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Urban Influence on Lake Ecosystem: A case Study of Papad Khind Lake, Virar, Maharashtra, India

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ABSTRACT

Papad Khind lake located in the Palghar district of Maharashtra, plays a critical role in local agriculture and groundwater recharge. Despite its socio-economic importance, limited scientific attention has been paid to its ecological health and environmental status. This study presents a water quality assessment of Papad Khind lake, focusing on water quality parameters like temperature, pH, COD, BOD, DO, turbidity, and TSS indicates the moderate to high pollution impact on water system by agricultural runoff and anthropogenic pressure.

Key words*: Papad Khind lake, Water quality, Fresh water systems.*

Introduction

Freshwater ecosystems, particularly small lakes and reservoirs, are critical to sustaining biodiversity, supporting local hydrological cycles, and meeting the domestic and agricultural needs of nearby communities (Chhaya *et al.*, 2018). In rapidly urbanizing regions, however, these ecosystems are increasingly vulnerable to anthropogenic pressures, leading to degradation of water quality and loss of ecological integrity. One such example is Papad Khind Lake, located in Virar East, Maharashtra, which has experienced growing environmental stress over the past decade.

Papad Khind Lake, historically a significant water resource for local residents, has transitioned from a potable water source to a non-utilitarian, recreational water body due to increasing levels of pollution and associated health concerns. Urban runoff, unregulated religious activities, encroachment, and improper waste disposal have all contributed to the lake's ecological decline. Despite its shrinking utility as a water source, the lake continues to play an important role as a seasonal habitat for flora and fauna, particularly during the monsoon season, and serves as a socio-cultural space for the community.

This investigation aims to assess the ecological status and physicochemical water quality of Papad Khind Lake, synthesizing available data to understand the extent of degradation and its implications for local biodiversity and human health. Parameters such as pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD) are examined. The paper further explores the need for integrated lake management strategies that prioritize conservation, pollution control, and sus-

tainable public use.

Review of Literature

Freshwater lakes across India have been extensively studied for their ecological functions and vulnerability to pollution, especially in urban and peri-urban contexts. Numerous studies highlight those small lakes like Papad Khind Lake, though often overlooked in national water policy, play a critical role in groundwater recharge, biodiversity conservation, and climate regulation (Kumar *et al*., 2018).

Water Quality Degradation in Urban Lakes

Urbanization has been widely documented as a primary driver of water quality decline in small lakes. Studies by Sharma *et al*. (2017) and Joshi and Shinde (2019) on lakes in Maharashtra report increased levels of nitrate, phosphate, BOD, and COD due to domestic sewage discharge, solid waste dumping, and storm water inflow. These pollutants promote eutrophication, reducing oxygen levels and endangering aquatic life (Carvalho *et al.* (2021), and Ritu *et al.* (2012).

In the context of Papad Khind Lake, similar trends are evident. According to a report by the Vasai Virar Municipal Corporation (VVMC, 2018), water sampling post-festival activities such as Chhat Puja indicated high BOD levels and decreased dissolved oxygen, rendering the lake temporarily unfit even for recreational use.

Seasonal and Anthropogenic Impacts

Seasonal variability also plays a crucial role in shaping the ecological health of lakes. A study on Powai Lake (Mumbai) by Chavan *et al.* (2015) observed that post-monsoon periods showed increased turbidity and nutrient loading due to surface runoff. This aligns with observations at Papad Khid Lake, where monsoon inflow exacerbates pollutant spread, particularly from nearby slum settlements and open defecation areas.

Biodiversity and Ecological Value

Research by Patil and Jagtap (2020) on Thane's Upvan Lake emphasizes the importance of small lakes in sustaining urban biodiversity, especially migratory birds and native aquatic flora. Biodiversity around Papad Khind Lake, although understudied, is visibly impacted by human encroachment and water quality deterioration. Informal reports and citizen observations note a decline in fish populations and aquatic vegetation, particularly after large-scale religious events.

Management and Conservation Approaches

Several studies advocate for community-based conservation and decentralized water quality monitoring to improve lake health. For example, Sinha *et al.* (2021) propose integrated lake basin management involving stakeholders like local residents, municipal bodies, and environmental NGOs. Papad Khind Lake, currently lacking a structured conservation framework, would benefit from similar models, especially if it is to be developed for eco-tourism or water sports as proposed by the VVMC.

Materials and Method

Description of study area

Water samples were collected during the seasons as summer, monsoon and winter from four different sites of Papad Khind lake, located in a Virar town in Palghar district, Mumbai, Maharashtra, India, during 2024-2025. It is situated at 19.4549° N, 72.8327°E and 25-meter elevation from the sea level.

Table 1.

Sr No	Sample Collection Site	Code No
1	East	Sample– A
2	West	Sample –B
3	North	Sample – C
4	South	Sample – D

Sampling

Sampling is done with the help of fishermen. From the four different sides of lake as East, West, North and South. Samples were collected in 1000 ml sample bottles, previously cleaned and washed with detergent and rinsed with tap water. Before being filled with samples, the bottles were rinsed twice with the sample water. The sampling was done in the morning 9AM to 10AM and the container were dipped and filled with at a depth of 40 – 50 cm below the surface of lake. The samples were then transported into laboratory and stored in a freeze for further analysis.

