

## Marine protected areas in India

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India has large coastal wetlands which cover an area of over 40,230 km<sup>2</sup>. Among various types of marine ecosystems, tidal mudflats, mangroves, estuaries, lagoons, beaches, marshes, vegetated wetlands and coral reefs have a major share. A total of 97 major estuaries, 34 major lagoons, 31 mangroves areas and 5 coral reef areas have been mapped and identified in India for conservation and sustainable use. There are a total of 31 Marine Protected Areas (MPAs) in India, primarily in marine environment, which cover a total area of 6271.2 km<sup>2</sup> with an average size of 202.1 km<sup>2</sup>. East coast and Andaman & Nicobar Islands have adequate areas in the MPAs whereas west coast and Lakshadweep Islands have poor representation. Also, another 100 PAs (10 in main Indian coast and 90 island PAs in Andaman & Nicobar) have terrestrial or fresh water ecosystems which constitute boundaries with seawater or partly contain marine environment, but they are not listed as MPAs as per the criteria. Although, India has a very long coastline and varied coastal habitats, contribution of the MPAs is only 4.0 % to the total area of the Protected Areas (PAs) and 1.3 % of the continental shelf area of the country. The common issues and problems that need to be tackled urgently for ensuring an effective management setup of the MPAs of the country are discussed.

[ **Key words:** Coastal wetlands, marine protected areas, marine park, marine sanctuary ]

The Indian coasts fall within the bounds of the tropics, which include the west coast, the east coast and the coast of Lakshadweep and Andaman and Nicobar Islands. The coastline of India measures about 7,516.6 km, which is distributed among nine coastal states and four Union Territories. Over 22.6% of total coasts of India are of islands (Andaman and Nicobar, Lakshadweep and Diu islands). The Exclusive Economic Zones (EEZs) in the country cover an area of about  $2.02 \times 10^6$  million km<sup>2</sup>, enclosed within 200 nautical miles (370.4 km) from the land. Basically, all the areas on the continental shelves (Indian Continental Shelf- 468,000 km<sup>2</sup>) are now under national sovereignty<sup>1</sup>. About 90% of the traditional fishing areas that were situated in international water are also under the jurisdiction of coastal states now.

The coastal wetlands include near shore gulf water, inlets, creeks, deltas, bays, lagoons, coastal lakes, backwater, estuaries, coral reefs, shoals, tidal flats, mudflats, beach, sand ridges, coastal dunes, mangroves, marsh, algae/sea-grass beds, strand features, salt affected lands, reclaimed lands and deltaic plains<sup>2</sup>. A total of 3960 sites of coastal wetlands have been mapped<sup>3</sup>, covering a total extent of 40,230 km<sup>2</sup>. Due to limitation of remote sensing

technology to detect small area accurately, small wetlands having less than 56.3 ha in size were not included in the mapping. These wetlands are distributed around nine coastal States and four Union Territories. Contribution of Gujarat State, including Rann of Kachchh, is about 25,083 km<sup>2</sup> (62.3%), which is the highest among all states of the country. Tamil Nadu (3,987 km<sup>2</sup>), West Bengal (3,604 km<sup>2</sup>), Orissa (1,854 km<sup>2</sup>), Andhra Pradesh (1,855 km<sup>2</sup>) and Andaman and Nicobar (1,078 km<sup>2</sup>) are other states, which have large area under coastal wetlands, including mangroves. Among various types of coastal wetlands, as mentioned above, tidal mudflats (23,621 km<sup>2</sup>) and mangroves (4,871 km<sup>2</sup>) are dominant<sup>4</sup>. Other categories are- estuaries (1,540 km<sup>2</sup>), lagoons (1,564 km<sup>2</sup>), sand beach (4,210 km<sup>2</sup>), marsh (1,698 km<sup>2</sup>), other vegetated wetlands (1,391 km<sup>2</sup>), coral reefs (841 km<sup>2</sup>), creeks (192 km<sup>2</sup>), back water (171 km<sup>2</sup>), rocky coast (177 km<sup>2</sup>), salt pan (655 km<sup>2</sup>) and aquaculture ponds (769 km<sup>2</sup>). A total of 97 major estuaries, 34 major lagoons and 241 creeks have also been mapped<sup>3</sup>, which are important for conservation.

