MedCrave
Step into the World of Research

Journal of Aquaculture & Marine Biology

Short Communication

Open Access

CrossMark

Management of backwater and brackish water wetlands in India: a scientific opinion

Abstract

India possesses an expansive coastline stretching over 7,500 km, accompanied by approximately 1.2 million hectares of highly diverse backwater and brackish water wetlands. These ecosystems—spanning lagoons, estuaries, backwaters, and tidal creeks—serve as vital ecological nodes and socioeconomic lifelines for coastal states including West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Goa, Karnataka, and Gujarat, as well as Union Territories like Puducherry and the Andaman & Nicobar Islands. Despite their critical functional roles in coastal defence, biological diversity maintenance, and capture-cum-culture fisheries, these transitional water bodies are increasingly imperilled by anthropogenic pressures, unsustainable land-use conversions, industrial effluent loading, and systemic administrative gaps.

This scientific opinion underscores the imperative need for localized and multi-tier management architecture in India. We propose a decentralized governance model involving dedicated Block-level Wetland Wardens and Wetland Managers, backed by local administrative bodies (Panchayats and Municipalities). We advocate for location-specific Action Plans focused on pollution abatement, biodiversity conservation, capacity building, and statutory enforcement. Strengthening field-level monitoring and embedding socio-environmental equity will ensure the ecological integrity and climate resilience of India's brackish water ecosystems.

Keywords: brackish water wetlands, backwaters, conservation management, fisheries, biodiversity, governance, wetland wardens, India

Volume 15 Issue 2 - 2026

N C Nandi,[1] M Deyashi[2]
[1]Social Environmental and Biological Association, India
[2]S B S Government College, Hili, Dakshin Dinajpur, India

Correspondence: N C Nandi, Social Environmental and Biological Association, India, Tel +91-98315-37281

Received: July 25, 2026 | **Published:** August 10, 2026

Introduction

India's marine and coastal landscape features an extensive coastline stretching over 7,500 km, flanked by dynamic transitional ecosystems that encompass approximately 1.2 million hectares. These ecosystems—comprising estuaries, backwaters, coastal lagoons, and complex networks of tidal creeks—form dynamic ecotones where marine and terrestrial processes converge. Across major maritime states such as West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, Goa, Karnataka, and Gujarat, as well as island territories (Andaman & Nicobar Islands) and Puducherry, brackish water bodies form the backbone of traditional and commercial capture-cum-culture fisheries.

Brackish water wetlands represent transitional environments where freshwater inflow mixes with oceanic saltwater, generating salinity gradients typically ranging from 0.5 to 30 ppt. Prominent examples illustrating their ecological and socioeconomic value include Chilika Lake in Odisha—Asia's largest brackish water lagoon, Vembanad Lake in Kerala—India's longest backwater lake system,[1] and the Indian Sundarban & Estuarine Delta in West Bengal—a mega-biodiversity hotspot featuring extensive tidal mangroves and traditional brackish water impoundments.[2,3]

Despite their critical role in sustaining rural coastal livelihoods and preserving aquatic biodiversity,[4] these aquatic systems face unprecedented ecological threats. Urban expansion, unsanctioned land reclamation, unregulated aquaculture expansion, chemical pollution, and siltation are severely degrading these environments.[5,3] To address these challenges, this paper examines the ecological significance of India's brackish water and backwater wetlands, identifies systemic management gaps, and outlines actionable, field-level recommendations for their sustainable governance.[6]

Ecological significance and faunal diversity

Brackish water ecosystems operate as vital biological buffers and ecological incubators. Their fluctuating salinity regimes and tidal fluxes support highly specialized, stress-tolerant biological assemblages. Brackish water wetlands host rich communities of macrozoobenthos, decapod crustaceans, mollusks, and finfish species. Mangrove-laden estuaries and tidal creeks act as critical nursery and feeding grounds for euryhaline fauna, including commercially important penaeid shrimps (*Penaeus monodon*, *Fenneropenaeus indicus*), mud crabs (*Scylla serrata*, *Scylla tranquebarica*), and finfishes (*Lates calcarifer*, *Mugil cephalus*, *Chanos chanos*). Extensive faunal documentation reveals the remarkable species richness and endemism present across eastern Indian coastal wetlands.[2,7]

Beyond biodiversity support, these ecosystems deliver essential ecosystem services, including coastal protection, water purification, hydrological balance, carbon sequestration, and livelihood security.[5] Mangrove roots and estuarine vegetation stabilize shoreline sediments, reduce wave energy, and mitigate storm surges and tidal hazards. These wetlands function as natural biofilters, trapping suspended solids, absorbing excess nutrients, and processing organic waste. Coastal brackish wetlands act as blue carbon sinks, trapping organic carbon in sediments over long timescales. Millions of traditional fishers, aquaculture farmers, and auxiliary workers depend directly on these ecosystems for income and food security.[3,4]

Major Threats and Management Challenges

Despite their ecological and economic importance, India's backwaters and brackish water wetlands face severe degradation due to compounding natural and human-induced factors (Figure 1).

