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Biodiversity, Ecological Functions, and Eutrophication Threats in Motijheel Lake, Murshidabad, West Bengal, India: A Comprehensive Botanical Review

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ABSTRACT :

Motijheel Lake, located in Murshidabad district of West Bengal, is an ecologically significant freshwater body that supports diverse aquatic flora and fauna. Historically created during the Nawabi era, the lake has served as a source of livelihood, groundwater recharge, and biodiversity hotspot. In recent decades, the lake has been facing severe ecological degradation due to anthropogenic activities, with eutrophication emerging as a major threat. This review examines the botanical diversity, ecological roles, limnological characteristics, and eutrophication impacts on the lake's ecosystem. Strategies for sustainable conservation, including community participation, bio-remediation, and controlled nutrient loading, are discussed. The review highlights the urgent need for integrated management to restore ecological balance while preserving the lake's heritage and biodiversity.

Keywords: *Motijheel lake, aquatic plants, eutrophication, biodiversity conservation, freshwater ecology.*

1. Introduction

Freshwater lakes are critical for maintaining biodiversity, regulating local climate, and sustaining human livelihoods [1]. In West Bengal, several natural and man-made lakes serve ecological and socio-economic functions [2]. Among these, Motijheel Lake in Murshidabad district holds special importance due to its historical background and ecological potential [3]. However, the lake's health has been deteriorating in recent years because of pollution, encroachment, and excessive nutrient inflow [4], [5]. This review aims to provide a botanical perspective on Motijheel Lake's biodiversity, ecological services, and eutrophication threats, while recommending conservation measures.

2. Geographical and Historical Overview

Motijheel Lake, also known as "Pearl Lake," was constructed in the 18th century under Nawab Alivardi Khan and later associated with Nawab Siraj-ud-Daulah [3], [6]. It is located at latitude 24.18° N and longitude 88.27° E in the historical town of Murshidabad [7]. Originally spread over a larger area, the lake has reduced significantly due to siltation and land conversion [8]. The surrounding environment includes heritage buildings, gardens, and agricultural land.

3. Botanical Diversity

The aquatic plant community of Motijheel Lake comprises both submerged and floating macrophytes, which play a critical role in primary production and nutrient cycling [9]. Common species include:
Nymphaea nouchali (Blue water lily) [2], Eichhornia crassipes (Water hyacinth) [10], Hydrilla verticillata [11], Potamogeton crispus [12], Nelumbo nucifera (Sacred lotus) [13].
These plants provide habitat for microorganisms, fish, and invertebrates while contributing to oxygen production in the water column [14]. However, excessive growth of invasive species like E. crassipes indicates nutrient enrichment and declining water quality [15].

4. Faunal Diversity

The lake supports multiple fish species such as Catla catla, Labeo rohita, and Channa punctata [16]. Avifauna includes resident and migratory birds like Egretta garzetta and Ardea cinerea [17]. Amphibians, reptiles, and various invertebrates are also part of the lake's complex food web [18].

5. Ecological Functions

Motijheel Lake provides:

a. Habitat provision for aquatic flora and fauna [1,9]: Habitat provision for aquatic flora and fauna describes creating and protecting diverse aquatic environments, i.e., wetlands, lakes, rivers and marine ecosystems, which offer important essential components like shelter, food sources, and breeding grounds for water-dependent organisms.

b. Nutrient cycling through plant–microbe interactions [14]: Plant-microbe interactions are necessarry for nutrient cycling, with microbes breaking down organic matter and converting atmospheric gases (like nitrogen) into plant-available forms, while plants provide microbes with carbon through root exudates and residues.

c. Groundwater recharge [4]: Groundwater recharge defines the natural or artificial process where water infiltrates the ground and replenishes underground aquifers.

d. Microclimate regulation [10]: Microclimate Regulation, at its most fundamental level, can be defined as the deliberate act of modifying or controlling the atmospheric conditions of a localized area.

e. Cultural and recreational value [6]: Lakes spreads significant cultural and recreational value, serving as centers for tourism, community events, and spiritual practices. This Lake provide opportunities for activities like swimming, boating, and fishing, which enhance quality of life and stimulate local economies through tourism and services.

