T. V.**

The review was completed to assess occasional variety in the physio-compound boundaries of water quality and to register the water quality record of Hebbal Lake, Bangalore. Four locations provided water samples for analysis. In all four locations, according to BIS, TDS, EC, and BOD were above acceptable levels. According to the findings of this study, effective measures are urgently required to prevent contaminated water from entering the lake and improve its overall water quality.

- **Deepti, Archana Bachheti, R. K. Bachheti & V.K. Mishra**

The objective of this study was to estimate the physiochemical parameters of the Bareilly-dwelling Nakatia River. From August to November of 2016, six different locations were used to collect samples. Analyses were conducted on a variety of parameters, including pH, TDS, alkalinity, chloride, total hardness, BOD, COD, nitrates, dissolved phosphates, and heavy metals. Additionally, a water quality assessment revealed that the water in the Nakatia River is no longer safe for human consumption, and appropriate measures to restore the river's water quality must be taken immediately.

- **Ajayan. A and Ajit Kumar, K.G**

The following parameters—water pH, temperature, conductivity, TDS, total alkalinity, and total hardness—were also analyzed in this study of Museum Lake Thiruvantapuram's seasonal changes in surface water chemistry: total alkalinity and total hardness. The outcomes demonstrated that WQI falls into the good category. The water body is an undisturbed biological system amidst the bustling city, and which is inside a bustling vacationer region. The DO, BOD, and Phosphate values fall short of the desired water quality threshold.

3. MATERIALS AND METHODOLOGY

3.1 Sample Collection and Physio-chemical Analysis

For six months, from November 2022 to April 2023, sampling was carried out every month. From four stations, water samples were taken (Fig. 3.1) using bottles of 5 litres. A sum of eight parameters were considered viz Dissolved Oxygen (DO), Total dissolved solids (TDS), pH, Biological Oxygen Demand (BOD), Alkalinity, Total Hardness, and turbidity were analyzed. For each month, tests were gathered at a particular time. In accordance with standard procedures, the physicochemical parameters were analyzed in the laboratory. Parameters related to water quality showed signs of seasonal variation. Using guidelines from WHO, CPCB, and the Bureau of Indian Standards (BIS), the observations were interpreted.

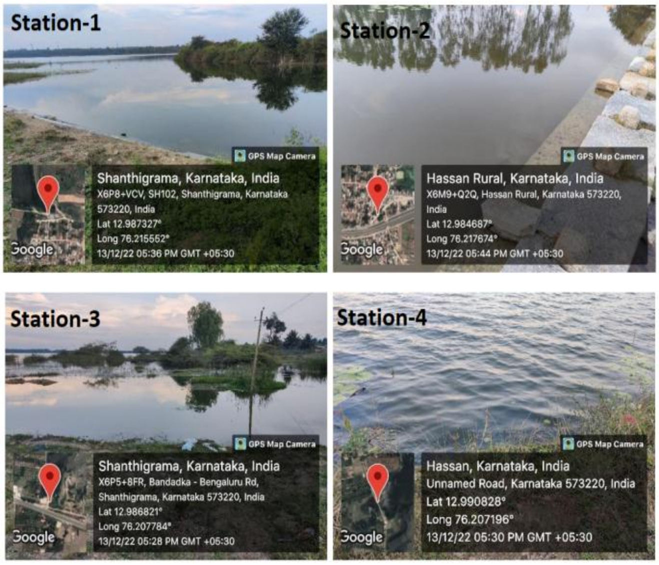

Fig 3.1: Sampling Stations

3.2 Methodology

We selected four distinct sampling locations to obtain the water sample for this study. Furthermore, the examples are gathered by grab sampling method from stations S1(12.987327°,76.215552°), S2(12.984687°,76.217674°), S3(12.986821°,76.207784°), S4(12.990828°, 76.207196°) in Plastic containers (5000 ml). The figures above depict the sampling locations. In accordance with the timetable established for each parameter, all collected samples were immediately sent to the laboratory for analysis.

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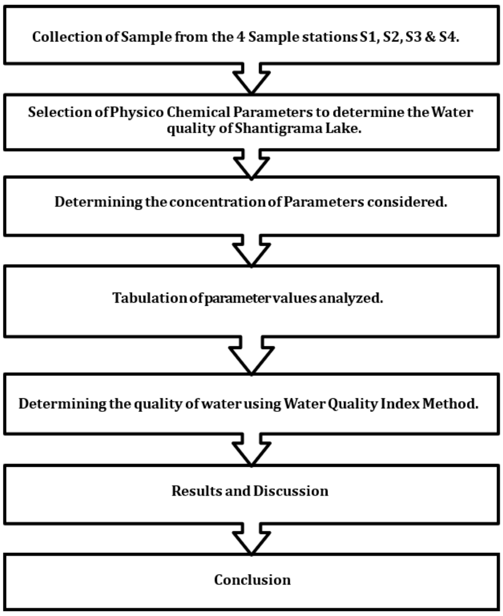