Realising the importance of marine ecosystems, especially mangroves and coral reefs, the Government of India (GOI) initiated efforts for their conservation and management. Marine ecosystems were declared

as ecologically sensitive areas under the Environment Protection Act, 1986 banning their exploitation, followed by a Coastal Regulation Zone (CRZ) Notification 1991 prohibiting development activities and disposal of wastes in the mangroves and coral reefs. The Ministry of Environment and Forests, GOI, initiated a scheme on conservation and management of mangroves and coral reefs during 1986-87 and has constituted a National Committee to advise the Government on relevant policies and programmes. On the recommendations of this committee, 31 mangrove areas in the country have been identified for intensive conservation. Mangrove afforestation programmes have been initiated in the intertidal areas to restore tidal forests. Taking into consideration the importance of coral reefs and the factors responsible for their deterioration, Andaman and Nicobar Islands, Lakshadweep Islands, Gulf of Mannar and Gulf of Kachchh have been identified for conservation and management. Efforts have been initiated to establish the Indian Coral Reef Monitoring Network (ICRMN) to integrate various activities on Coral Reefs through national and international initiatives. Institutions of database networking and capacity and training on coral reefs have been identified<sup>5</sup>.

The Coastal Regulation Zone Act 1991 was enacted by the Government of India to protect the Indian coasts from degradation. The area influenced by tidal action up to 500 m from High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL has been declared as Coastal Regulation Zone (CRZ). The maps for CRZ have been prepared using remote sensing technique. As per classification system of the CRZ, coastal zone has been divided into four categories<sup>6</sup> for regulating developmental activities and conserving marine ecosystems:

#### CRZ Category-I

Ecologically sensitive areas like mangroves, coral reefs, marine national parks and sanctuaries between LTL and HTL.

#### CRZ Category-II

Developed areas close to shore mainly urban or built-up area.

#### CRZ Category-III

Undistributed areas and those areas, which do not belong to Category-I and II.

#### CRZ Category-IV

Coastal stretches in Andaman and Nicobar, Lakshadweep and small islands.

The CRZ-I zone includes ecologically sensitive areas like mangroves, coral reefs, areas close to

breeding ground of fish and other marine life, areas of outstanding natural beauty and Marine Protected Areas. This zone is qualified for strict protection. The Supreme Court of India has directed all coastal states to prepare and implement the CRZ plan. As a result, most of the states have prepared their plans to protect coastal zones from degradation<sup>7</sup>.

To provide protection to the ecologically important areas, India initiated action through the state governments to create a network of MPAs under Wildlife (Protection) Act, 1972. Gradually their number increased to cover critical and important marine ecosystems. Now majority of coral reefs and mangroves are part of the MPAs in the country. Recognising ecological values and importance for biodiversity conservation, the GOI has notified three Biosphere Reserves in 1989 in marine areas viz. Great Nicobar Biosphere Reserve in Andaman and Nicobar (885 km<sup>2</sup>), Gulf of Mannar Biosphere Reserve (10,500 km<sup>2</sup>) in Tamil Nadu and Sundarbans Biosphere Reserve (9,630 km<sup>2</sup>) in West Bengal. Sundarbans National Park has been now included in the list of World Heritage Sites in 1985 and Chilka Lake in Orissa is now a site of Ramsar Convention for conservation of bird's habitat<sup>5</sup>.

In India, some of the national parks and sanctuaries were declared exclusively as MPAs in 1980s and 1990s. There are substantial numbers of protected areas in the region that include coastal elements (Fig. 1). To carry on proper analysis and documentation, the PAs in marine environment or having marine element in India are primarily classified into three categories in this paper, by interpreting IUCN definition<sup>8</sup> in India's context.