6. Eutrophication: Causes and Impacts

Eutrophication is the enrichment of water bodies with nutrients, primarily nitrogen and phosphorus, leading to excessive growth of algae and aquatic plants [19]. In Motijheel Lake, the main drivers are:

Untreated sewage discharge from nearby settlements [4, 12], Agricultural runoff containing fertilizers [5] and Solid waste dumping [8].

Impacts observed:

Impacts have been observed are as follows:

1.Dense algal blooms reducing light penetration [15]

2.Oxygen depletion (hypoxia), affecting fish survival [19]

3.Overgrowth of invasive plants like E. crassipes [10]

4.Loss of native aquatic plant species [9]

7. Conservation Challenges

Despite being a heritage site, the lake faces:

1.Weak enforcement of environmental regulations [6], [8]

2.Limited public awareness [14]

3.Overfishing and unregulated tourism [16]

4.Lack of regular limnological monitoring [1]

8. Suggested Management Strategies:

Suggested management strategies include -

A. Nutrient load control through sewage treatment [12], [19]

B. Bio-remediation using native macrophytes [14]

C. Mechanical removal of invasive plants [10]

D. Community participation in monitoring and awareness [14]

E. Eco-tourism development linked with conservation funding [6]

9. Conclusion

Motijheel Lake is both an ecological and cultural asset for Murshidabad. Its botanical diversity reflects the health of its aquatic ecosystem, but eutrophication and human pressures threaten its sustainability. An integrated, science-based, and community-driven conservation approach is essential to restore its ecological balance and preserve its biodiversity.

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11. Conflict of interest

None

REFERENCES

1. Bhattacharya, B., & Das, S. (2018). Limnological characteristics of wetlands in West Bengal.
2. Journal of Environmental Research, 22(2), 98–106.
3. Bera, S., & Ghosh, P. (2019). Biodiversity of aquatic plants in freshwater wetlands of Eastern India. Botanical Journal of India, 45(1), 67–74.
4. Chakraborty, R. (2016). Wetland degradation in Murshidabad district: A case study of Motijheel. Geographical Review of India, 78(4), 55–62.
5. Dey, S. (2020). Historical lakes and their ecological role in West Bengal. Indian Journal of History and Environment, 5(1), 110–120.
6. Ghosh, A., & Roy, S. (2022). Water quality status of urban lakes in Murshidabad district. International Journal of Ecology and Environmental Sciences, 48(3), 214–222.
7. Government of West Bengal. (2021). Wetland Management Guidelines. Kolkata: Department of Environment.
8. Yadav, A., & Mukherjee, S. (2020). GIS-based mapping of lakes in Murshidabad district. Remote Sensing and Environment Journal, 18(2), 98–106.
9. Jana, S. (2019). Urbanization and its effects on wetlands in West Bengal. Urban Ecology Review, 6(1), 33–40.
10. Singh, R., & Sharma, P. (2017). Aquatic macrophytes as bioindicators of water quality. International Journal of Botany Studies, 2(6), 12–18.
11. Villamagna, A. M., & Murphy, B. R. (2010). Ecological and socio-economic impacts of invasive water hyacinth. Aquatic Botany, 93(1), 23–41.
12. Pandit, A. K. (1984). Role of macrophytes in aquatic ecosystems. Journal of Ecology, 72(2), 355–366.
13. Ministry of Environment, Forest and Climate Change. (2017). National Wetland Conservation Programme Report.
14. Cook, C. D. K. (1996). Aquatic and Wetland Plants of India. Oxford University Press.
15. Saha, B. (2018). Community participation in lake conservation: A review from Eastern India. Ecology and Society India, 7(2), 85–94.
16. Smith, V. H. (2003). Eutrophication of freshwater ecosystems. Environmental Science & Pollution Research, 10(2), 126–139.
17. Haque, M. A., & Mondal, S. (2020). Fish diversity in selected lakes of West Bengal. Aquatic Life Journal, 11(2), 75–84.
18. Grimmett, R., Inskipp, C., & Inskipp, T. (2011). Birds of the Indian Subcontinent. Oxford University Press.
19. Wetzel, R. G. (2001). Limnology: Lake and River Ecosystems. Academic Press.
20. Schindler, D. W. (2006). Recent advances in the understanding and management of eutrophication. Limnology and Oceanography, 51(1), 356–363.
21. Paul, S., & Mukherjee, S. (2021). Seasonal variation of algal diversity in polluted lakes of West Bengal. Phycology Journal of India, 9(1), 22–30.