

# Biodiversity Action Plan

## For

### Malvan and Devgad Blocks, Sindhudurg District, Maharashtra

Prepared for  
Mangrove Cell, GoM



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## Abbreviations:

APL	Above Poverty Line
AR's	Artificial Reefs
ARFAD's	Artificial Reefs Fish Aggregating Devices
BDO	Block Development Officer
BPL	Below Poverty Line
CEO	Chief Executive Officer
CGWB	Central Ground Water Board
CIFT	Central Institute of Fisheries Technology
CMFRI	Central Marine Fisheries Research Institute
DAP	Diammonium Phosphate
DBT	Department of Biotechnology
DDT	Dichloro Diphenyl Trichloroethane
EPA	Entry Point Activity
ETS	Effluent Treatment System
FAD	Fish Aggregating Devices
FFAD	Floting Fish Aggregation Devices
FGD	Focused Group Discussion
FRP	Fibre-reinforced Plastic
GoM	Government of Maharashtra
HDPE	High Density Polyethylene
HV	High Value
IAY	Indira Awaas Yojna
ICAR	Indian Council of Agricultural Research
ICT	ICT Ltd.
IPM	Integrated Pest Management
IUCN	International Union of Conservation of Nature and Natural resources
JFM	Joint Forest Management
JNNSM	Jawaharlal Nehru National Solar Mission
KONBAC	Konkan Bamboo and Cane Development Centre
KVK	Krishi Vigyan Kendra
LPS	Low Pressure Sodium Vapor Lighting
LV	Low Value
MCX	Multi Commodity Exchange
MEDA	Maharashtra Energy Development Agency
MIDC	Maharashtra Industrial Development Corporation
MNREGA	Mahatma Gandhi National Rural Employment Gurantee Act
MoA	Ministry of Agriculture



APL	Above Poverty Line
MSAMB	Maharashtra State Agriculture Marketing Board
MTDC	Maharashtra Tourism Development Corporation
NABARD	National Bank for Agriculture and Rural Development
NBM	National Bamboo Mission
NCC	National Cadet Corps
NCDC	National Co-operative Development Corporation
NFDB	National Fisheries Development Board
NGO	Non-Governmental Organization
NIFPHATT	National Institute of Fisheries Post Harvest Technology and Training
NPK	Nitrogen Phosphorous Potassium
NPV	Net Present Value
NSS	National Service Scheme
OBC	Other Backward Classes
PFZ	Potential Fishing Zone
PRA	Participatory Rural Appraisal
PRA	Participatory Rural Appraisal
PVC	Poly Vinyl Chloride
R&D	Research and Development
RIDF	Rural Infrastructure Development Fund
RRA	Rapid Rural Appraisal
SC	Schedule Caste
SHG	Self Help Group
SNM	Sahyadri Nisarg Mitra
ST	Schedule Tribes
TED	Turtle Excluder Device
TERI	The Energy and Resources Institute
TTDC	Tarkarli Tourism Development Corporation
ZP	Zilla Parishad

## Executive Summary

A Participatory Rural Appraisal (PRA) exercise, to determine the impact of activities in coastal villages on marine biodiversity and assess the issues pertaining to rural development, was undertaken at 136 villages (78 villages of Malvan and 57 villages of Devgad block) in Sindhudurg district of Maharashtra. The study primarily focused on understanding the livelihood options of the local communities, the infrastructure gaps affecting the livelihood and the effect on coastal and marine biodiversity owing to usage of natural resources and anthropogenic activities. Secondly, the exercise also focused on identifying the key Entry Point Activities (EPA's), major infrastructure gaps, village level livelihood and human development needs. This would ultimately help in preparing micro-plans to minimize the impact on marine biodiversity and the Biodiversity Action Plans for the sustainable development of coastal villages.

The study revealed some important aspects about the major livelihood options of the villages in the study blocks. Agriculture is the major profession in both the blocks, with 90 percent of villages in Malvan and 80 percent in Devgad relying only upon agriculture either for self-consumption or for generating revenue. The second major source of livelihood is fishery with 10 percent of villages in Malvan and 20 percent in Devgad depending only upon fishery. Tourism is a major source of livelihood in 15 percent and 10 percent of villages in Malvan and Devgad blocks respectively.

Agriculture is primarily traditional with marginal mechanization. Farmers primarily cultivate paddy and mangoes. Rice is mainly cultivated for self-consumption. Mango is a major crop to sustain livelihood. Of the two, horticulture was identified the most harmful for the environment owing to the high use of pesticides and the fact that horticultural areas are established by clearing out natural forest patches. The survey highlighted use of pesticides beyond the prescribed dose to combat increasing pest infestation. Fragmentation and small land holdings, followed by non-implementation of watershed management projects, heavy pest infestation on mango trees and crop raiding by monkeys are the major constraints affecting agriculture.

Fishermen continue to use traditional methods. They, however, earn less for their catch because of lower yield. Only seven villages in Malvan and ten villages in Devgad blocks practice mechanized fishing. During the focussed group discussions and transect walk, fisher folk repeatedly emphasized that competition with fishermen from other states, especially from Goa, Gujarat and Kerala is a bigger threat to local fishermen. Rampani, cast-net (Shendi- a local name), gill net, hook and gull methods are the major traditional methods of fishing. Lack of basic infrastructure, decrease in fish species and catch size, use of unpermitted mesh-size nets, overfishing, fishing by outside state trawlers, bottom trawling, fishing during annual banned period, increased fuel price and chain of middlemen affecting local economics were identified as the major constraints.

Although Sindhudurg district has been identified as a major tourism district in Maharashtra in 1997, tourism is still regarded a sunrise sector and a recent revenue generation option. Tourism has taken to the forerun as the major source of livelihood in nine and six villages in Malvan and Devgad respectively out of total 134 villages covered under this study. In several villages, tourism has not picked pace because of lack of basic infrastructure such as roads and sanitation, government rules and regulations, unplanned tourism activities and

lack of waste management. These are the major compounding issues affecting the growth of tourism.

Researchers identified two kinds of ecosystems during the study. They have broadly classified as terrestrial and marine. Terrestrial ecosystem consists of all the habitats such as deciduous forests, basalt plateaus, grasslands, scrub and freshwater wetland ecosystems. Marine ecosystem consists of offshore ecosystems and coastal belts such as mangroves, mudflats, estuaries and seashores. Anthropogenic impact in terms of habitat destruction and fragmentation, deforestation, mono-culturing, competitive fishing practices such as bottom trawling and use of purse seine nets, use of unpermitted mesh-size fishing nets, fishing during breeding season in the sea as well as the creek, poaching of protected species, collection of sea-shells, lack of awareness and concern for conservation practices, increased artificial lighting along beaches and insufficient coast guard monitoring are affecting the biodiversity of the region.

The study revealed that the district has unique biodiversity resources in terms of marine species of fish, turtles, corals and so on. Local communities continue to use several medicinal plants for various purposes. Endangered species of birds and turtles are regularly visiting the coast for nesting and breeding. There is, however, a decrease in the frequency from the past 4-5 years, due to increased activities along the coast and deforestation. A systematic approach must be adopted and coherent efforts in collaboration with the local communities must be undertaken to preserve the rich biodiversity resources.

There is a need to create awareness about the resource potential and its sustainable utilization to build a harmonious balance with natural rhythms such as breeding cycles of fishes and flowering of horticultural species of commercial significance. Furthermore, the potential of the local produce and its processed products can be tapped to generate revenue opportunities for the farmers, fisher communities, women and especially the youth.

It is important to note that the local communities display exemplary traditional practices, which are extremely sensitive to natural rhythms. Urbanization, increasing tourism and growing population have, however, led to newer trends and practices in the region. For example, increasing use of plastics, disposable items, water bottles, shopping bags, excessive use of soap has resulted in eutrophication of water bodies and so on. Local administrative systems are not yet equipped to tackle the load of solid waste resulting in pollution of beaches, farms, water bodies, creeks and sea front.

This report draws its strength from surveying the 134 villages in Sindhudurg district and proposes a livelihood-generation and sustainable development-oriented biodiversity action plan for mainstreaming marine biodiversity in the major production sectors of Sindhudurg.

The recommendations included in the action plan take into account the local traditions, practices that are deeply integrated into the society and the newer trends and livelihood options, which are being rapidly internalized into the cultural aspects of the district.

Implementation of this action plan would pave way for a paradigm shift of the region towards sustainable development, ensuring conservation of biodiversity of the region as well as livelihood for the communities.

## 1. Sindhudurg: An Introduction

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Sindhudurg district is located in the Konkan region of Maharashtra state and covers a geographical area of 5087 sq. kms. Its geographical co-ordinates are 15.37 N to 16.40 N latitudes and 73.19 E to 74.18 E longitudes. The Arabian Sea surrounds the district in the west with a coastline of 121 kms while the states of Karnataka and Goa lie in the south. Ratnagiri district lies in the north and Sahyadri hill ranges lie in the east.

Table no. 1 describes the socio-economic and geographic attributes of the study blocks. As seen in table no. 1, the population of the district as per census, 2011<sup>1</sup> is 8,48,868. The population has almost remained the same or has slightly decreased in comparison with 8,69,000, the population as per census of 2001. The district comprises of five towns and 743 villages. Oras (Kudal) is its headquarters. It comprises of two revenue sub-divisions viz. Sawantwadi and Kankavali. The eight blocks of the district are Sawantwadi, Vengurla, Kudal, Kankavali, Malvan, Devgad, Dodamarg and Vaibhavwadi.<sup>2</sup>

Most villages in the district comprise of a number of hamlets (wadis), ranging from about one to twelve. Thus, the district is characterized by typically small and scattered habitation, which is also a feature of the entire Konkan region. The sex ratio is 1137 females per 1000 males, which is higher than the state average of 934, indicating a greater incidence of male migration. This also indicates a greater percentage of women-headed households in the rural areas. Scheduled castes form about five per cent of the total population. The population of scheduled tribes is less than one per cent. The economy of the district is mainly dependent on agriculture, horticulture and marine fisheries, which engages 73 per cent of the working population. The fishing techniques used in the region are predominantly traditional in the form of Rampani, Shendi, Gill net, Cast net and hook and gull methods. However, the trawler fishing technique is also increasing at few fish landing sites such as Talashil, Miryabanda, Makrebag, Dandi and Achare in Malvan as well as Mithmumbari, Taramumbari, Wadatar, Padavane and Vijaydurg in Devgad block.

The main food crop in this region is paddy. In the recent years, there has been an increase in productivity due to use of hybrid seeds, fertilizers and pesticides. The district is famous for its horticultural crops, namely cashew and mango. The total area of the district is approximately five lakh hectares, of which about 40 per cent area is under cultivation. Only about two per cent of the cultivated area is under irrigation by wells and river. In all, 61 per cent of the population are cultivators and only twelve per cent are agricultural labourers, the rest 17 per cent are engaged in other occupations, mainly fishery, mining and artisan work. Most of the farmers have small and fragmented land holding (locally called "Khachara") that are jointly owned by several family members which is the major reason for low income and constraint to follow mechanized agriculture. Unlike neighbouring districts, Sindhudurg lacks industries<sup>3</sup>.

For the present study, 136 villages were selected with 78 villages of Malvan block and 58 villages of Devgad block.

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<sup>1</sup> <http://www.census2011.co.in/district.php>

<sup>2</sup> [http://cgwb.gov.in/district\\_profile/maharashtra/sindhudurg.pdf](http://cgwb.gov.in/district_profile/maharashtra/sindhudurg.pdf).

<sup>3</sup> [http://www.prayaspune.org/reli/PUBLICATIONS\\_files/B\\_1\\_2.pdf](http://www.prayaspune.org/reli/PUBLICATIONS_files/B_1_2.pdf)

**Table No. 1: A brief introduction of the study blocks:**

Sr.No.	Attributes	Malvan	Devgad
1.	Geographical Co-ordinates	16.0565°N, 73.4688° E	16.3735° N, 73.3778° E
2.	Geographical area	61829 hectares	78127 hectares
3.	Population	111,807	120,909
4.	Sex ratio	1032.485	1051.461
5.	Literacy rate	83.52%	79.74%
6.	Major occupations	Agriculture, fishery and tourism hospitality	Agriculture, fishery and tourism hospitality
7.	Number of villages	135	97
8.	Major market places	Achare, Malvan	Devgad, Vijaydurg, Jamsande, Talebazar, Shirgaon, Padel.
9.	Fish landing sites	Talashil, Miryabanda, Makrebag, Dandi and Achare	Devgad, Mithmumbari, Taramumbari, Wadatar, Padavane and Vijaydurg

## 1.1 Climate and rainfall:

Being a coastal district, climate in Sindhudurg is generally moist and humid throughout the year with humidity normally ranging between 63 to 88%. This range of humidity favours the cultivation of fruit crops like Mango (*Mangifera indica*), cashew nut, jackfruit, kokum, jambhool, avala and so on. Climatic conditions are strongly influenced by its geographical features. The district falls under the 'Assured and High Rainfall zone'. Winter season ranges from December to February followed by summers spread across March to May. June to September witnesses the south-west monsoon while October and November constitute the post-monsoon season. There is not much fluctuation in the temperature. Along the coast, the maximum temperature rarely goes beyond 38°C but in the interiors, it touches 40 to 41°C. The average minimum temperature recorded is 16.3°C in January. The normal annual rainfall over the district varies from 2300 mm (Malvan) and about 3205 mm (Kudal).

