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Cover: Illuminating the cruelty of Pangolin trade in India for the purpose of black magic, for the sanctity of protection. Using an animal's shell, ripping its armor against the world to protect oneself. When does one become the evil they are trying to ward off? — Acrylic on wood. © Maya Santhanakrishnan.

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REVIEW

Management challenges in marine protected areas: a field note from the Malvan Marine Sanctuary, India

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Abstract: Marine protected area (MPA) is an umbrella term for the protection and conservation of coastal biodiversity. MPAs are expected to work as an effective tool for marine biodiversity conservation and fishery management. As India has an extensive coastline of 7,517 km that supports approximately 250 million people for their livelihood, the existence of prosperous coastal and marine ecosystems is imperative for the sustainable economic growth of the country. In India, MPA is part of the protected area network notified under the Wildlife Protection Act, of 1972. In view of the socio-economic angle of the MPA, conserving the specific marine habitat and sustaining commercial activities like fishing pose tremendous challenges in achieving conservation goals. In this context, this paper evaluates the management challenges of the Malvan Marine Sanctuary located in Maharashtra State of India and subsequently discusses the possible solutions for effectively managing the sanctuary.

Keywords: Coastal ecosystem, corals, fishery management, government policy, legislation, mangroves, management, marine biodiversity, marine conservation, sustainable management, wildlife.

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INTRODUCTION

A marine protected area (MPA) refers to a designated coastal /marine area backed by legislation or other effective means aimed at its long-term conservation. Some MPAs are designed to exclude all anthropogenic activities including fishing, while others are managed with a specific objective such as fishery management, species conservation, or for recreational activities (Day et al. 2012). MPAs are expected to work as an effective tool for marine biodiversity conservation (Agardy et al. 2011). Scientific studies confirmed that well-managed marine protected areas can significantly increase the population density and biomass of several species (Halpern 2003; Selig & Bruno 2010). Unfortunately, over-exploitation of marine resources, pollution, unsustainable fishery, ocean acidification, and global warming put such a peculiar ecosystem under tremendous pressure (Dardi & Shanthakumar 2023). Hence, the conservation of marine ecosystems has become a global priority now. Interestingly, Aichi Biodiversity target 11 under the Convention on Biological Diversity (CBD) proposed to conserve 10 % of coastal and marine areas by 2020 (CBD 2020). Countries are presently working on conserving at least 30 % of their land, fresh waters, and oceans by 2030 as well (HAC 2021) also referred to as the 30 x 30 initiative.

India has an extensive coastline with a length of 7,517 km, supporting approximately 250 million people for their livelihood and integrated development (UNISDR/ UNDP 2012). Healthy and prosperous coastal and marine ecosystems are imperative for the sustainable economic growth of the country. India's coastal and marine ecosystems are under threat (Sivakumar et al. 2012). Unsustainable fishing, poor anchoring practices, and unregulated tourism impose severe harm to marine biodiversity. India's protected area network comprises national parks, sanctuaries, conservation reserves and community reserves. MPAs are also part of these protected area networks notified under the Wildlife Protection Act, 1972. Likewise, the Environment (Protection) Act, 1986 was enacted to protect the environment and prevent pollution. Coastal Regulation Zone Notification (Years—1991, 2011, & 2019) issued under the provision of the Environment (Protection) Act, categorized India's coastal areas into various zones as CRZ I to IV of which, CRZ 1A, referred to as ecologically sensitive areas (ESA) are demarcated to conserve and protect coastal areas and marine waters. MPAs are placed under CRZ IA as ESA along with four ecosystems, three habitats, two geomorphological features, and the archaeological and heritage sites. Similarly, the Biological Diversity Act of 2002 and subsequent Biological Diversity Rules, 2004, and the guidelines thereof ensure the conservation of marine biodiversity, sustainable use, and equitable sharing of its components, protecting traditional knowledge, and the intellectual property rights of dependent communities. This includes biodiversity heritage sites (BHS), areas designated for their unique and rich biodiversity that require conservation to maintain their ecological significance. The Wildlife (Protection) Act, 1972 protects at the species level and the landscape level. Species enlisted in schedules I–IV of this act are being protected irrespective of their location. All species are being equally protected within the notified protected areas. The act provides stringent regulation by restricting unnecessary human interference inside the national parks and sanctuaries. Given the socio-economic angle of the MPA, protecting the specific marine habitat, and sustaining commercial activities like fishing pose tremendous challenges in achieving conservation goals, particularly in a thickly populated country like India. Nonetheless, zoning in MPAs like core zones, buffer zones, and critical wildlife habitats ensures legitimate interaction with humans and marine living without compromising the conservation priorities. In this context, this review paper will highlight the management challenges and discuss the possible solutions for the effective management of the Malvan Marine Sanctuary located in Maharashtra State of India. For writing this research paper, information from numerous sources was utilized. These include the field interactions that the author had with various stakeholders of the sanctuary; available secondary sources of information on the sanctuary; and lastly, the management plan of the Malvan Marine Sanctuary.

