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**Status Report  
of Coastal  
and Marine  
Protected Areas  
in Maharashtra**

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## Summary

The state of Maharashtra, with an extent of nearly 10% of the total geographical area of India, is among the top five states in overall species diversity and natural resources. The coastal region, having an extent of approximately 720 km and popularly known as "Konkan", is known for its rich diversity and distinct culture. There are many important sites all along the coast, but broadly two main regions can be distinguished on the basis of the biological diversity, namely the Mumbai-Thane-Navi Mumbai area and the Sindhudurg coastal and marine ecosystem (SCME), which includes Malvan Marine Sanctuary (MMS) and mangrove reserved forests.

The Mumbai-Thane-Navi Mumbai area comprises the Mahul-Sewri mudflats, Elephanta Island and the Thane Creek area. The mudflats are recognized as an Important Bird Area (IBA) due to their congregations of wintering waders, Greater Flamingos and Lesser Flamingos. Apart from the large stretches of mangroves, Thane Creek is known for the Indo-Pacific Humpback Dolphin, which has been recorded in the area. This ecosystem is under threat from various infrastructural developmental projects and disposal of untreated sewage, industrial effluents and oil slicks.

### The Sindhudurg coastal and marine ecosystem encompasses three distinct sites:

- (1) Malvan Marine Sanctuary.
- (2) The archipelago at Vengurla Rocks.
- (3) Angria Bank.

A total of 367 species of marine plants and animals have been reported from Malvan Marine Sanctuary, including 10 or more species of marine mammal. The archipelago at Vengurla Rocks, including Burnt Island, is an IBA site and is known to have breeding colonies of eight tern species. Angria Bank, located 105 km from the shores of Vijaydurg, is a submerged plateau. Sporadic surveys to the site suggest that the area is rich in diversity of corals and reef ecosystems and a congregating site for breeding sharks and whale species.

The forest department has established a special cell to look into matters of mangrove ecology and conservation when restoring degraded parts. In order to increase the mangrove cover in the degraded areas, the Mangrove Cell has initiated mangrove afforestation programmes at six sites along the coast of Maharashtra since 2012-2013.

There is a need to improve the management and conservation of the rich and diverse marine and coastal resources. However, it is important that this be undertaken in partnership with the traditional communities and local stakeholders who are involved with the fisheries sector as it forms the backbone of the coastal and marine ecosystem

**Keywords :** *Coastal, marine, mangrove, Mumbai, Sindhudurg*

## Introduction

Maharashtra lies between latitudes 15°43' and 20°10' N and longitudes 72°39' and 73°30' E. It is the third largest State in the country, with a total geographic area of 3,07,748 km<sup>2</sup>, which is nearly 10% of the total geographical area of India. On the basis of the physiography, the State can be divided into three major divisions: the Deccan Plateau, the Western Ghats (also known as the Sahyadri Range) and the coastal region, popularly known as "Konkan". The coastal region is a narrow plain, barely 30 km wide, lying between the Sahyadri Range, in the east, and the Arabian Sea, in the west. It is 720 km long. The continental shelf is up to 100 km wide north of Mumbai and gradually decreases in width to around 40 km towards the south, near Vengurla.

Although the state is among the top five states in overall species diversity and natural resources, the coastline has seen large-scale developmental and reclamation activities, especially in Mumbai District. Apart from all this, there are pressures from an increase in marine trade, oil spills, large-scale developmental projects planned along the coast and



along the Western Ghats, such as damming rivers for water storage and power generation and increased sewage disposal due to increased urbanization and industrialization of coastal towns and cities.

The information on Maharashtra, though significant, is difficult to synthesize and interpret because of varying conditions in data collection. It also requires an integrated approach to sort out realistic and representative information for the state, and hence we highlight key regions of the state that are known to harbour critical diversity in marine and coastal species.

### Coastal Environment Settings of Maharashtra

The state has a coastline of 720 km from the River Tapi, in the north, to the River Terekhol, in the south, and spreads across six districts, namely Thane, Greater Mumbai, Mumbai, Raigad, Ratnagiri and Sindhudurg. The coast is indented with 15 rivers, 5 major estuaries, 30 backwater regions and numerous beaches. The total area of all the coastal districts is 30,645.5 sq km comprising built-up land (1.58%), agricultural land (44.14%), forests (19.48%), wasteland (28.72%), water bodies (4.13%) and land under grasslands, mining areas and salt pans (1.95%). The coastal geo-morphology is variegated due to indentation by a number of estuaries, creeks, bays with rocky cliffs and promontories, with sandy beaches in between. The soil is coarse and is made up of laterite. It is a rich source of nitrogen and potassium, but it is devoid of lime and is poor in organic matter.

