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Study of Physico-Chemical Parameters of Sarangkheda Barrage of Tapi Basin from Nandurbar District

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ABSTRACT

This research article presents a comprehensive analysis of the monthly physical parameters of water at Sarangkheda Barrage from October 2021 to September 2022. The study focuses on key water quality indicators, including pH, temperature (Temp), biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (D.O.), total dissolved solids (TDS), alkalinity, calcium (Ca), and magnesium (Mg). The data was collected on a monthly basis to assess the variations in these parameters throughout the year and their potential impact on the water ecosystem. The findings offer valuable insights into the water quality trends and highlight potential environmental concerns in the study area.

Introduction

Limnology emerged as a scientific discipline that encompasses the biological, chemical, physical, geological, and ancillary elements of all inland waterbodies (Lentic and Lotic, fresh and marine, natural or man-made). Planktonology, Environmental Engineering, Aquatic Biology and Ecology, Geoinformatics (GIS), Hydrochemistry, Aquatic Toxicology, Pollution, and Eutrophication are all active fields of study in inland water bodies. Air, water, and soil are essential for life on Earth. Water is a costly contribution of nature that is required for human, plant, and animal survival. Aquatic ecology is proportionate to a water body's biological and physicochemical properties.

The physicochemical features of a wetland influence the presence and growth of life, which gathers the complex interplay of the aquatic ecosystem; thus, many researchers have researched the qualities (physical, chemical, and biological) of distinct waterbodies. Aquatic ecosystems are made up of phytoplankton and hydrophytes as primary producers, zooplankton as primary consumers, fishes as secondary and tertiary consumers, and a variety of other creatures that contribute to aquatic biodiversity.Limnology's history may be traced back to the late nineteenth and early twentieth century, when pioneering researchers made substantial contributions to the science. Fritsch (1888) developed the first transportable biological station to investigate lakes, and Forel (1901) supplied substantial motivation for effective limnological research, earning him the moniker "father of modern limnology." Fritsch (1907) pioneered studies on the periodicity of algae in tiny ponds.

Several scientists, including West and West (1907), Hodgetts (1921), Pearsall (1921, 1923, 1930, and 1932), Thienemann, and Naumann (1922), contributed to the understanding of algal periodicity and the variables that regulate it. Storm (1924), Howland and Lucy (1931), and Hutchinson and Pickford (1932) studied the physical features of freshwater lakes, whereas Welch (1948) focused on the primary issue of "Biological Productivity" in limnology.

In India, limnological research has grown rapidly due to the country's diverse physiography, unique geology, and high biotic variety, offering a range of aquatic habitats. Early studies focused on temple tanks, diurnal variations, and ecological aspects of tropical waters. Researchers like Ganpati (1940, 1955, and 1960) and Gonzalves and Joshi (1946) made significant contributions to the study of Indian freshwater ecosystems.

In the 1970s and 1980s, several ecological studies were conducted, with a focus on water quality estimation, phytoplankton ecology, and the impact of pollutants on freshwater bodies. Studies by Tripathy and Pandey (1989), Gast and George (1989), and Varadaraj and Ayyappan (1989) emphasized the importance of chemical parameters in algal growth and bloom formations.

The 1990s saw a surge in research related to freshwater ecosystems, with a focus on algal systematics, distribution of nutrients, and trophic structures. Studies by Pandey et. al. (1995 and 1998), Nair (1999), and Tripathy (1989) explored the seasonal abundance and dependence of phytoplankton on physico-chemical environments.

Sarangkheda Barrage is medium irrigation project is constructed in the Tapi basin in Nandurbar district of Maharashtra. It plays a critical role in water resource management for the surrounding region. Monitoring the physical parameters of water in this area is crucial for understanding the water quality and its implications on aquatic life, agriculture, and human consumption. This study aims to provide an in-depth analysis of the water quality parameters observed from October 2021 to September 2022.

Materials and Methods

The collection of samples from various points helps in understanding the spatial distribution of water quality parameters. This approach ensures that the data is representative of the entire study area and helps in assessing the overall health of the water ecosystem. Water samples were collected on a monthly basis from various points along Sarangkheda Barrage. The samples were analyzed for pH, temperature, BOD, COD, D.O., TDS, alkalinity, calcium, and magnesium using standard laboratory methods (APHA, 2017). The data obtained was then subjected to statistical analysis to identify trends and variations. The specific laboratory techniques used for each parameter were based on established protocols and guidelines set by environmental agencies and scientific organizations (EPA, 2020; WHO, 2011). Statistical methods such as regression analysis, trend analysis, and time-series analysis were employed to understand the seasonal patterns and any long-term trends in the data (Smith et al., 2019).