## 1.2 Soil:

The district has mainly lateritic, coastal alluvial and salty land. Most of the region is covered by lateritic soil. Lateritic soil is rich in organic matter and consequently in nitrogen content. It contains high percentage of iron and aluminium oxide. This soil is good for paddy, groundnut and horticultural crops. Coastal alluvial soils are clay and loam. They have good fertility and support garden crops like coconut, areca-nut and so on. The coastal alluvial land is locally also known as khar or Khazanland.

## 1.3 Cropping Pattern:

The major occupation in both the blocks is agriculture (table no. 2) with rice i.e. paddy, finger millet (nachani) and horse gram (kulith) being major agricultural crops followed by

groundnut, cow pea and black lentil. Rabi crops are grown only in few villages with perennial water availability. Mangos, cashew, kokum, coconut and areca-nut are the preferred horticulture crops. The gross sown area under agriculture in Sindhudurg district is 1, 59,000 hectares<sup>4</sup>. It is interesting to note that the area under horticulture crops is more than the total area under agricultural crops. Paddy is the main food grain crop. Out of the total area under agriculture, 91 percent is used for Kharif crops and 31.7 percent is used for Rabi crops.

Groundnut is grown on 4.2 percent of the total area of agricultural land. Other food grains grown include finger millet (nachni) (3.6 percent) and horse gram (kulith) (3.4 percent). About 80 percent of the paddy produced is for self-consumption. The remaining 20 percent of paddy is sold to local traders/ agents for further sale or use for 'poha-making' industry in Kolhapur and Belgaum. Groundnut as well as nachani is consumed by farmers themselves. Kulith is also processed in some proportion to make kulith pithi for sale<sup>5</sup>.

The horticultural plantations include Mango (*Mangifera indica*), cashew (*Anacardium occidentale*) and coconut (*Cocos nucifera*) grown for commercial reasons. In some parts of the blocks, betel nut (*Areca catechu*), kokum (*Garcinia indica*), jackfruit (*Artocarpus heterophyllus*) and jaam/ wax apple (*Syzygium spp*) grow naturally. Mango and cashew are major income generating source for most of the villages followed by marginal income from Kokum and areca cut. Coconut is consumed locally. Some fruits like jackfruit, conker berry i.e. Karavanda go waste due to lack of awareness regarding processing/harvesting techniques. The Devgad block is famous for its Alphanso mangoes. The economy of majority of villages here is largely dependent on mango production. The rocky barren owned land on hillocks is generally used for horticultural plantations of mango and cashew.<sup>6</sup>

**Table no. 2: Area, production and productivity of important commodities in Sindhudurg district, 2005**

Sr. No.	Name of the commodity	Area in hectare	Production. in metric tonnes	Productivity in kg/hectare
1.	Rice	74400	196862	2646
2.	Hose gram	3500	3434	1184
3.	Finger millet	2900	NA	NA
4.	Groundnut	3600	7952	2209
5.	Mango	19100	47616	2493
6.	Cashew nut	40000	43360	1084
7.	Coconut	9800	9.56 crore	65 nuts/ tree

## 1.4 Water resources and irrigation:

According to the ground water information report prepared by the Central Ground Water Board, Ministry of water resources, Government of India, the major sources of water in Sindhudurg comprise of rivers, lakes, tanks, ponds, dug wells, bore wells and other minor surface water sources. The net annual groundwater availability is around 100.30 MCM

<sup>4</sup> <http://www.districtsofindia.com/DataTable.aspx?hid=26290andsc=21anddc=2130andsd=0>

<sup>5</sup> [http://shodhganga.inflibnet.ac.in/jspui/bitstream/10603/2488/11/11\\_chapter%202.pdf](http://shodhganga.inflibnet.ac.in/jspui/bitstream/10603/2488/11/11_chapter%202.pdf)

<sup>6</sup> Strategic Research and Extension Plan of Sindhudurg District-Agricultural Technology Management Agency, Sindhudurg



(Million Cubic Meters)<sup>7</sup>. There are around 4868 dug wells, 20 bore wells, 351 tanks and ponds and 2874 minor surface water sources.

According to the district disaster management plan for Sindhudurg (2013-14) prepared by Government of Maharashtra (GoM), Waghota, Sukhnadi, Tillari, Karli, Gad and Terekhol are six major rivers in the district.

1. The Waghota river has a course of about 48 kms from Shivgad, which is protected by the Deogad promontory from the south.
2. Gad river flows in a south-westerly course from the Sahyadris and joins the sea 3 miles north of Malvan.
3. Karli River is also known as Sarambal in the upper reaches and as Karli only at its mouth.
4. Terekhol in its upper reaches is known as Banda river.

According to the report on “physio-socio-economic setting of the region” by Mr. R.B. Patil, 2011<sup>8</sup>, the basic feature of all these west-flowing rivers is that they flow in rainy season and are almost dry in summer. The basins in width, depth and length are short and not navigable<sup>9</sup>. Table no. 3 represents the area covered by the major river basins in the district.

**Table no. 3: River basin and availability of water resources in the district**

Sr. No.	River basin	Length of the river (kms).	Backwater (panlot) area	Availability of water resources in hectare.
1.	Waghota	95	903	140
2.	Devgad	70	455	59
3.	Achare	53	275	50
4.	Gad	84	890	154
5.	Karli	92	753	117
6.	Terekhol	69	621	118
7.	Tillari	53	530	255

Except for the large dam constructed on Tillari and Talamba dam on Karli River, there are no major irrigation projects in both Malvan and Devgad blocks. Farmers are dependent on few rivers and mainly wells. Moreover, most of the rivers are connected to creeks. Fresh water gets mixed with salt water, rendering it unfit for irrigation. Well irrigation is mainly restricted to the mango plantations on the hill slopes.<sup>10</sup> All other crops including cereals, pulses, oil seeds and vegetables are irrigated using canals. Though the number of wells in both the blocks has increased, most of these wells are used for domestic purpose. The topography and social situation has put several hurdles in the smooth implementation of the watershed based soil and water conservation activities. The undulating topography, steep slopes, high rainfall and heavy runoff, hard lateritic rock, lack of soil on up-land plains, narrow valleys, limitations on size of catchments and inaccessible areas are some of the geographical factors that make it difficult for the existing government machinery to carry out the watershed activities. The major irrigation projects in Sindhudurg are presented below in table no. 4.

<sup>7</sup> Paranjpe S. C. (Nagpur, 2009). Ground water information, Sindhudurg District, Maharashtra. Report published by Central Ground Water Board, Ministry of Water Resources, Government of India. [http://cgwb.gov.in/district\\_profile/maharashtra/sindhudurg.pdf](http://cgwb.gov.in/district_profile/maharashtra/sindhudurg.pdf)

<sup>8</sup> [http://shodhganga.inflibnet.ac.in/bitstream/10603/2488/1/11\\_chapter%202.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/2488/1/11_chapter%202.pdf)

<sup>9</sup> [http://shodhganga.inflibnet.ac.in/bitstream/10603/2488/1/11\\_chapter%202.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/2488/1/11_chapter%202.pdf)

<sup>10</sup> [http://www.prayasapune.org/reli/PUBLICATIONS\\_files/B\\_1\\_2.pdf](http://www.prayasapune.org/reli/PUBLICATIONS_files/B_1_2.pdf)



Table No. 4: Small irrigation projects and their respective capacity in the district <sup>11</sup>

Sr. no.	Name of the project	Irrigation capacity in hectare	Actual use of irrigation in hectare
1	Madkhol	180	70
2	Adeli	104	22
3	Pavshi	97	79
4	Vapholi	104	38
5	Shirval	200	60
6	Pulas	73	08
7	Chorgewadi	210	54
8	Talewadi	184	58
9	Nileli	100	47
10	Oros	180	18
11	Chafeli	68	22

## 1.5 Forest ecology:

The total forest area is covered by tropical wet evergreen, tropical semi-evergreen and south Indian tropical moist deciduous type of forests. Further, the area is divided in forests having laterite red soil and forests with sandy loams. About 38600 hectares of area is under forest. The lower slopes, flat hill tops and terraces are either under cultivation or under some sort of degraded tree growth as 'Malki or Inam' lands<sup>12</sup>, while the treescape along the water bodies of the region consist of mainly teak, ain, kinjal, jamun, arjun, undil, jackfruit, cashews, mangoes, coconut and betelnut trees. The total forest area of Sindhudurg is 390 sq. kms. In the recent past, the trend of monoculture of fruit trees on privately-owned hill slopes has increased owing to economic benefits associated with it. However, it is severely affecting the ecological balance and food chain intermediates.<sup>13</sup>

According to the Disaster management report by GoM, the total built-up area accounts to 1.15 percent of the total whereas forest land (39,156 hectares) is 7.52 percent, waste land (2,48,000 hectares) is 47.63 percent and water bodies, rivers represent 9,544 hectares which is merely 1.83 percent of the total area.

<sup>12</sup>[http://shodhganga.inflibnet.ac.in/bitstream/10603/4339/8/08\\_chapter%202.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/4339/8/08_chapter%202.pdf)

<sup>13</sup>[http://faculty.washington.edu/hgwoelff/Evans%20UW\\_Request%2065\\_Enviro%20Impacts%20of%20Ag%20Technologies\\_03-17-2010.pdf](http://faculty.washington.edu/hgwoelff/Evans%20UW_Request%2065_Enviro%20Impacts%20of%20Ag%20Technologies_03-17-2010.pdf)

## 1.6 Villages selected for the study:

The villages selected for this study were mapped spatially using Google Earth software and illustrated in the images below for both Malvan and Devgad.

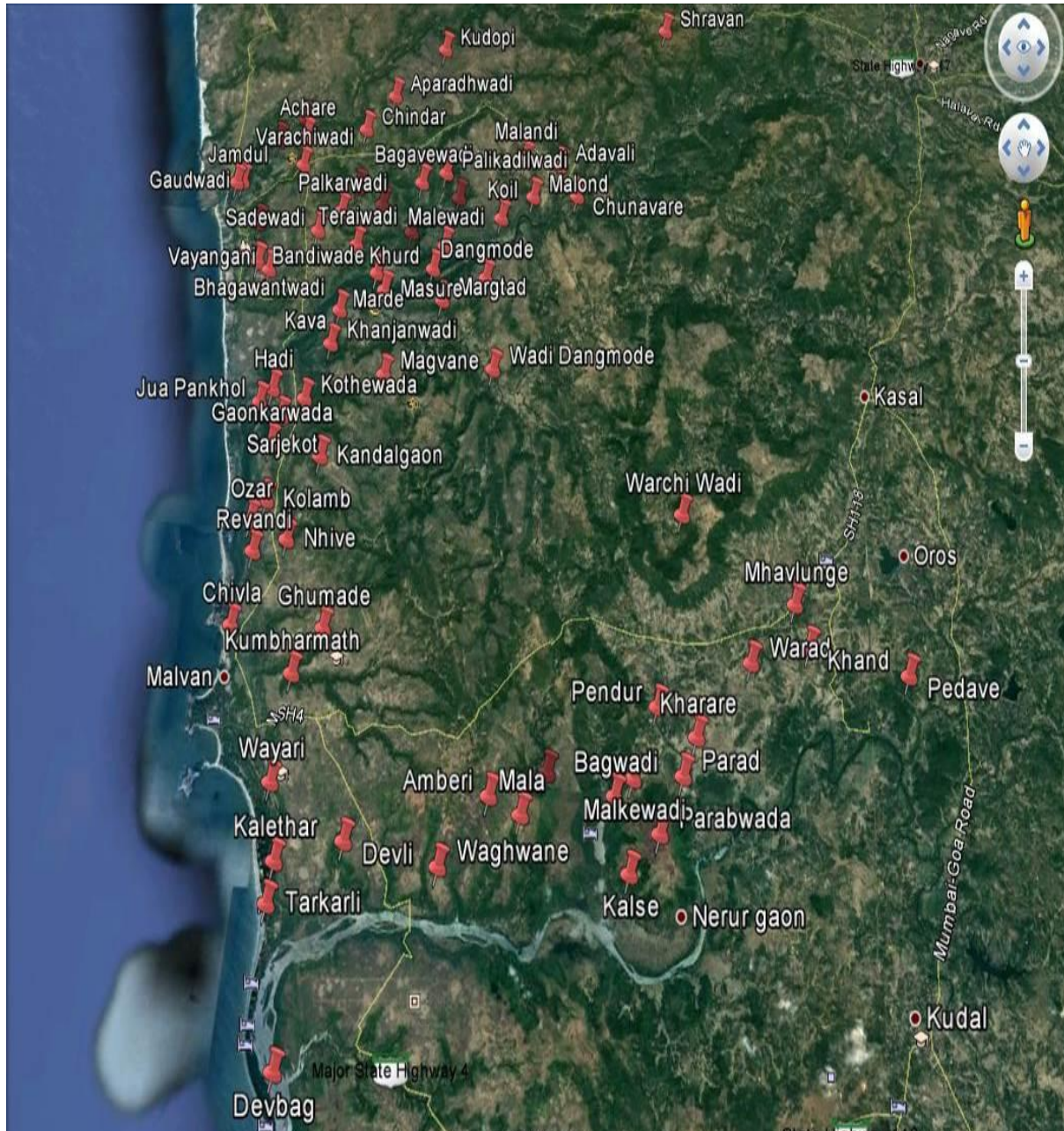


Image no. 1: Spatial map indicating study villages in Malvan

Developed by The Energy and Resources Institute (TERI)



