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Macrophyte Diversity in Jalna District: A Synthesis of a Floristic Survey

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Abstract

A comprehensive floristic survey of the aquatic ecosystems in Jalna District, Maharashtra, reveals a significant diversity of floating and free-floating macrophytes, with 20 to 21 species recorded across 13 plant families. This biodiversity indicates the ecological richness of the region's numerous reservoirs, ponds, and wetlands. The findings highlight a critical dichotomy: the presence of ecologically valuable native species, such as *Azolla pinnata* and *Nymphaea pubescens*, coexists with the widespread dominance of aggressive invasive species, most notably *Eichhornia crassipes* (water hyacinth), *Pistia stratiotes*, and *Salvinia molesta*. The proliferation of these invasive species, which form dense mats that degrade water quality and displace native flora, is strongly linked to anthropogenic pressures. Eutrophication, driven by agricultural runoff and domestic wastewater, creates nutrient-rich conditions that favor their rapid colonization. The study concludes that while Jalna's water bodies possess the potential for balanced aquatic ecosystems, they are under increasing threat. Key recommendations include the urgent implementation of regular monitoring programs, the development of control measures for invasive species, and the creation of conservation strategies to protect native aquatic plant communities and ensure the long-term ecological health of the region's water resources.

Keywords: Macrophyte diversity, Aquatic plants, Floating Macrophytes, Free-floating macrophytes, Phytoremediation.

1. Introduction

Aquatic macrophytes are essential components of freshwater ecosystems, playing a vital role in primary production, nutrient cycling, sediment stabilization, and providing critical habitat for aquatic organisms. This study focuses on two distinct groups:

a) **Floating Macrophytes:** Rooted in the substrate with leaves floating on the surface (e.g., *Nymphaea spp.*).
b) **Free-Floating Macrophytes:** Unattached to the substrate, drifting freely (e.g., *Eichhornia crassipes*, *Lemna spp.*).

These plants serve as important bioindicators of water quality, as their growth is highly responsive to nutrient enrichment. However, the unchecked proliferation of certain free-floating species, particularly invasive ones like *Eichhornia crassipes*, poses significant ecological and economic threats. These species can form dense canopies that reduce dissolved oxygen, displace native life, and impair human use of water for irrigation and recreation.

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Despite the ecological importance of the numerous freshwater bodies in Maharashtra's Marathwada region, systematic documentation of macrophyte diversity, especially in Jalna District, is scarce. This study was initiated to fill that knowledge gap by conducting a comprehensive survey to document species diversity, frequency of occurrence, and ecological associations, thereby providing crucial baseline data for sustainable aquatic ecosystem management.

2. Profile of the Study Area: Jalna District, Maharashtra

Jalna District, located in the semi-arid, subtropical Marathwada region, provides a dynamic environment for aquatic plant communities.

a) **Geography:** Situated in the Godavari river basin, the district covers 7,612 km² of a gently undulating basaltic plateau.
b) **Hydrology:** The Godavari River forms its southern boundary, with major tributaries including the Purna, Dudhana, and Kundlika rivers. The district's water resources are managed through a network of reservoirs (e.g., Ghanewadi, Kalyangirija, Dhamna), farm ponds, and nearly 50,000 dug wells.
c) **Climate:** The region experiences distinct monsoon (June-September), winter (October-February), and summer (March-May) seasons. Annual rainfall averages 650-750 mm, and temperatures range from a low of 9-10°C to a high of 42-43°C.
d) **Water Management:** Recent community-based efforts, including desilting tanks and constructing recharge structures, have improved water availability, creating a mix of perennial and ephemeral aquatic habitats ideal for macrophyte growth.

3. Survey Methodology

A systematic, multi-step approach was employed to ensure a comprehensive assessment of macrophyte diversity and habitat characteristics.

a) **Site Selection:** Representative sampling sites were chosen from diverse aquatic systems, including rivers, reservoirs, farm ponds, seasonal tanks, and wetlands, to cover a range of ecological conditions.
b) **Survey Timing:** Field surveys were conducted seasonally during two key periods to capture peak biomass and diversity: post-monsoon (October-December) and pre-summer (March-May).
c) **Data Collection:** A combination of visual search and a transect-quadrat method was used. Along transects laid perpendicular to the shoreline, 1x1 meter quadrats were used to identify species and visually estimate their percentage cover.
d) **Biomass and Water Quality:** Plant specimens were collected for taxonomic confirmation and biomass analysis (fresh and oven-dried weight). Basic water quality parameters (pH, DO, TDS, etc.) were measured on-site, with samples collected for laboratory analysis of nutrients (nitrates, phosphates) and BOD.