Malvan Marine Sanctuary

Malvan Marine Sanctuary (MMS) represents a unique combination of some of the richest and most varied marine ecosystems on the western coast of India. It is identified as one of the Critically Vulnerable Coastal Areas (CVCA) in the Coastal Regulation Zone (CRZ) notifications 2011 and 2019. The notification of the MMS was issued in the year 1987 by the state government of Maharashtra. It is located at 16.006 N & 73.466 E in Malvan Taluka of Sindhudurg District of Maharashtra. The sanctuary has a 'Core Zone' of 3.182 km^2 comprising the seascape, Sindhudurg Fort, and Padmagad Island which demands stringent protection. The rest of the 25.940 km^2 area falls under the 'Buffer Zone' category where restricted activities are permitted.

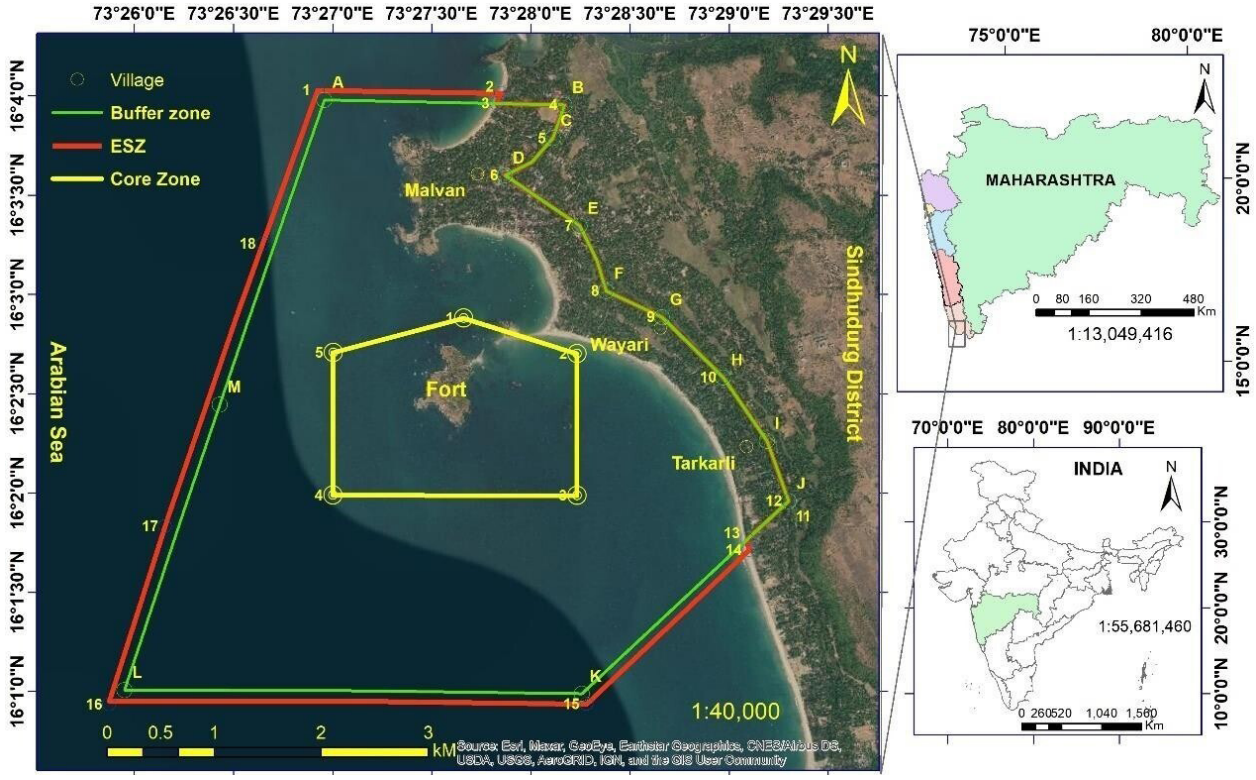

Image 1. Map of Malvan Marine Sanctuary (Source: Malvan Marine Sanctuary Management Plan 2020).