Chemical Analysis

Analysis was carried out for various quality param-

eters like Temperature, pH, TSS, BOD, COD, DO. Temperature and pH were determined on the site of collection while other parameters were analyzed in the laboratory using standard methods. The reagents used for the analysis was of analytical grade and distilled water was used for the preparation of solution. All physico- chemical analysis of water were carried out with the standard procedures.

Results

The pH value of water is an important indication of its quality and it is dependent on the carbon-dioxide carbonate-bicarbonate equilibrium, The pH of this study area varies between 6.5 to 7.5, Similarly the temperature ranges in the different sites of lake ranged from 2 °C to 35 °C.

The turbidity ranges observed between 12 to 14 NTU during study period. The Turbidity of any water sample is the reduction of transparency due to the presence of particulate matter such as lay or slit, finely divided organic matter, plankton and other microscopic organisms. It was observed that turbidity increases during monsoon season.

Total Suspended Solids found between 56 to 60 mg/l. The reason for such a high amount of total solid may be due to unfrosted land, therefore the adverse effects of surface runoff, dumping of waste material may cause increase in total solid levels.

Dissolved Oxygen was found between 5.3 to 5.5 mg/l. During winter as a result of low temperature and oxygen utilization, Dissolved Oxygen was recorded high, may be due to lower rate of decomposition of organic matter. Effect of waste discharge in

Table 2.

Sr No	Parameter	Sample A	Sample B	Sample C	Sample D
1	pH	6.8	6.7	6.8	6.8
2	Temperature (°C)	33.8	33.7	33.5	33.7
3	Total Suspended Solids (mg/l)	58	60	58	56
4	Turbidity (NTU)	12	12	13	12
5	BOD (mg/l)	5.2	4.9	5.0	4.9
6	COD (mg/l)	44	44	44	44
7	Dissolved Oxygen (mg/l)	5.4	5.5	5.4	5.4

(Summer – April 2024- June 2024)

Table 3.

Sr No	Parameter	Sample A	Sample B	Sample C	Sample D
1	pH	7.3	7.6	7.5	7.8
2	Temperature (°C)	30.1	30.3	28.8	29.0
3	Total Suspended Solids (mg/l)	75	74	78	75
4	Turbidity (NTU)	17	19	20	18
5	BOD (mg/l)	8.0	7.8	7.2	7.8
6	COD (mg/l)	50	50	51	53
7	Dissolved Oxygen (mg/l)	3.2	3.0	3.8	3.7

(Monsoon – June 2024 - September 2024)

Table 4.

Sr No	Parameter	Sample A	Sample B	Sample C	Sample D
1	pH	7.6	7.3	7.8	7.8
2	Temperature (°C)	26.8	27.1	26.8	27.0
3	Total SuspendedSolids (mg/l)	58	60	58	56
4	Turbidity (NTU)	12	12	13	12
5	BOD (mg/l)	5.2	4.9	5.0	4.9
6	COD (mg/l)	44	44	44	44
7	DissolvedOxygen (mg/l)	5.4	5.5	5.4	5.4

(Winter - December 2024- February 2025)

a water body is determined by the oxygen balance of the system; it is rapidly getting removed from the wastewaters by discharge of the oxygen demanding waste.

Total BOD found to between 4.8 to 5.2. High BOD levels suggest that the lake's natural microbial activity is under pressure, consuming significant oxygen to break down organic matter, which in turn leads to oxygen depletion and poor habitat conditions for aquatic life.

Total COD Found between 43-45 Elevated COD further confirms the presence of non-biodegradable contaminants**,** often linked to anthropogenic activities like solid waste dumping, immersion of idols, and runoff from surrounding urban areas.

Conclusion

The water quality assessment of Papad Khind Lake reveals significant insights into its ecological health and the extent of anthropogenic pressures. Key parameters such as turbidity, BOD, COD, DO, and TSS indicate that the lake is moderately to heavily impacted by organic and inorganic pollution sources. Elevated BOD and COD values suggest a high organic load, likely from domestic sewage or agricultural runoff, while reduced DO levels point to oxygen depletion that may stress aquatic life. Increased turbidity and TSS levels further confirm sediment inflow and possible algal activity, contributing to reduced water clarity and light penetration.

Seasonal variations, especially during December, reflect a relative decline in biological activity and runoff, leading to slightly improved turbidity levels. However, the overall data still signal a need for intervention.

To restore and maintain the lake's ecological balance, immediate measures such as controlling pollutant sources, regular monitoring, and promoting sustainable watershed practices are essential. This study underscores the importance of continuous water quality monitoring to inform management decisions and support the conservation of Papad Khind Lake as valuable freshwater resources.

Conflict of Interest- None

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