#### Category-I

The PAs having entire area in intertidal, subtidal terrain and overlaying seawater as per IUCN definition. This category of MPA covers mangroves, coral reefs, creeks, algal bed, estuaries, lagoon, intertidal areas and seawater.

#### Category-II

The Island PAs in Andaman and Nicobar and Lakshadweep Islands which have major or substantial part in intertidal zone and small part in terrestrial ecosystems.

#### Category-III

PAs in coast, covering major part in terrestrial ecosystems and small parts of intertidal area or partially influenced by marine environment or island PA; inland wetlands in coastal zone with

opening in sea or influenced by coastal environment; sandy beach and mudflats (beyond intertidal line but occasionally interacting with seawater). These PAs are not considered as MPAs.

Generally, management in Category III focuses on conservation of terrestrial biota, although they also contribute to conservation of some the marine life, especially sea turtle, waterfowls. As per the IUCN Criteria, the parks and sanctuaries in Category-I and Category-II in India can be considered MPAs as programmes focus there on conservation of mangroves, corals, marine biodiversity or water birds, preferring marine habitats. Based on above classification, the list of MPAs in India in different Categories I and II has been proposed in Table 1. Although each PA was examined on above criteria, there may be possibility of error in some cases in classifying them.

Marine Protected Areas in India comprise national parks and wildlife sanctuaries belonging to Categories I and II, as discussed above. They cover coastal wetlands, especially mangroves, coral reefs and lagoons and have been notified under Wildlife

(Protection) Act, 1972. Total area of 31 MPAs (33 sanctuaries and national parks) in India is 6 27,121 ha., which is very small compared to extent of the Protected Areas (586 PAs, covering  $15.64 \times 10^6$  ha) in the country. Although, India has very long coast line and varied coastal habitats, contribution of the MPAs is only 4.0 % to the total area of the PAs. Distribution of the MPAs in India is not uniform. Most of the MPAs are on the east coast and Andaman Islands, whereas the other three biogeographic provinces have poor presentation. Table 2 shows the distribution of MPAs according to biogeographic provinces<sup>9</sup>. Among states, West Bengal, Orissa and Andhra Pradesh have major shares while Karnataka, Kerala and Lakshadweep Islands are yet to be identified for declaring sanctuary or national park in marine environment.

Average size of the MPA in India is 20,214 ha, although the majority of them have size less than 10,000 ha. Of 31 MPAs in the country, only 11 marine parks and Sanctuaries have area more than 10,000 ha. Tables 3 and 4 show the distribution of MPAs according to size class and progressive increase of the number of MPAs during last thirty years.