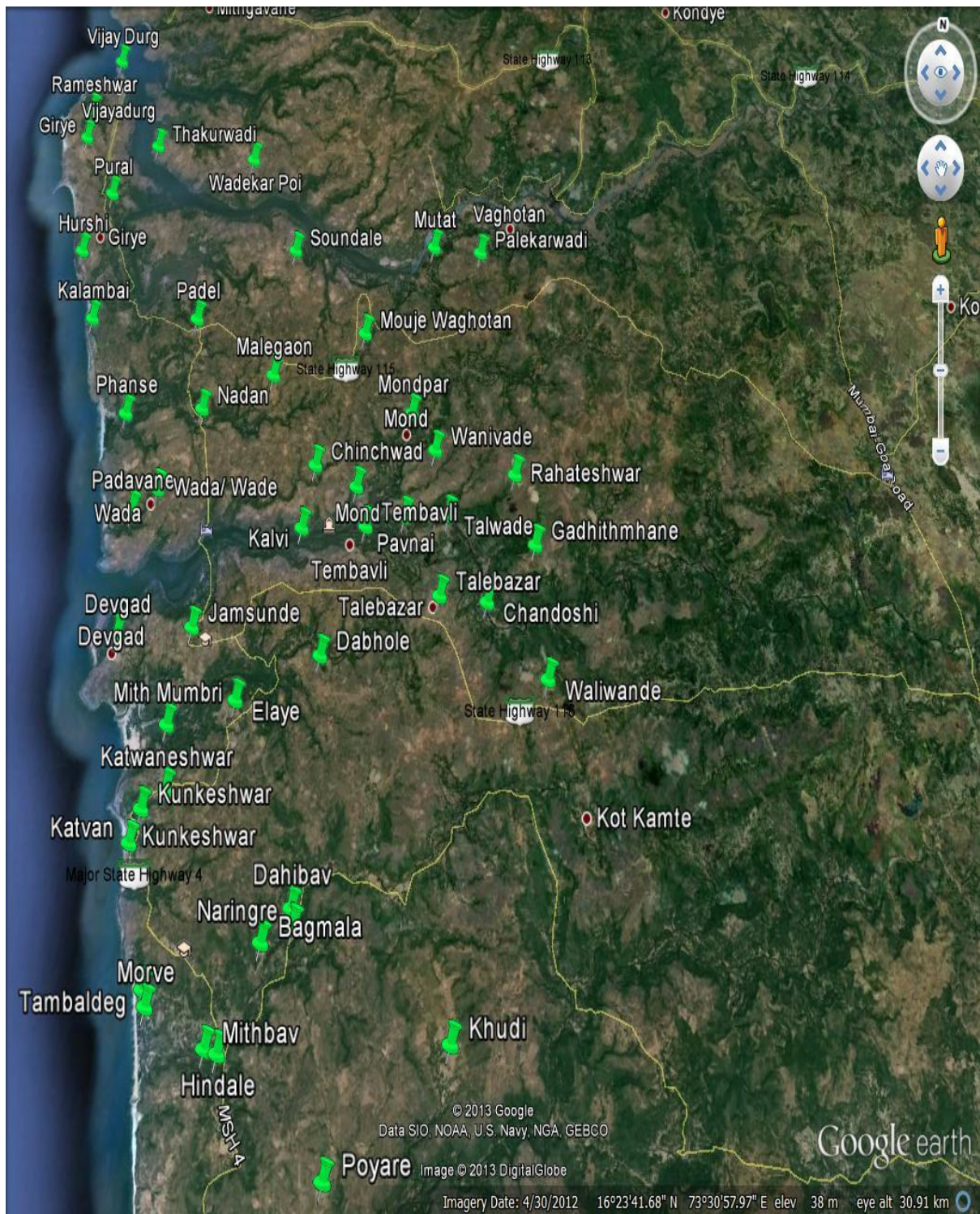


Image no. 2: Spatial map indicating study villages in Devgad

Developed by TERI

### 1.6.1 Villages with unique features in study blocks:

The Malvan block has few villages with unique features which are enlisted below in table no. 5.

**Table no. 5: Unique features of the villages in Malvan**

Sr. No.	Gram Panchayat (GP)	Village name	Unique features
1.	Achare	Jamdulwadi	Island ecology and highest number of white bellied sea-eagle nesting sites i.e. 4 were documented
2.	Amberi	Mala	Villagers reported that fresh water tortoises are seen occasionally at a stream of river
3.	Chindar	Aprajwadi	Ephemeral spring supplying water for domestic use
4.	Chindar	Chindar	Establishment of a co-operative dairy is proposed
5.	Chindar	Gavthanwadi	Large wetland providing domestic water
6.	Devbag	Devbag	Covered by sea from three sides, one of the most preferred tourist destinations
7.	Devli	Devli	2 big prawn farming units established by businessmen from Mumbai and Pune respectively
8.	Dhamapur	Dhamapur	Large wetland and reserved forest patch supplies domestic water to Malvan city, one of the few villages in Malvan with abundant water for irrigation
9.	Hadi	Hadi	Large mangrove patches
10.	Hadi	Juva Pankhol	Island ecology
11.	Kalse	Kalse	Agro-tourism has started recently. Sugarcane is an alternate crop. One of the few villages in Malvan with abundant water for irrigation
12.	Kalse	Malkewadi	Sugarcane is an alternate crop. One of the few villages in Malvan with abundant water for irrigation
13.	Kumbharmath	Ghumade	Agro tourism and spice garden
14.	Kumbharmath	Kumbharmath	Small scale poly-house farming of flowers and vegetables
15.	Masure	Khanjanwadi	Most severely affected village with salt water intrusion. Almost 70 to 80 percent agricultural land is "khazan land" in the recent past.
16.	Masure	Sayyad Juva	Island ecology

Sr. No.	Gram Panchayat (GP)	Village name	Unique features
17.	Revandi	Ozar	Old historic caves frequently visited by tourists
18.	Sarjekot Miryabanda	Sarjekot	A harbour and cold storage facility is under construction
19.	Talgaon	Khand	Covered by creek from three sides.
20.	Tarkarli	Tarkarli	Covered by sea from three sides, one of the most preferred tourist destination by tourists
21.	Tondavali	Tondavali	Fast developing tourist destination; Reserved <i>Casurina spp.</i> forest patch with white bellied sea-eagle nesting, preferred beach for nesting by Olive Ridley turtles. Exchange of rice or sugar for collected solid waste by rag pickers; A shell island is in the close vicinity of the village.
22.	Wayangani	Wayangani	Most preferred beach for nesting by Olive Ridley turtles
23.	Warad	Warad	A very big fresh water lake
24.	Wayri Bhootnath	Wayri	A private company purchases fish in bulk from local fishermen for export, which assures market for the locals

**Table no. 6: Unique features of the villages in Devgad**

Sr. No.	Gram Panchayat (GP)	Village name	Unique features
1.	Padavane	Padavane	Turtle and white bellied sea-eagles nesting site
2.	Pural	Pural	A large mangrove patch along beach with high potential to be developed as mangrove boardwalk site
3.	Katvan	Katvan	Dolphins sighted at Katvan beach at times
4.	Talebazar	Bagtalvade	A very large paddy wetland
5.	Devgad	Devgad	A major market place for all Devgad villages
6.	Jamsande	Jamsande	A major market place for all Devgad villages
7.	Nadan	Virwadi	2 islands in creek with mangrove vegetation and a colony of flying foxes
8.	Kunkeshwar	Kunkeshwar	Famous lord Shiva temple visited by many pilgrims throughout the year

Sr. No.	Gram Panchayat (GP)	Village name	Unique features
9.	Tambaldeg	Tambaldeg	Village solely dependent on fishery with no availability of agricultural land due to sand. It is also the most preferred beach for nesting by Olive Ridley turtles, known as one of the hotspots in terms of community-based marine turtle conservation centre.
10.	Waghotan	Mouje Waghotan Kasaba Waghotan	Heavy amount of quarrying in the past for construction activities
11.	Vijaydurg	Vijaydurg	Vijaydurg fort an attraction for many tourists
12.	Padel	Padel	A major market place near Vijaydurg for its nearby villages. A good intercropping pattern of horticultural crops and spice can be seen in the village.
13.	Rameshwar	Rameshwar	Village is famous for its temple.
14.	Hindale	Hindale Morave	Preferred nesting site by Olive Ridley turtles and important habitat for migratory birds.
15.	Wada	Wada	Vimleshwar temple is a famous spot in the village. It is also famous due to bat colony present in the temple.



## 2. Project overview:

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### 2.1 Aims and objectives of the study:

1. To document the issues pertaining to rural development of the coastal villages involving major infrastructure gaps affecting livelihood.
2. To determine present community livelihood options and natural resource use and identify ways to minimise those impacts by promoting sustainable community livelihood programmes.
3. Identification of the key EPA through Rapid Rural Appraisal (RRA) and identification of infrastructure gaps, livelihood and human development needs through conduct of Participatory Rural Appraisals (PRAs), resulting in preparation of micro plans (Biodiversity Action Plans) for the coastal villages.
4. To assess impacts of local communities on the biodiversity in order to identify the specific geographical, demographic and cultural impact of a village/ urban area on the coastal and marine biodiversity of the nearby landscape and seascape and to examine ways to minimize them while re-inforcing, perpetuating and replicating positive effects.
5. To assess and prepare Bio-diversity Action Plans, an exercise to make a rapid assessment of the most appropriate EPA through a participatory process. It is also an important step in the formulation of a village level “Biodiversity Action Plan” (BAP) of these coastal villages.

### 2.2 Approach and methodology:

The study was carried out in Malvan and Devgad blocks of Sindhudurg using **Participatory Rural Appraisal** (PRA) method. In all, 136 villages were selected for the study comprising 78 villages of Malvan and 58 villages of Devgad. The list of villages has been attached as **ANNEXURE-IX** and **ANNEXURE –X** with this report.

The PRA study involved different tools and techniques such as

- Semi-structured interviews
- Focussed group discussion
- List making
- Time line
- Ranking
- Organizational charts
- Seasonal calendar
- Flow diagrams
- Trend-lines

The overall methodology of the study was segregated in four stages (Figure no 1). The activities undertaken in each stage are also described below.



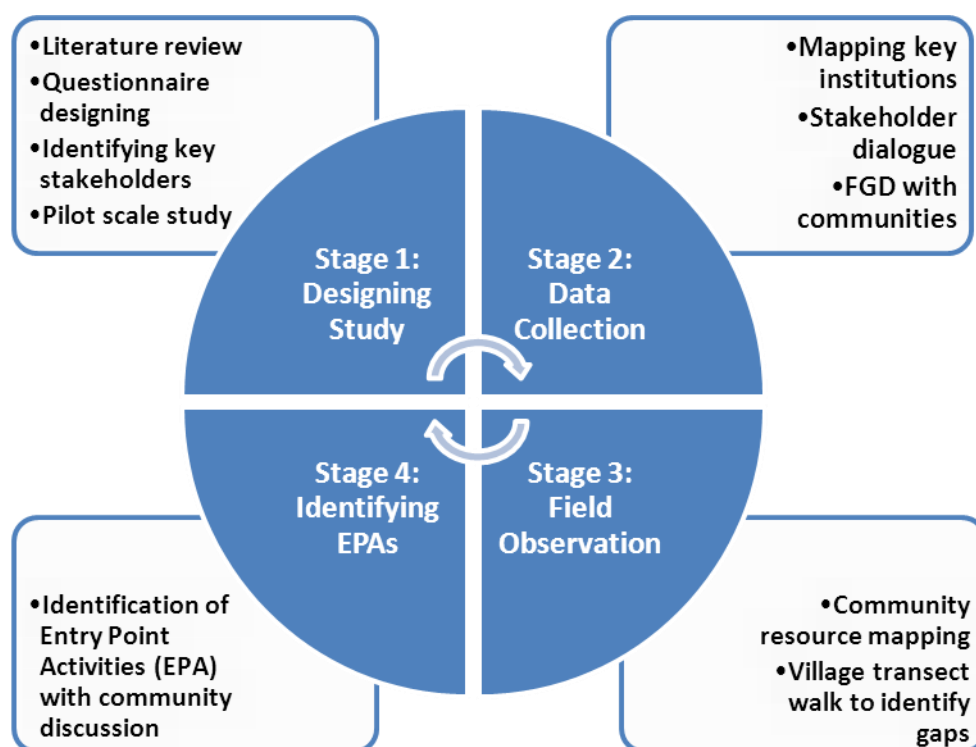


Figure no 1: Methodology of the PRA study

### 2.2.1 Stage 1 - Designing study

This stage included the following activities.