The area is generally warm and humid due to the proximity to the sea. It experiences three distinct seasons: summer, monsoon and winter. The summer runs from March to May and is hot and humid. The average temperature ranges from 30°C to 40°C, with the peak temperatures in April and May. In 2010 the maximum temperature recorded was 46°C. The monsoon lasts from June to September. During this season the region receives an average rainfall of 300 mm to 900 mm. Winter is from October to February are mild when the average temperature ranges from 20°C to 25°C, falling up to to 15°C at night.

### Coastal and Marine Protected Areas

There are two distinct sites within the coastal and marine areas of Maharashtra that are recognized for the diversity of their species assemblages, the Mumbai-Thane-New Mumbai area and the Sindhudurg coastal and marine ecosystem (SCME), which includes Malvan Marine Sanctuary (MMS).

#### 1. Mumbai-Thane-Navi Mumbai Bay

This unique complex, which includes a mix of habitats (mangrove patches and mudflats), is 26 km long. This bay is juxtaposed between Mumbai city (west), Thane (north) and New Mumbai (east) districts (Figure 1a). There are two sites within this region, the Mahul-Sewri mudflats and Thane Creek. This area may be one of the few sites in the region in which high biodiversity has been recorded. Within this complex lies Elephanta Island, which is an international tourist destination.

Fig 1a : Mumbai-Thane-New Mumbai Bay



**The Mahul-Sewri mudflats :** The mudflats of Mahul and Sewri (19°01' N, 72°52' E) lies in the eastern part of Mumbai District. The mudflats are a stretch of intertidal areas located along the Arabian Sea in an area approximately 10 km long and 3 km wide and dominated on the landward side by a fringe of mangrove vegetation. The area has the jetty of Mumbai Port Trust (MbPT), Bhabha Atomic Research Centre (BARC), Tata Electrical, refineries of the Oil and Natural Gas Commission (ONGC), Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL), and hence the general public is prohibited from entering it.

This area is recognized as an Important Bird Area (IBA) (Islam & Rahmani 2004) as it supports large congregations of Greater Flamingo *Phoenicopterus roseus* and Lesser Flamingo *P. minor*, besides numerous wintering waterfowl and wader species, including globally threatened species (Spotted Greenshank *Tringa guttifer*, Greater Spotted Eagle *Aquila clanga*, Eastern Imperial Eagle *Aquila heliaca* and Lesser Flamingo).

A total of 53 species of vascular plant, of which 10 species are mangroves and 13 are mangrove-associated species, have been reported from the area. The predominant mangrove species is *Avicennia marina*, while *Avicennia officinalis*, *Sonneratia alba*, *Sonneratia apetala*, *Excoecaria agallocha* and *Acanthus ilicifolius* also occur within the area. Among the faunal entities are polychaetes (2 species) of the genus *Lycastis*, 15 species of mollusc (8 species of gastropod, 5 species of bivalve, 2 species of pulmonate), crustaceans including barnacles, crabs (5 species), prawns and shrimps (3 genera), 28 species of butterfly, 7 species of snake, 1 lizard species, 2 skink species, around 150 avifaunal species and 9 species of mammal, including the Golden Jackal *Canis aureus* (Verma et al 2002).

**Thane Creek :** This creek (19°07'30" N, 72°57'30" E), situated between the east coast of Mumbai city and the west coast of Navi Mumbai, is a mixture mangrove forest and salt pans. The salt pan lands are potential areas for mangrove development and can be easily reverted to their original status, that of mangroves.

About 90 species of plant have been recorded from this site. The vegetation is dominated by mangroves and mangrove-associated species. Among the mangroves, *Avicennia marina*, *A. officinalis*, *Sonneratia alba*, *S. apetala*, *Aegiceras corniculatum* and *Ceriops tagal* are the dominant species. Among the mangrove associates and halophytes, *Salvadora persica*, *Clerodendrum inerme*, *Aleuropus lagopoides* and *Sesuvium protulacastrum* are dominant (Nitsure 2002).

About 27 species of phytoplankton, 33 species of reptile, 13 species of crab, 7 species of prawn, 23 species of butterfly, 21 species of fish, 205 species of avifauna (including Greater and Lesser Flamingoes, Osprey *Pandion haliaetus*, White-Bellied Sea-Eagle *Haliaeetus leucogaster*, Spotted Greenshank *Tringa guttifer*, Lesser Sand Plover *Charadrius mongolus* and Little Stint *Calidris minuta*) and mammals such as the Jungle Cat *Felis chaus*, Golden Jackal and Common Mongoose *Herpestes edwardsi* have been recorded here (Quadros 2001; Deshmukh 1990; Kulkarni 2009). There are sighting records of the Indo-Pacific Humpback Dolphin *Sousa chinensis* from the area.

