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DETERMINATION OF WATER QUALITY INDEX OF GHODAZARI LAKE IN WINTER SEASON

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ABSTRACT

This research focuses on how environmental factors and household activities affect water quality in a specific area. Conducted over a year, the study is aimed at the assessment of the physico-chemical properties and water quality index WQI of Ghodazari Lake, located in Nagbhir, Chandrapur District, during the winter season. Its objective is to evaluate the usefulness of the water for public use, recreational activities, and other purposes. Collection and analysis of Water samples were done over a period from September 2021 to August 2022. Then the data was processed to calculate the Water Quality Index (WQI) and then compared with the drinking water standards recommended by the World Health Organization (WHO) and the Bureau of Indian Standards (BIS). The analysis showed that, almost all the parameters were within permissible limits. Turbidity, total dissolved solids (TDS), and electrical conductivity (EC) were found upto the acceptable thresholds. A total of eleven water quality parameters was considered in the WQI approach to assess the overall groundwater quality, which resulted in a WQI value of 85. This categorizes the lake water as unsuitable for drinking purposes for both humans and domestic animals, falling into the "poor" category.The findings highlight an urgent need for proper wastewater management in the vicinity of Ghodazari Lake to improve its water quality and preserve its aesthetic value. Additionally, it is recommended to plant vegetation along the lake's boundaries, which can act as a natural water purifier.

INTRODUCTION

Temperature, turbidity, nutrients, hardness, alkalinity, and dissolved oxygen are crucial elements for supporting life in aquatic environments. Water quality encompasses the collective physical, chemical, and biological properties of a water body, indicating its overall condition. Therefore, evaluating water quality involves analysing a range of physicochemical, biological, and microbiological parameters which reflect both living and non-living aspects of ecosystem.

The Water Quality Index (WQI) assigns a single numerical value to represent the overall quality of water at a specific time and location, derived from several water quality parameters. The purpose of this WQI is to simplify complex water quality data into actionable information to publisize. It serves as a concise indicator of water quality, aiding in public awareness, pollution control efforts, and water quality management initiatives.Major degrading factors include excessive eutrophication due to nutrient and organic matter loading, construction and logging activities etc. (Nirbhavane and Khobragade, 2017) Pollutants that originate from human activities (agricultural runoff post agricultural activities) & pesticides from farms that wash into waterways also pose threat to the aqua life. The anthropogenic discharges represent a constant polluting source, whereas surface runoff is a seasonal phenomenon, mainly affected by climatic conditions (Singh et al., 2004). This study focuses on assessing the physicochemical characteristics of water and calculating the Water Quality Index ofGhodazari Lake in Nagbhir, Chandrapur District, Maharashtra, India. Through this analysis, the study aims to provide insights into the overall quality of water for public use, recreational activities, and environmental conservation efforts.

Materials

Ghodazari village is situated in Nagbhir Taluka in Chandrapur district and is 90 km away from Chandrapur city. It belongs to Vidarbha region in the state of Mahrashtra. Ghodazari dam also popularly and locally known as ‘Ghodazari lake’ or ‘Ghodazaritalav’ is surrounded by dense forest spread in 159 km2 (61 sq.m.) of southern tropical dry forest and this lake is widely known and named after the village itself that is in the middle of the forest about 2 km from the dam (lake) and the resort. This perennial water body is utilized by wild life for drinking and for irrigation, fisheries and domestic purposes by people respectively.

Longitude :20o 32’ 29. 25” N, Latitude :79o 37’ 44.33” E

Methods

Specimens were gathered in sterilized polyethylene containers with a capacity of one litre. Monitoring activities took place from September 2021 to August 2022, encompassing the winter season. Parameters prone to fluctuations, such as temperature, electrical conductivity (EC), pH, and dissolved oxygen (DO), were directly measured at the sampling sites. Subsequently, the samples were studied at the laboratory for the evaluation of additional physicochemical attributes, including sodium, total hardness, total alkalinity, calcium, magnesium, sulphate,chlorides, nitrate, phosphate, and biochemical oxygen demand (BOD). Comparison of the parameters was done according to the standard methods. The calculation of water quality index (WQI) of the water body was carried out by the weighted arithmetic index method.Moreover, calculation of quality rating or sub index (qn) was done by the expression given below:

Qn = 100[Vn - V10] / Sn – V10]

Where: qn=Quality rating for the nth water quality parameter,

Vn=Estimated value of the nth water quality parameters of collected sample,

Sn=Standard permissible value of the nth water quality parameter,

V10=Ideal value of the nth water quality parameter in pure water.