Results

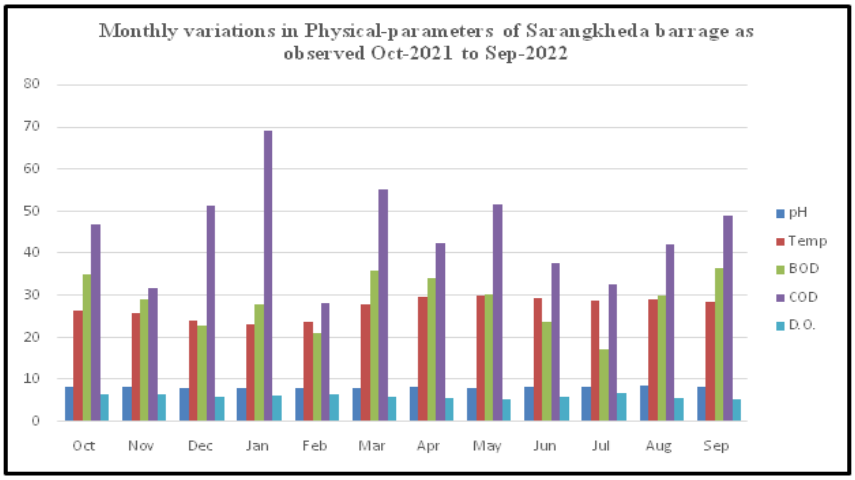
The analysis of the monthly data reveals significant variations in the studied parameters over the course of the year. The pH values remained within the acceptable range, indicating a near-neutral condition. However, temperature fluctuations were observed, with the highest values recorded during the summer months. BOD and COD showed seasonal variations, with higher organic and chemical pollutant levels during the monsoon season. D.O. levels exhibited fluctuations, raising concerns about aquatic ecosystem health. TDS levels were relatively stable throughout the year, except for a substantial spike in July. Alkalinity, calcium, and magnesium levels showed patterns that may influence water hardness and potential environmental impacts.

Discussion:

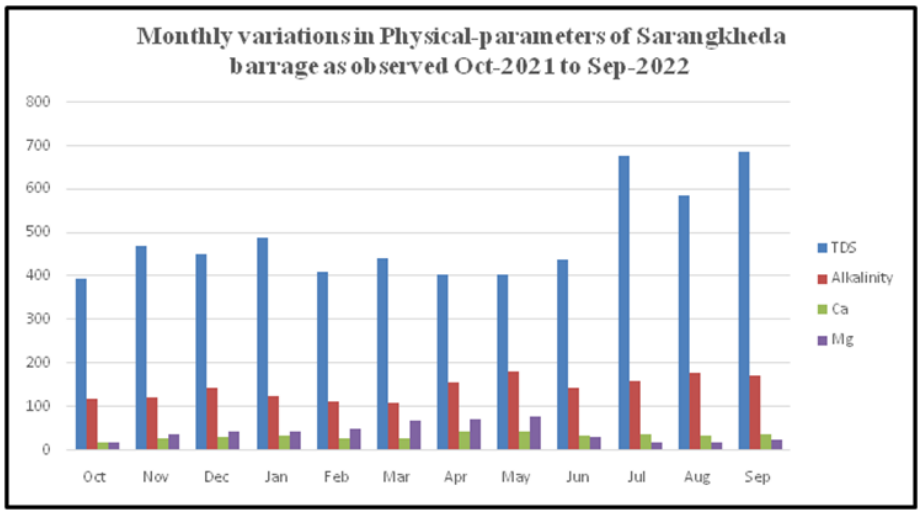
The observed variations in water quality parameters may be attributed to seasonal changes, anthropogenic activities, and natural processes. The increased BOD and COD during the monsoon season can be linked to agricultural runoff and industrial discharges. Low D.O. levels may be attributed to organic matter decomposition and reduced aeration. The spike in TDS during July could be a result of natural mineral dissolution or pollutant influx. Elevated alkalinity, calcium, and magnesium levels may have implications for water treatment and potential effects on aquatic life.

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
pH	8.2	8.3	8.1	8.1	8.04	8.1	8.2	8.0	8.2	8.3	8.5	8.4
Temp	26.34	25.80	23.92	23.10	23.76	27.86	29.72	30.00	29.44	28.68	28.9	28.32
BOD	34.87	28.89	22.92	27.71	21.17	35.76	34.22	30.3	23.67	17.33	29.89	36.43
COD	46.78	31.63	51.29	68.91	28.1	55.14	42.40	51.55	37.53	32.50	41.98	48.8
D.O.	6.50	6.50	5.86	6.24	6.60	5.89	5.59	5.25	6.02	6.76	5.56	5.22
TDS	395.60	471.40	450.60	488.00	410.00	443.20	404.60	403.40	439.40	677.60	587.40	686.20
Alkalinity	119.64	120.97	143.58	124.36	114.26	109.61	156.56	183.20	143.40	158.87	178.21	173.42
Ca	17.76	28.63	29.93	33.49	29.52	28.72	42.63	45.05	34.18	37.43	33.59	36.49
Mg	19.57	37.90	42.90	43.04	49.41	68.82	72.04	79.98	32.68	19.31	18.16	25.40

Table 01: Monthly Physical parameters of Sarangkheda barrage as observed Oct-2021 to Sep-2022



Graph 01: Monthly Physical parameters of Sarangkheda barrage 01



Graph 01: Monthly Physical parameters of Sarangkheda barrage 02

Conclusion

The study highlights the importance of continuous monitoring of water quality parameters to assess their trends and potential impacts. The findings provide valuable information for water resource managers, policymakers, and environmentalists to take necessary actions for maintaining and improving water quality at Sarangkheda Barrage. Further research and management strategies are required to address the specific issues identified in this study and ensure sustainable water management in the region.

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