

SAGARIKA



Published under the GoI-UNDP-GEF Project on Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in the Sindhudurg Coast, Maharashtra

from the Office of the Nodal Officer, GoI-UNDP-GEF Sindhudurg Project cum
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Published under
The GoI-UNDP-GEF Project
“Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors
in the Sindhudurg Coast, Maharashtra”

Project Information

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Implementing Partner(s): Ministry of Environment, Forest and Climate Change, Government of India

Field Implementing Unit: Mangrove Cell, Department of Forests, Government of Maharashtra

Location(s): Sindhudurg Coast including three talukas, viz., Devgad, Malvan and Vengurla

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FOREWORD

As the GoI-UNDP-GEF Sindhudurg Project enters its final phase, we are bringing out this publication in an attempt to showcase the results of the efforts undertaken in the last five years. This is the second edition of Sagarika magazine by the GoI-UNDP-GEF Project on 'Mainstreaming Marine and Coastal Biodiversity Conservation into Production Sectors in Sindhudurg district, Maharashtra'. Over the duration of the project, a significant number and variety of activities have been implemented on the ground. There has been a steady rise in the acknowledgement of our interventions over the years, as seen from the increased media attention from regional to international level. Most notably, encouraged by the success stories from Sindhudurg and from the sister project in the East Godavari Region of Andhra Pradesh, UNDP India, in partnership with the Ministry of Environment, Forests and Climate Change has conceptualised a project for upscaling some of our best practices across the coastal states of India. The Project, which is being proposed under a wide ambit of enhancing climate resilience of India's coastal communities, has been submitted to the Green Climate Fund (GCF) for financial assistance.

Over the next few pages, we have attempted to capture our efforts towards making the agriculture, tourism and fisheries sectors more sustainable, not just by actively focussing on conservation, but also by effectively demonstrating the organic link between biodiversity conservation and income generation. The success of these interventions is evident from the number of programmes that are now being upscaled with support from line departments.

Among the interventions in the Fisheries Sector, the successful outcomes of the use of square mesh net at cod end of fishing trawlers has been acknowledged by the District Collector, who has sanctioned funds to the tune of Rupees 19 lakhs for Phase II of the programme in the Sindhudurg District. One of the significant outcomes is that the Animal Husbandry, Dairy and Fisheries Department has, vide a Government Notification, made the use of 40mm square mesh nets for trawlers in Maharashtra mandatory. The pilot project on Joint Patrolling by the Forest and Fisheries officials has also been strengthened with the officials of Fisheries Department being empowered under the Wildlife Protection Act.

In the agriculture sector, introduction of the System of Rice Intensification (SRI) has seen commendable progress and has gained wide acceptance amongst the local farmers as well as the Agriculture Department. In Kharif 2016, SRI was upscaled to all eight talukas of Sindhudurg. The additional livelihood options, inter-alia, seeking to reduce the community's dependency on the natural resources, such as mangrove crab culture, oyster and mussel culture, and integrated multi-trophic aquaculture, have also been proposed for upscaling across Maharashtra. To further strengthen the livelihood programmes, a multi-species hatchery is also being proposed in the district. The land for setting up the hatchery has already been handed over to the Mangrove Cell by the Revenue Department. The Fisheries Department has taken the responsibility of completion of the project.

Considering the environmental and economic benefits of the additional livelihood activities promoted under the Project, the Government of Maharashtra has sanctioned funds to the tune of Rs. 24 crore in the Annual Budget for 2017-18 for upscaling these activities in the State's coastal belt. The Mid Term Review (MTR) of the Project has also been completed and the findings have been very encouraging. In addition, the project has been reviewed by the GEF Focal Point for India and the UN Assistant Secretary General in April 2016, who acknowledged the effective incorporation of relevant Sustainable Development Goals in the project interventions.

The State Government of Maharashtra has established a Mangrove and Marine Biodiversity Conservation Foundation of Maharashtra that would form the institutional pillar for implementation of several coastal and marine related activities in the State. The by-laws of the Foundation have accorded special priorities for continuing some of the activities initiated under the Sindhudurg Project.

As we prepare to take the Project to its logical conclusion with the unwavering support from the line departments pushing us forward, we do so with the objective of filling out whatever gaps we may have overlooked. I hope this magazine will be a useful medium to update our partner agencies, stakeholders and the community at large on some of the practical developments in the subject of mainstreaming coastal and marine biodiversity conservation.



N. Vasudevan

Additional Principal Chief Conservator of Forests, Mangrove Cell, Mumbai
& Nodal Officer, UNDP Sindhudurg Project

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“More and more States are turning to the oceans as a source of economic and social development, while realizing that their resources have to be developed in a sustainable manner.”

*- António Guterres,
UN Secretary General*

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"It is a curious situation that the sea, from which life first arose, should now be threatened by the activities of one form of that life. But the sea, though changed in a sinister way, will continue to exist: the threat is rather to life itself."

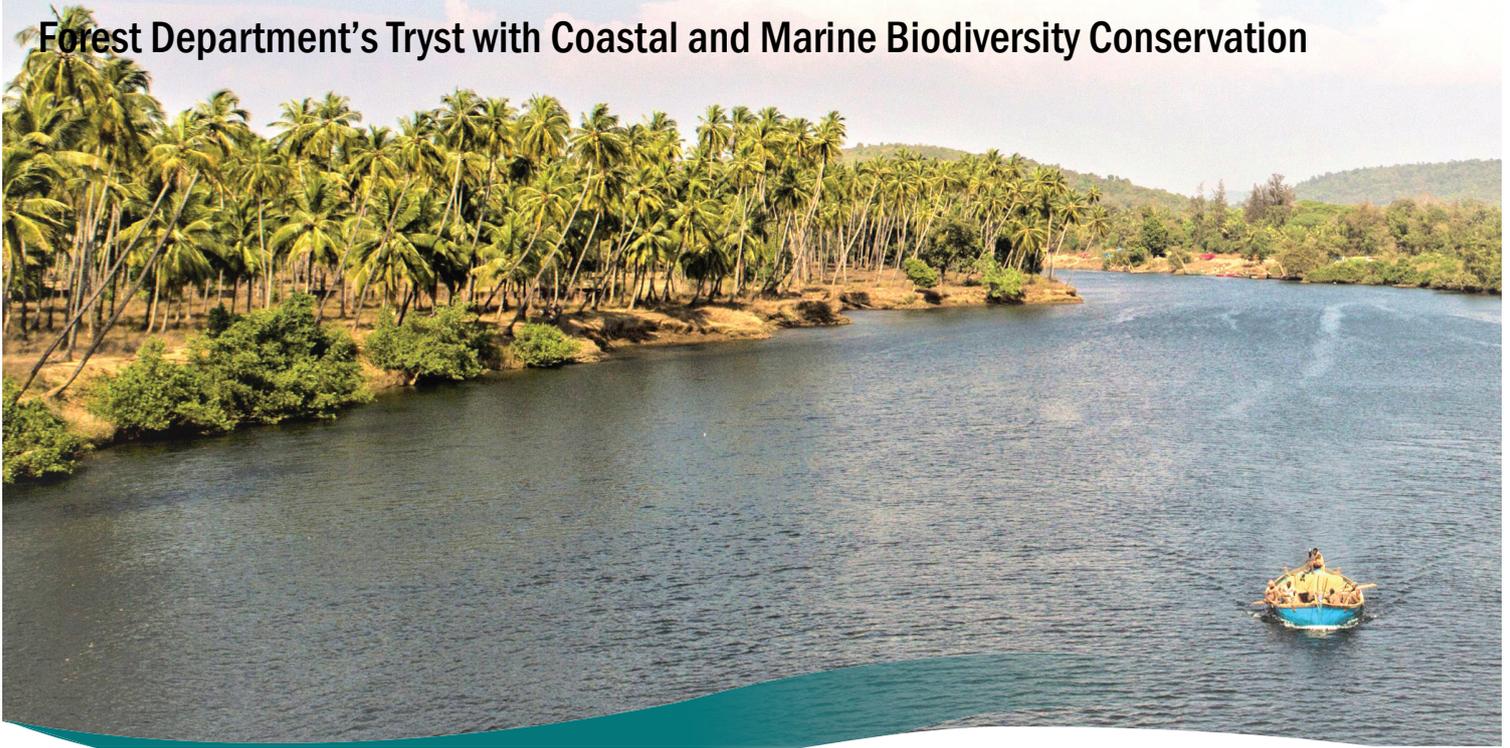
-Rachel Carson,
Marine Biologist

P25 The Turtle Saviour of Sindhudurg

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SAILING IN UNCHARTED WATERS

Forest Department's Tryst with Coastal and Marine Biodiversity Conservation



N. Vasudevan, *IFS*, Addl. Principal Chief Conservator of Forests, Mangrove Cell

The ocean constitutes over 90% of the habitable space on the planet. Not surprisingly, the seas around us harbor far greater biodiversity than ever existed on terra firma. Within this astoundingly rich environment, many marine species are struggling for survival and many more are facing varying degrees of threats to their existence. However, a lion's share of our conservation efforts (and funds, too) has always been directed towards the terrestrial life forms. As the natural guardians of mangrove forests and as authorities empowered under the Wildlife Protection Act, foresters do have the mandate to conserve the coastal and marine life forms, but due to our limited understanding of the marine environment and lack of training and orientation, we generally tend to stick to our traditional boundaries on the land. Be that as it may, globally, the case for increased attention to the protection of our coastal and marine environment has been steadily gaining currency in the recent decades.

The Forest Department of Maharashtra ventured into the realm of conservation of coastal and marine biodiversity in 2012 by creating a dedicated unit called the "Mangrove Cell". As the country's first such state-wide unit, its creation has led to the unprecedented extension of the activities of Maharashtra Forest Department to the coastal areas. In a very short period, the Cell, despite serious staff shortage and resource crunch, has been instrumental in launching many path-breaking initiatives, and in bringing coastal and marine biodiversity issues to the forefront of our conservation agenda.

Maharashtra has a long coastline of about 720 km, interspersed by several rivers, creeks and backwaters. About 30,000 hectares of mangroves adorn our coastal belt, with as many as twenty different species, making it the richest in terms of species diversity in the whole of India's western coast. Our coastal waters are a rich treasure trove of marine biodiversity. Among the many unique life forms found there are the sea grasses, corals, fishes, sea turtles, coastal birds, dolphins, porpoises and the whales. Many of them find themselves in different schedules of the Wildlife Protection Act, due to their endangered status.



DID YOU KNOW?

The only living record of *Heritiera littoralis*, or 'Sundari,' in the entire west coast is found in Sindhudurg, Maharashtra.

Importance of Mangroves

Mangroves are natural barriers against sea intrusion, as demonstrated well during the devastating Tsunami in 2004. By breaking up large storm surges and strong tidal currents, mangroves can protect the sea coast from erosion. They are important land builders, which filter sediments from land and stretch the land boundaries towards the sea. The enormous productivity of mangrove swamps enables them to act as nursery grounds for many species of fish and shell fish. They also offer protection to many juvenile fishes against predators. Scientists say that the ability of mangrove forests to perform carbon sequestration is several times that of Amazon Rain forests. Mangroves are therefore our best friends in our fight against climate change and sea level rise. They also maintain the stability of the shoreline and prevent the release of toxic wastes into the coastal waters, a function that is particularly significant for a city like Mumbai, which has large swathes of mangroves around it.

Conservation of Mangroves in Maharashtra

The mangrove forests were not under any umbrella of conservation, until the Bombay High Court, in October 2005, directed that mangroves on government land were to be notified as 'Protected Forests' and handed over to the Forest Department for management. By the year 2008, 5469 ha of mangroves in and around Mumbai were thus notified as 'Protected Forests'. The State government then went a step further and took the decision in 2013 to elevate the status of mangrove forests on government land from 'Protected Forests' to 'Reserved Forests'. Today, about 15,088 ha of mangroves on government land in 7 coastal districts in Maharashtra are notified as 'Reserved Forests'.

After the establishment of the Mangrove Cell, a series of measures were initiated for conservation of mangroves. Hundreds of thousands of mangrove saplings were raised in nurseries. Patrolling was intensified in mangrove areas, leading to the booking of a large number of offence cases, seizure of vehicles and arrest of offenders. Thousands of illegal shanties, which had cropped up on mangrove lands in various parts of Mumbai were removed through a sustained campaign, overcoming stiff resistance from powerful forces. Satellite mapping of mangrove areas was carried out, district by district, on a 1:5,000 scale and the areas in the possession of Forest Department were demarcated on the ground with clear boundary markings.

As a result of the above measures, the mangrove cover of the State registered a sharp increase. According to the "State of Forest Report 2015" published by the Forest Survey of India, the mangrove cover of Maharashtra, which had remained constant at 186 sq. km. from 2005 to 2013, jumped to 222 sq. km. by 2015 - a phenomenal growth of nearly 20%. It is notable that the mangrove cover in the whole country grew by 112 sq. km. during this period, to which Maharashtra's contribution was 36 sq. km. In other words, Maharashtra, with just 4% share of the mangrove cover in India, contributed to 32% of the national increase during the two-year period, from 2013 to 2015.