1. Intensive literature review was carried out to refine the approach for the PRA exercise
2. The questionnaires and biodiversity field books were designed and refined prior to the field study.
3. The key stakeholders were identified and primary contacts were established.
4. A pilot study was carried out in two villages of Malvan viz. Tondavali and Achare for fine tuning of the exercise as well as to acquaint the team with the field conditions.

### 2.2.2 Stage 2 - Data Collection

1. **Mapping of key institutes** - The key institutes in the region included government institutions, research and educational centres, special training centres for scuba diving and ornamental fish cultivation and Maharashtra Industrial Development Corporation (MIDC) areas. Self Help Group (SHGs) were identified and primary contacts were established.
2. **Stakeholder dialogue and Focused Group Discussion (FGD) with communities** - This process involved FGDs with different occupation groups and informal interviews with gram panchayat (GP) members, zilla parishad (ZP) members and key informants. As seen in picture no. 1, first-hand information was obtained by interacting with gram panchayat members such as sarpanch and other ward members of the village. Similar informal discussions were held with ZP members, wherever possible. The FGDs were conducted with different occupation members such as farmers, fishermen and people

serving tourism industry (picture no. 2). Formal interviews were held with SHGs at “Sindhu-Saras”, an event organised by a government body in Kudal to understand the issues and constraints affecting productivity of SHG’s (picture no. 4). TERI met government officials such as chief executive officer (C.E.O.), collector and block divisional officer (B.D.O) to get a broader perspective and assistance for the study. TERI also met representatives of educational institutions such as Krishi Vidyapeeth research station, SFURTI, Konkani Nisarg Manch, Krishi Vidyan Kendra (KVK) and private industries (e.g. food processing units, production units and so on) for market linkages such as Konkani bamboo and Cane Development Centre (KONBAC) (please refer picture no. 3).

### 3. Questionnaires, tables and charts: List making, time line, ranking and so on -

The questionnaires were designed for FGDs with all the major professions such as fishery, agriculture and tourism. A questionnaire for secondary data from GP and Talathi were also prepared and refined in the due course of study. The tables on various aspects were integrated in the questionnaires itself. Secondary data was collected from various departments including:

1. Nagar Parishad office
2. Agricultural department
3. Fisheries department
4. Tahsil office
5. Land records department of both Malvan and Devgad blocks and so on
6. Other necessary secondary data and reports were obtained from internet.



Picture no. 1: Discussion with GP members of Achare and fishermen of Wadatar



Picture no. 2: Visit to KONBAC bamboo processing unit, Kudal, Malvan



Picture no. 3: Discussions with SHGs at Sindhu Saras event, Kudal, Malvan



Picture no. 5: Resource mapping with villagers of Kolamb



Picture no. 5: Transect walk for mapping issues and biodiversity at Chander village, Malvan

#### 4. Diagrams: Organizational charts, seasonal calendar, flow diagrams and trend-lines -

The organizational charts, seasonal calendar, flow diagrams and trend-lines were integrated in the FGD questionnaires itself, wherever applicable.

### 2.2.3 Stage 3 - Field observation

#### **Spatial Analysis: Community Resource Mapping and Transect Walk -**

The spatial analysis tool was used in terms of preparing community resource maps with the help of villagers. A transect walk was carried out to assess visible impacts on the ecosystem and associated biodiversity in and around the village as well as to assess the intensity of issues and problems raised during FGD's (picture no. 5 and 8). The resource maps were prepared for almost all the villages with the help of the villagers. The respective maps for each village are attached with each village report.

- The fishery-related transect included visits to the fish landing sites to collect information about fish species, market value, type of marketing, types of boats, types of nets, mesh size and number of boats along the coast for fishing.
- The village level transect additionally documented nesting and roosting sites of endangered birds, breeding sites of turtles and possible anthropogenic impacts. The extent of handicrafts prepared with shells and other marine organisms sold into the market was also taken into consideration.
- The agriculture-related transect involved documenting the issues and key infrastructure gaps such as watershed infrastructure, intensity of monkey menace and other pest diseases of horticulture e.g. *Eryophite* mite infestation of coconut, Hopper and Thrips infestation of Mango and so on.

### 2.2.4 Stage 4 - Identification of EPA

#### **Identification of EPAs via discussion with communities**

Based on the entire exercise identification, possible EPA was done via discussion with villagers for each village and priority ranking for the same was assigned.

Priority-wise EPA's for Malvan and Devgad block are mentioned in annexure no. VIII (A) and VIII (B) respectively.



### 3. Livelihood options:

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The major source of livelihood for people residing in Malvan and Devgad is agriculture followed by fishery. Sindhudurg district has huge potential for fishery in view of the 121 kms coastline and 14 creeks. Tourism industry is booming in few villages having serene beaches such as Tondavali, Devbag, Tarkarli, Achare, Wayri and Sarjekot in Malvan and Vijaydurg, Kunkeshwar and Devgad in Devgad. Although agro tourism is a new concept for the region, it is picking up at few villages such as Kalse and Ghumade in Malvan and Vijaydurg and Padel in Devgad. Out of total working population, 61 percent are cultivators and 12 percent are agricultural labourers. The remaining 17 per cent are engaged in other occupations like fishery, mining and artisan work.

#### 3.1 Fishery

##### 3.1.1 An overview

Fishing in Malvan and Devgad is traditional but is increasingly becoming mechanized through use of fibre boats with outboard motor used for gillnet, hook-and-line and cast-net technique of fishing. Use of mechanised trawlers has noticeably increased in the recent years. Traditional methods of fishing include Rampani, Shendi and gill net. Both coastal and creek fishing is practised in Malvan and Devgad. In Malvan, 11 out of 78 and in Devgad, 16 out of 57 villages are fishery villages. Out of total fish catch of 1647 metric tonnes, around 90 percent is consumed locally in Sindhudurg district. There is one private processing unit at Tarkarli, which undertakes canning and salting of fish.

One more unit with modern technologies and export orientation is coming up at Kudal to process sea products. There is good scope for processing of low value fish catch, which goes as waste and is at many times thrown by fishermen back into sea. Small processing facilities upto 0.5 MT per day by a group of fish folk could be set up by investing about INR 4 lakh per unit at about 5 to 6 places in coastal blocks of Vengurla, Malvan and Devgad.<sup>14</sup>

The fishing season traditionally starts on “Narali-Pournima”, a festival of fishermen in August. The fishing season lasts for 9 to 10 months, barring monsoon (June 10 to August 15). Fishermen do not venture in to the sea during monsoon. The major fish landing sites in Malvan and Devgad are given below in table no. 7 and the major fishery villages in study blocks are given in table no. 8. The “Rampani”, gill net fishing, trawler fishing, purse seine fishing and trap method are the major fishing methods employed in the creeks in the region (picture no. 7, 8, 9, 10, 11 and 12).

The number of hours fishermen spend on each type of traditional method of fishing varies. They spend three to seven hours for Rampani, gill net, cast net and trap-net methods of fishing on an average whereas trawler fishing is practiced for 12 to 48 hours. The types of fishing and associated villages are given in table no. 9. Experts have observed that the number of hours spent in fishing and the number of attempts for fishing has been increasing steadily in the last few years. Fish catch has declined and expenses on overall fishing activity have increased. Fishermen either use nylon or traditional cotton nets commonly called as “Sava”. The minimum fishing net mesh size for coastal fishing is about 50 mm for coastal as well as creek fishing. For fish species in the study blocks, refer annexure VII.

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<sup>14</sup> [Potential Linked Credit Plan \(PLP\) 2008-09 Sindhudurg district Maharashtra.](#)

**Table no. 7: Major fish landing sites in Devgad and Malvan**

Sr. No.	Block name	Fish landing sites
1.	Devgad	Devgad, Mithmumbari, Taramumbari, Wadatar, Anandwadi, Padavane and Vijaydurg
2.	Malvan	Talashil, Miryabanda, Makrebag, Dandi and Achare

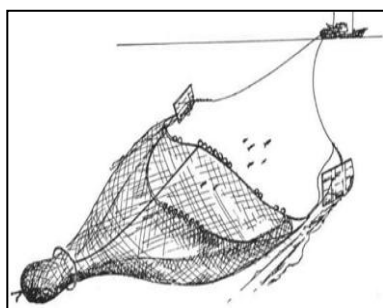
**Table no. 8: Major fishery villages in Devgad and Malvan**

Sr. No.	Block Name	Coastal fishery villages	Creek fishery villages
1.	Devgad	Devgad, Kunkeshwar, Katwaneshwar, Tambaldeg, Morbe, Mithmumbari, Wadatar, Padavane, Mithbav Katvan and Vijaydurg	Virwadi, Wadatar Chichwad, Dahibav, Mithbav, Mond, Girye, Tirlot, Thakurwadi, Munage, Jamsande and Rahateshwar.
2.	Malvan	Devbag, Tarkarli, Tondavali, Wayri-Bhoothnath, Wayangani, Malvan, Sarjekot, Kolamb and Achare.	Devbag, Tarkarli, Kolamb, Tondavali, Sarjekot, Achare, Revandi, SayyadJuva, Ozar, Jamdul, Kavawadi and Kalse.

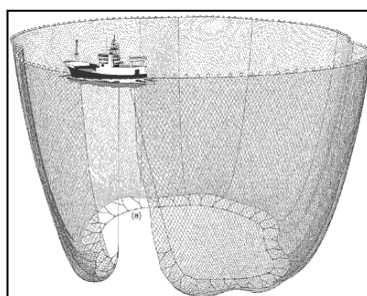
**Table no. 9 : Villages and type of fishing practices in Malvan and Devgad**

Sr. no.	Fishing type	Malvan villages	Devgad villages*
1.	Rampani	7	6
2.	Gill net	8	4
3.	Purse seine	3	3
4.	Trawler	7	8

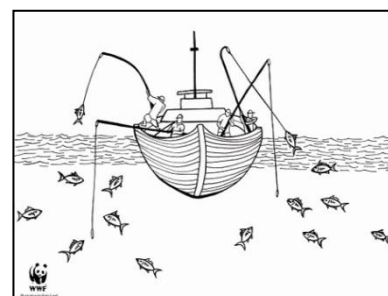
\*(Note: The number of villages considered is out of 78 villages for Malvan and out of 20 villages in Devgad, which are covered so far in the study.)



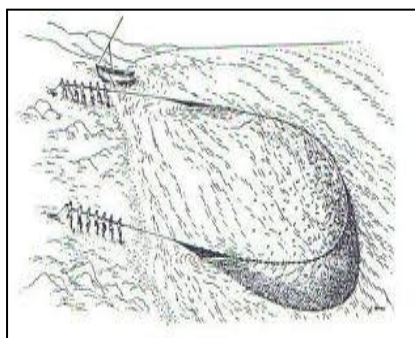
Picture no. 8: Trawler



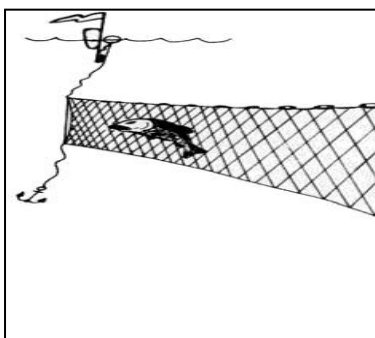
Picture no. 8: Purse seine net



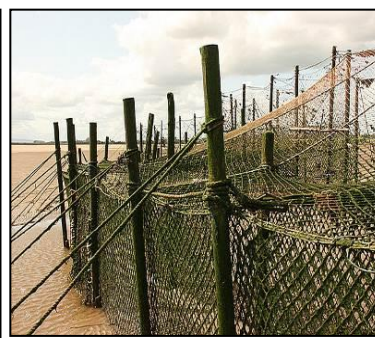
Picture no. 8: Fish and line



**Picture no. 11: Traditional Rampani**



**Picture no. 11: Gill net**



**Picture no. 11: Trap method**

### 3.1.2 Observations and trends

1. The fishermen complained of lack of basic infrastructure in terms of fully equipped jetty with cold storage facility and market for fish auctioning. The lack of marketing linkages is a major setback for the fishing industry.
2. Fishermen have observed a gradual decrease in fish catch and number of fish species locally like Indian salmon (Rawas), Jew fish (Ghol), pomphret, mussels, oysters, clams and so on.
3. Local fishermen are facing stiff competition from those using purse seine net and large trawlers. Fishermen from other states are exploiting the fish catch in this region resulting in drastic reduction in the fish catch, they complained.
4. Fishermen perceive their numbers have also increased drastically in the recent past. The FGD revealed that this profession is not limited to fishermen community alone. People capable of buying fishing infrastructure are also entering the profession.
5. Fishermen sell most of their catch to agents, the rates for which are pre-decided. They complained of poor returns since the input expenses have increased (picture no. 13 and 14).
6. The low value fishes are dried and salted along the beach and packaged in coconut zap i.e. local packaging material made up of dried coconut leaves, which is an eco-friendly and low cost packaging method used at most of the fish landing sites such as Makrebag, Malvan, Devgad and so on (picture no. 15 and 16).
7. Trawler vessels are insured but nets are not. Fishermen wish their nets are insured too.
8. Most of the fishermen understand the impacts and ill effects of purse seine fishing and bottom trawling but continue to follow the practice due to heavy investments incurred in the fishing vessels and low catch of fishes in the recent past.
9. There is a steady increase in the past years in the number of hours spent, expenses on overall fishing activity and the number of attempts for fishing and decrease in fish catch. Trawlers are spending, on an average, 12 hours to 72 hours at sea.