The sanctuary borders Malvan Port on the northeastern side, sandy beaches on the eastern side, Mandal Rock of the Malvan Port on the southern side, and Malvan Rock on the western side.

Climate

Malvan falls in a tropical monsoon region with less variation in the temperature during the day and throughout the season. December is the coldest month with a mean daily maximum temperature at 32.7 °C and a mean daily minimum temperature of 18.7°C. On the other hand, April is the hottest month (34°C). The relative humidity during the south-west monsoon is very high (86–90 %). The annual average rainfall is 2,916 mm. The average wind speed in the region is in the range of 6.6–17.9 kmph. The coastal currents are clockwise or shoreward from February to September, while anti-clockwise from November to January and transitional in October.

Marine biodiversity

MMS has a relatively rich distribution of corals. There are more than 25 species of both reef-building and non-reef-building corals recorded in and around the MMS (SDMRI & BNHS 2017). The corals are mostly slow-growing species that belong to genera like *Porites*, *Pavona*, and *Leptastrea*. Malvan Sanctuary is home to more than 32 species of seaweeds including 12 species of Rhodophyceae, 11 species of Chlorophyceae, and nine species of Phaeophyceae (Rode & Sabale 2015). Phytoplankton forms the primary source of the marine food chain. A study conducted by Hardikar et al. (2017) observed 57 phytoplankton species falling under five classes namely diatoms (40 spp.), dinoflagellates (9 spp.), Chlorophyceae (5 spp.), Cyanophyceae (2 spp.), and Dictyochophyceae (1 sp.).

There are seven species of sea snakes such as Beaked Sea Snake *Hydrophis schistosus*, Short Sea Snake *H. curtus*, Annulated Sea Snake *H. cyanocinctus*, Malacca Sea Snake *H. caerulescens*, Pelagic Sea Snake *Pelamis platurus*, Viper-headed Sea Snake *H. viperinus*, and Little File Snake *Acrochordus granulatus* found in the Malvan seascape (Dakshin Foundation 2016). They are often caught as bycatch in fisheries leading to large mortalities. Sea snakes are a protected species in India and are listed under Schedule IV of the Wildlife (Protection) Act, 1972. Of the total seven species of sea turtles found globally, four species are known to occur in the MMS region, namely, Green turtle *Chelonia mydas*, Hawksbill *Eretmochelys imbricata*, Loggerhead *Caretta caretta*, and Olive Ridley *Lepidochelys olivacea* are known to regularly nest along the coast of the Sindhudurg District

(Somaraj 2020).

The presence of seven species of marine mammals has been recorded directly and indirectly along the Malvan shore. Indian Ocean Humpback Dolphin *Sousa plumbea* and Indo-Pacific Finless Porpoise *Neophocaena phocaenoides* are the frequently sighted marine mammals within the sanctuary area. In addition to these, Bottlenose Dolphin *Tursiops truncates*, Spinner Dolphin *Stenella longirostris*, Bryde's Whale *Balaenoptera edeni*, Blue Whale *B. musculus*, and Sperm Whale *Physeter macrocephalus* have been reported around the sanctuary by Konkan Cetacean Research Team (KCRT) as a part of the Government of India- Global Environment Facility-United Nations Development Programme (GoI-GEF-UNDP) project in 2014–15 (KCRT 2015).

Barman et al. (2007) recorded 108 species of fish belonging to 48 families in 13 orders in MMS. Among them, four 'Vulnerable' species—*Congresox talabonoides*, *Muraenesox cinereus*, *Tenualosa ilisha*, and *Arius thalassinus*— and two 'Near Threatened' species—*Chiloscyllium griseum* and *Scoliodon laticaudus*—are found in the sanctuary. The fishes of the family Carangidae are the dominating group among the important edible fishes.