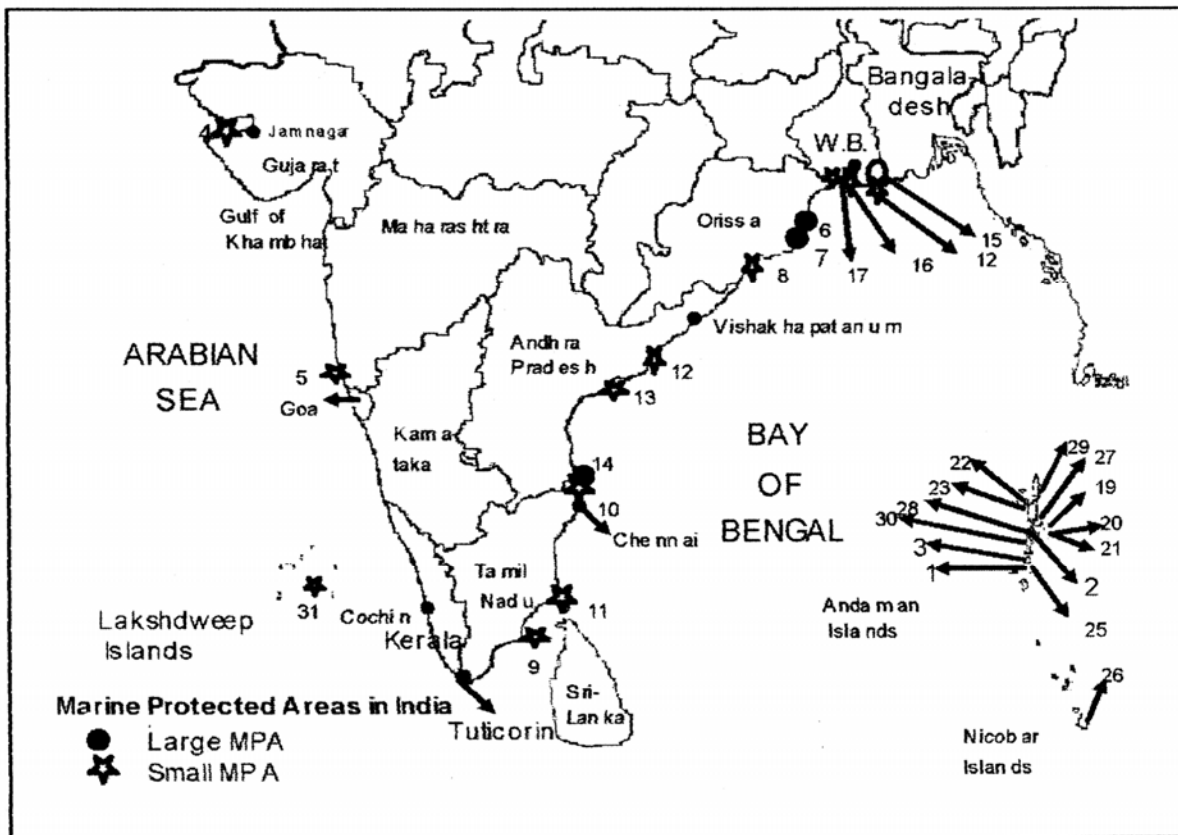


Fig. 1 — Location of marine protected areas (location no. in map corresponds to serial number of MPA in Table 1)

Table 1 — Marine Protected Areas (national parks and sanctuaries)

Category I	Area (ha)
1. Mahatma Gandhi Marine NP, Wandoor, South Andaman	28, 150
2. Rani Jhansi Marine NP(Richies Archipelogo) Andaman	25, 614
3. Lohabarrack (Salt water Crocodile) Sanctuary, South Andaman	10, 000
4. Gulf of Kachchh Marine NP, Jamnagar, Gujarat	16, 289
Marine Sanctuary, Gulf of Kachchh, Jamnagar, Gujarat	29, 503
5. Malvan Marine Sanctuary Sindhudurg, Maharashtra	2, 912
6. Bhitarkanika NP,Cuttak, Orissa	14, 500
Bhitarkanika Sanctuary, Kendrapara, Orissa	67, 200
7. Gahirmatha Marine Sanctuary, Kendrapara, Orissa	143, 500
8. Chilka (Nalabund) WLS, Khundra, Puri, Ganjam, Orissa	1, 550
9. Gulf of Mannar Marine NP,(Ramnathpuram/Tuticorin) Tamil Nadu	623
10. Pulicat Lake (Bird) Sanctuary, Tiruvellore, Tamil Nadu	15, 367
11. Point Calimere Sanctuary, Nagapattinum, Tamil Nadu	1, 726
12. Coringa Wildlife Sanctuary, East Godavary, Andhra Pradesh	23, 570
13. Krishna Wildlife Sanctuary, Krishna/Guntur, Andhra Pradesh	19, 481
14. Pulicat Lake Bird Sanctuary, Nellore, Andhra Pradesh	50, 000
15. Sundarbans National Park(Tiger Reserve), North & South 24-Pargana, West Bengal	133, 010
16. Halliday Sanctuary, South 24-Pargana) West Bengal	595
17. Lothian Island Sanctuary, (South 24-Pargana, West Bengal	3, 800
18. Sajnakhali Sanctuary, South 24-Pargana, West Bengal	3, 624
<b>Total</b>	<b>623, 630</b>
<b>Category II</b>	
19. North Buttan N.P., Middle Andaman	44
20. Middle Buttan N. P., Middle Andaman	44
21. South Buttan N.P., Middle Andaman	03
22. North Reef Island Sanctuary, North Andaman	348
23. South Reef Island Sanctuary, Middle Andaman	117
24. Cuthbert Bay Sanctuary, Middle Andaman	582
25. Cingue Sanctuary, South Andaman	951
26. Galathea Bay Sanctuary, Great Nicobar*	1, 144
27. Parkinson Island Sanctuary, Middle Andaman	034
28. Mangroves Island Sanctuary, Middle Andaman	039
29. Blister Island Sanctuary, North Andaman	026
30. Sandy Island Sanctuary, South Andaman	158
31. Pitti Wildlife Sanctuary, Lakshadweep	01
<b>Total</b>	<b>3, 491</b>
<b>Grand Total – 33 national parks and sanctuaries (31 MPAs)</b>	<b>627, 121</b>