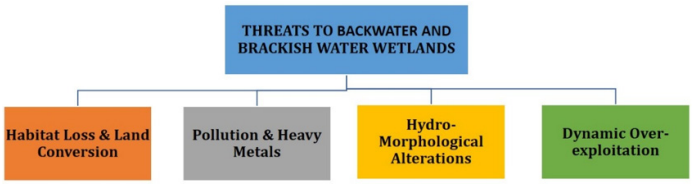

Figure 1 Major threats to backwater and brackish water wetlands in India.

Land conversion and encroachment

Dynamic land conversion driven by urban expansion, industrialization, and infrastructure projects (ports, highways, tourist facilities) systematically fragments and shrinks coastal wetlands.[5] Unregulated conversion of traditional brackish water impoundments (*bheries*) into concrete residential or commercial zones alters local hydrology and diminishes flood-retention capacity.

Environmental pollution and eutrophication

Industrial effluents, untreated municipal sewage, agricultural runoff containing toxic pesticides, and chemical discharges from intensive aquaculture systems contaminate backwater networks.[8] Eutrophication triggers hypoxia, microalgae blooms, and frequent fish kills, which reduce biological diversity and impair water quality.

Hydro-morphological disruption and siltation

Reduced river discharge caused by upstream damming, water diversion, and heavy silt accumulation disrupts natural estuarine flushing mechanisms.[5] Siltation shallows water depth, alters salinity patterns, accelerates biological succession toward semi-derelict states, and blocks migration pathways for diadromous aquatic species.

Regulatory and institutional enforcement gaps

While India has overarching environmental regulatory frameworks—such as the Coastal Regulation Zone (CRZ) Notification, Wetlands (Conservation and Management) Rules, and the Water (Prevention and Control of Pollution) Act—field-level implementation remains weak.[9] Key challenges include:

i. Overlapping administrative jurisdictions among municipal, forestry, revenue, and fisheries departments.

ii. Insufficient dedicated manpower at local administrative levels.

iii. Absence of clear enforcement mechanisms at the grassroots level to quickly deter illegal encroachments and pollution.

Proposed strategic governance and action plan

To transition from fragmented oversight to structured, sustainable management, India requires a multi-tier governance model supported by clear, enforceable local action plans (Figure 2).

Block-level decentralized cadre

Effective wetland conservation requires direct, physically present governance at the local level (Block/Ward/Panchayat) rather than centralized, remote administration, which can be achieved by establishing a dedicated, block-level decentralized wetland management cadre (Figure 2). This structure comprises three key roles:

i. **Wetland wardens:** Oversee field surveillance, environmental protection, and statutory policing by inspecting perimeters to prevent illegal encroachment, monitoring unauthorized waste dumping, issuing spot-fines via formal citations, and maintaining ecological boundaries.

ii. **Wetland managers:** Focus on resource planning, sustainable production, and extension services by regulating capture-cum-culture fisheries, advising on eco-friendly aquaculture, tracking key water quality parameters (salinity, dissolved oxygen, pH, and heavy metals), facilitating Payment for Ecosystem Services (PES) schemes, and conducting community outreach.

iii. **Master trainers and field assistants:** Provide technical support and capacity building by training local fishers in eco-friendly harvesting, maintaining biological records, operating water-testing kits, and promoting sustainable resource management at the village level.

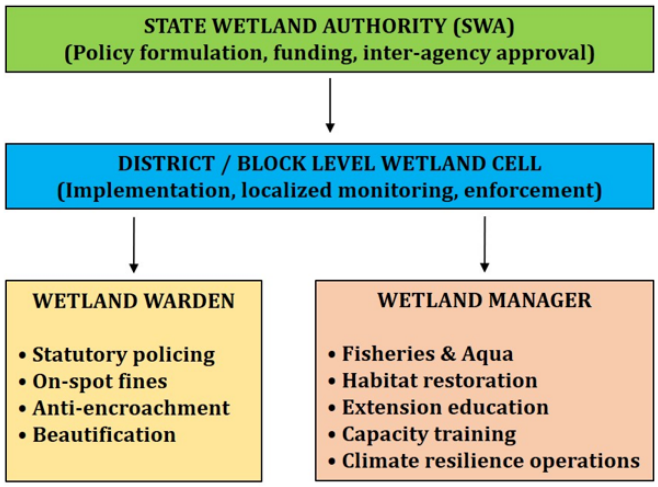

Figure 2 Proposed multi-tier strategic governance model and action plan system.