**Picture no. 13: Auction of fishes at market in Makrebag, Malvan**



**Picture no. 13: Fish market at Makrebag, Malvan**



**Picture no. 15: Salting of fishes at Malvan beach**



**Picture no. 15: Fish drying at Malvan beach**

10. Trend line analysis of mechanized versus non-mechanized fishing shows that the fish catch has declined over past five years drastically. Fishermen practising non-mechanized fishing with “Rampani” are severely affected. (Figure no. 3).<sup>15</sup>

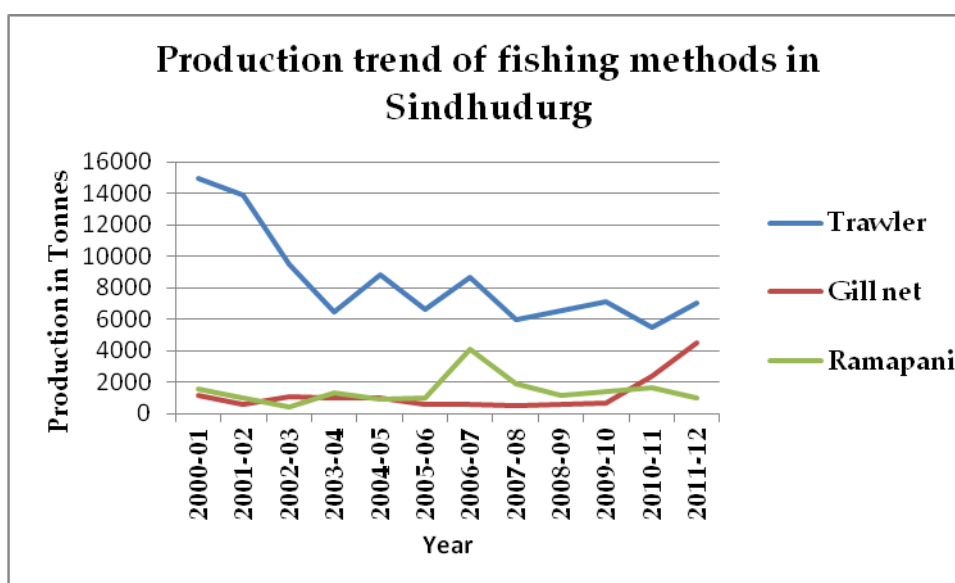


Figure no. 2: Trend of mechanized and non- mechanized fishery yield in the past five years

11. Trend-line year-wise analysis of gill net fishing versus number of fishing attempts shows that the catch size has increased from 2009 and number of fishing attempts has increased. After 2011, there is a sharp decline in catch size (Figure no 4)<sup>16</sup>.

<sup>15</sup> Source: Fishery Production Reports of Maharashtra state department of Fisheries for the years 2000-01, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09 and 2009-10

<sup>16</sup> Source: Fishery Production Reports of Maharashtra state department of Fisheries for the years 2000-01, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09 and 2009-10

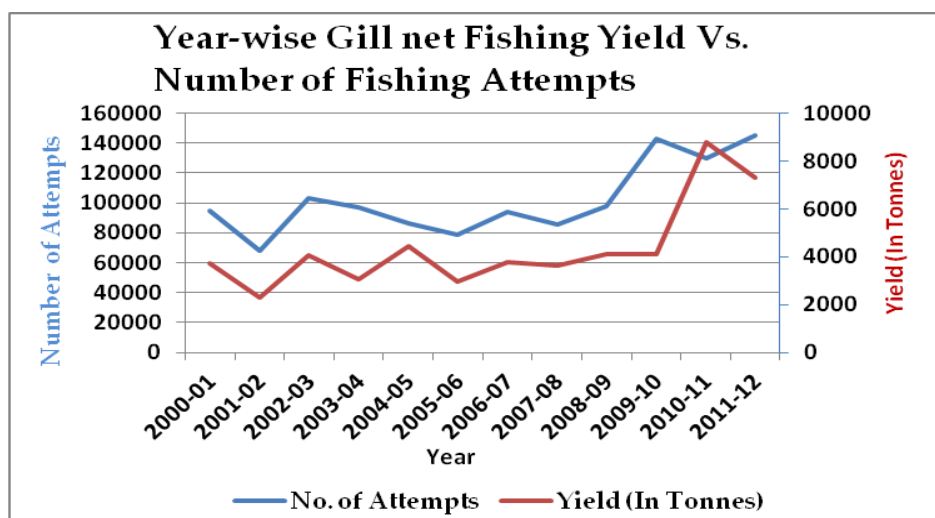


Figure no. 3: Year-wise gill net fishing yield vs. number of fishing attempts

12. Trend-line, year-wise analysis of “Rampani” fishing efficiency shows that total yield has declined steeply from 2007 onwards (Figure no. 5).<sup>17</sup>

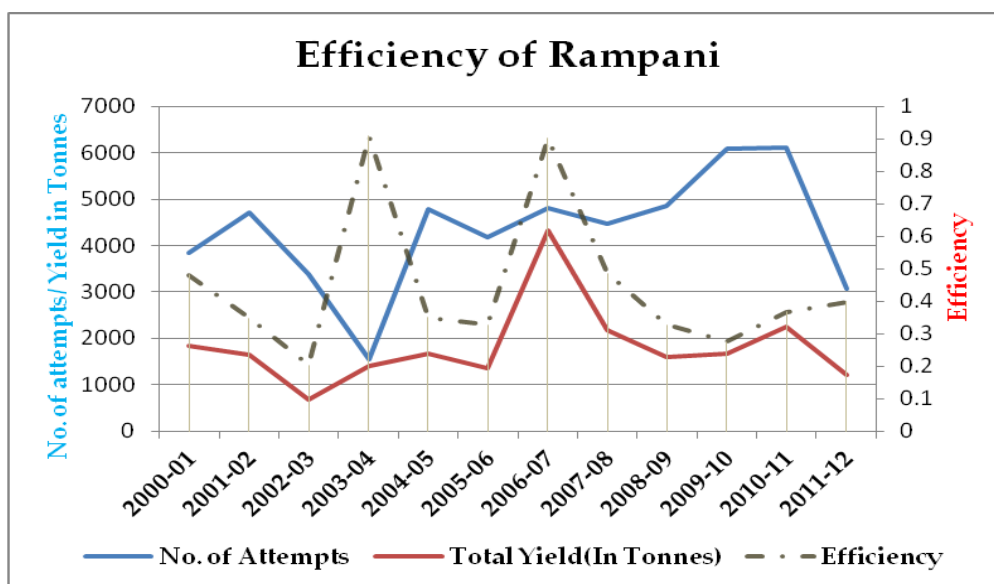


Figure no 4: Efficiency of Rampani

13. Trend-line analysis for year-wise fish production of five years from 2005 to 2009 for fishing zones in Maharashtra shows that the total fish production at Sindhudurg

<sup>17</sup> Source: Fishery Production Reports of Maharashtra state department of Fisheries for the years 2000-01, 2001-02, 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09 and 2009-10.

zone is lowest compared to all other zones in Maharashtra with Mumbai zone ranking first in terms of total fish production (Figure no. 5).<sup>18</sup>

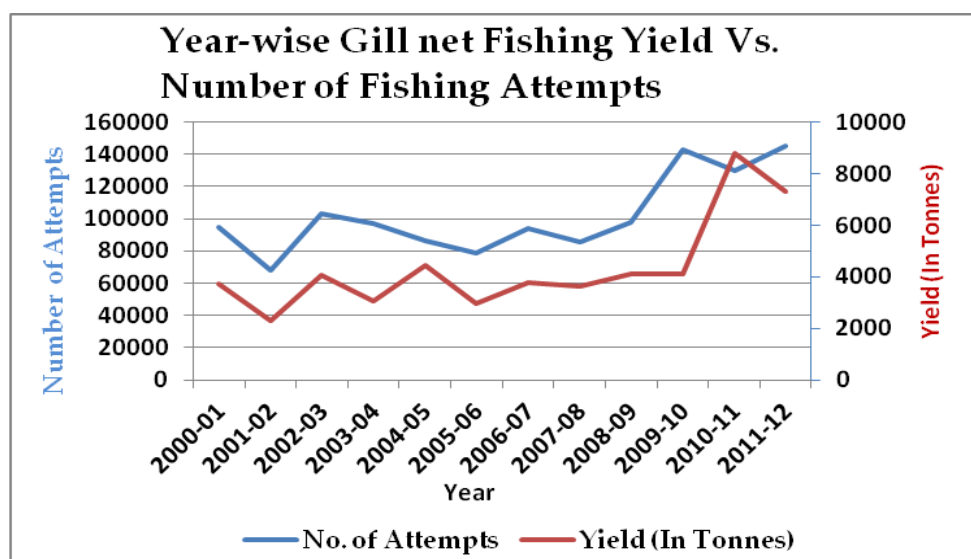
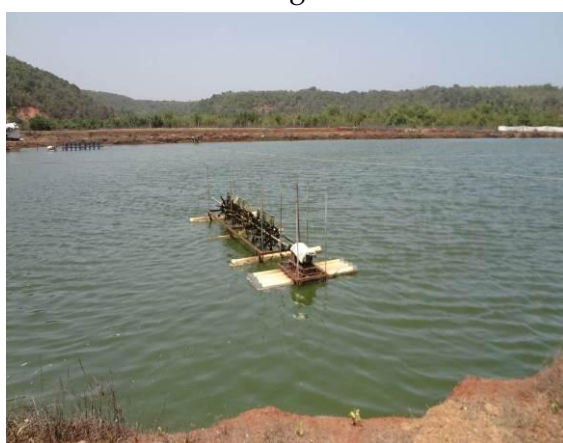


Figure no. 5: Year-wise fish production for fishing zones in Maharashtra

### 3.1.3 Estuarine/ Creek fishery:

1. Heavy siltation in all the major creeks is another important issue, especially for creek fishing as it is affecting boat traffic and causing decline in fish catch.
2. Fishing in creeks is active throughout the year. Fishing in creeks is at its peak during monsoon owing to high demand from hotel industry.
3. Fishermen sell most of their catch to agents, the rates for which are pre-decided. They complained of receiving poor returns since the input expenses pertaining to fishing net repairing, fuel, ice and transportation is higher.
4. Malvan and Devgad have few villages with high potential for edible oyster, clam, mussel and cage fish culture in creeks (Picture no. 17 and 18).



Picture no. 17: Prawn culture unit at Devli, Malvan



Picture no. 16: Trap method of fishing in Wadatar creek, Devgad

<sup>18</sup> [Source: Fishery Production Reports of Maharashtra state department of Fisheries for the years 2005-06, 2006-07, 2007-08, 2008-09 and 2009-10.](#)

### 3.1.4 Views of fishermen:

1. Traditional fishermen complained of severe competition from those practising mechanized fishing. Most agreed on the importance of preserving traditional fishery practices.
2. They expressed an urgent need to control trawlers from other states encroaching upon Maharashtra coastline.
3. They expressed a desire for cage culture of high value brackish water fish such as Indian whiting (Sula), Mangrove red snapper (Tamboshi) and shell fish such as oyster, clams and mussels to compliment their annual income.
4. Fishermen practising in creek area also expressed a need to assign definite creek areas amongst fishing families for shell fish culture to avoid conflict of interests.
5. They want the Fisheries Department of Maharashtra to complete the Anandwadi jetty project at Devgad on a priority basis. This will provide cold storage, bunkering facility and boat repair facility for the fishermen. Work on the project has stopped due to relocation issue of residents of Anandwadi hamlet.