\*Galathea National Park (11,000 ha) includes area of Galathea Sanctuary. Galathea Bay Sanctuary is mainly in marine environment whereas major part of the park is in terrestrial ecosystems

Table 2 — Distribution of MPAs by biogeographic province

Biogeographic Provinces	State/UT	MPAs (no.)	Area (ha.)
8A West coast	Gujarat	*2 (1)	45792
	Maharashtra	1	2912
8B East Coast	Tamil Nadu	3	17716
	Andhra Pradesh	3	93051
	Orissa	*4 (3)	226750
	West Bengal	4	173645
8C Lakshadweep	Lakshadweep	1	001
10A Andaman Islands	Andaman & Nicobar Islands	14	66110
10B Nicobar Islands	Andaman & Nicobar Islands	1	1144
<b>Total</b>		<b>33 (31)*</b>	<b>627121</b>

Table 3 — Distribution by size class

Size class (ha)	No. of MPAs	Total area (ha.)
0-10	2	4
11-100	5	187
101-1,000	7	3374
1,001-10,000	6	21132
10,001-100,000	11 (9)*	325415
10,001-100,000	9	325415
Above 100,000	2	276510
Total	33 (31)*	626622
Average size		22214

\*Marine Sanctuary, Jamnagar and Marine National Park, Jamnagar are two legal units (ecologically superior area as Marine Park and its surrounding or neighbouring areas as sanctuary) but they form part of one area in the Gulf of Kachchh. Similarly-Bhitarikanika National Park and Bhitarikanika Sanctuary in Orissa are part of one area (MPA). Thus there are a total of 33 marine national parks and sanctuaries but 31 MPAs.

#### Gujarat State

Realising the conservation significance of the coral reefs and mangroves, Gujarat State Government declared southern part of the Gulf of Kachchh along with 42 islands as Marine Sanctuary in 1980, which has been expanded to about 45793 ha. in 1982. To provide total protection, islands and some of the area of the sanctuary have been notified as Marine National Park, which happened to be the first Marine National Park of the country<sup>10</sup>. Practically, both Marine Sanctuary and Marine National Park are part of one ecological area or MPA in the Gulf for purpose of management. Rann of Kachchh, a saline desert, was part of open sea in the past, but now it is a unique wetland. Entire land of the Rann (1,930,000 ha) submerges under knee-deep water during monsoon and dries after rainy season, leaving dotted water bodies in winter. Tidal water and rainwater meet in monsoon to form huge shallow lake for three to four month and form a hybrid environment of inland and coastal wetlands. Two wildlife sanctuaries- Wild Ass Sanctuary (495,400 ha) and Kachchh Desert Sanctuary (750,600 ha.) have been constituted by the state government in this area, but they are not classified as MPA. Similarly, Khijadia Bird Sanctuary, a reclamation bund (manmade lake) across two creeks, is influenced by the marine environment but not categorized as MPA. Estuaries of rivers in south Gujarat have good patch of mangroves and they support some of the threatened species and hence they require legal protection. Rodgers *et al.*<sup>9</sup> recommended that suitable area in the Gulf of Cambay (2,000 ha.) and Kori Creek (5,000 ha.) should be notified as PAs in the state.