Mangroves in Maharashtra

List of mangrove species found in M'tra:

1. *Avicennia marina*
2. *Avicennia officinalis*
3. *Rhizophora mucronata*
4. *Rhizophora apiculata*
5. *Bruguiera gymnorhiza*
6. *Bruguiera cylindrica*
7. *Kandelia candel*
8. *Ceriops tagal*
9. *Sonneratia alba*
10. *Sonneratia apetala*
11. *Sonneratia caseolaris*
12. *Excoecaria agallocha*
13. *Aegiceras corniculatum*
14. *Xylocarpus granatum*
15. *Lumnitzera racemosa*
16. *Dolichandron spathacea*
17. *Cynometra iripa*
18. *Heritiera littoralis*
19. *Acanthus ilicifolius*
20. *Acrostichum aureum*

District	Reserved Forests (mangroves) (in ha)
Mumbai	276.65
Mumbai (suburban)	3723.40
Palghar	2908.26
Thane	2062.83
Raigad	4193.29
Ratnagiri	1435.79
Sindhudurg	487.36
Total	15087.60



UNDP-GEF Project in Sindhudurg District

The launching of the UNDP-GEF Project on “Mainstreaming of Coastal and Marine Biodiversity in Sindhudurg District” in the latter half of 2012 gave Mangrove Cell the opportunity to initiate a number of innovative programmes for conservation of our coastal and marine biodiversity. The first-ever scientific expedition to assess the biodiversity of Angria Bank was conducted in 2014 with the help of National Institute of Oceanography, Goa, using a Research Vessel called Sindhuh Sadhna. Angria Bank is a shallow submerged plateau, spread across 600 sq. km, located at a distance of about 62 nautical miles off the Malvan coast. During the expedition, experts conducted dives at 15 locations in Angria Bank and brought a wealth of information about the coral reefs and the biodiversity richness of the bank and firmly placed it on the coral map of India. To augment the coral growth around Malvan and to provide a healthy breeding site for marine species, deployment of artificial reefs and transplantation of corals were undertaken. Through the sea turtle conservation programme, a number of

Baseline studies have assessed the diversity and population of corals, coastal birds, sea snakes, otters, and Bengal monitor lizards along Sindhudurg coast.

hitherto unknown turtle nesting sites were identified, nests protected and hatchlings released safely into the sea. Baseline studies were also conducted to assess the diversity and population of corals, coastal birds, sea snakes, otters, and Bengal monitor lizards along Sindhudurg coast.

As part of the UNDP-GEF project, population estimation of marine mammals like dolphins and finless porpoises were carried out for the first time in the country. Based on photographic analysis of fin characteristics, 572 individuals of Indian Ocean Humpback Dolphins have been identified along Sindhudurg coast. For the first time, blue whales and Bryde’s whales could be photographed from Maharashtra coast, but more importantly, two blue

whales stranded in different parts of Ratnagiri coast could be safely guided to deeper waters with the help of villagers in Ratnagiri. The Cell is now working on building a network of marine mammal conservation centres along the Maharashtra coast.

Another significant intervention was the introduction of by-catch reduction devices in trawlers with the help of Central Institute of Fisheries Technology (CIFT), Kochi. Convinced by the results of scores of on-board trials, owners of all the 317 trawlers in Sindhudurg decided to adopt the ‘square mesh nets at cod ends’. This simple innovation substantially reduces the juvenile catch in a trawler net, while saving on the fuel cost. This has tremendous implications for the long-term sustainability of fisheries and has the potential for replication all along the Indian coast. For stricter monitoring of the movement of fishing vessels, joint patrolling of the Sindhudurg waters by officials from Forest and Fisheries department was undertaken in two successive years. This has led to better enforcement of the Marine Fisheries Regulation Act as well as the Wildlife Protection Act.



THE SINDHUDURG PROJECT: AN OVERVIEW

Conservation

- Landscape level planning
- Identification of Alternative Tourism Destinations
- Baseline studies
- Mangrove nursery and plantation
- Mangrove mapping
- Artificial reef and coral transplant
- Joint Patrolling
- Eradication of ghost nets
- Angria Bank exploration
- BRJED on fishing trawlers
- Solid Waste Management



Olive Ridley hatchlings raised in the hatchery, being released into the sea

Capacity Building

- Training on handling stranded and beached cetaceans for local officials
- Snorkelling guide training
- Sustainable marine fishing for fishers community
- PADI certified diving
- Wildlife Law Enforcement training for officials of Forest and Fisheries Department by Wildlife Crime Control Bureau



Snorkelling guide training programme

Livelihoods

- Crab farming
- Oyster and mussel culture
- Integrated multi-trophic aquaculture
- System of Rice Intensification
- Apiculture
- Eco-tourism



Beneficiaries of the crab farming and oyster culture programmes



Thane Creek Flamingo Sanctuary

GIZ-CMPA Project

GIZ Project

Based on the 'International Climate Initiative' Agreement between Government of India and the Federal Republic of Germany, a bilateral project towards improving conservation of marine biodiversity called "Sustainable Management of Coastal and Marine Protected Areas" (SM-CMPA) has been launched in Maharashtra with the help of the German agency GIZ. As part of this Project, marine biodiversity conservation measures were implemented in 3 project sites, viz. Thane Creek, Velas to Dabhol Coast and Ansure Creek in Ratnagiri. A number of baseline studies and awareness programmes were organised with the help of the local communities in various parts of Ratnagiri District.

Balancing biodiversity conservation with livelihood promotion

Sustainable conservation can happen only if the local communities start deriving tangible benefits from the mangrove ecosystem. Embodying this principle, the Mangrove Cell has sought to promote the organic link between conservation and livelihood. In order to increase the income-earning potential of mangroves, crab farming was introduced in several villages of Sindhudurg with the support of the 'Marine Products Export Development Authority' (MPEDA). This has not only led to the creation of income for the farmers but also generated a renewed interest in protecting mangroves. By linking income-generation with conservation, a sustainable approach towards conservation has been promoted.

Another important livelihood activity that is being promoted by Mangrove Cell is the oyster farming by women's self-help groups in coastal areas. The Cell also introduced the System of Rice Intensification (SRI). SRI is an improved system of rice farming using minimum seeds, water and fertilisers to achieve increased productivity and reduced greenhouse gas emissions. This has caught the imagination of the farmers of Sindhudurg and as a result, about 500 acres of rice farms are now converted to this eco-friendly system.

Corals around Sindhudurg Fort attract large number of tourists. Over the years, the number of snorkeling and SCUBA diving tourist activities have gone far beyond the carrying capacity of this fragile ecological niche. In order to reduce the tourism pressure in the waters around Sindhudurg, attempts were made to identify and promote new underwater diving destinations. 12 such destinations have been identified so far. The Cell has also conducted several training programmes for the youth in sustainable methods of SCUBA diving and snorkeling, which has not only raised a generation of professional underwater tourism operators, but also facilitated the implementation of programmes such as eradication of ghost nets (abandoned fishing nets, which become death traps for marine organisms).

Launching of the GIZ Project was one of the triggers that led to the notification of the 'Thane Creek Flamingo Sanctuary'. This is Maharashtra's second marine sanctuary after Malvan. Spread over an area of 1690 hectares, it is home to over 200 species of birds, many of which are migratory. Several diagnostic studies on the biodiversity of this hotspot have been commissioned and undertaken since the declaration of the Sanctuary. A 'Coastal and Marine Biodiversity Centre', which is being developed at Airoli, Navi Mumbai, as part of the GIZ Project will serve as the gateway to this Sanctuary and is expected to evolve into a fine destination for tourists and environmentalists alike. It will be an educational and recreational centre focused on coastal and marine biodiversity conservation



The 'Coastal and Marine Biodiversity Centre', developed at Airoli, Navi Mumbai, will serve as the gateway to the Flamingo Sanctuary and is expected to evolve into a fine destination for tourists and environmentalists alike.

GIZ-CMPA Project

Capacity Building Programmes

One of the biggest challenges before Mangrove Cell was to build a task force equipped to deal with the complex issues of mangrove management. Since this was a totally new subject to the Forest Department, strenuous efforts had to go into the capacity building of its staff. A series of training programmes and exposure visits on mangrove conservation and various aspects of marine biodiversity conservation were conducted, not only for the forest staff, but also for personnel from fisheries department, fishers' community, and other stakeholders in the coastal environment. In addition to subjects like mangrove ecology, mangrove nursery and plantation techniques, training was imparted to officials on a wide range of subjects such as wildlife crime control (with specific reference to marine protected species), beaching and stranding of marine mammals, identification of marine mammals, turtle conservation, SCUBA diving etc. There were training and awareness programmes specifically meant for fisher folk on sustainable fishery, for snorkelling guides of Malvan on eco-friendly snorkelling practices, for farmers on nature-friendly farming, for dolphin tour operators on less intrusive dolphin-watch, for homestay owners on adopting a green rating system, etc. A number of training programmes and exposure visits were organised for rural women on livelihood activities such as crab farming, mussel farming, oyster farming, apiculture etc.

Partnerships

Mangrove Cell has successfully demonstrated an inter-departmental approach towards marine and coastal biodiversity conservation, by partnering with a range of government departments such as Fisheries, Agriculture, Tourism, Revenue, Police, Urban Development,

Revenue, Skill Development etc. The Cell also forged strong partnerships with many leading national institutions and agencies, facilitating the introduction of state-of-the-art technologies and best practices to the Maharashtra shores. National Institute of Oceanography (NIO), Central Marine Fisheries Research Institute (CMFRI), Central Institute of Fisheries Technology (CIFT), Central Institute of Brackish Water Aquaculture (CIBA), Marine Products Export Development Authority (MPEDA), Wildlife Institute of India (WII), Salim Ali Centre for Ornithology (SACON) and Bombay Natural History Society (BNHS) are just a few names in that long and illustrious list of partners. Mangrove Cell also works with several NGOs, Citizen's Groups, educational institutions and private research organisations.

The Mangrove Foundation

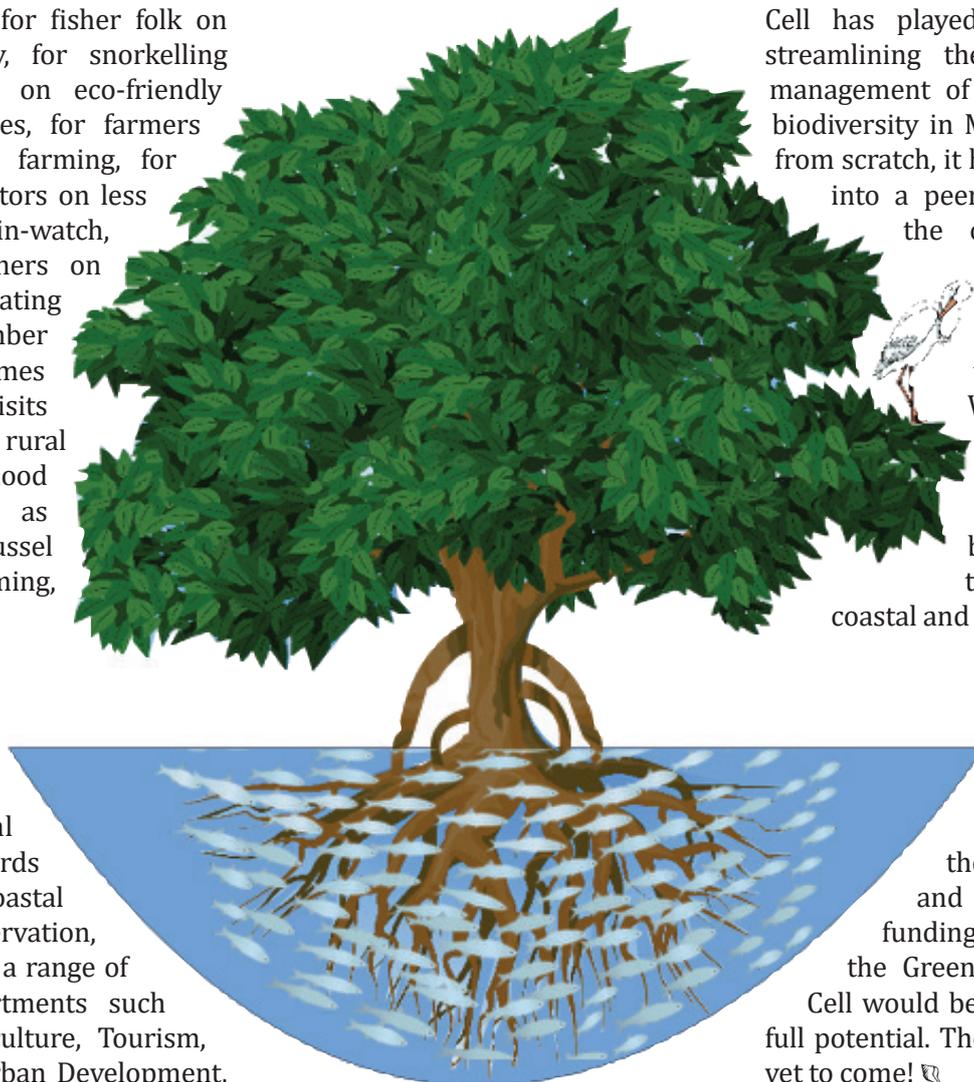
Government of Maharashtra has recently set up a 'Mangrove and Marine Biodiversity Conservation

Foundation of Maharashtra'. This registered society has been entrusted with sufficient autonomy to plan and execute innovative programmes for conservation of coastal and marine biodiversity and to promote research programmes and livelihood activities in the coastal sector. With this, a new chapter in coastal and marine biodiversity conservation is sure to unfold in Maharashtra. Governmental efforts in marine biodiversity conservation can now be complemented well by the corporate sector, semi-government and non-governmental organizations. The Foundation, with a handsome corpus of Rs. 115 crores is designed as an institution equipped with the necessary skill set and the operational flexibility to address the whole gamut of issues linked to coastal and marine biodiversity conservation and shall ensure the long term sustenance of the initiatives undertaken by the Cell.