Assume there are 'n' water quality parameters, and each quality rating or sub-index (qn) associated with the nth parameter is a numerical representation indicating its deviation from the standard permissible value in polluted water.The unit weight was determined using a value inversely in proportion to the recommended standard value (Sn) of the respective parameter.

WQI = Σqn Wn / ΣWn

Where: Wn=Unit weight for nth water quality parameter,

Sn=Standard permissible value of the nth water quality parameter,

K=Constant for proportionality.

The overall WQI was calculated by aggregating the quality rating with the unit weight linearly

WQI = **Σ**qn Wn / **Σ**Wn Where:

qn = Quality rating for the nth water quality parameter, Wn=Unit weight for nth water quality parameter

RESULT

pH: pH value is highlysignificant for plankton growth (Chisty, 2002). According to Umavathi et al (2007) pH is ranged 5 to 8.5 is the best for plankton growth. During present study water pH values were found was 7.1 to7.5. It has shown the alkalinity nature throughout the study period.

Electrical conductivity : The average of electrical conductivity with standard error value is 3.14 ± 0.77. The electrical conductivity was reported during winter season is 220Ω/cm.

Alkalinity: According to Wetzel, surface water Alkalinity is basically a function of carbonate, hydroxide content and also comprises the assistance from borates, phosphates, silicates and other bases. Capacity of water is measured by Alkalinity to neutralize a strong acid (Wetzel, 1983). For this study, the alkalinity in the water samples is observed to have ranged from 108-114 mg/L.

Total dissolved solids: Total dissolved solids denote mainly the various kinds of minerals present in the water. Salinity behaviour of groundwater is indicated by total dissolved solids (Goher, 2002). The range of total dissolved solids is from 256-272 mg/l during winter.

Total Hardness: Chiefly,ions such as bicarbonate calcium,carbonate,magnesium, chloride and sulphate in water change the water hardness(Kotadiya et al, 2013). The water samples hardness at Ghodhazri Lake ranged between27.8 to 28.5 mg/L. which comes under permissible limit of 310 mg/L.

Calcium: Calcium asions in fresh water is most abundant and is significant in the construction of shell, bone building and plant precipitation of lime (Narayan et al, 2008). Calcium after analysiswas observed ranging between 18.20 to 19.5 mg/L.

Magnesium: Magnesium is usuallyrelated with calcium in all types of waters, but in general, its concentration stays lower than the calcium. Magnesium is integral for chlorophyll growth and functions as a limiting factor for the phytoplankton growth(Smitha et al, 2007). The amount of magnesium in the water samples has been observed to have ranged between 9.6 to 9.8 mg/L.

Dissolved oxygen: The higher value of dissolved oxygen is indicative of ahealthy aquatic life. Amount of dissolved oxygen in water samples was observed ranging between 5.12 to 5.4 mg/L.

Chloride: The chloride in drinking water gets originated from natural sources, industrial effluents,sewage and urban runoff that comprises of de-icing of salt and saline intrusion (Solanki, 2006). Chloride concentration in water samples was notified in much lower concentration between 25 to 40 mg/L.which indicates lower pollutant level in the lake

Nitrate: Nitrates are one of the contributing actors to freshwater caused by the release of sewage and industrial waste and runoff from agricultural fields. The highest amount of nitrate concentration was known to support the formation of blooms (Solanki, 2001). In the present study, the amount of nitrate was observed ranging from 2.42 to 3.08 mg/L.

Biochemical Oxygen Demand: The biochemical oxygen demand may be measuredin terms of oxygen needed for the microorganism to perform the biological decomposition of dissolved solids or organic matter in the waste water under aerobic conditions (Verma et al, 2010). The biochemical oxygen demand was observed to have ranged between 4.5 to 4.8 mg/L.