Table 4 — Progressive increase of MPAs

Year	No. of MPAs	Area (ha.)
1970	1	1726
1975	3	201936
1980	10	357435
1985	12	401774
1990	27	434226
1995	27	434226
2000	31	626621

#### Maharashtra State

Recently, Maharashtra on the west-coast of India, has declared Malvan Marine Sanctuary (2,904 ha) where coral patches are important marine ecosystems. Although the state government has notified the sanctuary, management is yet to be established because local people oppose the declaration of the MPA. Tidal creeks in and around Mumbai have good mangroves and public awakening contributed a lot to check their degradation. Some of these areas need adequate legal protection and hence can be considered for declaring sanctuary. Dasgaon (500 ha) is another suitable area for sanctuary<sup>9</sup>. Mangroves near Malwan also need legal protection.

#### Lakshadweep Islands

In Lakshadweep Islands, the lagoons are very different from those on the mainland in the sense that they are actually coral reef lagoons wherein the water mass got enclosed in an atoll or within a barrier reef. A group of 36 islands, known as Lakshadweep, is the Union Territory of India and these islands are coral atolls, arising from lagoon<sup>11</sup>. Only 10 of these islands are inhabited. Lagoons, numbering about 15, cover large area and they are important wetlands along with coral reefs. Pitti, a tiny island has been declared as Bird Sanctuary, but rich coral reefs and lagoons do not have legal protection under MPA. Rodgers *et al.*<sup>9</sup> recommended for declaration of Balapani and Pitti as sanctuaries to conserve biodiversity of the area. Coral reef (31,040 ha), lagoon (22,150 ha) and beach (10,800 ha) are coastal wetlands estimated in Lakshadweep Islands.

#### Andaman and Nicobar Islands

Union Territory of Andaman and Nicobar Islands has constituted 105 PAs (9 national parks and 96 wild sanctuaries) and all of them have coast or some kind of marine environment. These PAs cover a total area of 162,020 ha (national parks-115,394 ha and wildlife sanctuaries-46,740 ha). Out of these, 15 PAs (5 national parks and 10 wildlife sanctuaries),

covering a total area of 67,130 ha (national parks-53,860 ha and wildlife sanctuaries 13,220 ha) have marine ecosystems-mangroves, sandy beach and coral reefs. Many other PAs in Andaman and Nicobar have small areas of sandy coasts, mangroves, creeks, and coral reefs along with terrestrial moist forests but they are not categorised as MPAs. Although majority of 105 PAs in Andaman and Nicobar have marine ecosystem or influenced by the marine environment, only 15 have been listed as MPA (Category I and II) and the rest of PAs can be classified in Category III, which constitute boundaries with tidal line and partially contribute to marine biodiversity conservation.

#### *Tamil Nadu State*

Tamil Nadu state has constituted three PAs in the marine environment, which cover a total area of 17,716 ha. Gulf of Mannar National Park (6,230 ha), covering 21 islands, has been basically constituted to protect coral reefs in the Gulf. The area of islands<sup>12</sup> ranges between 0.5 ha and 130 ha. Very small patch of mangroves also occurs in the Park. Dugong and dolphin are important marine mammals in the area. Point Calimere Sanctuary (1,726 ha) and Pulicat Lake Sanctuary (15,367 ha) are other two MPAs in the state, but they do not have corals. Mangroves occur in small areas in both the sanctuaries. These sanctuaries are more famous for birds, but other forms of wildlife also enjoy protection. Pulicat Lake is very important area for birds, as this brackish water lake is at confluence of rainwater and seawater. Part of these two sanctuaries covers terrestrial habitats, where blackbuck and other mammals also occur. Muthupat is a proposed marine sanctuary to protect mangroves.