Tail piece

In five years of its existence, Mangrove Cell has played a crucial role in streamlining the conservation and management of coastal and marine biodiversity in Maharashtra. Starting from scratch, it has gradually evolved into a peerless organization in the country, worthy of emulation by other coastal States. It is no surprise that the Draft National Wildlife Action Plan (2017-31) urges each coastal State to set up a similar body to strengthen the conservation of coastal and marine biodiversity.

Mangrove Cell has now entered its exponential growth phase. In the coming years, with the support of the State, the Centre and some International funding agencies (such as the Green Climate Fund), the Cell would be poised to realize its full potential. The best, as they say, is yet to come! 🐦



FIVE YEARS OF MANGROVE CELL



In October 2005, a Bombay High Court order directed that mangroves on government land were to be notified as 'Protected Forests' and handed over to the Forest Department for management.



In 2012, the Forest Department of Maharashtra ventured into the realm of conservation of coastal and marine biodiversity by creating the country's first such state-wide unit called the 'Mangrove Cell'.



In the latter half of 2012, the GOI-UNDP-GEF Sindhudurg Biodiversity Project was launched. It gave the Mangrove Cell the opportunity to initiate a number of innovative programmes for conservation of coastal and marine biodiversity in Maharashtra.



In 2013, the 'Mumbai Mangrove Conservation Unit' (MMCUC) was constituted for protection of mangroves of Mumbai and adjoining areas. The unit is headed by a Divisional Forest Officer and has undertaken conservation works including mangrove nursery raising, mangrove plantations, clean mangrove campaigns, etc.



Based on the International Climate Initiative Agreement between Government of India and the Federal Republic of Germany, a bilateral project towards improving conservation of marine biodiversity was launched in Maharashtra with the help of the German agency GIZ in 2014.



In an effort to closely monitor the status of mangroves in Maharashtra, satellite mapping of mangrove areas were carried out, district by district, on a 1: 5,000 scale and the areas in the possession of Forest Department were demarcated on the ground with clear boundary markings.



The GIZ Project launch triggered the notification of the Thane Creek Flamingo Sanctuary, Maharashtra's second marine sanctuary after Malvan. Spread over an area of 1690 hectares, it is home to over 200 species of birds, many of which are migratory.



The Government of Maharashtra has recently set up a Mangrove and Marine Biodiversity Conservation Foundation of Maharashtra. It will be entrusted with autonomy to plan and execute innovative programmes for conservation of coastal and marine biodiversity.



A Coastal and Marine Biodiversity Centre has been set up at Airoli, Navi Mumbai, as part of the GIZ Project. It will serve as the gateway to the Flamingo Sanctuary and is expected to evolve into an educational and recreational centre focused on coastal and marine biodiversity conservation in Maharashtra.

PROMOTING SUSTAINABLE LIVELIHOODS:

An overview of the best practices

By Subir Ghosh, Project Coordinator

The GoI-UNDP-GEF project on “Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in Sindhudurg” is being implemented in 316 villages (including 80 fishing villages) in the three coastal talukas of Malvan, Devgad and Vengurla. The total population of the project area is estimated to be 287,477 persons. The per capita income of the district in 2005-06 was INR 32,862 against the state average of INR 42,056. The district income in 2005-06 stood at INR 2,996 crores, when State Domestic Product was INR 438,058 crores, which is just 0.68 percent of the state’s income. The population below the poverty line is 29.80, 35.49 and 41.15 percent in Devgad, Malvan and Vengurla respectively, the average being 35.48 percent. The Project has resulted in generation of good practices in the areas of planning; sustainable resource use; conservation of coastal and marine biodiversity; climate change and sustainable livelihood. Many of these good practices may be applicable in the sustainable development context of other coastal districts of Maharashtra as well as coastal States. Considering the emphasis being laid on attaining the Sustainable Development Goals of the UN, it is necessary that these good practices are replicated across the country. Whereas most of these good practices are relevant in the context of coastal development, some of them may also be replicated in non-coastal regions as well.

Livelihood activities in the SCME are dominated by marine fishing. Tourism is a growing economic activity. Livelihood activities, other than fishing, include animal husbandry and agriculture. The principal agricultural crops are paddy, coconut, mango, cashew and Kokam. Taking into account the natural resources, the livelihood activities which were promoted in the coastal region of the Sindhudurg district under the UNDP-GEF project is discussed here.

Mangrove Crab Farming

Mangrove mud crab farming is very popular in Asian countries like Bangladesh, India, Thailand, and Philippines. Mud crabs have a huge demand and command a high price in the international market. Many countries of the world import huge quantities of crabs for consumption, resulting in an increasing demand for supply. To meet this demand, aquaculture of crab farming is gaining importance. However, the real benefit of crab farming lies in conservation of the mangrove resource, through such income generating activities as mariculture of crabs in pens and ponds. The importance of mangroves in protection of the shoreline against coastal erosion, flooding and environmental calamities besides providing the much needed nursery ground for early stages of coastal and marine life forms as well as in carbon sequestration is well known. Crab farming is thus playing an important role in conservation of mangrove while meeting the livelihood needs of the coastal communities.

About 40% of the mangroves in Maharashtra are on private lands. These mangroves are always in the fear of being razed down for profitable enterprises. Since mangroves provide healthy breeding grounds for crabs, the promotion of crab farming on private mangrove lands instills the need for mangrove conservation among the communities. Furthermore, crab farming serves as a resilient livelihood option for the coastal communities over traditional fisheries which is declining day by day due to various factors including delayed rainfalls, sea level and temperature rise.

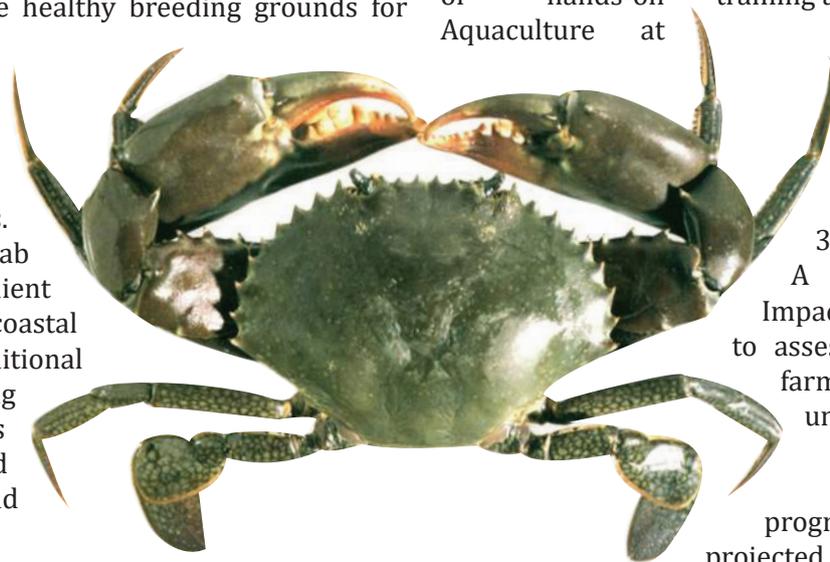
At present mud crab farming in India is largely based on collection of crablets or crabs from the wild for fattening or grow-out, which has evolved over hundreds of years, hatchery production of mud crabs being a relatively recent innovation, with most research and development taking place over the last few decades. Marine Product Export Development Agency (MPEDA) and Rajeev Gandhi Centre for Aquaculture (RGCA) are



Crab farmers displaying mangrove mud crabs which have attained commercial size.

two of the leading institutes which have opened the avenues for commercialization of mud crab hatchery technology. This has effectively led to organized Mud Crab Aquaculture in the coastal areas of the country, particularly among the weaker sections of the society by giving them an alternate livelihood option. The institutes have also strengthened the production base for export of live and value-added products such as soft shell crab.

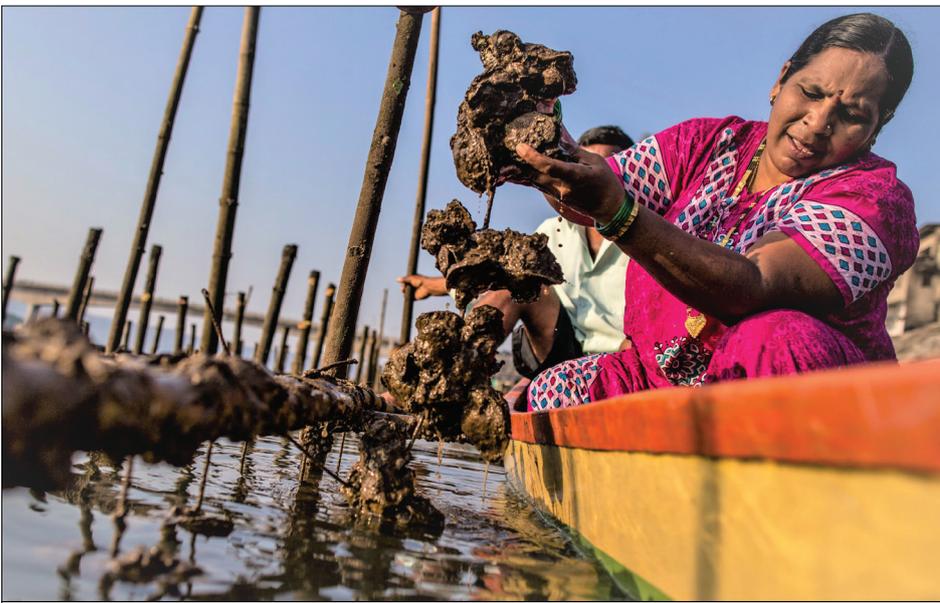
Under the Sindhudurg Project, MPEDA and RGCA have initiated Stock Enhancement Program of Mangrove Crab in Mangrove Pens and Tide Fed Farms in the coastal talukas of Sindhudurg District. The activity has been introduced in 15 villages across the three coastal talukas of Sindhudurg, involving 179 beneficiaries, who have been trained through conduct of awareness visits and conduct of hands-on training at Rajeev Gandhi Centre for Aquaculture at



Sirkali. The crab farming programme has been implemented in four phases and over 100,000 crablets have been stocked in approximately 30 acres of mangrove area.

A detailed Environment Impact Assessment (EIA) study to assess the potential for crab farming in Sindhudurg, is underway.

The upscaling of the programme in Maharashtra is projected to have a significant economic impact. A total of 22000 ha of area is under mangrove in the coastal areas of Maharashtra. Under the Green Climate Fund (GCF) project alone, it has been proposed to develop 3% of the available area, which will involve scaling up the activity to 1500 acres of area in 5 districts. This is expected to provide livelihood support to 15000 families, resulting in crab production of 600 MT, generating additional income of Rs. 30 Cr per annum.



Woman beneficiary of the oyster culture programme monitoring the growth of oysters in the Wadathar oyster unit, Sindhudurg

having good oyster fishery resource. Subsequently, a pilot project was initiated with technical support from the Central Marine Fisheries Research Institute (CMFRI) to demonstrate mussel and oyster culture practices in Sindhudurg, taking advantage of the natural spat fall in the identified creeks and locations.