This ecosystem is under threat from various factors such as illegal reclamation and dumping. The Navi Mumbai airport and the proposed six-lane Mumbai-Trans Harbour Link (MTHL) across the creek are under consideration. The mangroves are used as fuel wood by the local slum dwellers. This is an increasing burden on the limited resources of this ecosystem. Municipal sewage disposal, seepage of industrial effluents and oil slicks are of concern as they affect mangroves and mudflats. There is a need to understand the load of heavy metal pollutants on the fishery resources since fishing and mangrove crab harvesting are being practiced in these waters. The effects of bio-magnification of heavy metal pollutants on the health of the locals needs to be investigated.

## 2. Sindhudurg Coastal and Marine Ecosystem (SCME)

The coastal and marine diversity of Sindhudurg District is considered to be one of the highest in the state. The Sindhudurg Coastal and Marine Ecosystem (henceforth SCME) encompasses three distinct :

- (1) Malvan Marine Sanctuary (MMS) Malvan.
- (2) The archipelago at Vengurla Rocks.
- (3) Angria Bank (Figure 1b).

The area has been documented from 1947 onwards (MacDonald 1947). These three sites are known for their critical habitats, including rocky shores, sandy shores, rocky islands, estuaries, mudflats, marshy land, mangrove habitats, coral reefs and algal forests.

**Malvan Marine Sanctuary :** MMS was declared in 1987 and has an area of 29.12 km<sup>2</sup>, with a core area of 3.18 km<sup>2</sup>. The core area include Sindhudurg fort, Padmagad Island and submerged rocky structures, while the rest of the areas are along the coast of Malvan town, with sandy beaches interspersed by rock formations extending into the sea, thereby supporting the formation of corals.

A total of 367 marine species (flora and fauna) have been reported from the region, including 73 species of sea weed

Fig 1b : Sindhudurg coastal and marine ecosystem (SCME)



(CMFRI 1987), 18 species of mangrove and associated forms (Bhosale 2005), 9 species of coral (Qasim & Wafar 1979), 73 species of mollusc, 47 species each of polychaete and arthropod, 18 species of sea anemone and 74 species of fish. Around 200 species of bird and 10 or more species of marine mammal have been recorded from this area.

Although the area was declared a sanctuary in 1987, the local fishing communities felt that the initial consultations with them were insufficient and that later efforts to compensate for this were weak. The potential benefits of the sanctuary vis-à-vis livelihood options were not perceived as substantial by the communities, resulting in widespread protests against its formation. Apart from this, the management structure is further complicated by the fact that core parts of the MMS include the Sindhudurg Fort, which is under the management of the Archaeological Survey of India (ASI). Further, the land within the fort is privately owned. The process of demarcating the area after taking adequate measures to protect the occupational interest of the local fishers and settlement of rights is yet to be completed. Hence, till date there has been no implementation, and the regulations of the sanctuary remain non-operational. Though the communities are pro-conservation and their awareness level is high, the opportunities to bring them on board in conservation initiatives need concerted efforts.

**Archipelago at Vengurla Rocks :** This is an archipelago of 20 islands located around 14 km west to northwest of Vengurla town, Burnt Island being the largest island. Grasses such as *Cymbopogon* species, *Celosia argentea* and *Mollugo sperbula* have been recorded. These islands support a colony of over 18,000 Indian Edible-Nest Swiftlets or Indian Swiftlets *Collocalia unicolor* and a breeding congregation of eight tern species (Common Tern *Sterna hirundo*, Roseate Tern *S. dougallii*, White-Cheeked Tern *S. repressa*, Bridled Tern *S. anaethetus*, Sooty Tern *S. fuscata*, Large Crested Tern *S. bergii*, Lesser Crested Tern *S. bengalensis* and Indian River Tern *S. aurantia*) (Pande 2002). This archipelago is inhabited, but there are reports of large-scale poaching of the Indian Edible-Nest Swiftlets (Pande 2002).

**Angria Bank :** This is a submerged, sunken plateau at the edge of the continental shelf off India's west coast, located approximately 105 km west of Vijaydurg. Angria Bank has a depth of 20.1 m, and its dimensions are around 40 km north to south and 15 km east to west. There has been no systematic study of the area, but anecdotal evidence from the area suggests that the sunken plateau is rich in diversity of corals and reef ecosystems and a congregating site for nursing sharks and whale species. Initial surveys undertaken at Angria Bank have highlighted the richness of the area. Due to the significant diversity present within the area, it has the potential to be declared one of India's marine protected sites.