#### *Andhra Pradesh State*

Three sanctuaries- Krishna, Coringa and Pulicat are mainly in the marine environment. Krishna Sanctuary (19,481 ha) and Coringa Sanctuary (23,570 ha) have mangroves, estuaries and back water whereas Pulicat is a lagoon of brackish water and known for water birds and fishes. Pulicat lagoon is the largest brackish waterbody in the south India and the second largest saltwater lake in the country. This 55,300 ha lagoon spreads in two states i.e. Andhra Pradesh and Tamil Nadu and supports a host of migratory birds and aquatic life. About 84% of this lake is in Andhra Pradesh and rest of the area in Tamil Nadu. For all purposes this is practically marine sanctuary and, hence has been treated as MPA (Table 3). Navapada

is another area, which has been recommended by the Rodgers *et al.*<sup>9</sup> for being declared as sanctuary. Kolleru Lake Sanctuary (30,855 ha), a fresh water lake opens into the Bay of Bengal. This lake includes some area of mixed environment, which also contributes to the marine life conservation.

#### *Orissa State*

Orissa has notified one marine national park and two marine sanctuaries, covering a total area of 225,200 ha. Actually, Bhitarkanika National Park (14,500 ha) and Bhitarkanika Wildlife Sanctuary (67,200 ha) are parts of one ecological area or PA. Extensive moist forest and mangroves along with delta and estuarine areas of Mahanadi, Satabhaya, Dhamara, Bhitarkanika and Brahmani rivers have been included in the MPAs, which support one of the excellent mangroves. In India, the Orissa coastline is the most endowed-one where four species of sea turtle (Olive Ridley, Green, Hawksbill and Leatherback) have been reportedly found. Gahirmatha Sanctuary (14,350 ha), the world's largest Olive Ridley rookery, is large MPA, which covers extensive sandy beach and mangroves. At the mouth of river Rushkulya in the sanctuary, about 200,000 Olive Ridley Sea Turtle nested<sup>13</sup> in 1994. Over a half million Olive Ridley nest at Gahirmatha between January and May every year and the site was recognised as the largest nesting ground for sea turtles in the world<sup>13</sup>. Chilka lake supports one of the largest populations of waterfowl during wintering season. The area is known as ideal habitat for crocodile, dolphin and a variety of birds. An area of 1,553 ha of this lake has been notified as wildlife sanctuary. Balukhand (Konark) Sanctuary (7,172 ha) is also in marine environment but not listed in the Category I or II. Rodgers *et al.*<sup>9</sup> recommended that, Bhetnoi (15,000 ha) should be declared and another 10,000 ha area of the Chilka should be added to the existing PA.

#### *West Bengal State*

West Bengal has a coastline of about 650 km in the northern part of Bay of Bengal in Midinapur and South 24 Pargana districts. There is no exclusive Marine Sanctuary or Marine National Park on official gazette but the state has declared maximum area of the marine ecosystems under Protected Areas. Sundarban National Park (133,010 ha), a core area of the Tiger Project Area of 258,500 ha is strictly preserved. A national park and three wildlife sanctuaries (Halliday-595 ha, Lothian Island-3,800 ha

and Sajnakhali-36,240 ha) cover a total area of 173,645 ha of coastal wetlands. Fourth sanctuary-Narendrapur (10 ha) has lost its relevance and the State Wildlife Advisory Board resolved that there is no need to manage such areas as PAs. Wildlife Advisory Board of the state has also resolved to initiate action for obtaining permission from the Chief Naval Hydrographer at Dehradun to declare Marine Park at south of Sagardweep<sup>14</sup>. Sundarbans Biosphere Reserve (963,000 ha) is a wonderful natural area in the world, which cover 102 swampy islands, mangroves, Tiger Project Area, estuaries, backwater and waterways. Tiger, spotted deer, wild boar, dolphin, porpoise, crocodile, lesser cats and a variety of birds enjoy protection in this deltaic region of the state.