Oysters are natural filters with the ability to pump as much as 50-60 gallons of water a day. This helps trap nitrogen from the algae they eat and convert it into usable protein and keep coastal ecosystems healthy. Thus, bivalve farming is 'organic' in nature. Such eco-friendly farming practices can be taken up at the designated sites in estuarine areas by the local fishermen groups. Promoting oyster culture will help strengthen coastal livelihood and

Bivalve culture

Oyster is one of the best known and most widely cultivated marine animals. The oysters are highly esteemed sea food and considered a delicacy in USA, Europe, Japan etc. In India there is a growing demand for oyster meat in some parts of the country. Until recently, oyster farming has been considered as a traditional practice followed only in the temperate countries. The awareness about the vast potentialities for development of oyster farming in tropics is recent. Serious efforts are now being directed in its development under tropical conditions.

also address food security, acting as an adaptive means of resilient livelihood for the coastal communities over classic fishing which is declining due to various factors including delayed rainfall, sea level and temperature rise. In addition, oyster farms and the growing sanctuaries that our farmers are building, offer rich habitat for many kinds of marine life. Ecosystems rich in biodiversity help to ensure healthy coastal environments.

The Sindhudurg coast is blessed with a vast network of backwaters and creeks. The numerous estuaries and backwaters along the coast have shown significant mussel and oyster resource. In order to utilise the resources and promote mariculture-based livelihood activities, a study was awarded to Colleges of Fisheries, Ratnagiri for mapping the mussel and oyster culture potentials of Sindhudurg. Based on the study 38 villages in the 3 coastal talukas viz. Devgad, Malvan and Vengurla were identified,

Prior to the oyster farming programme in Sindhudurg, the women from the fishers' community would spend several back-breaking hours harvesting oysters from the rocks during low tide. Oyster farming on the other hand follows a simple method, which involves setting up of a bamboo raft with substrates in the creeks. The naturally available spat attaches itself to the substrates and in a span of twelve to fourteen months, the oysters achieve commercial size. The programme requires very little physical labour (mostly during the raft setting stage), and with low investment, promises high return.

IN FOCUS - PRASIDDHI SHG



Prasiddhi, the women Self-Help Group (SHG), who were involved with the pilot programme of bivalve culture in Wadathar, Sindhudurg were so pleased with the success of the programme, that they began training SHG members from nearby villages in the techniques of oyster farming. Their success story and the economic advantages of the oyster culture project were featured in the Indian Express daily, Kasturi Dhoke, the secretary of Prasiddhi, stated that the Sindhudurg Project had brought 'Prasiddhi' (fame; popularity) to the SHG.

In the pilot phase, a 8-fold return was observed on the investment. The programme also has a strong potential for upscaling as there are several creeks and estuaries with natural spat fall. In addition, the setting up of a multi-species hatchery will ensure steady supply of oyster spats and also guarantee a handsome harvest.

IMTA - Integrated multi-trophic aquaculture

Aquaculture is a viable option for meeting the food security of the burgeoning coastal populace of India, owing to declining wild fish stock and increasing demand for seafood, coupled with increase in pressure on coastal resources owing to sea level rise. However, coastal aquaculture in India is facing a sustainability issue, primarily being a mono-culture practice, based on farming of shrimp alone, since its inception during 1980s. Although shrimp aquaculture has grown dramatically during the last few decades, there are several issues which, still remain unresolved particularly, the issues related to the environment and consequent disease outbreak. The environment related issues include, discharge of waste water, eutrophication of receiving ecosystem, problems due to the feral population and disease occurrence in the wild stock. Hence a sustainable aquaculture systems need to address these issues.

In order to develop sustainable aquaculture and to protect the ecological integrity of the coastal ecosystem, the current aquaculture, which is based on single species, needs to be replaced with a multi-species aquaculture system involving components which would utilize the wastes generated within the system through the food chain and the detritus chain. Integrated multi-trophic aquaculture (IMTA), is a system that addresses these issues through a mix of aquaculture species, which thrive at different trophic levels in an aquatic system, comprising of planktivores (feeding on planktonic food, including phytoplanktons and zooplanktons); detritivores (decomposing plant and animal parts as well as faeces); filter feeders such as bivalves living on particulate suspended organic matter and finally the organisms which live on dissolved nutrients such as sea weeds. In this farming practice, uneaten feed, nutrients, wastes and energy from one trophic level act as input for the next trophic level and utilized as fertilizer, feed and energy for the next trophic layer. The synergistic interaction among the species results in bio-mitigation of the wastes. Although a distant prototype of IMTA existed in traditional aquaculture forms, the importance of IMTA as sustainable management option has been recognized recently.



The Sindhudurg district has approximately 8000 ha of brackish water area, of which a total of 1268 ha has been developed for aquaculture. Although climate and geography of the district is suitable for brackish water aquaculture, the potential of this district has not been optimally used. A preliminary analysis of socio-economic aspects of brackish water shrimp farming in this area indicate that monoculture of shrimp could not be sustained in these areas, as in the case of other coastal states on the east coast of India. Therefore, the need of the hour is a sustainable and viable brackish water aquaculture practice, based on the principles of IMTA. In this context, standardization of IMTA under the UNDP-GEF project was considered to be a necessary intervention for development of coastal aquaculture in Sindhudurg.

The IMTA systems were promoted as a sustainable alternative to monoculture of shrimp. Field trials on the following five models of IMTA were demonstrated in the pilot stage:

- Shrimp plus Mullet and sea weed (land based farm)
- Mud crab plus *Chanos/mullet* plus bivalves (land based farm)
- Shrimp plus mud crab plus mullet and sea weeds (land based system)
- Integrated mangrove aquaculture; mud crab plus fish (mangrove ecosystem)
- Fish and Poultry on the dyke (land based system)

Estimated productions in pond based IMTA system based on the results of partial harvest

Species	Estimated production (kg per pen of 250 M ²)	Estimated production (kg/ha)
<i>P.inidicus</i>	10	400
<i>Chanos chanos</i>	50	2000
<i>E. suratensis</i>	25	1000
<i>M. Cephalus</i>	25	1000
Total Production	110	4400

The beneficiaries were identified following surveys to identify suitable site. The identified farmers were then provided technical support and farming inputs for two culture cycles in this regard. As the final harvest is yet to be carried out, the estimated production is calculated from the average latest body weight and expected percentage survival. Estimated production in the demonstration trials is given in the table below. Total production is estimated to be 4400 kg/ha with a highest estimated production for milk fish.

The IMTA programme has the potential of being upscaled in five coastal districts of Maharashtra. The pen culture potentials in wet land areas would require mapping the existing potentials. However, with a tentative assessment for setting up 2000 units in 5 districts, based on small scale cage culture potentials in open waters of creeks and estuaries, the projected cost is Rs. 200 lakh.



SRI farmer uses a conoweeder for weed management in the paddy field.

System of Rice Intensification

The System of Rice Intensification (SRI) is a climate-smart, agro-ecological methodology for increasing the productivity of rice and more recently other crops by changing the management of plants, soil, water and nutrients. It is a relatively new methodology, involving set of practices that integrate management of plant, soil, water and nutrients. The potential of SRI is fully realized when all the five important practices are adopted together. According to Dr. Norman Uphoff, Professor Cornell University, USA and leading campaigner of SRI, this revolutionary innovative technology was borne out of personal experience of Fr Henry de Laulanie at Madagascar, and not as a development of scientific research. The method has spread to more than 50 countries and resulted in several success stories. Now, efforts are on to generate and document the scientific mechanisms responsible for the observed crop responses under the SRI method.

SRI can produce more paddy yield with less external inputs. Furthermore, SRI is environment-friendly and can be adapted to any type of rice variety (local variety, HYV, hybrid variety).

The SRI technique of paddy cultivation was identified as an intervention in the three coastal talukas of Sindhudurg district of Maharashtra under the UNDP-GEF Sindhudurg Project, considering the sustainability of the production system; its reduced dependence on inorganic fertilizers, pesticides resulting in lesser eutrophication and pollution of coastal ecosystem; its drought coping mechanism and adaptability to withstand vagaries of climate change; as well as its ability to reduce emission of methane compared to traditional paddy cultivation practices. Its attributes related to reduced pressure on land, water and power as well as its improved yield characteristics and better return to farmers are other features which have led the project authorities to consider supporting a pilot project to

demonstrate its benefits to the farmers in the three coastal talukas of Sindhudurg (VIZ. Vengurla, Malvan & Devgad). The pilot project was implemented by a CSO named Mayem Panlot Sangh (MPS), Mayem, Sindhudurg.

In all, 268 farmers were introduced to SRI technique for paddy cultivation over three farming seasons during 2014-2015, covering 85 acres. More than 2500 farmers have been exposed to the farming technique. The potential beneficiaries were selected through conduct of village level meetings, group discussions, field visits to demonstrations units. The pilot project covered 23 farmers during Kharif 2014, another 245 farmers during Rabi 2014-15. The paddy

farming in the district comprises traditional system of paddy cultivation and the 'Charsutri' (improved package of practice) advocated by the Konkan Krishi Vidyapith, Dapoli.



Comparative grain yield

Enthusied by the results under the pilot project for SRI, the District Authorities had taken a decision to scale up the activity to 1000 acres of paddy growing area in Sindhudurg during 2016-17. The programme was supported by the District Agriculture Office, and was implemented by Dilasha Janvikash Pratisthan, an NGO based out of Aurangabad. During Kharif 2016, 526 acre could be covered involving, 1035 farmers in all 8 talukas of Sindhudurg. The remaining area of 474 acre will be covered during the Rabi season.

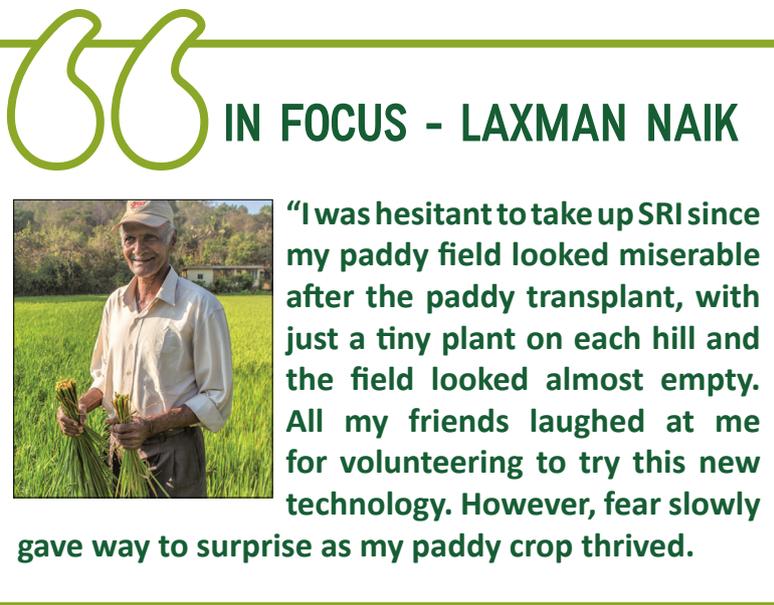
The results of the SRI Kharif Programme 2016, indicates the following trend.

- Increase in No. of tillers per hill, following SRI, over traditional paddy observed to be 92.6 percent
- Increase in No. of grains per panicle, following SRI, over traditional paddy was observed to be 30.4 percent
- Increase in grain yield, following SRI, over traditional paddy was observed to be 23.54 percent
- Increase in Straw yield, following SRI, over traditional paddy was observed to be 17.3 percent

Taking into account the results of the district level scaling up operations in Sindhudurg, another step forward is being planned for scaling up SRI to 8000 acres across all the coastal districts of Maharashtra under the Green Climate Fund.

Upscaling of the livelihood programmes

Considering the successful outcome of the above interventions implemented under the Sindhudurg Project, several decisions have been taken at the district, state and national level for upscaling the programme. First and foremost, the Government of Maharashtra has allocated funds to the sum of



IN FOCUS - LAXMAN NAIK

“I was hesitant to take up SRI since my paddy field looked miserable after the paddy transplant, with just a tiny plant on each hill and the field looked almost empty. All my friends laughed at me for volunteering to try this new technology. However, fear slowly gave way to surprise as my paddy crop thrived.

Rs 9 crore for setting up a multi-species hatchery that can supply crab, bivalve and seabass seeds to farmers in Maharashtra. A suitable land under the Revenue Department, has been identified for the hatchery and the same has been transferred by the Department to the Mangrove Cell. The Detailed Project Report for the hatchery is currently under preparation.

The Government of Maharashtra has also allotted Rs 15 crore for the financial year 2017-18, for upscaling the crab farming and bivalve farming programmes across the coast of Maharashtra. Furthermore, all the above programmes have been proposed for upscaling under the Green Climate Fund project on ‘Enhancing Climate Resilience of India’s Coastal Communities’.