Congregation of Whale Sharks is also reported from Malvan waters (Premjothi et al. 2016). Though good diversity of mangroves is observed in the Malvan region along the creeks, only two species of mangroves namely *Avicennia marina* and *Sonneratia alba* have been observed in the sanctuary area, particularly at Sindhudurg Fort and Rock Garden. As the sanctuary area is an abode to both terrestrial and migratory birds, it is designated as an Important Bird Area (IBA) by Birdlife International and BNHS, Mumbai.

Management challenges

1. Legal Status: The sanctuary was notified under the Wildlife Protection Act, of 1972. As a matter of legal procedures prescribed in the Act, all the existing rights inside the notified area had to be settled before proceeding with the final notification. Since the core zone of the sanctuary includes both the Sindhudurg Fort and the Padmagad Island, private rights over 17.68 ha of land have to be acquired by the government within two years from the date of notification of the sanctuary. Such acquisition of the private land and settlement of rights did not happen due to strict opposition from the affected local communities. Fishermen community marked strong dissent against the creation of the sanctuary as they fear it will take away their traditional fishing rights and livelihood options existing in the area. Apart from this, the prior concurrence of the union government is also required since the sanctuary is created in the territorial waters. Furthermore, the limits of the area of the territorial waters to be included in the sanctuary shall be determined in consultation with the chief naval hydrographer of the union government after adopting adequate measures to protect the livelihood interests of the local fishermen. This is yet to be done due to the pending settlement process. As a result, the boundary of the core and buffer zone is not properly demarcated in the field. This poses a major impediment to enforcing the regulatory measures in the sanctuary area for the authorities.

People's apprehensions about the sanctuary are still not faded away as was demonstrated while implementing the GOI-GEF-UNDP project in Sindhudurg in the year 2012. The sanctuary opponents viewed any conservation activities of the forest department with suspicion and considered it a covert attempt to impose restrictions on the sanctuary. The locals even do not want any signage of the Forest Department which establishes the existence of the MMS in Malvan. Strong protest without any dilution in its severity was observed even while proposing an eco-sensitive zone (EEZ) around the sanctuary in 2020 and the UNDP-GCF Project in 2022. Consequently, any implementation of the Wildlife (Protection) Act 1972 in its appropriate form has not materialized in the sanctuary other than prohibiting the killing/ hunting of any protected species in the sanctuary.

2. Livelihood dependency: The buffer zone of the sanctuary is extended to the Gram Panchayats of Tarkarli and Wayari and Malvan Nagar (town) Parishad. The sphere of influence includes seven villages, i.e., Dhuriwada, Gawandiwada, Rajkot, Makarebag-Medha, Dandi, Wayari, Tarkarli, and their seaward side. In the seven villages falling under the sanctuary area as mentioned above, the per capita income of the district is INR 1,30,987 (as per the 2011 census) against the Maharashtra State's average of INR 2,15,000 (District Statistical Department 2015). The average income of a fisherman can vary between INR 1,500 and INR 50,000 per month based on the catch and method of fishing (Somaraj 2020). The middlemen earn more than the active fishermen. At present, there are 19 fishery societies with 14,779 active members. The total population of Malvan city is 18,648 as per the 2011 census. Fishing and tourism are key drivers of the rural economy in Malvan with its dependence on natural resources viz., coral reefs, dolphins, and turtles. The fishing communities

Image 2. A diver with ghost net. © Rohit Sawant.

Image 3. Traditional fishing (Rampan) in the Malvan Marine Sanctuary. © Rohit Sawant.

have over-reliance on the sanctuary as Malvan is a major fishing harbour. The buffer zone of the sanctuary includes transport routes and approaches to Malvan harbour. The traditional fishing practices observed in the sanctuary are shore seine (Rampan) and Cast Net (Shendi). Mechanized fishing gear such as gill nets, hooks, and line are also in use. More destructive fishing using Trawl nets and Purse Seine operates outside the sanctuary with adherence to the Maharashtra Marine Fisheries Regulation Act, 1981. Fishing has provided livelihood for boat owners, drivers, 'tandel' (navigator), 'khalashi' (labour), traders, transport service providers, ice manufacturers, supplier, and marketers. A sizable number of fisherwomen population is also involved in post-harvest operations of fishery produce, i.e., salting and drying of fish. They use the beaches in the buffer zone of the sanctuary for fish drying (Rajagopalan 2008).