The endangered and threatened fauna that have been recorded in SCME include the Whale Shark *Rhincodon typus*, Black-Tip Reef Shark *Carcharhinus melanopterus*, rays, Sperm Whale *Physeter macrocephalus*, Finless Porpoise *Neophocaena phocaenoides* and Indo-Pacific Humpback Dolphin. Nesting of the Olive Ridley *Lepidochelys olivacea* has been recorded from the coastal areas of SCME, and the Green Turtle and Leatherback *Dermodochelys coriacea*

have been reported from the area (Giri & Chaturvedi 2006). In addition, nesting tern colonies and Indian Swiftlet *Aerodramus fuciphagus* have been recorded at Vengurla Rocks. Nests of the White-Bellied Fish-Eagle have been recorded all along the coastal area.

The information regarding the diversity and richness of SCME has been obtained through sporadic visits to the sites. Till date no systematic study has been undertaken in SCME. The increasing intensity of marine resource exploitation, the unplanned, unregulated tourism industry and sewage disposal are major concerns within the region. Also, infrastructural projects planned along the coast for facilitating the fishing industry may have negative impacts on the marine and coastal biodiversity of the region. Till date there has been no significant industrialization along the coast, but cascading effects of mining operations undertaken along the Western Ghats and their effects on the connecting river ecosystem are a concern. Increasing conversion of private forest lands to orchards and usage of insecticides and pesticides on the marine and coastal biodiversity are other issues that need to be addressed. Keeping all this in mind, the forest department is implementing a programme that aims to put in place an enabling environment for progressive mainstreaming of biodiversity conservation considerations in the activities of production sectors operating within SCME.

### 3. Mangrove Reserved Forest

The forest cover of Maharashtra spreads over 50646 km<sup>2</sup>, containing a diverse mangrove forest along the coast which has an extent of 186 km<sup>2</sup> (FSI 2011). The creation of the Mangrove Cell in 2012 was an initiative to address the concerns within the marine and coastal ecosystems. The "mangrove forest" has been declared a reserved forest. Using satellite mapping and the CRZ maps of 2002, initial surveys were undertaken by the Mangrove Cell. These suggest that nearly 300 km<sup>2</sup> (30,000 ha) of mangrove area will be notified. Of this area, 170 km<sup>2</sup> is on government land, and the remaining 130 km<sup>2</sup> is under private ownership. The area on government land is being notified as reserve forests (Table 1).

**Table 1 :** District-wise mangrove area under "Reserved Forest" category

District	Notified area (ha)	Notification awaited (ha)	Total area (ha)
Mumbai	276.65	-	276.65
Mumbai Suburban	3746.94	-	3746.94
Thane	1471.41	4935.65	6407.06
Raigad	983.8	3218.07	4201.87
Ratnagiri	-	2289.8	2289.8
Sindhudurg	-	864.77	864.77
<b>Total</b>			<b>17,787.09</b>

Numerous studies relating to phenology, floristics (e.g., Bhosale 2005), associated species and ecosystem services have been carried out. Most of these studies have highlighted the the metropolitan city's needs, which have caused nearly 70% decline in the past 25 years (<http://cat.org.in/index.php/article/pil-87-of-2006-mangroves/>). Reclamation activity for expansion of agricultural, industrial and residential land, exploitation for fuel sources and industrial and domestic pollution have had negative effects on the mangrove species.

### The Way Forward

The Mangrove Cell initiated a mangrove afforestation programme in 2012-2013. Nurseries have been established at six sites along the coast. Using the saplings from these nurseries, a large-scale afforestation programme is being carried out with the help of local communities. Apart from this, assisted natural regeneration has been undertaken at three sites in Mumbai. There are other research projects under way to study the diversity and distribution of species in Maharashtra and to map the mangrove areas. The Mangrove Cell has presently initiated a programme with the Gesellschaft für Internationale Zusammenarbeit (GIZ), a branch of the government of Germany, in which Thane Creek and two other sites in Ratnagiri District, namely Ansure Creek and the Dabhol-Velas coastal stretch, will be taken up for marine and coastal conservation.

The state is also implementing a programme with the help of the MoEF and UNDP on the Sindhudurg coast. Despite the existence of MMS for over two decades, a congenial environment for effective management of the marine protected area has yet to be evolved. In the absence of any headway in the formation of MMS, conservation of the biological diversity outside the boundaries of MMS in SCME has got very little attention. The main sectors (fishing, tourism, ports, maritime

traffic, manufacturing units and agriculture) operating within the wider land/seascape of SCME may impact the coastal and marine diversity due to their development models and growth strategies. It is in this light that the project will help build environmental safeguards and conservation considerations while taking into account the developmental and resource management models of these key sectors, which are necessary for sustaining livelihoods within the region, and addressing retrogressive factors such as the anticipated impacts of climate change.

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