BENEFITS OF SRI

- Positive Yield Attributes: 60-80% higher grain yield and 50-75% straw yield, as compared to traditional method
- Low water requirement: Reduction in water requirement by 25-50%
- Reduces pressure on Land: Higher productivity (40-80%)
- Low seed requirement: Only 8Kg/Ha seed required, compared to 80 kg in traditional system
- Low Inorganic Fertiliser use: Dependence on green manure and compost reduces use of inorganic fertilisers
- Low pesticide use: Owing to low plant density, penetration of sunlight and aeration of the field is proper resulting in low incidences of disease and pests
- Greenhouse gas emission: Methane gas emission is less because of lack of standing water column
- Improved grain quality: More grain & less chaff
- Grain ripening is quicker: Grain ripening is 7-10 days sooner
- Improved Food Security: Higher productivity from small holdings
- Low labour requirement: In long run labour requirement reduced
- Reduce production costs: With increased output and reduced costs (10-20%), farmers net income is likely to increase
- Better Drought Copping: Owing to low seed rate, staggered nursery is feasible in the event of unfavourable monsoon

CETACEANS OF SINDHUDURG

By The Konkan Cetacean Research Team

The Sindhudurg Coast and Marine Ecosystem is one of the 11 ecologically and economically critical habitats identified along the Indian coast. Several globally significant species, specifically cetaceans are found in abundance in the Sindhudurg coast. However, very little focussed efforts had gone into studying these fascinating creatures in the Sindhudurg waters. With a view to bridging this information gap, the Sindhudurg Project sanctioned a project to assess the distribution and abundance of cetaceans in Sindhudurg, with technical support from a group of young team of biologists, identifying themselves as the Konkan Cetacean Research Team. The study was carried out in three phases - Phase 1 started in May 2014, Phase 2 in March 2015 and

Phase III in November 2015. KCRT assessed the biodiversity of marine mammals along the Sindhudurg coastline and estimated population parameters of two coastal cetacean species, *Sousa plumbea* (Indian Ocean Humpback Dolphin) and *Neophocaena phocaenoides* (Indo-Pacific Finless porpoise). Incidental mortalities and strandings of cetaceans throughout the coast of Sindhudurg were recorded by setting up a community based monitoring network and examined carcasses to gain life history data and to understand causes of mortality. In addition, the team also assessed the dolphin watching tourism industry and its role on the socio-economic well-being of local communities in Sindhudurg district, Maharashtra. The following report briefly summarises the characteristics of the two significant cetacean species found in Sindhudurg, as observed during the study.



Interesting facts

- 41 days were spent on photo identification survey and 11829 dorsal fin photographs were taken
- 572 dolphin individuals have been identified
- Of the population surveyed, about 15.5% consists of juveniles or young animals (unmarked individuals). It can therefore be inferred that the minimum *S. plumbea* population size is 661 individuals.

Cetaceans of Sindhudurg:

Near coastal cetacean species observed on transect surveys:

- Indian Ocean Humpback dolphin (*Sousa plumbea*)
- Finless porpoise (*Neophocaena phocaenoides*)
- Bryde's whale (*Balaenoptera edeni*)
- Blue whale (*Balaenoptera musculus*)

Species recorded through community inputs:

- Bottlenose dolphin (*Tursiops sp.*)
- Spinner dolphin (*Stenella sp.*)

Unidentified baleen whale species

- Sperm whale (*Physeter sp.*)

The Indian Ocean Humpback dolphin and Finless porpoise are the common near-shore cetaceans found along the Sindhudurg coast. The Humpback dolphins inhabit the narrow coastal band from the shore to 20m

depth and finless porpoises, from the shore to about 100m depth. Despite a large habitat overlap, these two species seem to co-exist without interacting and are seldom seen together.

Finless porpoises are a shy and cryptic species, difficult to discern unless the water surface is very calm. They have a small profile in the water and can be easily mistaken for a floating object due to the absence of a fin. Their occurrence in this area is rare. During the November season there were maximum sightings (group size) of finless porpoises from Devbag to Redi and incidentally no humpback dolphin sightings. Porpoises prefer undisturbed habitats and are spotted in large numbers when fishing activities are minimal.

Humpback dolphins, on the other hand, are relatively common and can be spotted easily due to their large and distinctive fin and hump. They are generally observed in large scattered groups, usually engaged in social activities. These dolphins prefer very shallow waters and can often be seen from the shore. We had once observed, while standing on Tarkarli beach, a group of three adults and one juvenile, 200 meters from the water line. The adults seemed to have been teaching the young one how to catch fish, right among the breakers.

Dolphins tend to invest a lot of time in feeding or looking for food. Inhabiting muddy coastal waters, they often rely on high frequency clicks to echolocate fish. They are observed swimming sideways or belly-up as they scour the water from above for prey. When the prey is successfully located, dolphins dive with their tails rising out of the water. Local fishers report that these dolphins frequently fish from or around gill nets. Many a times, seagulls are seen in association with dolphin pods as the birds benefit by feasting on fish disturbed by dolphins.

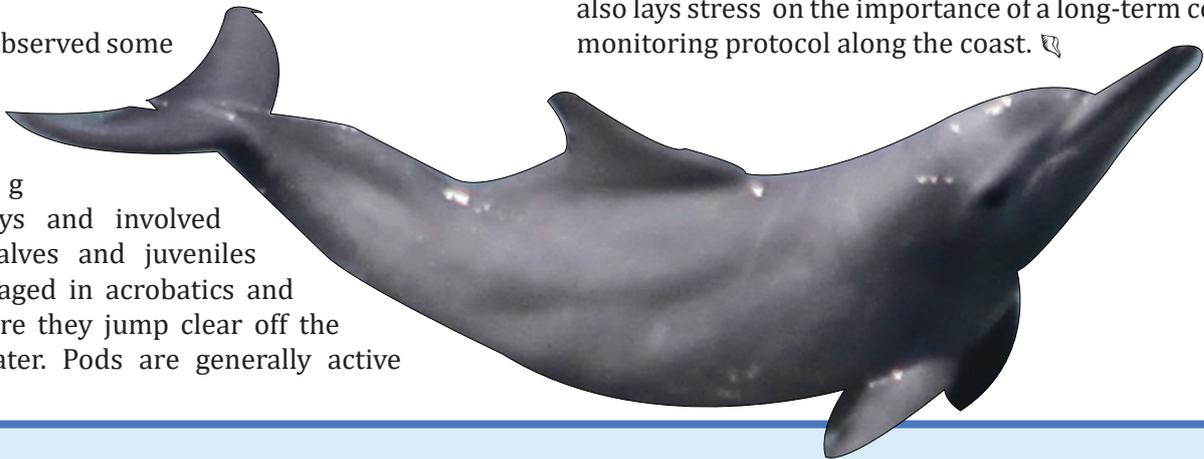
During November-January, we spotted a large number of calves and juveniles in many pods along the coast.

We also observed some individuals swimming belly-up, signifying sexual displays and involved in mating. Calves and juveniles are often engaged in acrobatics and breaches where they jump clear off the surface of water. Pods are generally active

around day-time. Mother and calves are always seen in close association swimming in closely together in a synchronised fashion; sometimes small calves are seen swimming between two adult females called crèche groups.

During the study, cetacean sightings were recorded along with environmental variables and anthropogenic pressures e.g. depth, salinity, distance from shore and distance from nearest fresh water source and fishing boat traffic. Photographic data was collected to estimate Indian Ocean Humpback Dolphin population through Mark-Recapture method. As part of this, 572 dolphins were identified.

Through direct observation, we have recorded 150 Indian Ocean Humpback Dolphin (*Sousa chinensis*) groups, 65 Indo Pacific finless porpoise (*Neophocaena phocaenoides*) groups, one Blue whale (*Balaenoptera musculus*) group and eight Bryde's whale (*Balaenoptera edeni*) groups. With very little being currently known about cetaceans in Indian waters, this project enabled in generating data on abundance, distribution and behaviour that will provide a platform for more detailed studies. It also lays stress on the importance of a long-term cetacean monitoring protocol along the coast. 🐬



Blue Whales Spotted off Sindhudurg Coast after 100 years

A mother-calf pair of blue whales, the largest mammals in the world, was spotted along the coastline after nearly 100 years in Maharashtra. The sighting was recorded near Kunkeshwar, at Sindhudurg, 2.7km offshore at a depth of 16m between March and May 2016. Researchers also spotted four Bryde's whales during the same period.

The last sighting of the blue whale recorded off the coast of Maharashtra was in 1914. According to the records of the Central Marine Fisheries Research Institute (CMFRI) – a dead blue whale had washed ashore at the time. In the recent past, another sighting of the mammal was observed in 2010 along the coast of Mangalore.

This record sighting was covered widely in the national and international media.



STRENGTHENING POLICIES FOR COASTAL AND MARINE BIODIVERSITY CONSERVATION



By C. Sasikumar, Former Project Manager, Sindhudurg Project

The National Environment Policy (2006) of Government of India underscores the fact that “while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource”. This element is true to our 7500 kms of coastal stretch as well. With over 4.0 million people depending for their livelihoods on the marine fisheries resources in India, sustainable use of the resources is imperative. Dovetailing this Policy brief with Chapter 17 of the Agenda 21, adopted in Rio-Earth Summit 1992, brings out the need for integrated management of coastal zones for sustainable use of marine resources. Countries, including India, that adopted the Agenda 21, committed themselves to provide for an integrated policy and decision-making process, including all involved sectors, to promote compatibility and a balance of uses. Such national coordinating mechanisms are helpful in providing for ‘Integration of sectoral programmes on sustainable development’ for settlements, agriculture, tourism, fishing, ports and industries affecting the coastal area.

Considering the above scenario, the Government of India in partnership with UNDP, and Government of Maharashtra has been implementing a GEF funded project titled “Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in Sindhudurg Coast, Maharashtra” since 2011-12. Mainstreaming

Mainstreaming marine biodiversity into sectors benefit the human communities who depend on coastal resources while maintaining the biological diversity and productivity of these ecosystems.

marine biodiversity into sectors improve and benefit the quality of life of human communities who depend on coastal resources while maintaining the biological diversity and productivity of coastal ecosystems. Experiences from across the world suggest that any commitment towards public participation requires a transformation of governance structures. As aptly brought out in the report of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) (1996), the key to success in achieving this goal is the need to provide an equitable, transparent and dynamic governance process that is acceptable to the community.

In India, marine conserved areas have been created either on species or ecosystem centric approach. They have been established within the country’s territorial waters and vast expanse of rich resource within the Exclusive Economic Zones (about 188 nautical miles) is left ‘un-protected’. Generally, a precautionary approach on regulations are practiced, imposed by the Government on the community and consultation processes are weak. Fisheries being the key extractive resource, depletion of the fish stock is inevitable paradigm under current system of management; Fishery management is confined to seasonal closures (that too, with minimum scientific evidence of its functionality). Besides, the funds allocated for MPA governance and management is nominal in comparison to terrestrial PAs, which itself may be a fraction of the budget for conservation in India. Priority accorded to manpower for coastal area protection and conservation is low.

The GOI-UNDP-GEF Sindhudurg Project has brought out the key gaps in knowledge of coastal and marine biodiversity conservation, as compared to the terrestrial sector and aims to address the barriers in weak coordination between sectors; inadequacy of the Wildlife Act for protecting marine areas and weaknesses in fisheries legislation, etc. Several interventions were initiated under this Project in the Sindhudurg region to meet the objectives of the Project. Several amongst these have already gained wide acceptance amongst the local community and other stakeholders. Notable three such interventions that have found success at the policy/legislation level are described in the following paragraphs:

Square Mesh Nets in trawlers

The Strategic Goal B of the Aichi Targets envisages that by 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits. It is imperative to have an enabling environment for the communities to reach a stage of self-regulation to shed the tendency of over exploitation of the resources.

The need for developing selective fishing gears in order to conserve resources, protect non-targeted resources and endangered species, as stressed in the FAO Code of Conduct for Responsible Fisheries, becomes more meaningful. Protection of juveniles and conservation of non-target species is therefore, an imperative for balancing the ecosystem and removal of fish resources in a more sustainable manner. Under the auspices of this project, Square mesh net was introduced in Sindhudurg District of Maharashtra, with a view to demonstrate that biodiversity conservation of coastal areas and sustainable livelihoods can go hand in hand. The partnership brought in technical expertise from the Central Institute of Fisheries Technology (CIFT), working closely with local fisherfolk to introduce the square mesh net in the cod end of trawl gears in

Sindhudurg. Though, met with initial scepticism, the initiative has gone a long way in becoming something that fishermen have embraced in their journey to sustainable marine fishing. Since 2015, every trawler in the district now uses square mesh nets.

With traditional diamond-shaped nets, the gaps in the mesh compress when the nets get weighed down by the catch, leaving little room for juvenile fish to escape. However, the square shaped mesh retains its shape in the water and juvenile fish below a certain size can escape through the gap in the nets. The new technology has increased the fishers' income by INR 10,000 (US\$152) each month owing to reduced consumption of diesel. On an average catch of 18 kgs, it is estimated that the use of square mesh allows over 3 kgs of juvenile fish to escape. In Sindhudurg, all 317 trawlers have adopted more sustainable fishing practices. Maharashtra's Fisheries Department has now issued an order proposing the mandatory use of square mesh nets for all 17,000 trawlers in the region. Considering the positive outcomes of the programme, the Maharashtra State has also passed a Government Resolution making the use of 40 mm square mesh nets mandatory across coastal Maharashtra.