Discussion

The Water Quality Index (WQI) for Ghodazari Lake, calculated using the Weighted Arithmetic Method, is 85.40, which falls under Grade C, indicating poor quality of water. The pH of the water plays a crucial role in supporting biotic components, as most aquatic plants and animals thrive within a moderate pH range. In this study, the pH of the lake water across all seasons is slightly alkaline, reflecting the lake's alkaline nature.

The lake's alkalinity and total hardness remain within permissible limits throughout the year. Parameters such as Dissolved Oxygen (DO) and Biological Oxygen Demand (BOD), which signify the availability of oxygen in the water, also fall within acceptable limits, suggesting the presence of a viable aquatic ecosystem. Other parameters analyzed do not significantly deviate from standard limits.

With appropriate conservation measures, rehabilitation efforts, and the implementation of effective techniques, it is feasible to better the water quality of Ghodazari Lake to make it potable.

Suggestion

To enhance the water quality of Ghodazari Lake, focused efforts on conservation, rehabilitation, and sustainable management are essential. Regular monitoring of key parameters like pH, Dissolved Oxygen, and Biological Oxygen Demand should be conducted to ensure compliance with water quality standards. Implementing eco-friendly practices, such as reducing pollution sources and promoting community awareness, can further protect the aquatic ecosystem. Afforestation around the lake and the use of advanced water treatment technologies can enhance the lake's ecological health. Collaborative efforts among local authorities, environmental organizations, and residents can make the water suitable for potable use, irrigation and pisciculturepractices whilepreserving biodiversity.

Table 1: Water Quality Index (WQI) and its status according to Chaterjee and Raziuddin [7] and Thakor et al. [8].

S.N.	Water Quality Index Level	Water Quality Status
1	0-25	Excellent
2	26-50	Good
3	51-75	Poor
4	76-100	Very poor
5	>100	Unsuitable for drinking

Table: - 2 Average with standard error values of physico-chemical parameters ofwater samples collected from GHODAZARI LAKE

	2021-22	Winter season
S.N.	Parameters	Observed Value
1	pH	7.1 ± 0.40
2	Electrical conductivity (Ω /cm)	220 ± 0.62
3	Alkalinity (mg/L)	114 ± 2.46
4	Total Dissolve Solid (mg/L)	265 ± 5.08
5	Magnesium (mg/L)	9.6 ± 0.78
6	Chloride (mg/L)	40 ± 1.8
7	Biochemical Oxygen Demand (mg/L	4.5 ± 0.18
8	Dissolved Oxygen (mg/L)	5.4 ± 0.48
9	Nitrate (mg/L)	2.42 ± 0.72
10	Calcium (mg/L)	18.2+0.67
11	Total Hardness (mg/L)	27.8 ± 7.9

Table 3: Calculation of WQI of water samples of Ghodazari Lake in winter season

Sr. No	Parameters	Observed Value	Standard Value (Sn)	Ideal Value (V10)	1/Sn	(Wn)=K/Sn	Quality Rating (Qn)	WnQn
1	pH	7.1	8.5	6	0.1176471	0.1815454	83.52941176	15.16438198
2	Electrical conductivity (Ω /cm)	220	250	0	0.004	0.0061725	88	0.543183891
3	Alkalinity (mg/L)	114	114	0	0.0087719	0.0135363	100	1.353628118
4	Total Dissolve Solid (mg/L)	265	500	0	0.002	0.0030863	53	0.163572422
5	Magnesium (mg/L)	9.6	30	0	0.0333333	0.0514379	32	1.646011791
6	Chloride (mg/L)	40	250	0	0.004	0.0061725	16	0.098760707
7	Biochemical Oxygen Demand (mg/L)	4.5	5	0	0.2	0.3086272	90	27.77644897
8	Dissolved Oxygen (mg/L)	5.4	6	14.2	0.1666667	0.2571893	90	23.14704081
9	Nitrate (mg/L)	2.42	50	0	0.02	0.0308627	4.84	0.14937557
10	Calcium (mg/L)	18.2	75	0	0.0133333	0.0205751	24.26666667	0.499290243
11	Total Hardness (mg/L)	27.8	300	0	0.0033333	0.0051438	9.266666667	0.047665758
					0.5730857	**0.8843491**	**ΣQn=878.9027**	**ΣWnQn=85.40347**