### 3.1.5 Fishery sector issues and possible recommendations:

The important issues of fishery sector are mentioned below in table no. 9

Table no. 10: Fishery sector issues and possible recommendations

Sr. No.	Issues	Recommendations
1.	<b><u>Decline in fish catch and fish species:</u></b>  All fishery villages covered under PRA study complained of decline in fish species and fish catch owing to unregulated, rampant and illegal fishing by trawlers and purse seine net fishing method.	<b><u>Installation of artificial reefs/ Floating fish aggregating devices:</u></b> The NFDB provides funds for the same. The wastage of fuel and time in searching for fishing grounds can be avoided. Such habitats may also help to prevent the most destructive of fishing practices like bottom trawling. The unit cost for a structure is around Rs 2.5 lakhs. (For more details, please refer to the Entry Point Activities section of report).
2.	<b><u>Neighbouring state trawlers encroaching coastline for fishing:</u></b> Big trawlers from adjacent states such as Gujarat, Goa, Karnataka and Kerala overfish, even during monsoon.	<b><u>Effective monitoring, empowering the coast guard</u></b> Improve coast guard monitoring infrastructure and capacity building of coast guards for effective monitoring.
3.	<b><u>Lack of landing, berthing and bunkering facility:</u></b>  Most of the fishery villages complained of lack of basic infrastructure such as adequate landing and berthing facility for	<b><u>Construction of Jetty and cold storage</u></b> As per the order passed on August 26, 2009, the Fisheries Department of Maharashtra has proposed jetties at Wayri, Sarjekot, Makrebag, Nivati Medha, Tambaldeg and Vengurla in Sindhudurg district. The construction of jetty has started in Sarjekot but there is



Sr. No.	Issues	Recommendations
	boats.	<p>no development yet at other places.</p> <ul style="list-style-type: none"> <li>• A jetty at Sarjekot may suffice for adjacent villages such as Kolamb and Revandi. However, its capacity needs to be augmented accordingly.</li> <li>• A jetty is proposed at Devgad but work has stopped due to Anandwadi hamlet relocation issue.</li> <li>• Assistance may be sought from NFDB for infrastructure development and cold storage facilities at fishing harbours and landing centres.<sup>19</sup></li> </ul>
4.	<p><b>Lack of cold storage facilities:</b></p> <p>The cold storage facility is major constraint due to which fishermen have to sell their catch at lower price. Also most of the fish catch is injured in the nets at the time of fishing and therefore it perishes quickly resulting into loss to fishermen.</p>	<p><b>Ice factory and cold storage units to help reduce fish damage and prolong storage period:</b></p> <ul style="list-style-type: none"> <li>• Only one cold storage facility has been proposed by Fisheries Department of Maharashtra government at Sarjekot, Malvan. This is a major requirement of the majority of fishery villages, as reflected during FGD's.</li> <li>• This cold storage facility at Sarjekot may suffice for adjacent villages such as Kolamb, Revandi and Malvan. However, its capacity needs to be augmented accordingly.</li> </ul>
5.	<p><b>Increasing fuel charges:</b></p> <p>The major constraint discussed during FGD'S is increased fuel charges and low subsidy on fuel used for fishing boats. On an average, fishermen with small boats require around 600 litres of diesel per month and the larger boats require about 3700 litres per month.</p>	<p><b>Possible alternative energy options:</b></p> <ul style="list-style-type: none"> <li>• Bio-diesel could be an important alternative. In one study conducted by TERI, biodiesel directly blended with diesel in proportion of 5 to 15 percent gave excellent results without any need for alteration in the engines of trawlers and boats.<sup>20</sup></li> <li>• There is huge scope of establishing a plant for biodiesel production using fish waste in Sindhudurg. Experts have successfully used fish waste oil to produce biodiesel in countries like Honduras, Germany and Vietnam.<sup>21</sup></li> <li>• Karnataka State Biofuel Development Board has pioneered a pilot plant to extract bio diesel from sardine fish oil after separating Omega 3 fatty acid<sup>22,23</sup> in Karnataka using a German technology.</li> </ul>

<sup>19</sup><http://nfdp.ap.nic.in/pdf/6.Guidelines%20for%20Infrastructure%20for%20Post%20Harvest%20Processing.pdf>

<sup>20</sup>[http://www.teriin.org/index.php?option=com\\_ongoingandtask=about\\_projectandpcode=2006RT34](http://www.teriin.org/index.php?option=com_ongoingandtask=about_projectandpcode=2006RT34)

<sup>21</sup><http://aquaticbiofuel.files.wordpress.com/2008/12/fishwaste2.pdf>

<sup>22</sup><http://www.deccanherald.com/content/301801/bio-diesel-ethanol-pilot-plant.html>

Sr. No.	Issues	Recommendations
6.	<b><u>Unavailability of ice and ice-boxes:</u></b> This was one of the major issues raised by majority fishery villages.	Setting up of decentralized ice factories with the help of government subsidies.
7.	<b><u>Unavailability of market infrastructure for auction of fish:</u></b> Small, closed market infrastructure at major fish landing sites is the immediate need for both the study blocks.	NFDB assists in infrastructure development of market places for auction of fish catch. <sup>24</sup>
8.	<b><u>Lack of open market and chain of middlemen:</u></b> The fishermen have to rely on middlemen to get appropriate price for their fish catch. Most of the times, the price quoted is lesser than market price and fishermen have no choice but to sell the catch at the quoted price since fish is perishable. Establishing fair-trade linkages for fishery as well as processed food items produced by villagers is the need of the hour.	Establishment of forward linkages and exploring export potential.
9.	<b><u>Unavailability of loans and subsidies:</u></b> This was amongst the priority concerns raised by most fishing villages. Most of the government schemes related to fishery sector do not reach them, they complained. They did not get loans to buy fishing crafts and other items easily and most of the district level and nationalized banks ask for guarantee and follow stringent protocol.	<b><u>Provide loan and subsidy linkages:</u></b> <ul style="list-style-type: none"> <li>Fisheries department of Govt. Of Maharashtra is the nodal body in providing loans and schemes for fisheries. Sindhudurg District Co-operative Bank provides small funds. However, most of the fishermen are unaware of the funding agencies. So a workshop at block level could be organised with the help of these funding agencies to educate them about available government schemes and facilities.<sup>25</sup></li> <li>Other agencies include NFDB, National Co-operative Development Corporation (NCDC) and so on.<sup>26</sup></li> </ul>

<sup>23</sup>[http://collections.mun.ca/PDFs/theses/Jayasinghe\\_PunyamaThilomi.pdf](http://collections.mun.ca/PDFs/theses/Jayasinghe_PunyamaThilomi.pdf).

<sup>24</sup><http://nfdb.ap.nic.in/pdf/6.Guidelines%20for%20Infrastructure%20for%20Post%20Harvest%20Processing.pdf>

<sup>25</sup>[http://fisheries.maharashtra.gov.in/index.php?option=com\\_content&view=article&id=240&Itemid=60&ndlang=en](http://fisheries.maharashtra.gov.in/index.php?option=com_content&view=article&id=240&Itemid=60&ndlang=en)

<sup>26</sup> <http://nfdb.ap.nic.in/pdf/GL.pdf>

Sr. No.	Issues	Recommendations
10.	<p><b><u>Heavy siltation in the creeks:</u></b></p> <p>Almost all villages along major creeks in both Malvan and Devgad block have complained of heavy siltation in creeks affecting the fish catch and movement of boats.</p>	<ul style="list-style-type: none"> <li>Maharashtra maritime board carry out water survey as per graph of the creek/ports and make it available to the companies/persons needing it. Also, it carries out work such as excavation of the silt to make navigation smooth.<sup>27</sup></li> </ul>
11.	<p><b><u>Unavailability of common facility centre for processing of low-value fish:</u></b></p> <p>Majority of the catch is low value fishes, which are salted and dried on the beach itself under unhygienic conditions. This catch is regularly raided by infected dogs on the beaches. The dried fishes are then packaged in coconut zap i.e. local packaging material made up of dried coconut leaves. This is an eco-friendly and low-cost packaging method used at most of the fish landing sites. A low-value fish processing unit will help increase the income of fishermen.</p>	<p><b><u>Common facility centre for processing of low-value fish:</u></b></p> <ul style="list-style-type: none"> <li>Establish a centre for low-value fish processing, centrally located for a cluster of villages.</li> <li>National Institute of Fisheries Post Harvest Technology and Training, Ministry of Agriculture (NIFPHATT) conducts training on value addition, development of products, training for processing and refrigeration technicians and so on.<sup>6</sup> Specialized courses could be organized for training the stakeholders for low-value fish processing.</li> <li>The CIFT has also developed value-added products such as fish pickles, cutlets, fingers, papads and so on. It has also developed technologies for fish smoking, fish drying and equipment for deboning. It provides training and consultancy services in fishing, fish processing and so on.<sup>6,7</sup></li> </ul>
12.	<p><b><u>Fishing net damages due to puffer fish or natural calamities:</u></b></p> <p>Puffer fish, locally known as “Kent masa”, is a major menace as they damage nets during fishing. Fishermen also raised the issue of major losses incurred during natural calamities. Government compensation does not reach all fishermen due to stringent action protocol.</p>	<p><b><u>Providing Insurance for fishing net damage:</u></b></p> <ul style="list-style-type: none"> <li>Possibility of fishing net insurance could be tried out in collaboration with Maharashtra state fisheries department and insurance agencies.</li> </ul>
13.	<p><b><u>Fishing during annual banned period by few fishermen:</u></b></p>	<ul style="list-style-type: none"> <li>Creating awareness regarding the breeding season</li> </ul>

<sup>27</sup> <http://119.226.133.155/home/english/homedept/pdf/Citizen-maritime-charter-Eng.pdf>.



Sr. No.	Issues	Recommendations
	It was reported by fishing communities as well as by few key informants in the region that fishing practices are active even during annual banned fishing period by few fishermen in the region and at larger scale from outside-state large trawlers as and when weather permits.	of fishes and long-term significance of the ban during the breeding season. <ul style="list-style-type: none"> <li>Improve coast guard monitoring infrastructure and capacity building of coast guards for effective monitoring.</li> </ul>
14.	<b><u>Use of banned mesh size fishing nets:</u></b> The minimum mesh size of fishing nets, as recorded during transect walks at majority of fish landing sites, was less than what is mandated by government agencies.	<ul style="list-style-type: none"> <li>Restriction on net-manufacturing and net-trading companies and agencies. Similarly, restriction on sale of nets of banned mesh sizes. The permissible minimum mesh net size is 110 mm.</li> </ul>
15.	<b><u>Lack of awareness pertaining to endangered fishes, rules and acts.</u></b>  Most of the local fishermen are unaware about the protected coastal and marine flora and fauna in the region as well as rules and acts for the conservation of same.	<b><u>Training and Awareness</u></b>  <ul style="list-style-type: none"> <li>Awareness workshops and seminars need to be arranged giving information about importance of endangered fishes, rules and acts for conservation and ill effects of rampant unsustainable fishing should be organized at the village level.</li> </ul>
16.	<b><u>Lack of forward/ export linkages:</u></b>  The fishery villages also raised the issue that certain low value fishes such as Indian oil sardine locally called as “Tarli” have good economic value in other countries like Japan. One private company near Tarkarli in Malvan buy the fish catch at lower rate and export it to other countries fetching higher profit; however the local fishermen are deprived from getting their worth due to lack of forward linkages.	<b><u>Provide fish export linkages:</u></b>  <ul style="list-style-type: none"> <li>Establish a centre for possible export linkages of fishes having good market value abroad and buy fishes at a fixed affordable rate so that the fishermen’s reliance on middlemen for selling their fish catch will be lowered as well as the profit will increase.</li> </ul>
17.	<b><u>Weather Information Centre/ Weather alert system:</u></b>	<b><u>Weather Information Centre/ Weather gauge and Mobile advisory services</u></b>

Sr. No.	Issues	Recommendations
	The fishermen informed that there is requirement of effective weather alert system to inform fishermen about any future natural calamity for their security.	<ul style="list-style-type: none"> <li>Weather monitoring station located at Malvan provides weather related forecast and alert to most of the fishermen. Currently weather alert is provided by Sarjekot Panchkroshi Fisheries Co-operative Society Ltd., Malvan to fishermen members of the society via mobile.</li> <li>Toll free call centre to provide alerts based on latest information on weather could be established.<sup>9</sup></li> </ul>
18.	<p><b><u>Need of a fishery information centre:</u></b></p> <p>Fishermen expressed necessity for a fishery information centre for providing training of high tech Mari-culture and fish processing technology to increase their annual income and reduce the dependence on fishery.</p>	<p><b><u>Fishery information Centre:</u></b></p> <ul style="list-style-type: none"> <li>Establishing fishery information centre at Malvan and Devgad.</li> <li>Appropriate linkages with concerned Institutions could be established. For example, The CIFT undertakes training programme on sea food quality assurance, microbiological methods, value added products preparations, hygienic handling of fish, fabrication of nets and training on responsible fishing.<sup>7</sup></li> </ul>

#### 4.1.6 Fishery – Possible EPA's:

- Shrimp culture, clam, crab, mussel culture, ornamental fish culture (Marine) and open sea/ estuary cage fish culture:
  - The training workshop and bank assistance seminar on shrimp culture, clam/ edible oyster, crab, mussel culture and ornamental fish culture could be organised at village level. National Bank for Agriculture and Rural Development (NABARD) has several schemes for mari-culture techniques, which can be explored.<sup>28,29</sup> NFDB and NCDC also provides financial assistance for different mari-culture techniques.<sup>4</sup>
  - Central Marine Fisheries Research Institute (CMFRI) conducts training programme on marine fish cage culture and mari-culture of mussel, oysters, clams and shrimps, methods in marine fisheries and so on.<sup>4</sup>
- Installation of artificial reefs and floating fish aggregation devices. (for details refer section 7.3)

<sup>28</sup>[http://www.nabard.org/modelbankprojects/fish\\_paddycumfish.asp](http://www.nabard.org/modelbankprojects/fish_paddycumfish.asp)

<sup>4</sup>[http://www.nabard.org/modelbankprojects/fish\\_shrimp.asp](http://www.nabard.org/modelbankprojects/fish_shrimp.asp)

<sup>4</sup><http://www.cmfri.org.in/division/mariculture.html>

<sup>29,4</sup><http://nfdb.ap.nic.in/pdf/GL.pdf>.