(A detailed report on the square mesh nets in trawlers can be found on Page 22.)

Joint Patrolling of Seas and empowering Fisheries Department under Wild Life (Protection) Act, 1972

The Wild Life (Protection) Act, 1972 lists several marine species in its Schedules. Notable amongst them include all Cetaceans (Whales, Dolphins and Porpoises), marine turtles, nine species of marine Sharks (including the huge Whale Sharks), Rays and Stakes, apart from Giant Groupers, all Sygnathidians (Pipe fishes), Sea Horses, Corals and nine species of molluscs, in the Schedule-I, thereby according them the highest degree of protection from hunting and trade. Section 50 of the Act empowers the Director, Wildlife Preservation and the Chief Wildlife Warden, or an officer authorized by them, to search, stop any vehicle/vessel, arrest, detain any person who has committed an offence under the Act and seize any wild animal/animal parts/products. Similarly, Section 55 of

the Act also empowers the State Chief Wildlife Warden or any officer authorized

by the State Government to file a complaint

before the Court of law for cognizance of the offence. The Joint Patrolling programme has been well designed to deal with illegal fishing under Maharashtra Marine Fisheries Regulation Act (MMFRA) and protection of schedule-I species under the Wildlife Protection Act, (WPA) 1972, emanating out of mechanized fishing operations in the

Sindhudurg coastal and marine environment. A common guideline incorporating provisions of both the Acts was to be prepared for sharing with the participants.





Joint Patrolling exercise in progress

This being the scenario, implementation of the provisions of the Wild Life (Protection) Act, 1972 in marine seascape was a challenge, as the Act, being largely terrestrial centric, had few provisions to cater to marine ecosystems. Coupled with this, the marine fishing being the domain of the Fisheries Department of the State, nabbing offenders of the Wild Life (Protection) Act was a difficult task, without the coordination of the Fisheries Department. Considering these, the Project initiated a joint patrolling operation with the Forest and Fisheries Departments coordinating in patrolling along the Sindhudurg coast. The Joint Patrolling exercise was conducted during the fishing season of 2016.

In order to carry out the exercise, the Deputy Conservator of Forests (DCF), Sawantwadi had deputed two Foresters and two Forest Guards. In addition, the DSP, Sindhudurg deputed two armed Police Constables for participation in the workshop and subsequent joint patrolling. The Fisheries Department had hired the speed boat and had also deputed its field staff who would carry out joint patrolling exercise. The programme has been very effective in dealing with cases of incursion of fishing trawlers and purse seiners from other states entering into Sindhudurg waters. As a result of patrolling, the number of incidences has come down drastically.

Considering the success rate in joint patrolling exercise, the State Government of Maharashtra, vide their Gazette Notification dated 1st December 2016, inter-alia, decided to empower the Assistant Commissioner of Fisheries, Department of Animal Husbandry and Fisheries, of the seven coastal districts of Maharashtra as “authorized officers” under sub-section (2) of section 39, sub-section (1), (3), (6) and (8) of section 50 and clause (b) of section 55, of the Wild Life (Protection) Act, 1972. This step is hoped to bring down the offences under the Act during the coming days. It has also proved to steer a way for mainstreaming marine biodiversity into Fisheries sector.

National Wildlife Action Plan (2017-2031)

The Indian Board for Wildlife (IBWL), an advisory Board to the Central Government, chaired by the Hon'ble Prime Minister, in its meeting in 1982 recommended for preparation of a dedicated National Wildlife Action Plan. Accordingly, the first Action Plan (NWAP-1) was drafted and adopted in the year 1983. It was implemented from 1983 through 2001. On its completion and based on new concerns and challenges, the Plan was revised and a new Action Plan (NWAP-2) was adopted by the IBWL in its XXI Meeting held on 21st January 2002. This Plan was for the period 2002-2016.

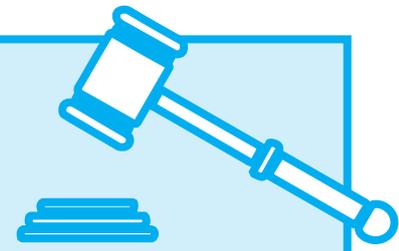
The National Wildlife Action Plan (NAWP) 2017-2031 has included, for the first time, dedicated chapters on fresh water ecosystems, coastal and marine ecosystems, wildlife health, climate change, human wildlife conflict mitigation, etc.

Thereafter, the Standing Committee of the National Board for Wildlife (NBWL), on the suggestion of the NBWL, recommended to the Ministry of Environment, Forest and Climate Change to undertake a review of NWAP-2 and also prepare a Plan for the period 2017-2031. Accordingly, Ministry of Environment, Forest and Climate Change constituted a committee under the chairmanship of Mr. J.C. Kala, Ex-Director General of Forest and Secretary to Government of India, to review the National Wildlife Action Plan (2002-2016) and to develop a Plan for next 15 years. The Committee had several rounds of meetings and consultations to prepare the new Draft Action Plan. Comments from State Forest Departments, general public, etc. were also sought on the Draft Action Plan.

As against the previous two Action Plans (NWAP-1 and NWAP-2), the approach of the Planning was to keep in the current trends of conservation issues. This demanded a more holistic approach of planning, considering a landscape a conservation platform. It also included, for the first time, dedicated chapters on Fresh water ecosystems, Coastal and marine ecosystems, Wildlife Health, Climate Change, Human Wildlife Conflict mitigation, etc.

As the GOI-UNDP-GEF Coastal and marine project was in implementation since 2011-12 and considerable successful results had emerged from its interventions, especially in the Sindhudurg region, the Nodal Officer, UNDP-GEF Project, Sindhudurg had made the following suggestions to the Ministry of Environment, Forest and Climate Change, towards inclusion in CHAPTER V - Conservation of Coastal and Marine Ecosystems of the Action Plan document:

POLICY IMPACTS OF THE GOI-UNDP-GEF SINDHUDURG PROJECT



Empowerment of Fisheries officials:

On 1st December 2016, the Revenue and Forests Department, Maharashtra, passed a Government Resolution empowering the Assistant Commissioners of Fisheries of the seven coastal districts of Maharashtra, under the Wildlife Protection Act, 1972.

Mandatory use of Square Mesh Nets by trawlers:

On 10th January, 2017, the Department of Dairy, Animal Husbandry and Fisheries passed a Notification prohibiting the use of trawl gears having less than 40 mm square mesh codend by mechanized fishing vessels.

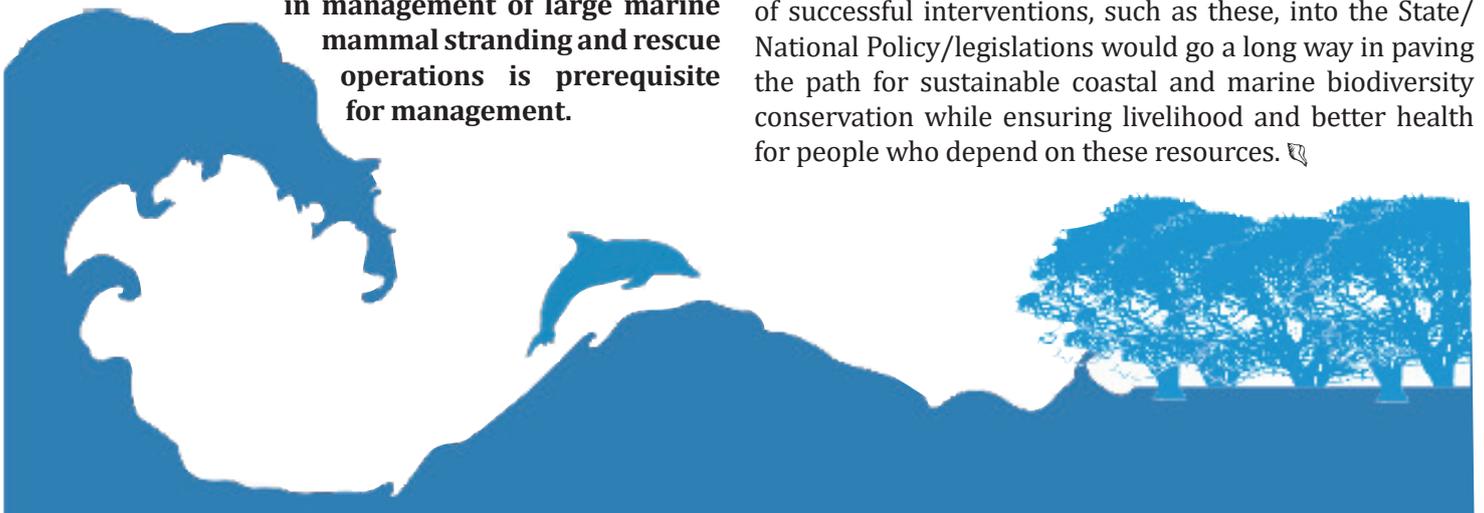
National Wildlife Action Plan (2017-2031):

As the GOI-UNDP-GEF Coastal and marine project has been in implementation since 2011-12 and considerable successful results had emerged from its interventions, especially in the Sindhudurg region, the Nodal Officer, UNDP-GEF Project, Sindhudurg had made several suggestions to the Ministry of Environment, Forest and Climate Change, towards inclusion of points on coastal and marine biodiversity conservation in CHAPTER V- Conservation of Coastal and Marine Ecosystems of the Action Plan document.

- **Including provisions in the Wildlife (Protection) Act, 1972 to declare Marine Protected Areas beyond the territorial waters, and programmes to conserve the unique biodiversity of the EEZ.**
- **Developing an integrated conservation strategy involving coastal states and different stakeholders for conservation of sharks found in the marine waters listed in Schedule-I of the Wildlife (Protection) Act, 1972, besides, strengthening coordination amongst various stakeholders including Departments, Scientific institutions, local communities for planning and implementation of conservation actions for sharks.**
- **Initiating steps for focused management intervention and protection to biodiversity rich areas within the Indian Exclusive Economic Zone (EEZ). Also, to initiate assessments of biodiversity within the EEZ so that priority areas for conservation could be identified.**
- **Initiating steps for bringing an institutionalized mechanism for handling whale/dolphin beaching cases, including rescue and release operations.**
- **Training and capacity building of officials of Forest Department, Scientific Institutions and local people in management of large marine mammal stranding and rescue operations is prerequisite for management.**
- **Initiating of long term research and monitoring programmes for understanding their pattern of migration, breeding, feeding communication and potential threats.**
- **Pursuing avenues of multilateral collaboration between concerned maritime nations for ensuring effectiveness of the interventions.**

Conclusion

The objective of GEF supported projects is to have sustained impact on the global environment through partnerships. It represents a commitment by the country to implement its priorities towards global environmental objectives. To a great extent, the Sindhudurg project has been successful in fulfilling this objective of the GEF and the Convention on Biological Diversity (CBD). The transformational changes in legislation through pilot projects, as in the first two case studies mentioned above, are examples that can be scaled up in other coastal states. The third case study is the essence of all the interventions undertaken in the project to the national level policy document. It is hoped that adoption of the new National Wildlife Action Plan (2017-2031) would enable other coastal States to work on similar identified priority projects within the Plan period. Besides, adoption of successful interventions, such as these, into the State/National Policy/legislations would go a long way in paving the path for sustainable coastal and marine biodiversity conservation while ensuring livelihood and better health for people who depend on these resources. 🌿



CORALS FOR THE FUTURE



By *Avadhoot Velankar*, UNV Conservation Biologist
& *Rohit Sawant*, Project Management Specialist

Ever since rapid biodiversity loss has been equated to impending doomsday for human civilizations, scientists and conservationists world-wide are trying to protect as many species as possible. Few decades later, this conservation movement is trying to catch up with the destruction caused due to anthropogenic pressures and are diversifying it with site and issue specific approach. These conservation efforts today vary from outright activism like Sea Shepherd Conservation Society intercepting and obstructing whaling ships before they can hunt cetaceans, to Svalbard Global Seed Vault, Norway which is meticulously collecting and preserving crop varieties around the world to ensure global food security. Terrestrial ecosystems are being preserved through networks of protected areas as well as ex situ efforts to repopulate rare species like vultures. Despite these efforts marine ecosystems are the ones which still remain over harvested and also least protected. Due to nature of ocean currents, no one single source can be pointed to cause damage to oceanic ecosystems and localized conservation efforts are deemed futile, alluding to Gerret Hardin's tragedy of commons.