Fig 3.2: Methodology Flowchart

Table 1: Physiochemical Parameter

Sl.No.	Parameters	Methods	Units
1.	pH	Electrometric method	No unit
2.	Turbidity	Turbidity Meter	NTU
3.	Total Hardness	EDTA Titrimetric method	mg/L
4.	Alkalinity	Titrimetric method	mg/L
5.	Acidity	Titrimetric method	mg/L
6.	TDS	Gravimetric Method	mg/L
7.	DO	Winkler's Method	mg/L
8.	BOD	Winkler's Method	mg/L

3.3 Water Quality Index

A single value for the water quality index (WQI) provides information about water quality. WQI is normally utilized for the discovery and assessment of water contamination and might be characterized as an impression of the composite impact of various quality boundaries on the general nature of water (Horton, 1965). Physical-chemical and biological indices are the two broad categories of WQI indices. The values of various physicochemical parameters in a water sample serve as the basis for physicochemical indices, whereas biological indices are derived from biological data.

Table 2: Water Quality index Scale

WQI Rating	Status	Possible Usage
0-25	Excellent	Drinking, Irrigation and Industrial
26-50	Good	Drinking, Irrigation and Industrial
51-75	Fair	Irrigation and Industrial
76-100	Poor	Irrigation
101-150	Very poor	Restricted use for irrigation
Above 150	Unsuitable	Proper treatment required before use

The unit weight (W_n) and quality rating scale (q_n) are calculated using the expressions given below.

$$W_n = K / S_n$$

Where,

S_n = Standard permissible value of n^{th} water quality parameter.

K = Constant of proportionality

$$K = [1 / (\sum 1/S_{n=1,2....n})]$$

$$Q_n = [(V_n - V_{id}) / (S_n - V_{id})] \times 100$$

Where,

V_n = Estimated value of n^{th} water quality parameter at a given sample location

V_{id} = Ideal value for n^{th} parameter in pure water.

(V_{id} for pH = 7 and 0 for all other parameter)

S_n = Standard permissible value of n^{th} water quality parameter

Calculation of WQI was carried out in this work by Horton's method. The WQI is calculated by using the expression given in equation,

$$WQI = \sum qnWn / \sum Wn$$

Where, q_n=Quality rating of n^{th} water quality parameter.

W_n=unit weight of n^{th} water quality parameter.

Table 3: BIS Standards and Unit Weights

SL. No	*Parameters*	*BIS standard*	*Unit weight (Wn)*
1	pH	8.5	0.1947
2	Total Dissolved Solid	500	0.00331
3	Turbidity	5	0.0423
4	Total hardness	300	0.0055
5	Alkalinity	200	0.0083
6	Acidity	200	0.005
7	Dissolved Oxygen	5	0.3310
8	BOD	10	0.3310

4. Results and Discussion

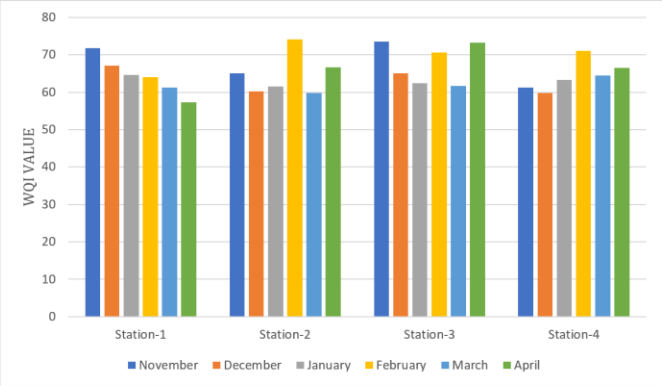

Fig: 4.1: Seasonal variation of WQI

In the above graph, x-axis represents months and the y-axis represent the water quality index values. For station 1, the WQI values for the month of November, December, January, February, March and April of 2023 are 71.82, 67.03, 64.66, 64.06, 61.3 and 57.35 respectively and it falls under the fair category which can be used for irrigation and industrial purpose. For station 2, the WQI values for the months of November December, January, February, March and April are 65.12, 60.23, 61.57, 74.11, 59.81 and 66.6 respectively and it falls under the fair category which can be used for irrigation and industrial purposes. For station 3, the WQI values for the months of November December, January, February, March and April are 73.48, 65.06, 62.47, 70.66, 61.63 and 73.30 respectively and it falls under the fair category which can be used for irrigation and industrial purposes. For station 4, the WQI values for the months of November December, January, February, March and April are 61.21, 59.83, 63.28, 71.10, 64.47 and 66.49 respectively and it falls under the fair category which can be used for irrigation and industrial purposes.

5. CONCLUSIONS

The summary of WQI values for all months is given in Figure 4.1. The calculated WQI implies that the lake water quality was "Fair" in all the 6 months considered. The high WQI score in the month of February. The overall WQI of Shantigrama Lake fell within the 'Fair' category of the WQI classification and is suitable for irrigation and industrial purposes. Overall, it can be concluded that the water quality of the lake Shantigrama Lake is good and with some primary water treatment it can be utilized for consumptive use, also with its vast expanse and storage capacity if proper treatment is given it can also be used for water supply to the nearby regions. The findings of this study may aid decision-makers in the sustainable management and protection of the lake.

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BIOGRAPHIES

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