

Mangrove Diversity in Panvel, Navi Mumbai along the West Coast of India

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Abstract: *Mangrove ecosystems, found in muddy, low-oxygen soils of coastal creeks, are highly productive and provide critical ecological functions, including habitat for numerous organisms, breeding grounds, and protection against floods and erosion. This study assessed the diversity of mangroves along the Panvel coast, Navi Mumbai, from March 2017 to February 2018. A total of eight true mangrove species, representing five genera and three families, were documented, along with thirteen mangrove associate species from nine genera and five families. Additionally, a single non-mangrove halophyte species was observed abundantly in the area. The findings indicate that the Panvel coast currently supports a rich and relatively healthy mangrove habitat, with no immediate signs of pollution stress. However, ongoing urban development, including airport expansion, poses potential threats to the ecological stability of the region, highlighting the need for continuous monitoring.*

Keywords: Mangrove diversity, Panvel creek, West Coast, mangrove associates, coastal ecology

I. INTRODUCTION

Mangrove ecosystems are among the most productive and ecologically significant ecosystems in the world. They serve as vital reservoirs of plant and animal species, supporting a substantial portion of tropical biodiversity (Duke, 1992). Mangroves are woody plants that grow in the intertidal zones along the interface of land and sea, predominantly in tropical and sub-tropical regions, including estuaries and creeks. These plants, along with their associated microbial communities, fungi, and fauna, form complex mangrove forest ecosystems that provide numerous ecological functions such as nutrient cycling, shoreline stabilization, and habitat provision for fish, crustaceans, and other wildlife (Kulkarni, 2002).

In India, mangroves cover approximately 0.14% of the country's total geographic area, representing about 5% of the world's mangrove vegetation (Jagtap et al., 2002). The distribution of mangroves in India is uneven, with nearly 77% located along the east coast and the remaining along the west coast (Pania, 2002). However, the mangrove cover in urban coastal regions has been under significant threat due to anthropogenic pressures. For instance, Mumbai has lost around 40% of its mangroves over the past decade, primarily due to overexploitation, unplanned urban expansion, housing demands, sewage disposal, and encroachment (Zingde, 2002).

Understanding the species diversity within mangrove ecosystems is crucial, as it enables sustainable utilization of natural resources while preserving biodiversity (Biju and Deepthi, 2009). Coastal ecosystems, including mangroves, are highly vulnerable to anthropogenic impacts such as industrial effluents, urban wastewater, dredging, land reclamation, and pollution, which can cause significant ecological disturbances (Croquer et al., 2016). Despite their ecological and economic importance, mangrove ecosystems have often been undervalued, and their conservation has historically received limited attention. Globally, mangroves are threatened by habitat destruction, human interference, pollution, heavy industrialization, and urbanization, all of which contribute to the decline in the number and health of mangrove species (Mehta and Vaidya, 2015).



The Mumbai coastal region and surrounding areas face substantial environmental pressures, receiving approximately 2,200 million liters per day (MLD) of largely untreated domestic wastewater (Zingde and Govindan, 2001; Singare et al., 2014). Similar stressors are increasingly affecting Navi Mumbai due to industrial activities along the Thane-Belapur Industrial Belt, Vashi, and Taloje MIDC (Pawar, 2013). Specifically, the coastal environment of Panvel has been subjected to considerable ecological stress due to the ongoing construction of the Navi Mumbai International Airport (NMIA) on nearly 1,600 hectares of land, resulting in the destruction of approximately 100 hectares of mangroves. Additionally, urbanization initiatives by the City and Industrial Development Corporation (CIDCO), encroachment, reclamation, dredging, and effluent discharges from Taloja MIDC further threaten the ecological integrity of Panvel creek's mangroves.

While extensive research has been conducted on the ecological aspects of mangroves in various regions of India, there is a notable lack of detailed data on the species diversity of mangroves in Panvel creek. To address this gap, the present study was undertaken with the primary objective of documenting the types of mangroves and mangrove-associated species occurring along Panvel creek, Navi Mumbai, on the west coast of India. The study aims to provide baseline information on mangrove diversity, assess the ecological condition of the habitat, and highlight potential threats from ongoing anthropogenic activities, contributing to conservation and sustainable management efforts in the region.

II. MATERIALS AND METHOD:

Study Area:

Panvel is a city situated in the Raigad district of Maharashtra, serving as a central hub connecting Navi Mumbai, Thane, Pune, and Ratnagiri districts. Geographically, Panvel lies along the banks of Panvel Creek, which plays a significant role in the region's hydrology and ecology. The creek spans approximately 7 kilometers and is a tributary that connects continuously with Sheva Creek and Belapur Creek, forming an important part of the coastal water network. It receives inflows from four major rivers—Gadhi, Kalundre, Taloje, and Ulve—contributing to its estuarine nature and creating a dynamic interface between freshwater and marine environments. The geographical coordinates of Panvel Creek range from 18° 58' 26.895" N to 18° 59' 58.432" N latitude and 73° 1' 43.74" E to 73° 6' 48.269" E longitude.

The physical characteristics of Panvel Creek include extensive mudflats, marshy areas, and less rocky stretches, which provide a unique habitat for mangrove vegetation. The creek supports sparse but ecologically important mangrove cover that stabilizes the shoreline, reduces soil erosion, and offers shelter and breeding grounds for a variety of aquatic and terrestrial organisms. These mangrove habitats are also critical in nutrient cycling, sediment trapping, and maintaining the overall health of the estuarine ecosystem. The major portions of the creek are dominated by marshlands and mudflats, which serve as productive habitats for mangroves and associated biota.