Value K = 1.54313

REFERENCES

- APHA-AWWA-WPCF (2012). Standard Methods for the Examination of Water and Wastewater, 22nd edn. Water Environment Federation Washington, DC.
- BIS (Bureau of Indian Standards) 10500, Indian standard drinking water specification, First revision, 1991, pp 1-8.
- Botkin DB, Keller EA (1995). Environmental Science: Earth as a living plane, Water Pollution and Treatment, John Wiley and Sons.
- Chaterjee C and Raziuddin M (2002). Determination of water quality index (WQI) of a degraded river in Asanol Industrial area, Raniganj, Burdwan, West Bengal. *Nature Environment and Pollution Technology* 2: 181-189.
- Goher MEM (2002). Chemical studies on the precipitation and dissolution of some chemical elements in Lake Qarun, Ph.D. Thesis faculty of sciences, Al-Azhar University, Egypt.
- Kotadiya NG, Acharya CA, Radadia BB, Solanki HA (2013). Determination of Water Quality Index and suitability of a rural freshwater body in Ghuma village, District Ahmedabad, Gujarat. *Life Sciences Leaflets* 2: 68-67.
- Lenore Clesceri S APHA (1989). Standard Methods for the Examination of water and wastewater (17th edn.) APHA, AWWA, WPCE, Washington DC.
- Mayanglambam, B., & Neelam, S. S. (2022).Physicochemistry and water quality of Loktak Lake water, Manipur, India. *International Journal of Environmental Analytical Chemistry*, 102(7), 1638-1661.
- Menberu, Z., Mogesse, B., &Reddythota, D. (2021). Evaluation of water quality and eutrophication status of Hawassa Lake based on different water quality indices. *Applied Water Science*, 11, 1-10.
- Miller, K., Hooda, P.S., & Downward, S.R. (2010). The Impact of treated sewage wastewater discharge on the phosphorus levels and hydrology of two second-order rivers flowing into the Thames. *J. Environ. Monitoring*, 27(5): 101-105.
- Murugesan A, Ramu A, Kannan N (2006). Water quality assessment from Uthamapalayam municipality in Theni District, Tamil Nadu, India. *Pollution Research* 25: 163-166.
- Narayana J, Puttaiah ET, Basavaraja D (2008). Water quality characteristics of Anjanapura reservoir near Shikaripur, District Shimoga, Karnataka. *Journal of Aquatic Biology* 23: 59-63.
- Nirbhavane G, Khobragade K. Study of Water Quality of Sion Lake, Mumbai, Maharashtra. Scholars Journal of Engineering and Technology. 2017; 5(8):413-415.
- Reddy VK, Prasad KL, Swamy M, Reddy R (2009).Physico-chemical parameters of Pakhal lake of Warangal District, Andhra Pradesh, India. *Journal of Aquatic Biology* 24: 77-80.
- Singh KP, Malik A, Mohan D, Sinha S. Multivariate Statistical Techniques for the Evaluation of Spatial and Temporal Variations in Water Quality of Gomti River (India) - a Case Study. Water Research. 2004; 38(18):3980-3992.
- Smitha PG, Byrappa K and Ramaswamy SN (2007). Physico-chemical characteristics ofWater Samples of Bantwal Taluka, South-eastern Karnataka, India.J.Environ.Biol.28:591-595.
- Solanki HA (2001). Study on pollution of soils and water reservoirs near industrial areas of Baroda. Ph.D. Thesis submitted to Bhavnagar University, Bhavnagar.
- Solanki HA, Pandit BR (2006). Trophic status of lentic waters of ponds water of Vadodara, Gujarat, India. *International Journal of Bioscience Reporter* 4: 191-19.
- Thakor FJ, Bhoi DK, Dabhi HR, Pandya SN, Chauhan NB (2011). Water Quality Index (WQI) of Pariyej lake District Kheda, Gujarat. *Current World Environment* 6: 225-231.
- Verma PU, Chandawat D, Solanki HA (2010). Study of water quality of Hamirsar lake – Bhuj. *International Journal of Bioscience Reporter* 8: 145-153.
- World Health Organization (W.H.O.) (1998). Guideline for drinking water quality. Health criteria and other supporting information (2nd edn.) Geneva, 2: 231-270.