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Address for correspondence:
C. Siva Naga Jyothi, Research Scholar, Department of Zoology, [University Name], Andhra Pradesh, India
Email:
tallamsriranjani@gmail.com

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Limnological Studies With Respect to the Ichthyofauna and Avifauna of Hyderabad Lakes, Telangana

C. Siva Naga Jyothi[1], T. Sriranjani[2]
[1]Research Scholar, Department of Zoology, [University Name], Andhra Pradesh, India
[2]Head, Department of Zoology, D.K. Govt. College for Women(A), Nellore, India

Abstract

Hyderabad, often referred to as the "Limnological Capital of India," historically hosted approximately 250 water bodies that supported rich biodiversity. However, rapid urbanization and industrialization have led to severe ecological degradation. This study integrates limnological assessments of key lakes—including Hussainsagar, Ameenpur, Himayathsagar, and Osman Sagar—with a focus on their ichthyofauna and avifauna diversity. Limnological analysis reveals a spectrum of water quality, with Hussainsagar exhibiting extreme pollution (WQI: 618.45) while others like Himayathsagar remain relatively stable. Faunal surveys documented between 9 to 30 fish species and up to 261 bird species across these wetlands. The research highlights a significant negative correlation between heavy metal contamination and species diversity, emphasizing the urgent need for sustainable management and the protection of designated Biodiversity Heritage Sites (BHS).

Keywords: *Limnology, Ichthyofauna, Avifauna, Hyderabad Lakes, Heavy Metals, Biodiversity Heritage Site.*

Introduction

The Hyderabad metropolitan area in Telangana is characterized by a unique urban wetland environment. Historically, these lakes were constructed during the Qutb Shahi and Nizam eras for irrigation and drinking water. Today, these water bodies serve as critical "local nature reserves" for resident and migratory fauna. However, unplanned development, insufficient sewage treatment, and industrial effluents have triggered massive habitat degradation. Ameenpur Lake, notably, was declared the first urban Biodiversity Heritage Site in India in 2016 to safeguard its unique biological diversity. This paper examines the physicochemical health of these lakes and its direct impact on their aquatic and avian inhabitants.

Materials and Methods

Surveys were conducted seasonally across representative wetlands.

- **Limnological Analysis:** Water samples were analyzed for **pH, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD)**, and **Total Dissolved Solids (TDS)** following APHA standard methods.
- **Heavy Metal Assessment:** Concentrations of **Lead (Pb), Cadmium (Cd), and Chromium (Cr)** were determined in water and fish tissues using **Atomic Absorption Spectrophotometry (AAS)**.
- **Faunal Documentation:** Avifauna was recorded using the point count technique and line transects. Ichthyofauna were documented through periodic catches with the assistance of local fishermen.

Limnological Profile of Hyderabad Lakes

The physicochemical properties of these wetlands are highly spatially and seasonally heterogeneous.

- **Pollution Gradients: Hussainsagar Lake** shows severe hypoxic levels of DO (3.2 mg/L) and extreme organic loading (BOD: 48.6 mg/L), making it unsuitable for most aquatic life. In contrast, **Himayathsagar and Osman Sagar** maintain higher water quality as they are protected catchments.
- **Eutrophication:** Lakes such as **Hasmathpet** and **Ameenpur** are reported to be on the verge of eutrophication due to domestic sewage and the immersion of religious idols.
- **Water Quality Index (WQI):** WQI values for Ameenpur (142.56) and Hussainsagar (618.45) indicate "poor" to "severely degraded" conditions.

Heavy Metal Contamination and Bioaccumulation

Heavy metal pollution is a critical concern due to its bioaccumulative nature in the food web.

- **Matrix Concentration:** High levels of Pb (0.089 mg/L) and Cr (0.156 mg/L) were detected in polluted sites, exceeding Bureau of Indian Standards (BIS) limits.
- **Bioaccumulation in Fish:** Studies on species like *Labeo rohita* and *Catla catla* reveal that heavy metals such as **Zinc, Lead, and Iron** accumulate most significantly in the **liver and gills**. Bioaccumulation in fish brain tissues has also been documented in Hussainsagar, leading to bans on fishing in the area.

Ichthyofaunal Diversity

The lakes support various native and introduced fish species.

- **Species Composition: Ameenpur Lake** hosts 9 fish species, while **Raviryala Pedda Cheruvu** supports up to 18-30 cultivable and edible fin species. The order **Cypriniformes** is dominant due to its ecological adaptability.
- **Invasive Threats:** The presence of **Tilapia (*Oreochromis* sp.) and invasive Catfish** poses a significant threat to local native biodiversity. Management plans are required to remove these species and restore native ichthyofauna.

Avifaunal Diversity

Hyderabad's lakes are vital nodes in the **Central Asian Flyway**.

- **Species Richness: Ameenpur Lake** is a major hotspot, with species records increasing to **261 species** by 2019. Across four large wetlands, 87 waterbird species representing 24 families were recorded in a single year.
- **Key Species:** Notable birds include the **Greater Flamingo**, Northern Pintail, and the Near Threatened **Oriental Darter** and **Black-headed Ibis**. The return of the **Red-breasted Flycatcher** in 2026 highlights the enduring ecological value of these sites.
- **Pollution Impact:** Correlation analysis shows a significant negative relationship (**r = -0.76**) between heavy metal concentrations and bird species diversity.

Anthropogenic Pressures and Conservation

- **Encroachment:** Urban sprawl has reduced Ameenpur Lake's area from 300 acres to approximately **93 acres**.
- **Pollution Sources:** Untreated industrial effluents from zones like Patancheru and domestic sewage from unsewered colonies are the primary pollutants.
- **Conservation Strategies:** Recommendations include establishing **Sewage Treatment Plants (STPs)**, enforcing a **30-meter buffer zone** beyond the Maximum Water Level, and engaging local communities in stewardship.

Conclusion

Limnological studies confirm that the ecological health of Hyderabad's lakes is in a state of crisis. While these wetlands continue to support significant ichthyofaunal and avifaunal diversity, the increasing burden of heavy metals and organic pollutants threatens local extinction of sensitive species. Designating sites like Ameenpur as Biodiversity Heritage Sites is a positive step, but it must be coupled with rigorous pollution control and habitat restoration to ensure the survival of Telangana's aquatic heritage.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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