## 3.2 Agriculture:

### 3.2.1 An overview

The agriculture is the most important profession in both Malvan and Devgad blocks. Out of the total 78 villages undertaken for PRA study in Malvan, 72 villages are dependent on agriculture primarily or secondarily whereas in Devgad 53 out of 57 villages covered so far are dependent on agriculture as primary or secondary source of livelihood. Agriculture is mostly traditional with little mechanization in form of use of power tillers. Farmers have not adopted mechanized farming due to small and fragmented land holdings. On an average, only 2-3 power tillers are present in villages to be used by villagers on hourly rent basis. Unplanned watershed management is the most important issue for the region. In most of the villages, irrigation is dependent on monsoon with very few villages having perennial water supply for agriculture.

#### Cropping pattern:

Kharif crops are mostly grown here. The main crops are rice and finger millet. Few crops like horse gram, black lentil (udid), wal, groundnut and pavata are planted after the monsoon season but that too mainly for self-consumption and not for commercial sale.

**Table no. 11: Area under cultivation of different crops in Sindhudurg district:**

Sr. no.	Type of crops	Area sown in hectares	Annual production in MTs
<b>Food grains:</b>			
1	Paddy	74400	217500
2	Horse gram	3500	2200
3	Finger millet	2900	3434
4	Groundnut	3600	7952
<b>Horticultural crops:</b>			
1	Mango	23283	62000
2	Cashew	40072	43400
3	Jamun	16000	3200
4	Coconut	9800	1440
5	Kokum	1200	12500

1. The cropping area of major agricultural crops is highest for paddy at 74,400 hectares, which is followed by groundnut at 3,600 hectares, then horse gram at 3,500 hectares and finger melle at 2,900 hectares. (Figure no. 6 and Table no. 10)

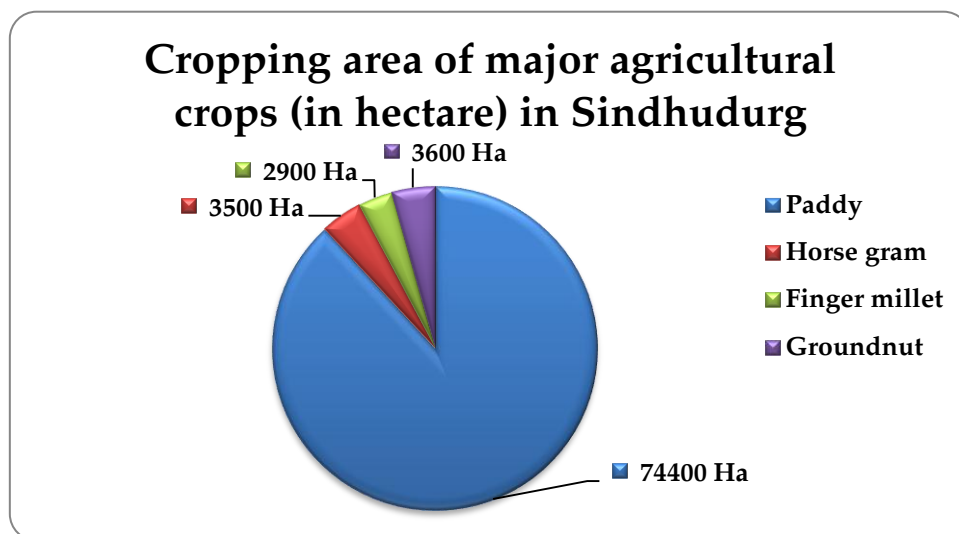


Figure no. 6: Cropping area of major agricultural crops (in hectares) in Sindhudurg

- The annual production trend of major agricultural crops shows that production of paddy is highest at 2,17,500 metric tonnes (MT) followed by groundnut 7952 MT, finger millet 3,434 MT and horse gram 2,200 MT. ( Figure no. 7 and Table no. 10)

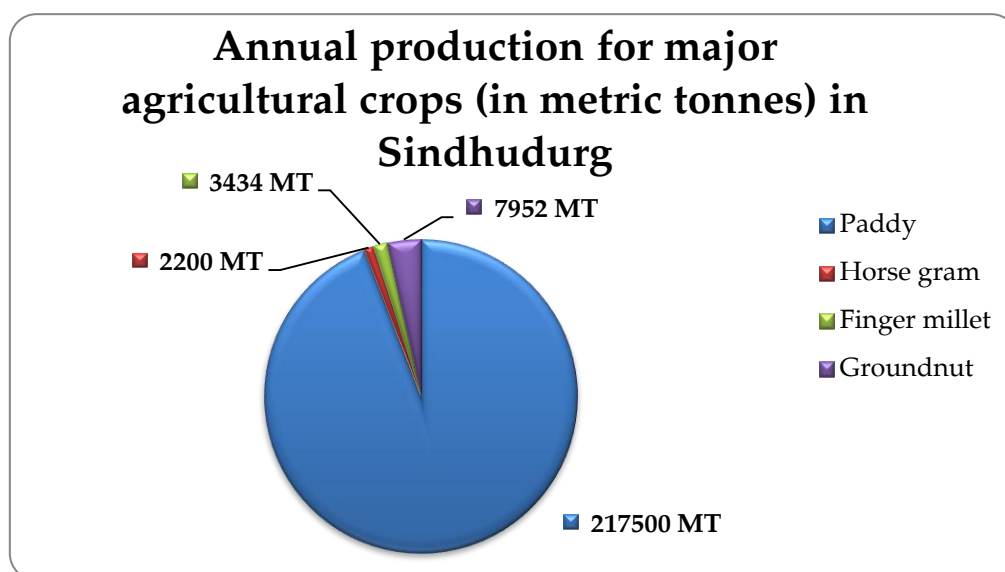


Figure no 7: Annual production for major agricultural crops (in metric tonnes) in Sindhudurg

- The cropping area of major horticultural crops is highest for cashew at 40,072 hectares followed by coconut 9,800 hectares, mango 2,383 hectares, jamun 1,600 hectares and kokum 1,200 hectares. (Figure no. 8 and Table no. 10)

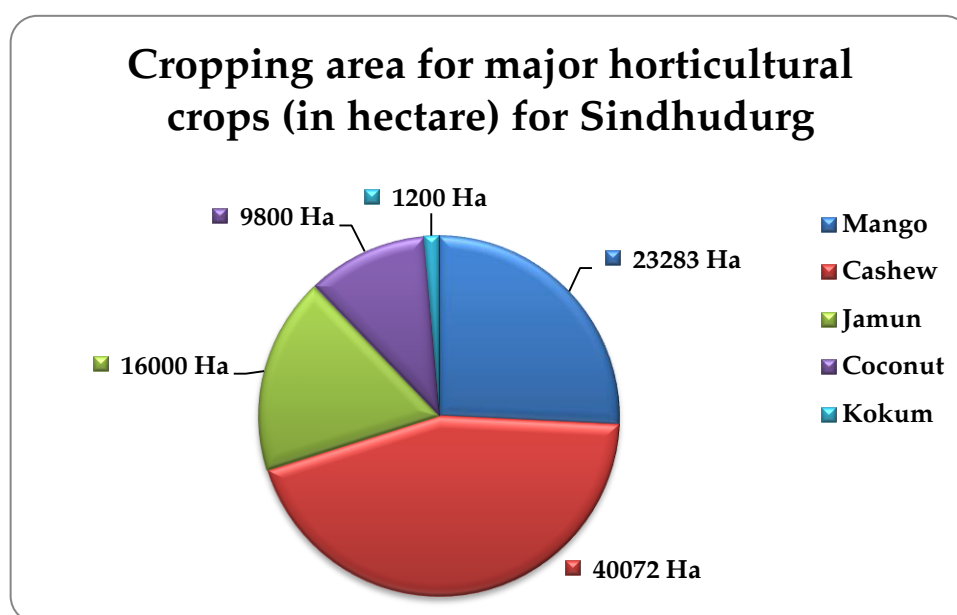


Figure no 8: Cropping area for major horticultural crops (in hectare) for Sindhudurg

- The annual production trend of major horticultural crops shows that production of mango is highest at 62000 MT followed by cashew nut at 43,400 MT, jamun at 3,200 MT and coconut at 1,400 MT. The annual production of coconut is low compared to other horticultural produce due to severe Eryophite mite and bumble bee infestation followed by langur raiding, which feast upon the coconuts when they are immature. (Figure no. 9 and Table no. 10)

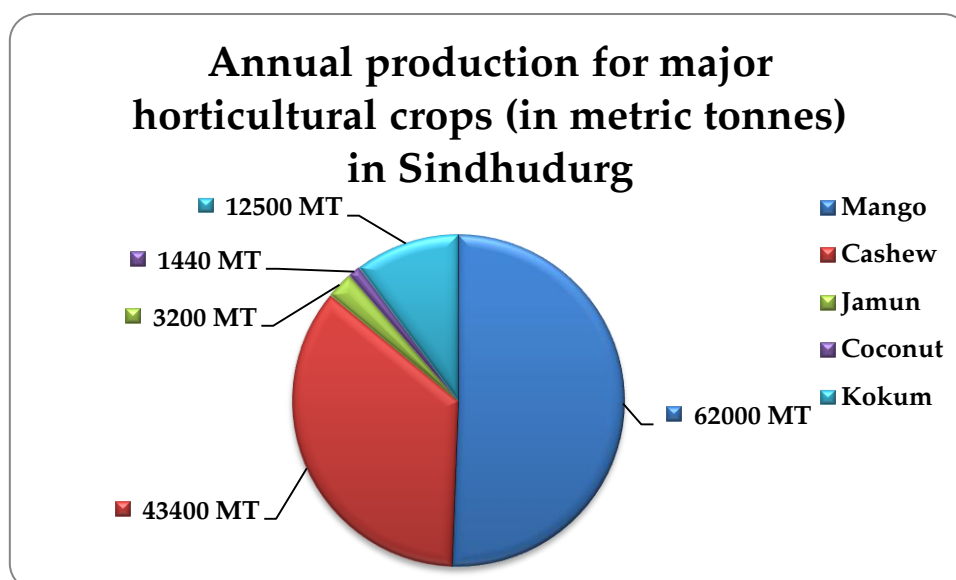


Figure no 9: Annual production of major horticultural crops in Sindhudurg

There are few newly-introduced commercial crops like sunflower, sugarcane (in few villages like Bandivade Budruk and Kalse), which are gaining high revenue from the livelihood point of view (Picture no. 19 and 21). Also, one of the farmers in Bandivade Budruk village



is cultivating *Jatropha* for biodiesel production (Picture no. 20) and a villager in Kumbharmath is successfully cultivating flowers and vegetables in small poly-house (Picture no. 22).

Horticultural crops grown commercially in Devgad include mango (*Mangifera indica*) and cashew (*Anacardium occidentale*). This is the main source of income for all the agriculture villages. In Malvan block, natural plantation consists of mango, cashew as well as betel nut (*Areca catechu*), kokum (*Garcinia indica*), jackfruit (*Artocarpus heterophyllus*) and jaam/ wax apple (*Syzygium spp*).



