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Assessment of Dissolved Oxygen in Shivganga Pond, Deoghar, Jharkhand: An Environmental Perspective Through Indian Knowledge System

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ABSTRACT

Dissolved oxygen (DO) is one of the most vital indicators of aquatic ecosystem health, directly influencing biological productivity, species distribution, and overall environmental sustainability. The present study assesses the seasonal variation of dissolved oxygen in Shivganga Pond, Deoghar, Jharkhand, India, to evaluate its ecological condition through the lens of environmental science and the Indian Knowledge System (IKS). Water samples were collected quarterly during July 2024, October 2024, January 2025, and April 2025. The recorded DO values showed considerable seasonal fluctuation, ranging from 0.63 mg/L to 6.2 mg/L. Higher dissolved oxygen was observed during the monsoon season, while critically low concentrations were recorded during summer months. These variations reflect the influence of temperature, organic matter decomposition, and anthropogenic activities on oxygen dynamics. Traditional Indian ecological wisdom emphasizes the maintenance of water purity and natural aeration of water bodies for sustaining life. The observed decline in dissolved oxygen during warmer months highlights ecological stress and signals the need for conservation-oriented management. The study underscores the relevance of integrating scientific assessment with Indian Knowledge System principles to promote sustainable freshwater ecosystem management.

Keywords: *Dissolved Oxygen; Shivganga Pond; Aquatic Ecology; Water Quality; Indian Knowledge System; Environmental Sustainability*

Freshwater ecosystems are fundamental to environmental stability, biodiversity conservation, and human well-being. Among various water quality parameters, dissolved oxygen (DO) holds a central position as it governs metabolic processes of aquatic organisms and regulates biochemical reactions within water bodies. Adequate oxygen availability is essential for maintaining healthy aquatic ecosystems, while oxygen depletion often leads to ecological imbalance and biodiversity loss. Limnology is the study of the structural and functional interrelationships of organisms of inland waters as they are affected by their dynamic physical, chemical, and biotic environments (Wetzel, 2001).

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In the Indian Knowledge System, water bodies have traditionally been managed as living ecosystems rather than mere resources. Ancient Indian practices emphasized cleanliness, aeration, seasonal rejuvenation, and controlled usage of ponds and tanks to sustain oxygen-rich environments. Such traditional ecological insights align closely with modern limnological understanding of dissolved oxygen dynamics. In India, pond ecosystems are not only vital for ecological balance but also serve as important places for social and religious activities, often bearing the brunt of anthropogenic pressures without adequate regulation or scientific monitoring (Bhattacharya et al., 2016).

Shivganga Pond, located in Deoghar, Jharkhand, is an ecologically and culturally significant freshwater body. Increasing anthropogenic pressure and seasonal environmental changes necessitate scientific evaluation of its ecological health, (Sharma et al., 2025) The present study aims to assess the dissolved oxygen status of Shivganga Pond across different seasons and interpret the findings through an integrated environmental and Indian Knowledge System perspective. Indian Ponds like Shivganga is exposed to human interference in the form of holy dips in huge number during Shravan month (July-August) of Hindu religion, idol immersion, tourist wastes, sewage discharge, and surface runoff have raised concerns about the quality of water in this pond (Bhatnagar & Sangwan, 2009; Dutta & Chandra, 2020; Daripa et al., 2023).

STUDY AREA

Shivganga Pond is situated in Deoghar district of Jharkhand, India. The region experiences a tropical monsoon climate characterized by hot summers, moderate winters, and a distinct monsoon season. The pond is influenced by rainfall, surface runoff, religious activities, and local human settlements. Seasonal climatic variation plays a major role in determining the limnological characteristics of the pond, particularly dissolved oxygen levels.

Fig 1 Google Map view of Shivganga Pond Deoghar Jharkhand India

MATERIALS AND METHODS

Sampling Strategy

Water samples were collected from Shivganga Pond on a quarterly basis during:

- July 2024 (monsoon)
- October 2024 (post-monsoon)
- January 2025 (winter)
- April 2025 (summer)

Sampling was conducted following standard water quality monitoring procedures to ensure accuracy and reliability. Water samples were analysed for 16 physicochemical parameters to determine comparative of changes in these two water bodies with respect to the benchmark advocated by WHO calls for a scientific and judicious use of inland water bodies.

DISSOLVED OXYGEN ANALYSIS

Research was conducted at CSIR Institute, Durgapur (Recognized By West Bengal Pollution Control Board). Method follow (APHA, 2017, 23RD Edition. Dissolved oxygen was measured in mg/L using standard analytical methods recommended for freshwater quality assessment. 4500-O-C :Oxygen (Dissolved) Determination By Azide Modification Of Winkler Method. Care was taken to minimize oxygen loss during sample collection and analysis. The analysis of the biological diversity material and the physicochemical factors of the water body constitute an evolution of the water quality (Cairns and Dickson, 1971).

RESULTS

Table 1: Seasonal Variation of Dissolved Oxygen (DO) in Shivganga Pond, Deoghar, Jharkhand (2024–2025)

Sl. No.	Sampling Month	Season	Dissolved Oxygen (mg/L)
1	July 2024	Monsoon	6.20
2	October 2024	Post-monsoon	1.39
3	January 2025	Winter	2.00
4	April 2025	Pre-monsoon / Summer	0.63

The dissolved oxygen concentration in Shivganga Pond exhibited pronounced seasonal variation during the study period.