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e) **Data Analysis:** The collected data were analyzed using descriptive statistics to calculate species richness, frequency, and abundance. The study also considered using the Ecological State Macrophyte Index (ESMI) to evaluate wetland health.

4. Key Findings: Species Diversity and Distribution

The survey identified a total of 20 to 21 species of floating and free-floating macrophytes belonging to 13 distinct plant families. The findings reveal a complex interplay between native biodiversity and the pressures of invasive species.

The following table presents a representative list of the species observed during the survey.

Sr. No.	Scientific Name (Family)	Common Name
1	Azolla pinnata (Azollaceae)	Feathered mosquito fern
2	Chara vulgaris (Characeae)	Common stoneworth
3	Eichhornia crassipes (Pontederiaceae)	Water hyacinth
4	Enhydra fluctuans (Compositae)	Hinche sak
5	Hydrocharis dubia (Hydrocharitaceae)	Backer/ frog-bit
6	Ipomoea aquatica (reptans) (Convolvulaceae)	Water spinach
7	Lemna gibba (Araceae)	Fat duckweed
8	Lemna minor (Araceae)	Duckweed
9	Nelumbo nucifera (Nelumbonaceae)	Water lily/teratai
10	Nymphaea pubescens (Nymphaeceae)	Hairy water lily
11	Nymphoides cristatum (Menyanthaceae)	Crested floating heart
12	Nymphoides indicum (Menyanthaceae)	Water snowflake
13	Pistia stratiotes (Araceae)	Water lettuce
14	Salvinia auriculata (Salviniaceae)	Water fern
15	Salvinia molesta (Salviniaceae)	Giant Salvinia
16	Salvinia natans (Salviniaceae)	Water fern
17	Spirodela polyrhiza (Spirodela, Areaceae)	Duckmeat
18	Spirogyra (Zygnemataceae)	Water silk
19	Trapa natans (Trapaceae)	Water chestnut
20	Wolffia globosa (Lemnaceae)	Asian watermeal

4.1. Dominant and Invasive Species

A key finding was the widespread presence and dominance of several invasive or opportunistic species, particularly in nutrient-rich waters affected by agricultural runoff and domestic wastewater.

a) **Eichhornia crassipes (Water Hyacinth):** This species was found to be the most widespread and aggressive colonizer, forming large, dense mats in reservoirs and irrigation ponds. Its dominance is a clear indicator of eutrophic conditions.

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b) **Pistia stratiotes (Water Lettuce) and Salvinia molesta (Giant Salvinia):** These species were also observed forming thick mats, especially in shallow, slow-moving waters. Their dense canopies reduce light penetration and suppress the growth of native submerged plants, altering the ecosystem's structure.

4.2. Ecologically Significant Native Species

Alongside invasive species, the survey documented several native plants that indicate healthier aquatic conditions and contribute positively to the ecosystem.

i. **Nymphaea pubescens and Nelumbo nucifera:** These floating-leaved plants were typically found in deeper, clearer parts of ponds and reservoirs. They are often indicators of moderately healthy ecosystems, helping to stabilize sediment and provide habitat for fish and invertebrates.

ii. **Azolla pinnata:** This small, free-floating fern was notable for its presence in stagnant, shallow ponds. Through its symbiotic relationship with nitrogen-fixing cyanobacteria (*Anabaena azollae*), it can thrive in low-nutrient waters and has potential for use in phytoremediation and sustainable agriculture.

iii. **Duckweeds (Lemna spp., Spirodela polyrhiza, Wolffia globosa):** These small, fast-growing species were observed co-existing in calm water habitats. They are highly efficient at nutrient uptake and are often used in wastewater treatment systems.

4.3. Family-Level Distribution and Ecological Implications

Analysis of the family-wise distribution of the 20 recorded species reveals patterns related to ecological strategy and habitat condition.