As the fish catch was depleting over a period, fishermen started migrating to the tourism sector. It provides multiple job opportunities in SCUBA diving, snorkelling, dolphin safari, and other water sports (De et al. 2020). Besides, boat owners, shopkeepers, and restaurants also depend upon tourism along Malvan Beach. The data retrieved from the Maharashtra Maritime Board (MMB) revealed that more than four lakh tourists visited Malvan annually in 2018–19 (Somaraj 2020). Unlike fishery, tourism service providers earn higher economic returns with less amount of actual effort once the line of business is established well. Thus, the majority of the people have resource dependency on the sanctuary area for fishing and tourism. This makes regulating the entry and movement of people within the sanctuary difficult.

3. Management: The sanctuary is managed by the Maharashtra State Forest Department. It is under the administrative control of the Mangrove Cell of Maharashtra. It is managed by the range forest officer (RFO), Mangrove Cell who also has jurisdiction in the entire Sindhudurg District. Considering the extent of the sanctuary and threats, more manpower and logistics are required for the effective management of the area. The lack of skilled staff equipped for the management of marine ecosystems is a constraint since forest field personnel are traditionally trained to manage terrestrial landscapes. Moreover, they are bound to departmental transfers and it makes a fresh start for the administrator recurrently. Strict implementation of the wildlife-related laws in the sanctuary prohibits fishing, trespassing of boats (fishing and tourism), anchoring of fishing vessels, and functioning of Malvan Port. People residing in the core area need to be rehabilitated outside. Hence, local communities and people's representatives have been regularly agitating for the de-notification of this sanctuary due to reservations about restricted movement and livelihood opportunities. The affected communities demanded written consent from the park management for their free movement and commercial activities which cannot be fulfilled legally.

4. Lack of clarity: There are no specific laws for the administration of the MPA in India. Both marine and terrestrial protected areas are on the same pedestal under the Wildlife Act. Usually, the MPA is located at the intersection between fishery activities and biodiversity conservation. Hence, the scope of management in a marine landscape is not similar to that in a terrestrial area. Moreover, the absence of distinct measurable

management objectives in the MPA under the existing wildlife laws creates confusion and dilemmas among various stakeholders. Hence implementation of the activities for example, boundary demarcation, proper zonation as core and buffer zones, and imposing restrictions are far more challenging in the sanctuary due to the lack of cooperation from the communities and coordination with other public departments.

RECOMMENDATIONS

1. Rationalization of the Boundary

On account of People's agitation and the suggestions given in the management effectiveness evaluation (MEE) report of the Ministry of Environment Forest and Climate Change, the administration decided to carry out a feasibility study to understand the status of marine biodiversity in and around the sanctuary to identify the potential areas to be included in the sanctuary. Accordingly, Shinde et al. (2023) reported the following outcomes:

· The study area along Malvan beach is classified under three categories, i.e., potential protected areas (PAs), conservation priority areas, and sensitive areas based on biodiversity richness and anthropogenic threats.

· Areas with relatively high biodiversity richness and less degree of threats such as Kawda complex, seven rock complex, and lighthouse complex are included in the potential PAs. Similarly, Chiwla Beach Complex and Sargassum Forest Complex are classified under the conservation priority areas due to high anthropogenic pressure. Sensitive areas are under severe threat and hence currently have low species richness. King's Garden area near the Sindhudurg Fort which is part of the core area of the Malvan sanctuary is classified under the sensitive areas.

· Potential PAs may be considered for the re-notification as a sanctuary and the conservation priority area may be incorporated as a buffer zone or eco sensitive zone to check the unregulated fishing and water-based tourism activities. On the other hand, sensitive areas can be excluded from the sanctuary to safeguard the occupational interests of the local communities.

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2. Habitat conservation and species recovery programs

· The coral reef ecosystem is highly fragile in Malvan Sanctuary due to coral bleaching and human disturbances. Coral transplantation, artificial reef deployment, establishing coral nurseries shall be explored for the restoration of this ecosystem. As a maiden attempt at coral transplantation as part of the UNDP-GOI project in 2014 was successful, a similar intervention is being planned in the GOI-GCF project in the sanctuary in the near term.

· Illegal harvesting and trade of scheduled species listed under the Wildlife Protection Act, 1972 shall be strictly prohibited.