Sustainable financing and penalty mechanism

To establish a sustainable financing and penalty mechanism, financial systems should ensure that funds generated from environmental penalties stay within the local conservation ecosystem by depositing revenue from fines collected by Wetland Wardens into dedicated, audited Block Wetland Conservation Funds. To guarantee transparency, these fines should be tracked using serialized receipt books or digital platforms, and the retained funds should directly support local restoration projects, biological monitoring, educational signage, community nature interpretation facilities, and performance awards for staff.

Capacity building, incentives, and accountability

Managing dynamic, stressful aquatic ecosystems demands a well-trained, highly motivated workforce through robust capacity building, incentives, and accountability. Field staff should receive structured professionalization training in aquatic ecology, environmental law, water quality monitoring, and conflict resolution. To incentivize dedication and service, field personnel should be recognized through state-level conservation awards, accelerated promotions, and formal professional commendations. Finally, strict accountability must be enforced, ensuring that dereliction of duty, deliberate failure to address encroachments, or corrupt practices incur formal show-cause proceedings, administrative fines, or disciplinary action.

Citation: Nandi NC, Deyashi M. Management of backwater and brackish water wetlands in India: a scientific opinion. *J Aquac Mar Biol.* 2026;15(2):108–110. DOI: 10.15406/jamb.2026.15.00449

Lake-specific and estuary-specific action plans

Because coastal systems differ across geographic regions,[10] management must move away from generic guidelines and adopt site-specific Action Plans:

i. **Pollution abatement:** Establishing decentralized wastewater treatment facilities, constructing biological filtration channels, and regulating aquaculture feeds and chemicals.[8]

ii. **Biodiversity and habitat protection:** Designating seasonal non-fishing zones, protecting critical breeding grounds, and carrying out mangrove restoration in degraded estuarine areas.[5]

iii. **Fisheries optimization:** Supporting low-impact, multi-trophic polyculture practices (combining finfish, crabs, and natural biofilters like seaweeds or mollusks) to maximize yields without exceeding biological carrying capacities.

Conclusion

Backwater and brackish water wetlands are invaluable ecological and economic assets for India. Preserving them requires bridging the gap between national environmental policy and local implementation. Deploying trained Wetland Wardens and Wetland Managers at the Block level, backed by dedicated funding, legal authority, and site-specific Action Plans, will help protect these fragile transitional zones from degradation. Empowering local communities and establishing proactive, field-based governance will preserve India's brackish water ecosystems for future generations.

Baseline management suggestions are as follows: Climate change and storm surges are required to be handled using lessons learned from training as well as past experience, if any and or in the extreme event seeking expertise available in the region and at the country level. Furthermore, Vembanad Lake and Chilika Lake are well connected as well as for the availability of well experienced and skilled administrative man powers posting here. It is also mentioned that brackish water impoundments of Sundarban Biosphere Reserve are located at places where road and or water transport are available.

Acknowledgments

None.

Conflicts of interest

The authors declare that there are no conflicts of interest.

References

1. Nandi NC, Khan R, Dev Roy MK. *Faunal diversity of vembanad lake: A ramsar site in Kerala, India.* Special publication of SEBA. SEBA; 2018:1–210.
2. Mandal AK, Nandi NC. *Fauna of sundarban mangrove ecosystem, West Bengal, India.* Fauna of conservation areas no. 3. Zoological survey of India; 1989:1–116.
3. Nandi NC. Issues and approaches in aquaculture of rural ponds of Southern West Bengal with introspection over the years. *J Aquac Mar Biol.* 2022;11(2):65–68.
4. Pramanik SK, Nandi NC. *Fisheries sociology of Indian Sundarban.* Narendra publishing house; 2011:1–300.
5. Bassi N, Kumar MD, Sharma A, et al. Status of wetlands in India: a review of extent, ecosystem benefits, threats and management strategies. *J Hydrol Reg Stud.* 2014;2:1–19.
6. Sarkar P. Reflections from Indian scientist Dr. Nepal Chandra Nandi. *Wetl Sci Pract.* 2021;38(1):21–23.
7. Nandi NC, Das AK, Dey A. *Wetland faunal diversity of West Bengal.* WBBB & NBI; 2013:1–256.
8. Central Pollution Control Board. *Report on Assessment of water quality in estuarine and coastal areas of India.* Ministry of environment, Forest and climate change, Government of India; 2019.
9. Cullet P. *Water law in India: Overview of existing framework and proposed reforms.* IELRC Working paper no. 2010-01. International environmental law research centre; 2010.
10. Space Applications Centre. *National Wetland Atlas.* Indian Space Research Organisation; 2011.

Citation: Nandi NC, Deyashi M. Management of backwater and brackish water wetlands in India: a scientific opinion. *J Aquac Mar Biol.* 2026;15(2):108–110. DOI: 10.15406/jamb.2026.15.00449