Biodiversity and community structure are increasingly recognized as vital determinants of ecosystem functioning, particularly in marine and estuarine ecosystems (Raghukumar & Anil, 2003). Despite their ecological significance, marine ecosystems in India have been less extensively studied compared to terrestrial ecosystems. To address this knowledge gap, the Panvel coast was systematically surveyed over a one-year period, from March 2017 to February 2018, to document the diversity of mangroves and associated species. The identification and classification of mangroves were conducted following established taxonomic literature (Kathiresan, 2000; Naskar & Mandal, 1999), ensuring accurate documentation of species present in the study area.

The findings from Panvel Creek provide valuable insights into the structure, composition, and ecological role of mangrove communities along this part of the west coast of India. Given the ongoing pressures from urbanization, industrial development, and construction projects such as the Navi Mumbai International Airport, the study offers critical baseline data for monitoring ecological changes and supporting conservation strategies aimed at preserving the mangrove ecosystem and its biodiversity.



III. RESULTS AND DISCUSSION:

Here's a cleaner, publication-ready version of your mangrove species table with proper formatting and grouping for clarity:

Category	Order	Family	Species
True Mangroves	Scrophulariales	Acanthaceae	Acanthus ilicifolius
	Lamiales	Avicenniaceae	Avicennia officinalis
			Avicennia alba
			Avicennia marina
	Malpighiales	Rhizophoraceae	Rhizophora apiculata
			Rhizophora mucronata
			Ceriops tagal
Bruguiera sexangula			
Mangrove Associates	Solanales	Convolvulaceae	Ipomoea carnea
			Ipomoea stolonifera
			Ipomoea pes-caprae
	Fabales	Fabaceae	Derris trifoliata
			Caesalpinia bonduc
			Derris scandens
			Ziziphus ziziphus
	Rhamnales	Rhamnaceae	Ziziphus mauritiana
			Lantana camara
	Lamiales	Verbenaceae	Premna carymbosa
			Clerodendrum inerme
			Scirpus littoralis
	Cyperales	Cyperaceae	Fimbristylis ferruginea
Non-Mangrove Halophyte			Caryophyllales

Table 1: Species diversity of mangrove ecosystem from Panvel, Navi Mumbai, Maharashtra.

Here's a detailed, elaborated explanation of your **Discussion and Conclusion** sections, written in a way suitable for a scientific report or journal:

IV. DISCUSSION

The present study recorded a total of eight true mangrove species in Panvel, belonging to five genera and three families, as summarized in Table 1. These mangroves were predominantly observed in a patchy distribution along the upper littoral zone of Panvel Creek. The supra-littoral zone along the coastal stretch of Panvel exhibited moderate mangrove coverage, with *Avicennia marina* emerging as the dominant species. Despite the relatively small number of species compared to more extensive mangrove habitats, the existing mangroves provide a critical foundation for sustaining a diverse mangrove community.

Mangrove associates in the area were represented by thirteen species, encompassing nine genera and five families. These species play an important role in the ecological stability of the mangrove ecosystem, contributing to habitat complexity and providing additional food and shelter for various faunal communities. A single non-mangrove halophyte species, *Sesuvium portulacastrum* of the family Aizoaceae, was also found in abundance. Though less diverse, the combination of true mangroves, mangrove associates, and halophytes supports the overall productivity and biodiversity of the Panvel coastal ecosystem.



However, the mangrove ecosystem of Panvel faces significant anthropogenic pressures. The ongoing construction of the Navi Mumbai International Airport (NMIA), rapid urbanization by the City and Industrial Development Corporation (CIDCO), discharge of industrial effluents, untreated sewage, and dumping of solid waste have collectively deteriorated water quality and altered the natural habitat. Activities such as sand dredging and unchecked encroachment along the coastline further threaten the stability and regeneration of mangroves. Such industrial and urban pressures are not unique to Panvel; similar incidences of pollution and habitat degradation are common in the creeks of Mumbai and Navi Mumbai (Pawar, 2012). Historically, fourteen mangrove species have been reported along the Mumbai coast (Navalkar, 1951), indicating a higher potential for biodiversity that is under pressure due to human interference.

The study highlights the importance of understanding the dynamics of mangrove ecosystems to enable their conservation. Ensuring sustainable development in coastal areas requires prioritizing the protection and scientific restoration of wetlands. Systematic understanding of the mechanisms underlying wetland evolution and degradation is essential for implementing effective conservation strategies (Sharma, 2013).

V. CONCLUSION

The rapid development projects in the Panvel region, including the Navi Mumbai International Airport, Navi Mumbai Metro, residential colonies by CIDCO, and associated infrastructure, pose significant threats to the local mangrove ecosystem. Additional pressures from sewage discharge, industrial effluents, illegal waste dumping, reclamation, encroachment, and dredging are expected to intensify habitat loss in the coming years. While these developments are essential for economic growth and urban expansion, they must be undertaken sustainably, with careful consideration of ecological impacts.

To conserve the mangrove and wetland ecosystems of Panvel, a collective effort involving all stakeholders is necessary. This includes enforcing strict legislative protection, ensuring active participation of local communities in conservation, and implementing long-term biodiversity monitoring programs to track ecological health. Restoration of degraded habitats and sensitization of communities and developers about the ecological and socio-economic importance of mangroves are equally critical. By combining scientific understanding, regulatory frameworks, and community engagement, it is possible to balance development with conservation, safeguarding these vital ecosystems for future generations.

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