

Review on freshwater bivalve Molluscs: Importance and conservation status in Maharashtra

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World Journal of Biology Pharmacy and Health Sciences, 2024, 20(03), 313-316

Publication history: Received on 05 November 2024; revised on 12 December 2024; accepted on 14 December 2024

Article DOI: <https://doi.org/10.30574/wjbphs.2024.20.3.1023>

Abstract

Freshwater bivalve molluscs are ecologically and economically significant, providing essential ecosystem services such as water filtration, nutrient cycling, and habitat structuring. In Maharashtra, these molluscs play a crucial role in maintaining aquatic ecosystem health while also supporting livelihoods through fisheries and aquaculture. However, anthropogenic pressures, including pollution, habitat degradation, and overharvesting, threaten their populations. This review explores the importance of freshwater bivalves in Maharashtra, their ecological roles, economic contributions, and current conservation status. It emphasizes the need for sustainable management practices to protect these vital resources.

Keywords: Freshwater bivalves; Maharashtra; Conservation; Water filtration; Ecosystem services; Economic value

1. Introduction

Freshwater bivalve molluscs, particularly species from families like Unionidae and Corbiculidae, are indispensable components of aquatic ecosystems [1]. In Maharashtra, these organisms contribute to ecosystem health and socio-economic activities such as fisheries and pearl production, they are possessing valuable nutrients [2]. However, their populations are under threat due to habitat loss, pollution, and climate change. Economically, they provide food, pearls and raw materials for industries, with increasing interest in their role in pollution monitoring and bioremediation [3]. Despite their significance, freshwater bivalve populations are declining due to anthropogenic pressures. This review evaluates the ecological and economic importance of freshwater bivalves in Maharashtra, highlighting the urgent need for conservation strategies.

2. Ecological Importance

2.1. Water Filtration

Freshwater bivalves enhance water quality by filtering suspended particles, algae, and pollutants. For instance, *Lamellidens marginalis*, a common species in Maharashtra, can filter large volumes of water, improving aquatic ecosystem health [4]. Freshwater bivalves act as natural biofilters, removing suspended particles, organic matter, and pollutants from the water column. For instance, a single *Corbicula fluminea* can filter up to 5 liters of water per day, contributing to improved water clarity and oxygen levels [3].

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2.2. Nutrient Cycling

Bivalves process organic matter and recycle nutrients like nitrogen and phosphorus, supporting aquatic productivity [3]. Bivalves recycle nutrients by processing organic matter and releasing bioavailable nitrogen and phosphorus, supporting primary productivity [5]. Additionally, their burrowing behaviour stabilizes sediments and prevents erosion, creating habitats for benthic organisms.

2.3. Habitat Structuring

Bivalves create microhabitats, benefiting benthic communities and promoting biodiversity. Beds of bivalves stabilize sediments, preventing erosion and maintaining habitat integrity [6]. Bivalve beds provide microhabitats for invertebrates and fish, increasing species richness and ecosystem complexity [7].

2.4. Biodiversity and Habitat

Freshwater bivalves are integral to maintaining biodiversity in aquatic environments. They provide habitat and food for a range of organisms, from microorganisms to larger predators [8], [9]. Their presence contributes to the structural complexity of ecosystems, enhancing habitat for other aquatic species

Table 1 Ecological Role, Species and their Impact

Ecological Role	Species in Maharashtra	Impact
Water Filtration	<i>Lamellidens marginalis</i>	Improves water clarity and reduces pollution
Nutrient Cycling	<i>Parreysia spp.</i>	Supports primary productivity
Habitat Structuring	<i>Indonaia caeruleus</i>	Enhances benthic biodiversity

3. Economic Importance

3.1. Fisheries and Aquaculture

Freshwater bivalves are harvested for food and pearls, contributing to global and regional economies. For example, the freshwater pearl industry in China is valued at over \$8 billion annually [10]. In Maharashtra, freshwater bivalves are harvested for food and aquaculture. They support local livelihoods, particularly in rural communities near rivers and lakes [2]. As food for both aquatic and terrestrial species, freshwater mussels contribute significantly to aquatic ecosystems by enhancing water clarity and quality, supplying nutrients and shelter for aquatic invertebrates at the base of the food chain [11].

3.2. Pearl Production

As the only gemstone created by a living thing, pearls can be categorized as organic gemstones. An immune reaction to a foreign particle can cause the ancient group of life known as mollusks to make pearls. According to studies, mollusks that produce pearls first existed 530 million years ago. However, only bivalves are capable of producing nacreous pearls; other mollusks cannot. There are over 10,000 bivalve mollusc species known to exist worldwide [12]. Species like *Lamellidens corrianus* are used in freshwater pearl culture, an emerging industry in Maharashtra [13].

3.3. Bioremediation

Bivalves bioaccumulate pollutants, making them valuable for bioremediation efforts. Their use in cleaning polluted water bodies has been explored in the state [14].

Table 2 Economic Contribution, Species and their Economic Value

Economic Contribution	Species	Region in Maharashtra	Economic Value
Fisheries	<i>Lamellidens marginalis</i>	Konkan region	Livelihood support
Pearl Production	<i>Lamellidens corrianus</i>	Nashik, Pune, Ahilyanagar	Emerging industry
Bioremediation	<i>Parreysia favidens</i>	Industrial zones	Pollution control

4. Conservation Status

4.1. Threats

- **Pollution:** Industrial and agricultural runoff introduces heavy metals and pesticides, affecting bivalve survival.
- **Habitat Loss:** Dam construction and sand mining disrupt habitats.
- **Overharvesting:** Unsustainable harvesting practices for pearls and food have led to population declines.
- **Invasive Species:** Invasive molluscs like *Corbicula fluminea* compete with native species.

4.2. Conservation Efforts

- **Legislation:** The Wildlife Protection Act, 1972, provides a framework for bivalve conservation.
 - **Habitat Restoration:** Efforts include reintroducing native species and controlling invasive species.
 - **Community Participation:** Engaging local communities in sustainable practices and awareness campaigns is critical.
 - **Research and monitoring:** Enhanced research on bivalve ecology and long-term monitoring programs are essential for informed conservation planning [15].
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5. Discussion

The ecological and economic importance of freshwater bivalves in Maharashtra cannot be overstated. However, the threats they face require immediate action. Integrating traditional knowledge with scientific research and involving local stakeholders can enhance conservation outcomes. According to Clarke (1973) [16], mussels have been observed in lakes and streams on a variety of substrates, including mud, clay, sand, and coarse gravel. They are frequently linked to vegetation. Case studies from other regions indicate that habitat restoration and pollution control measures significantly improve bivalve populations and ecosystem health [15].

6. Conclusion

Freshwater bivalve molluscs in Maharashtra are vital for maintaining ecosystem balance and supporting livelihoods. However, their declining populations highlight the need for targeted conservation strategies. By combining legislative measures, community engagement, and scientific research, Maharashtra can ensure the sustainable management of these critical species.

Compliance with ethical standards

Acknowledgements

The authors are thankful to SARTHI and MAHAJYOTI (An Autonomous Institutes of Government of Maharashtra) for sanctioning Research Fellowship.

Disclosure of conflict of interest

The authors declare that there is no conflict of interest.

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