· The stranding of marine mammals and sea turtles is frequent along the Malvan coast, particularly in the monsoon season. A well-trained rescue team and a temporary treatment centre for stranded animals need to be established in Malvan for the treatment and recovery of injured animals.

· Mandatory uses of bycatch reduction devices (BRD) inside the sanctuary help in the reduction of bycatch and thus save the juvenile fish fauna. Trials during the GOI-GEF-UNDP project in 2014–15 showed that on average about 5–6 l of diesel was saved during one-day trips with square mesh cod end, as compared with the traditional cod end.

· Sensitization of fishermen is necessary to avoid dumping ghost nets in the sea thereby reducing incidents of marine animals getting entangled in the ghost net and getting killed.

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3. Sustainable livelihood development

Local communities heavily depend on the sanctuary for fishing and for water-based tourism activities. Hence, they need to be well informed about the importance of the sanctuary for sustaining their livelihood. Local communities having a high sense of ownership can eventually decide the success and failure of the sanctuary.

· As an option for alternative income generation, creek-based aquaculture, i.e., fish cage culture, oysters and mussels farming, crab farming, and marine ornamental fish hatcheries should be encouraged among the locals with technical and budgetary support from the state government. Such projects have already been initiated at the village level under the GOI-GEF-UNDP projects of 2014 in the Sindhudurg District and were found to be beneficial to the rural economy. Similarly, the ongoing UNDP-GCF project aims to enhance the resilience of the coastal communities through sustainable livelihood opportunities and capacity building. These activities will not only improve the household income but will also help in developing harmony between people and the management.

· Permit system for snorkelling and scuba diving should be strictly followed in the sanctuary area and

a diving license should be issued to the shops by the district government authorities. Scuba diving needs to be permitted only in designated areas with adequate depth. The average depth in which scuba diving is presently practiced is less than 3–4 m which is not ideal for the same (IISDA 2017). New dive sites might be created outside the sanctuary by sinking wrecks in sandy patches. These wrecks would help in coral regeneration and act as FADs (fish aggregating devices).

· Dolphin watches and sea turtle festivals in the hatchery sites are gaining popularity. It should be allowed under the strict supervision of the park management or concerned department according to the norms and regulations. Trained villagers as hatchery watchers in hatching sites would help keep a check on people's interference in the turtle-hatching beaches.

4. Administration and Management

A dedicated team is required for the management of the sanctuary. Manpower should be increased by creating new posts such as a beat guard for looking after the protection as well as the ecotourism under the supervision of a forest round officer (RO) and a range forest officer (RFO). Specialized posts such as research officers, marine biologists, boat drivers, *etc*. can be recruited on a contractual basis. Joint patrolling with the help of the Fisheries Department, Police and Indian Coast Guard needs to be regularly done to check IUU (Illegal unregulated and unreported) fishing. Capacity building for the front-line staff on map reading, diving, surveying, and wildlife laws is also essential for better management. Adequate budgetary provisions need to be made in advance as roughly INR 4 crore (around USD 480,000) is required for the management of the sanctuary annually after the reorganization (Somaraj 2020).

5. Modification of the existing laws

Conservation objectives are different in terrestrial protected areas and in MPA. The nature of resource dependency in terrestrial and MPA is also beyond comparison. Hence parallels cannot be drawn between terrestrial and marine sanctuaries/ marine national parks. There should be clear guidelines and management objectives for the MPA which should address both the socio-economic and ecological dimensions of the protected area. Hence an amendment in the Wildlife (Protection) Act, 1972 is required to incorporate specific administrative frameworks for the MPA in India.

CONCLUSION

MMS is met with reluctance from the affected local communities and leads to outright objection in the present scenario. It is mainly attributable to their feeling of victimization and alienation due to the prohibitory nature of wildlife laws. Recently implemented sustainable livelihood programs and capacity building of the stakeholders have helped in changing their perception to a certain extent. Any landscape conservation effort will be fruitful only with community participation and in this case, it will happen only if the boundaries of the sanctuary are reorganized efficiently after consultation with the stakeholders. Such efforts are under the active consideration of the Maharashtra State Government, and it is going to be a win-win situation for both the government and the affected communities. Needless to say, instead of a total ban on commercial activities, a consensus-based 'seascape approach' in MPA in India can win the trust of local communities. Thus, amendments in the Wildlife Protection Act, of 1972 with regard to the MPA are imperative for a sustainable future.

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