#### *Other states*

There are 100 PAs (10 in main Indian coast and 90 island PAs in Andaman & Nicobar and Lakshdweep islands) which constitute boundaries with seawater or partly contain some marine environment. Total area of these PAs is 1,745,440 ha, which contribute to marine biodiversity conservation but these are not included in the MPAs. Goa, Karnataka, Kerala, Daman Diu, Dadara and Nagar Haveli have coastal ecosystems but none of them have constituted MPA, although proposals have been submitted for some of the area by the respective Governments. Chorad Island Sanctuary in Goa is partly covered by marine environment but it is not listed with the MPAs and can be listed in Category III. Similarly Fudam Sanctuary in Daman and Diu in marine environment does not qualify for inclusion in the list. Carambolim in Goa (100 ha), Honavar (2,000 ha), Kundapur (100 ha) and Sand Rock Coast (200 ha) in Karnataka, Malabar wetland (500 ha) and Kumrkon (500 ha) in Kerala should be considered for declaration as Marine Sanctuary<sup>9</sup>.

#### *Management issues*

The MPAs in India are managed by the wildlife wing of the Forest Department, which is also custodian of the PAs. During last two decades, wildlife conservation programmes have developed and evolved, but management of MPAs has yet to reach its maturity. The common issues and problems that need to be tackled urgently for ensuring an effective management setup of the MPAs of the country are: legal issues, including settlement and demarcation of boundaries; lack of adequate

management and protection infrastructure; inadequate scientific and technical person in management; absence of scientific management plans for majority of the MPAs; uncontrolled exploitation of fishes, prawns, crabs, corals, shells and marine algae etc; increasing use of the areas for ports and jetties, loading and unloading of large number of ships and oil tankers; discharge of pollutants; expansion of salt and aquaculture ponds. Traditional uses of coastal water by the local people, especially fishermen for fishing and landing sites are also problems of the management.

The IUCN has prepared guidelines for MPAs after summarising the global scenario of management<sup>8</sup>, which can be used to develop guidelines in India's context. Establishing the MPAs, preparing the plans and managing them effectively in India may be based on the following guidelines.

1. The MPAs in the country contribute to the maintenance and conservation of marine biological diversity and abundance, which are relevant to sustainable fisheries and maintenance of the coastal processes.
2. It is not feasible in many of the MPAs to avoid the questions of resource use from exclusive preservation, because marine natural resources and their habitats are all sought now by many users for different purposes.
3. The tendency in some areas to oppose the traditional use for fisheries in the MPAs seems to be counterproductive, inhibiting cooperation between traditional users and Forest Department in creating and managing MPAs.
4. There has been a conflict and lack of cooperation between Forest Department and fisheries management agencies in almost all areas. This lack of joint action inhibits progress in establishing MPAs and managing them, wherever it is manifest. Management plans should be designed to serve both sustainable use and conservation objectives and relevant agencies should work together in planning and management.
5. Local people and stakeholders must be involved from the earliest possible stage in any MPA that is to succeed. Cooperative action and effective involvement of coastal communities depend on proper understanding among partners. This involvement should extend to them receiving clearly identifiable benefits from the MPA.

6. Socio-economic considerations usually determine the success or failure of MPAs. In addition to biological resources and physical factors, these considerations should be addressed from the outset in identifying sites for MPAs, and in selecting and managing them.
7. MPA must have clearly defined objectives against which its performance is regularly checked, and a monitoring programme to assess management effectiveness. Management should be adaptive, meaning that it is periodically reviewed and revised as dictated by the results of monitoring.
8. Integration of scientific knowledge with management is essential and hence forest officials who have ultimate responsibility for conservation should be trained on the subject.
9. There is a need of appropriate legislation, which provides scope of managing an MPA on the basis of the principle and point of management discussed above.
10. The high degree of linkage between land and marine ecosystems, and the connectivity of the sea require that MPAs be integrated into management regimes that deal with all human activities that affect marine life. Thus, management of MPAs should be integrated with other policies of coastal land use and use of the sea, especially the gulfs and bays.

Although, the MPA officials have been authorised to enforce laws, the management is not as effective as terrestrial PAs in the state. If the present trend continues, expanding industrial activities may compound the situation. It is possible to control and regulate activities when all stakeholders are partners in responsible manner to the conservation programmes. Thus, it is vital for Marine Park Authority to work with these sectors and stakeholders at the earliest given opportunity.

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