Corals reefs worldwide harbor marine biodiversity and are responsible for replenishing economically important fish. And just like other oceanic systems, corals are affected by changing thermohaline and industrial effluents and solid waste dumped in the seas, which cannot be mitigated using localized efforts. But still there are few measures to ensure their survival in future. Coral transplantation is one of such measures which addresses these issues and acts as back up repository for existing coral reefs.

A smallest of temperature rise can trigger the coral symbiont, zooxanthellae which have photosynthetic pigments, to leave host bodies giving corals stark white appearance termed as bleaching.

Corals are architectural species belong to phylum Cnidaria and are close relatives of jelly fishes. Their colonies are called polyps which secrete their species specific exoskeleton which forms elaborate structures which we are familiar with. Coral polyps on their own can't survive and are dependent on dinoflagellates called zooxanthellae which have photosynthetic pigments. This symbiotic relationship is very fragile as zooxanthellae are very sensitive to environmental stressors. A smallest of temperature rise can trigger these symbionts to leave host bodies giving corals stark white appearance termed as bleaching (Picture 1). Current research postulates that only 2 of major 12 existing coral reefs are near pristine conditions (Great Barrier Reef and Torres Strait Islands) while remaining are nearing extinction (especially Western Panama and Jamaica) all since industrial revolution (Pandolfi et al. 2003, Science, 301, pp955).

This poses as a major alarm since coral reefs are breeding grounds of fishes on which food security of entire globe is dependent on.

Traditional approach to protect coral reefs is establishing protected areas or No-Take Zones which prohibit any human activity like fishing in a designated area with live pristine corals. But such protected areas are small in size in relation to the scale of anthropogenic and natural disturbances and hence inadequate. Bellwood D. R. et. al. suggested that protected areas should be coupled with management of functional groups such as herbivorous fishes to ensure proper health ('Confronting Coral Reef Crisis', Nature, 2004, Vol 429, pp827-833). They also

postulated that lack of resources may result in hampered efficacy of the protected areas which increases likelihood of 'paper parks'. Hence it becomes necessary to adopt other complimenting measures to protect corals. Coral transplantation is one of such techniques which in India is being used at 6 different sites in Gulf of Kutchch (Gujarat), Gulf of Mannar (Tamil Nadu), Lakshadweep islands (Indian Ocean), Andaman and Nicobar islands (Bay of Bengal) and Malvan Marine Sanctuary in Maharashtra.

Basic idea behind coral transplantation is placing pieces of live healthy corals from a donor site to nearby degraded or suitable sites. To conduct successful coral transplantation, researchers using SCUBA diving as a tool conduct a baseline survey identifying areas with high coral coverage. They also locate areas with degraded corals or no corals. Areas with adequate depth, current and sunlight penetration are surveyed intensively for physio-chemical parameters such as temperature, PH, Salinity, turbidity, dissolved oxygen (DO), biochemical and chemical oxygen demand (BOD and COD) as well as biological parameters such as plankton density, benthic fauna etc. Locations which match closely to donor sites with reference to enviro-chemical and biological parameters are chosen as recipient sites. Fragments of suitable coral species are extracted from donor sites. These fragments are transported to recipient sites immediately after extraction. During transportation, the fragments are kept in small tubs filled with sea water which is kept aerated and temperature and PH is monitored till the fragments are transplanted at the recipient sites. Before transplantation, a substrate is necessary for corals to grow on. For this purpose, concrete frames constructed out of ferro-cement are submerged at the sites. For transplantation, a small coral fragment is tied on to a small cement slab with ropes. The slabs are then placed upon concrete frames that have been submerged earlier with support from the local fisher communities. This area is then periodically monitored for coral growth, alignment of frames and slabs, algal growths and other physio-chemical parameters. Any unwanted growths or debris are removed to ensure optimal coral growth.



In Sindhudurg district of Maharashtra, Suganthi Devadason Marine Research Institute, Tuticorin (SDMRI) in partnership with Bombay Natural History Society, Mumbai (BNHS) has taken up coral restoration with funding support through GOI-UNDP-GEF Sindhudurg project. SDMRI and BNHS researchers have found an area in the core zone of Malvan Marine Sanctuary near Sindhudurg fort to be a suitable donor site with 29% hard coral cover. In a baseline survey, they identified 13 species of hard corals at MMS, but during one of the subsequent surveys in December 2015 massive bleaching was observed at donor site which was attributed to rise in temperature due to El Nino event.

Although 12 of the species were found to be badly affected, coral assemblages of *Turbinaria spp* were found least damaged during this bleaching event. This tolerance of *Turbinaria spp* to environmental conditions prompted researchers to choose it as candidate coral species for transplantation. Two recipient sites were chosen off the coast of village Dandi in Malvan taluka which showed optimum physio-chemical and biological parameters. At these sites total of 125 concrete frames for coral transplantation of approximately 1m X 1m X 0.25m in size were deployed during December 2015. Coral fragments from donor sites were further divided to ~8 cm in size



Picture 1: Bleached coral. Above-average sea temperatures caused by global warming have been identified as a leading cause for coral bleaching worldwide

to be tied on small cement slabs (25 cm X 25 cm). A total of 50 such slabs with coral fragments were placed on 5 submerged concrete frames. Total area covered for coral rehabilitation was 0.25 km². Regular monitoring is being carried out on the deployed modules to check on health of deployed corals. Transplanted coral fragments have shown 100% survival rate and also have embedded into the cement slab which indicates growth.

Challenges

Though such effort is commendable such measures have few limitations. One major limitation is capacity of donor site. Transplantation of living corals requires extracting fragments from existing corals ; hence a smaller coral site can only donate few fragments without getting degraded itself.

In the case of Sindhudurg, a sudden bleaching was reported which affected 12 species severely than *Turbinaria spp.* Another factor affecting the rehabilitation of corals is recruitment of corals at the recipient sites. Corals are slow growing and depending on species it takes one complete year for corals to grow just by 2 to 10 inches. In existing natural ecosystems, corals and fishes are interdependent.

A healthy coral reef system has Epilithic Algal Matrix (EAM) which contains protein rich detritus. It is an important food source for herbivorous and detritivores fish. Assemblage of herbivorous and detritivorous fishes keeps algal growth in check creating optimal growth conditions for corals.

As per the current target, under the Sindhudurg Project, it is being planned to deploy 325 more concrete frames for coral transplantation at different locations in Vengurla along with 210 artificial reef modules.

During monitoring phase in Sindhudurg, coral transplantation plates were found covered in algal growth which had to be removed manually by SCUBA divers. Due to slow growth rate of corals, regular monitoring becomes labour intensive and costly task. To tackle this, SDMRI and BNHS have also deployed Artificial Reef structures at the sites in close vicinity of coral transplantation sites. Artificial reefs as can be seen above can provide shelter to reef fishes in absence of natural coral reefs and will help in holistically restoring coral reef ecosystem. Further these habitats can be used to develop underwater tourism and in turn reduce the tourism pressure which in the case of Sindhudurg is currently concentrated around the Sindhudurg Fort located on an island off Malvan coast.

Apart from these ecological issues affecting coral transplantations, another threat is from the local communities. Coral rich habitats are used by fishers traditionally for fishing and many of the suitable recipient sites lay in traditional fishing zones. In recent years, the communities have also started making use of these reefs for marine underwater tourism and the same has grown exponentially, perhaps beyond physical carrying capacity of the area. Hence it becomes

important to involve community in the planning process and ensuring their awareness regarding issues and necessity for coral transplantation.

Overcoming the challenges

In Sindhudurg this was achieved through constant dialogue with community. The communities were actively involved during selection of suitable deployment sites devoid of active fishing areas, labour oriented deployment of modules and subsequent monitoring.

Even though these challenges exist, coral transplantation is one of the best techniques currently available to restore degrading coral reefs. As per the current target, SDMRI and BNHS plan to deploy 325 more concrete frames for coral transplantation at different locations in Vengurla along with 210 artificial reef modules. To ensure the protection to existing coral assemblages along Maharashtra coast, Mangrove Cell of Maharashtra Forest Department and GOI-UNDP-GEF Sindhudurg project is also undertaking various allied activities through SCUBA diving training to local youth as an alternative livelihood to fishing in coral rich areas and providing safe anchorage points to reduce damage to corals due to boat anchors.

As we alluded earlier to Gerret Hardins tragedy of commons, and how everyone on the planet is partly and unknowingly responsible for destruction of corals, through community stewardship and with the help of emerging techniques such as coral transplantation in future reversing this trend is possible. 🐠

Module I: Coral transplantation

Coral transplantation: 0.25 sq.km

Module II: Artificial Reef

Artificial reef: 1 sq.km



USE OF SQUARE MESH NET IN TRAWLERS

By Paresh Khanolkar and V R Madhu, CIFT

Fishing by its nature has the potential to reduce the abundance of target species, affect its age, size and structure, and even alter the trophic structure within marine ecosystems.

These adverse effects are further magnified because of the capture of non-target species, particularly juveniles of commercially important species, which form major catch in trawls. In this regard, Central Institute of Fisheries Technology (CIFT) carried out a programme, funded by the GoI-UNDP-GEF Sindhudurg Project. The aim of this programme was to generate awareness on the concept of Bycatch Reduction Devices (BRDs), to evaluate the efficacy of various bycatch reduction devices through field trials, suggest device(s) for sustainable fisheries, and build capacities in fabrication of BRDs. To implement the project, awareness programmes

Success of the square mesh net programme:

On the 16th of November, 2016, a meeting was called by the then Principal Secretary to the Hon'ble Chief Minister of Maharashtra, to discuss the various programmes in the Fisheries Sector with the Secretary, Fisheries. In the meeting it was decided to make the use of square mesh nets mandatory across Maharashtra. Towards implementing Phase II of the programme in Sindhudurg, the District Collector has sanctioned funds to the sum of INR 19 lakhs.



On 25 September 2015, the United Nations General Assembly adopted 17 SDGs for the next 15 years. Two of them resonate very closely with the management of bycatch. One is Goal 12.3, which states: "By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses." The other is Goal 14.2, which states: "By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans."

Courtesy: FAO

conducted with local boat owners and fishers community. This was an important step for the project as the boat owners who were willing to collaborate to undertake onboard trials for the various BRD nets were identified. Also, three locals (one per taluka) belonging to the fisher community who had experience in trawl fishing operations were selected as technical assistants. Hands-on training program was conducted for net makers to change the orientation of the diamond mesh net (traditional) to square mesh codends. Once the fishing season commenced, comparative field trials using square and diamond mesh codends at three sites viz; Devgad, Malvan and Vengurla were initiated.

The results indicate a greater probability of juveniles and sub-adult fishes escaping from the square mesh codend than the traditional mesh. The average escapement per haul from the square mesh codend was observed to be around 2 kg. This formed approximately 5% of the total weight of the catch with an average value of approximately Rs. 40

representing 1.5% of the total catch value. The juveniles of commercially important species such as squids, croakers, thread fin breams and scads in the size range of 3-9 cm escaped from the square mesh. Taking into account that the escapees comprise juveniles of commercially important species, the economic losses are negligible. Over time, the juveniles can grow to adult size and in turn breed and help in recruitment, wherein the ecological gain offsets the economic losses. One of the participating fishermen calculated the approximate fuel savings on using square mesh codend which works out to be around 5-6 liters per day of operation. Thus, adopting this technology is critical for sustaining fisheries.

Apart from the square mesh codend, demonstration and field trials of Juvenile Fish Excluder cum Shrimp Sorting Device (CIFT-JFE-SSD) and Semi-pelagic Trawl System (CIFT-SPTS) were also carried out along the three talukas of Sindhudurg District. Based on the encouraging results of the trials, all 317 trawlers adopted the use of square mesh codend. 🐟

PROMOTING SUSTAINABLE TOURISM

By Sneha Pillai, UNV Outreach and Monitoring Associate

The natural beauty of Sindhudurg, with its warm white sands, tranquil blue waters, coupled with a rich and ancient history housed in its monumental sea forts and heritage buildings has long attracted tourists from across the country and beyond. Such is the diversity of Sindhudurg that it offers a wide range of choices palatable to the young and the bold, the old and the wanderers. Acknowledging this potential of the district, Sindhudurg became the first district to be declared as a Tourism District.

However, with increasing tourist footfall, the expanding tourism sector poses a serious threat to the natural wealth of Sindhudurg. With a growing number of private entities investing in the tourism sector of Sindhudurg, there is the fear of an unregulated and unsustainable growth of the sector causing irreversible damage to the fragile ecosystem of Sindhudurg. Towards mitigating these risks, the Project has promoted programmes on sustainable tourism, which includes community-based eco-tourism, as an additional livelihood activity, with a view to provide avenues for revenue generation among the local communities, while encouraging them to support conservation efforts and protect the natural health of the Sindhudurg landscape and seascape.