- In **July 2024**, the DO value was **6.2 mg/L,** representing the highest recorded concentration. (Table 1).
- In **October 2024,** a sharp decline was observed, with DO dropping to **1.39 mg/L**.
- During **January 2025**, the DO level showed a slight recovery to **2.0 mg/L.**
- The **lowest DO concentration** was recorded in **April 2025,** measuring **0.63 mg/L**.

The results indicate a clear trend of decreasing dissolved oxygen during warmer months, with partial improvement during cooler and monsoon periods.

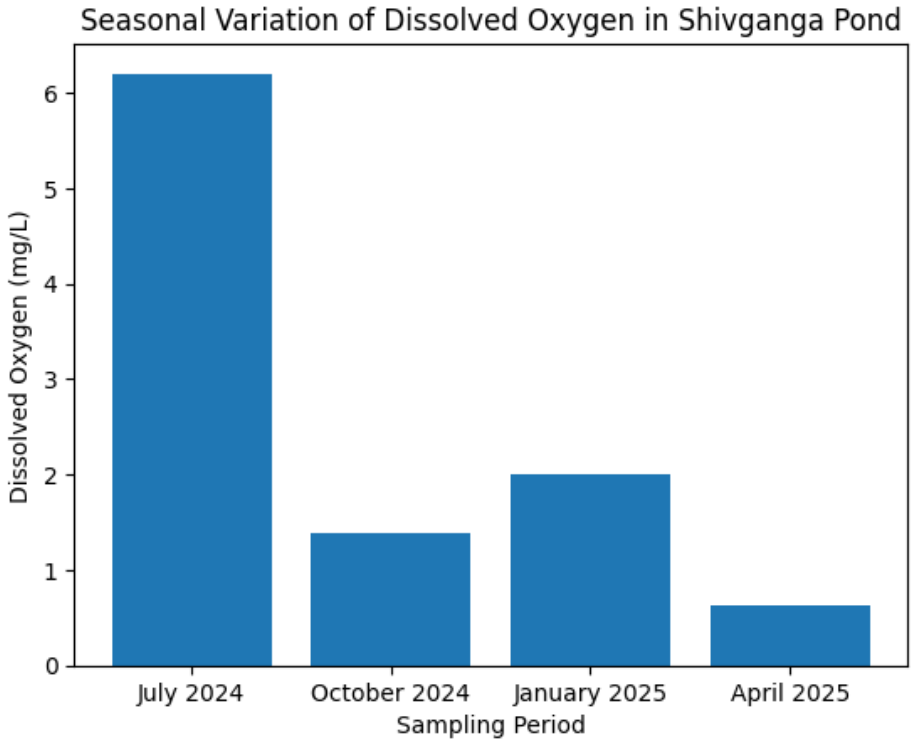

Fig 2 Quarterly Variation of Dissolved Oxygen in Shivganga Pond Deoghar Jharkhand India.

DISCUSSION

Seasonal fluctuation in dissolved oxygen concentration in Shivganga Pond reflects the combined influence of temperature, organic matter decomposition, and biological activity. Higher DO levels during the monsoon season may be attributed to increased water volume, rainfall-induced aeration, and lower water temperature, which enhances oxygen solubility.

The sharp decline in DO during post-monsoon and summer months (Figure 2) indicates increased oxygen consumption due to microbial decomposition of organic matter and reduced solubility at higher temperatures. Critically low DO levels observed during April suggest hypoxic conditions, which may severely stress aquatic organisms and disrupt ecological balance. According to Suhling et al., (2015) and Kemabonta et al., (2020) Plants are also affected by DO. The low levels of dissolved oxygen found at the site indicate deteriorating water quality and may be due to the presence of nutrients in water bodies as a result of anthropogenic activity.

From the perspective of the Indian Knowledge System, traditional water management emphasized desilting, regular cleaning, and maintaining natural inflow and outflow channels to promote water circulation and oxygenation. The present findings indicate deviation from these traditional ecological practices, resulting in reduced oxygen availability during certain seasons.

The observed dissolved oxygen dynamics highlight the ecological vulnerability of Shivganga Pond and the urgent need for integrative management strategies that combine scientific monitoring with traditional ecological wisdom.

Environmental and Indian Knowledge System Perspective

- Dissolved oxygen decline reflects ecological stress and imbalance.
- Traditional Indian practices advocate seasonal rejuvenation of ponds to maintain oxygen-rich conditions.
- Restoration of natural aeration and reduction of organic loading align with both modern science and IKS principles.
- Community-based management, rooted in traditional values, can improve oxygen dynamics.

CONCLUSION

The present study reveals significant seasonal variation in dissolved oxygen levels in Shivganga Pond, with critically low concentrations observed during summer months. Such conditions pose serious threats to aquatic life and overall ecosystem health. Integrating scientific assessment of dissolved oxygen with Indian Knowledge System principles provides a holistic framework for sustainable management of freshwater ecosystems. Regular monitoring, ecological restoration, and revival of traditional water conservation practices are essential to preserve the environmental integrity of Shivganga Pond.

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Conflict of Interest
The author declared no conflict of interest.

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