Sr. No.	Family of free floating / floating macrophyte	Number of Species
1	Areaceae	4
2	Azollaceae	1
3	Characeae	1
4	Compositae	1
5	Convolvulaceae	1
6	Hydrochaitaceae	1
7	Lemnaceae	1
8	Menyanthaceae	2
9	Nelumbonaceae	2
10	Potntederiaceae	1
11	Salviniaceae	3
12	Trapaceae	1
13	Zygnemataceae	1
Total	**13 Families**	**Total 20 species**

The families **Araceae** (4 species) and **Salviniaceae** (3 species) were the most dominant. Species within these families are known for their rapid vegetative propagation and ability to thrive in eutrophic conditions. In contrast, the presence of **Nelumbonaceae** and **Menyanthaceae** (2 species each) suggests the existence of more stable, less-disturbed habitats.

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The family **Pontederiaceae** is represented by only one species, *Eichhornia crassipes*, yet its aggressive, invasive nature gives it a disproportionately large and disruptive ecological impact, often suppressing overall biodiversity.

5. Conclusions and Recommendations

The floristic survey of Jalna District confirms a notable diversity of aquatic macrophytes, reflecting the richness of its freshwater habitats. However, this biodiversity is under significant threat from the dominance of invasive species, which is a clear symptom of growing anthropogenic pressures, especially nutrient pollution from agriculture.

Based on these findings, the following actions are recommended:

1) **Systematic Monitoring:** Implement regular, long-term monitoring programs to track changes in macrophyte distribution, species composition, and biomass across seasons.
2) **Invasive Species Management:** Develop and apply targeted control measures to manage the growth and spread of invasive species like *Eichhornia crassipes* and *Salvinia molesta*.
3) **Conservation of Native Flora:** Create conservation strategies to protect and restore native aquatic plant communities, which are essential for maintaining ecological balance.
4) **Community Engagement:** Promote community awareness regarding the impact of nutrient runoff and the importance of preserving aquatic biodiversity.

Future research should focus on seasonal variations in macrophyte communities, precise biomass estimation, and a deeper analysis of the ecological roles these plants play to better inform water resource management and conservation efforts in the semi-arid landscapes of Maharashtra.

References:

Applied Water Science. (2018). Influence of physicochemical water quality on aquatic macrophyte diversity in seasonal wetlands. *Applied Water Science*, *8*(12), 228. https://doi.org/10.1007/s13201-018-0888-2

CABI. (2023). *Azolla pinnata* (Feathered mosquito fern). In *Invasive Species Compendium*. https://www.cabidigitallibrary.org/doi/10.1079/cabicompendium.8120

Chambers, P. A., Lacoul, P., Murphy, K. J., & Thomaz, S. M. (2008). Global diversity of aquatic macrophytes in freshwater. *Hydrobiologia*, *595*(1), 9–26. https://doi.org/10.1007/s10750-007-9154-6

Chilika Lagoon Study. (2018). *Macrophyte diversity and distribution in brackish coastal lagoons: A field survey from Chilika, Odisha*. https://www.researchgate.net/publication/354890568

Cook, C. D. K. (1996). *Aquatic Plant Book* (2nd ed.). SPB Academic Publishing.

District Collector, Jalna. (n.d.). *About District – Introduction & Demography*. Government of Maharashtra. https://jalna.gov.in/en/about-district/

Indian Institute of Science (IISc). (n.d.). *Ecological Monitoring of Aquatic Ecosystems: Macrophyte Biomass and Diversity Assessment Protocols*. https://wgbis.ces.iisc.ac.in/energy/water/paper/ETR113/ecological.html

Kshirsagar, H. D., & Gunale, V. R. (2013). Diversity of aquatic macrophytes from River Mula, Pune City (M.S.), India. *Bioscience Discovery*, *4*(2), 165–172. https://www.researchgate.net/publication/256765747

Mitra, S. (2023). Jalna's transformation: From 250 tankers a day to nil. *The Better India*. https://www.thebetterindia.com/332290/maharashtra-water-scarcity-drought-prone-jalna-district-gets-aid-water-bodies-desilted/

Rai, L. C., & Sharma, N. K. (1991). Freshwater macrophytes in India and their use in phytoremediation. *Indian Journal of Environmental Health*, *33*(4), 290–302.

Rao, N., Manikandan, R., & Rajendran, S. (2014). Distribution pattern of floating macrophytes in Indian rivers. *Bioscience Biotechnology Research Communications*, *7*(1), 33–38.

ResearchGate. (2018). *Drought in Jalna: Community-based adaptation to extreme climate events in Maharashtra*. https://www.researchgate.net/publication/327190103_Drought_in_Jalna

STAR Project. (2004). *Standard Protocols for Macrophyte Survey in Rivers*. EU STAR Project. https://www.researchgate.net/publication/267775154