Eco-tourism, according to the Ministry of Tourism of India, is "broadly defined as tourism which is ecologically sustainable. The concept of ecological sustainability subsumes the environmental carrying capacity of a given area." The promotion of eco-tourism also features as a major objective in the State Tourism Policy of Maharashtra. Considering the same and the increasing global approach towards eco-tourism, the Project looks forward to strengthening its efforts towards promotion of eco-tourism.

Snorkelling and scuba diving

Divers from across the world make a beeline for Sindhudurg to explore the seas of Sindhudurg, which is home to over 350 species of marine flora and fauna, including Whale Sharks, Olive Ridley turtles, corals and several ornamental fishes. However, given the fragile nature of the ecosystem, it is essential to ensure that all underwater tourism activities are carried out in a manner which is least intrusive. For this purpose, a Snorkelling Guide Training Programme was conducted to bring forth a professional outlook to this industry, which



would not just mean enhanced tourist safety, but also a sensitive approach towards dealing with the marine flora and fauna. On similar lines, a Scuba Diving Professional Training was undertaken by the Indian Institute of Scuba Diving and Aquatic Sports to train the youth and officials in PADI certified diving. It has generated employment opportunities for the youth. Furthermore, the trained individuals have also undertaken efforts towards removing ghost nets entangled in the rocks near Sindhudurg Fort. So far, ghost nets over 2 lakh square kilometer in length have been removed. They have also rescued several marine animals which get entangled in these nets, such as Olive Ridley turtles, crabs, lobsters, etc.

Mangrove eco-tourism



In view of the existing and potential threats to the mangrove ecosystem, there is an urgent need for an integrated approach towards conservation of mangroves, its associated diversity and the sustainable use of natural resources towards livelihood. Considering the increasing tourist footfall at Vengurla, the picturesque landscape and the potential for eco-tourism in the region, it was felt worthwhile to try out innovative eco-tourism models involving local communities. A proposal in this context was received from a women-SHG in Mandavi creek region near Vengurla Port. Through the programme, the SHG has been conducting mangrove safari for tourists,

focusing on generating awareness on its importance, including identification of major mangrove species and their conservation. The group has also expressed an interest in maintaining a mangrove nursery and conducting mangrove plantation, realising the importance of healthy mangroves in attracting more tourists. The programme has also encouraged women's participation in tourism-related activities as seen from the recently opened restaurant run by the women SHG. To further boost the programme, they have proposed the setting up of a museum dedicated to mangrove biodiversity in the vicinity.

Nature trails

Salim Ali Centre for Ornithology and Natural History (SACON) has assessed the status and distribution of Avifauna within the coastal talukas of Sindhudurg district. As an outcome of the study, around 296 bird species were recorded from the coastal talukas of Sindhudurg district. Of the 296 bird species, five are globally threatened species- Red-headed Vulture, White-rumped Vulture, Indian Vulture, Great Knot, Wolly-necked Stork. Rare winter records like Amur falcon, Eurasian roller and Common buzzard were also spotted. The study also recorded Greater Crested Terns and Roseate Tern on Vengurla Rocks during the breeding season. Around 46 White-bellied Sea



eagle nests were also recorded around the coast and monitored for nesting success estimation. Considering the rich avifaunal biodiversity and its significance, the Project has proposed the promotion of Nature Trails in Wadatar, Mithbav, Hadi, Vengurla and Karli villages in the three coastal talukas of Sindhudurg. A total of 67 local individuals have been trained in biodiversity interpretation along these trails and they will act as guides, enriching the experience of the tourists on the trails by explaining the biodiversity seen around the nature trail and importance of conserving biodiversity. They will also ensure that the tourists abide by strict guidelines laid down to ensure minimal interference of the ecosystem.

Green Rating of Bed and Breakfast Units



The expanding tourism sector in Sindhudurg has encouraged the local residents to set up Bed and Breakfast facilities for tourists, offering a taste of the district's rich culture. However, the hospitality industry, if left unmonitored, can have a very adverse impact on the natural ecosystem. It not only adds severe pressure on resources such as water and electricity, but also generates a larger share of solid waste, which is often poorly managed. Towards ensuring that the B&B units in Sindhudurg adopt a sustainable approach, the Project has drafted a Green Rating System for the B&Bs in Sindhudurg, the feasibility of which has been assessed by The Energy and

Resources Institute of India, the developers of the National green rating system, GRIHA (Green Rating for Integrated Habitat Assessment).

The Project has also sanctioned two proposals for supporting the Gram Panchayats of Hadi and Wadathar towards developing community-based eco-tourism models in the villages. 🐦

THE TURTLE CONSERVATIONIST OF SINDHUDURG



There is no denying the significant role that local communities play in conserving our ecosystems. The story of environmental conservation across the globe is replete with anecdotes of the tireless efforts initiated by individuals who did not succumb to all those who question, "How can you, a mere individual, change the world?"

Suhas Toraskar is one such individual, whose efforts have brought a radical change in the approach of the local community towards conservation of marine turtles, especially the Olive Ridley Turtle (*Lepidochelys olivacea*) along the Sindhudurg coast of Maharashtra. In an interview with Merwyn Fernandes, former Conservation Biologist of the GoI-UNDP-GEF Sindhudurg Project, Toraskar narrates his experiences in Olive Ridley conservation.

When did you start your focussed efforts towards conservation of Olive Ridley turtles?

It has been over 20 years since I have been working towards protecting Olive Ridley turtles and hopefully, I will be able to continue to work toward its conservation and protection as long as I live.



Toraskar examines the turtle hatchery. Turtle eggs are preyed upon by dogs and other predators. Inside the hatchery, they are well protected until they hatch. The hatchlings are then released into the sea.

What has kept you motivated all these years towards its conservation?

I have nurtured this curiosity towards learning about wild creatures since my early childhood days. When I was in the 10th grade, my efforts in creating a model zoo for the school science project was



appreciated and rewarded. This transcended over the years as a desire to work towards protecting wild species. Being raised in a fisher's community is not easy and life can be tough. Fishing, after all, is just another form of hunting and there are several other marine creatures which get caught as by-catch during fishing, especially turtles. Therefore, after returning from Mumbai in 1995, I took up the task of preserving the nest of the Olive Ridley species. Back then, the eggs and meat of turtle was being consumed within the local community and there was nothing being done. Hence, I decided to raise awareness regarding the conservation of marine turtles by adopting practices that would not harm them. I was encouraged to take this up on a larger scale, after all five hatchlings in my first nest survived and were successfully released into the sea.

How did you tackle these issues of poaching?

By the late 1990s, hunting for meat had drastically reduced perhaps due to the religious connotations associated with the species, but I continued to receive reports of turtle nests being poached and this would upset me. In my endeavour, I received immense support from relatives and friends who would inform me

about turtle nesting grounds/eggs and entanglement of turtles in fishing nets. At times when I was unable to be present at the desired location, I relied on my friends and family to release the hatchlings and till date, I continue to seek their support for information about these nest/eggs. Today, many of the locals from my village and nearby villages inform me on sighting a turtle nest/eggs and slowly, this network has grown and it continues to expand. An incident that gave a real impetus to my efforts was an article about my work which was published in the local daily; since then, everyone recognises me as the person behind conservation and protection of the species.

How effective has this endeavour been in creating awareness about the species and the turtle festival?

The festival was initiated a long time back, but it was only in the last five years that it was formally recognised and is celebrated as “turtle festival” which is also advertised in all the local dailies. This year I met approximately 500 people during the three day festival and there has been a steady increase of people with every passing year. Through the years, I have built a library of videos which is screened during the festival, followed by an interactive session where I answer questions from the crowd. It is very encouraging to see the active participation of government officials from various departments, especially the forest department.

What needs to be done immediately to conserve these species?

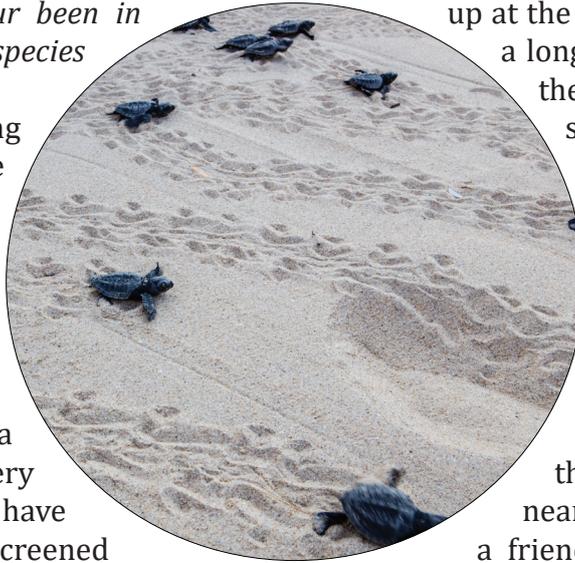
There are a few issues of immediate concern. One, there should be minimum lighting on the beach for turtles to come ashore to lay their eggs, as bright lights, especially during the night, may cause them to abort their eggs. Bright lights can also disorientate the hatchlings and prevent them from finding their way back to the sea. And two, there should be a check on the mesh size which are being operated, especially the gill and trawl nets which are problematic as turtles get entangled within them. A compensation scheme for nets being destroyed to release entangled turtles should be made available, for which guidelines need to be prepared.

What is the role of the community in further strengthening the conservation efforts?

Presently, the reporting of nestlings has

been streamlined due to the efforts undertaken in the last three years by UNDP and the Forest Department. However, since the forest department pays compensation as daily wages for those undertaking the responsibility of protecting the nest, everyone wants to be a part of it mostly for the money; however, without any proper training this might be quite deleterious. Also, the thought of conservation should come from within oneself, therefore, it is a request that instead of compensation, a small gesture of tokenism must prevail. Failure to do so should result in some form of punitive measures. I also feel that this activity can be linked to the village level Biodiversity Management Committee which is currently being set

up at the Gram Panchayat level as it will go a long way in streamlining and making the community connect with the species.



What is the future for marine turtle conservation within the Sindhudurg region?

I may not be able to speak about entire Sindhudurg, but with respect to Waingani and Daboli, I think there will be an increase in the number of turtles utilising the near shore waters for nesting. Recently, a friend from Kelus came across many turtles in the near shore waters there. Most of our sites are free from disturbance; hence, we will get plenty of turtles nesting there. However, if in the near future, we do not develop and promote sustainable tourism practices, then it may endanger the life of these species as was observed in Malvan and Devbag, because of the unmonitored activities. 🐢

Olive Ridley Turtle Conservation in Sindhudurg:

Under the Sindhudurg project, turtle conservation activities have been undertaken with the support of government officials, local NGOs and community members. As a result of these efforts, the number of Olive Ridley nests protected and the number of hatchlings released into the sea have shown an upward trend with every passing year.

In the year 2012-13, when the Project first initiated its conservation efforts, 16 nesting sites were recorded, 36 nests protected and 1884 hatchlings released. In comparison, in the year 2015-16, 15 nesting sites were recorded, 49 nests protected and 3212 hatchlings released.

ABOUT THE PROJECT

One of the 11 ecologically and economically critical habitats identified along the Indian coast, the Sindhudurg Coastal and Marine Ecosystem (SCME) is home to mangroves, coral reefs, rocky shores, beaches, estuaries and mud flats, which in turn supports a rich biodiversity, including several critically endangered species. One of the 7 marine Protected Areas in India, the Malvan Marine Sanctuary, also lies at the heart of the SCME. However, an expanding tourism sector and the lack of awareness about the significance of this biodiversity brought forth discernible destruction in the last decade. The existing institutional arrangement in the SCME as found to be inadequate in addressing these issues from a landscape perspective.

It is against this backdrop that the GoI-UNDP-GEF Project on Mainstreaming Coastal and Marine Biodiversity Conservation in Production Sectors in Sindhudurg Coast, Maharashtra was designed. The Project has initiated several programmes to address the degradation of the coastal and marine environment caused by the fisheries, tourism and agriculture sector. The Project has demonstrated a three-pronged approach towards mainstreaming biodiversity conservation in these production sectors. One - through the preparation of sector-wise plans, mapping of critically vulnerable sites, and assessment of the biodiversity and baseline estimates wherever needed. This has facilitated a better adoption of biodiversity conservation strategies by the line departments, as visible from the several policy changes made in the last few years.

Two - through capacity building and awareness generation of local communities and government officials in sustainable fishing, tourism, and agricultural practices, including introduction of new activities and encouraging adoption of sustainable practices in existing activities.

Three - through promotion of livelihood practices that emphasise on the need for healthy ecosystems, such as mangrove crab farming, mangrove safari, oyster and mussel culture in creeks, eco-tourism, integrated multi-trophic aquaculture (as opposed to the polluting practices of monoculture), and paddy cultivation through the System of Rice Intensification technique (a climate friendly technique which lays lesser pressure on resources than traditional paddy cultivation practices). The ecological and economic benefits of these livelihood practices have been acknowledged widely, and the line departments have mainstreamed most of the activities under Government schemes for upscaling.