Picture no. 19: *Jatropha* plantation in Bandivade Budruk



Picture no. 18: Sugarcane in Kalse and Masure, Malvan



Picture no. 21: Poly-house farming in Kumbharmath



Picture no. 20: Sunflower plantation in Bandivade Budruk (Bk.), Malvan

### 3.2.2 Agriculture: Observations and trends

1. In both the blocks, land holdings of farmers are very small, fragmented and are jointly owned. Due to these fragmented land holdings, use of mechanization and new improved technologies in agriculture are not feasible at both the locations. As a result, agri-produce is marginal and only sufficient for self-consumption.



2. On the use of hybrid varieties, villagers held mixed views. Some believe that rice production increased due to shift from local to hybrid seed varieties whereas others feel that the nutrition value and soil quality is going down due to hybrid varieties.
3. The villagers of Devgad block informed that from past 5 to 6 years, the thrips and leaf hopper infestation on mango has increased severely and affected 40 percent of crop. The farmers are left with no other choice but to use heavy dose of chemical pesticides.
4. Agriculture Department of Govt. of Maharashtra is encouraging application of organic as well as chemical pesticides but farmers overuse chemicals.
5. Farmers are demanding research on thrips issue. Representatives of pesticide companies in Kolhapur and Sangli are aggressively marketing most of these pesticides. Due to this, farmers are using a variety of pesticides and pests are gaining resistance. Farmers fall prey to the assurance given by different companies for controlling thrips infestation but none are effective.
6. Thrips basically attack the inflorescence. As a result, the capacity of each tree to bear fruits has declined severely. Almost all farmers strongly feel some research at Krishi Vidyapeeth level should be done immediately to control the infestation and avoid associated economic losses.
7. Fertilizer and pesticide use depends mostly on the economic status of farmers. Most of the villagers in Malvan block can't afford organic as well as chemical fertilizer and hence they depend on the fertilizer provided by the Gram Panchayat. Fertilizer and pesticide use is higher in the Devgad block compared to Malvan block for horticulture varieties of crops (e.g. mango and cashew). The farmers reported annual expenses up to INR 1 lakh or more per acre are incurred to control to pest infestation. Also, most of the farmers do not know the composition or specifics of pesticides. Some of the gram panchayats like Hadi are promoting use of vermi-compost as fertilizer (Picture no. 23) but its usage in other areas was very minimal due to several reasons. Farmers are willing to follow practices of organic farming subject to easy availability and proven usefulness of bio-pesticides and microbial fertilizers.
8. Urea and single super phosphate are the two major fertilizers used in the study blocks. Their use has increased in the past few years (Figure no. 9).
9. Bamboo could be explored as a raw material for making packaging box for mango but villagers reported that due to lack of flexibility and heat, they are not using it.



Picture no. 22: Vermi-compost unit at Hadi

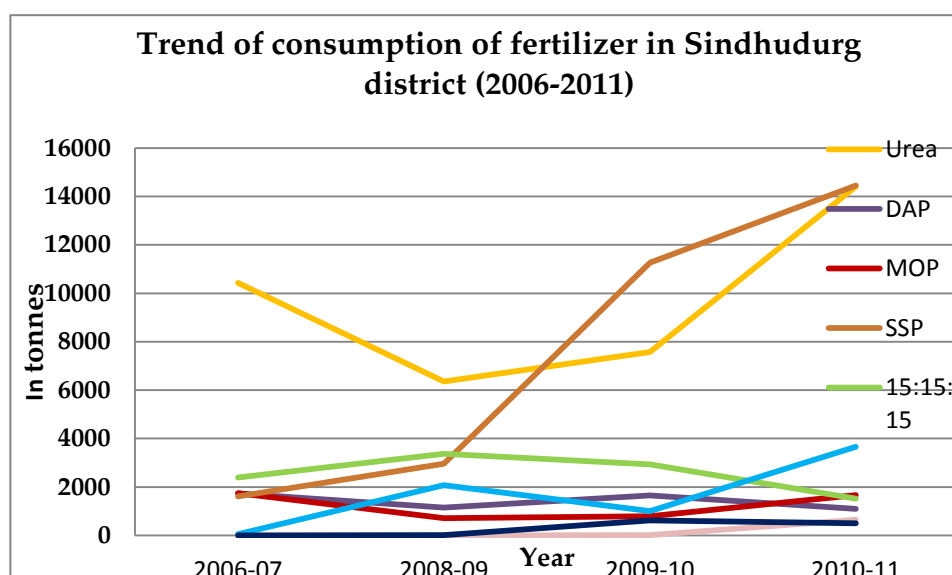


Figure no. 10: Trend of consumption of fertilizer in Sindhudurg district

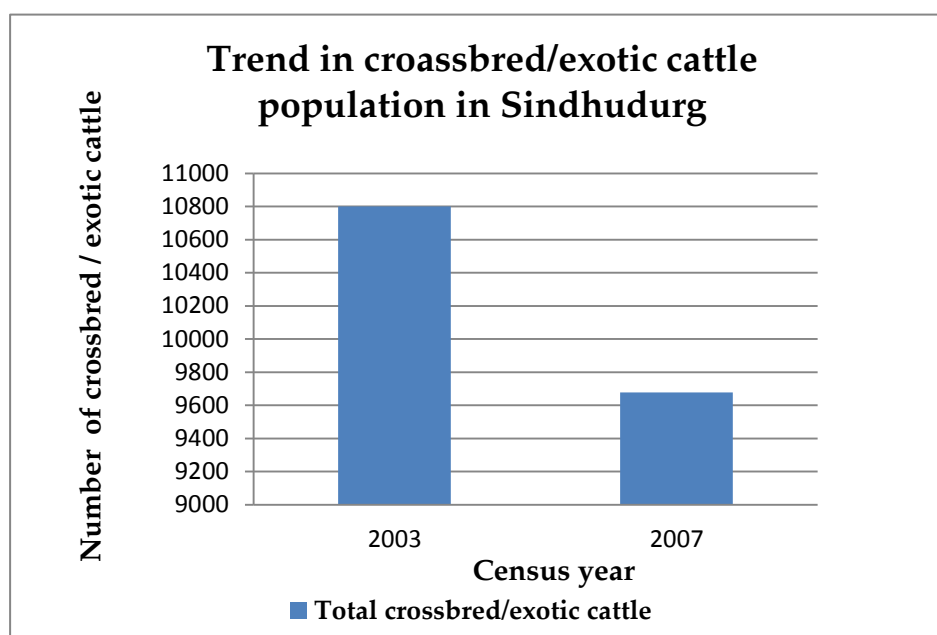


Figure no. 11: Trend in cross-bred/exotic cattle population in Sindhudurg

10. The total cattle (i.e. cross-bred/exotic) population shows a decline of 10 percent when the 2003 livestock census is compared with 2007 livestock census of Sindhudurg (Figure no. 11).

### 3.2.3 Agriculture sector issues and possible recommendations:

After the PRA study of more than 90 villages in Malvan and Devgad, few common issues were prevalent in both the districts, which are enlisted below with the possible recommendations for betterment of the situation. The issues are arranged in the priority order in table no. 12.

Table no. 12: Issues and possible recommendations

Issue	Recommendations
<p><b><u>Ranking-1: Unplanned Watershed Management</u></b></p> <ul style="list-style-type: none"> <li>Watershed basically means an area drained by a network of streams. Watershed management is the management of animals, land and water used to sustain people, while preserving natural resources and the environment.</li> <li>Poor watershed management is a prime issue of concern for the coastal areas of Sindhudurg. In spite of having very high groundwater table level and plenty of rainfall, water storage and conservation is improper. This leads to water scarcity mostly in summers, which is a hindrance</li> </ul>	<p><b><u>Recommendations:</u></b></p> <ul style="list-style-type: none"> <li>A micro-watershed plan and construction of check bunds can help address issues of water scarcity in most of the villages of Malvan and Devgad. However, watershed experts undertake ground survey for suitable locations.</li> <li>The Indo-German watershed development programme administered and managed by NABARD could be implemented for micro-watershed development.</li> <li>Use of drip irrigation is highly recommended. However, most of the farmers are marginal landholders and unaware of fund raising for the same, so the financial</li> </ul>

Issue	Recommendations
for agriculture in summers.	assistance should be provided by arranging a seminar on minor irrigation with the help of NABARD, Kudal branch, Sindhudurg.

### **Ranking 2: Severe monkey menace as potential crop raiders**

All the villagers of Malvan and Devgad raised the issue of monkeys raiding the fields, farms, settlements, vegetable plots and fruit blossoms which severely affects agriculture in the district.



**Picture no. 23: Monkeys raiding the crops**

### **Recommendations:**

- Farmers could try solar-powered monkey repeller instrument on an experimental basis. It works on the principle of ultrasonic radiation. Few Indian and Chinese companies are marketing it. It supposedly uses non-invasive ways to get rid of monkeys. Besides, it is said to be harmless to both humans and pets. The estimated cost for covering 5000 to 6000 sq ft area is around INR 14,800 (Please refer ANNEXURE No. XI).
- Agricultural solar fencing is one of the best methods for protection of crops and property from domestic and wild animal damages. It supplies a low amount of electric current, resulting in mild shock to those touching the fenced area. Fencing 5221 sq ft area of land would cost around INR 2, 46,200, according to a quotation obtained from vendors (Please refer ANNEXURE No. XII).
- Partial relief can be sought by restoring the natural habitat of monkeys in densely populated areas and improving their habitat by planting fruit-bearing trees such as native Indian fig (*Ficus auriculata*) in the forest area. This may decrease the conflict but may not be a permanent solution since monkeys tend to move back into areas where food is readily available.
- Responding to the calls of troubled farmers in Jammu, the government mooted several proposals including alternate cropping, re-location of monkeys and habitat improvement by planting fruit-bearing trees in forest areas and so on. It also tried establishing monkey castration centres and translocation of monkeys under the provisions of Wildlife Protection Act 1978 (amended up to 2002).
- Locals highlighted the need for alternate cropping pattern in summer. Few farmers in Malvan are growing crops like sunflower, which need less water and do not attract macaque and

Issue	Recommendations
<p>langur. The same can be explored for Kolamb.</p> <ul style="list-style-type: none"> <li>KVK Kirlos, Malvan is a government organization, which can help train farmers in alternate crop plantation techniques and marketing linkages.</li> </ul>	
<p><b>Ranking 3: Salt water intrusion (Picture no. 25)</b></p>  <p><b>Picture no. 24: Damage to agricultural land due to salt water intrusion and growth of mangroves</b></p>	<p><b>Recommendations:</b></p> <ul style="list-style-type: none"> <li>It was observed during the study that most of the agricultural villages along the creeks are severely affected by salt-water intrusion. Khanjanwadi village in Malvan is the worst-affected. They are severely affected due to the unavailability of check dams i.e. khar bandharas/bunds at appropriate locations and non-maintenance of the existing ones. During monsoon, salt-water intrusion is higher. This renders the fields near the creek unfit for cultivation. Also, mangroves grow rapidly in the area. This permanently changes the land use pattern. Many agricultural villages in Malvan block complained of increased mangrove encroachment in their agricultural fields due to salt water intrusion.</li> </ul>
<p><b>Ranking 4: Heavy pest infestation:</b></p> <p>Horticulture pests and insect infestation (Mango, Coconut, Cashew) e.g. Hoppers on Mango, mite infestation on coconut.</p>	<p><b>Recommendations:</b></p> <p><b>Organic farming and market linkages for organic produce:</b></p> <ul style="list-style-type: none"> <li>Organic farming information centre at block level to effectively monitor and facilitate the process of introducing efficient tools and techniques for organic farming may be established.</li> <li>Training workshops highlighting on bank assistance, seminars for demonstrating benefits of organic farming and providing marketing linkages for the produce with the retail industry could be organized.</li> <li>An awareness workshop at the village level to promote organic fertilizers, microbial bio-fertilizers and microbial bio-pesticides for integrated pest management may address the gaps and issues pertaining to the use of organic methods of farming.</li> <li>Training in usage of organic pesticides such</li> </ul>



Issue	Recommendations
	<p>as Neem (<i>Azadirachta indica</i>), organic fertilizers and techniques such as composting, vermi-composting and mulching may be useful.</p> <ul style="list-style-type: none"> <li>• KVK Kirlos, Malvan is a govt. organization, which can help in organizing training programmes on organic farming and integrated pest management (IPM).</li> </ul>

#### **Ranking 5: Less yield and market value for local produce**

Villagers have informed that, in general, agricultural production is falling for the past few years. They attribute it to the increased use of fertilizers and pesticides, hybrid varieties that initially produce higher yields but fail at a later stage, climatic change and less availability of water. Villagers also expressed a general trend of apathy towards agriculture. Migration of youth to industrial areas is common. Thus, agriculture has become a much less-preferred option of livelihood.

Also, the local markets do not offer good rate for the agricultural produce and additional transportation cost further reduces the profit margins.

#### **Recommendations:**

#### **Establishing co-operative societies and farmers club (e. g. NABARD farmers' club):**

Few of the villages have a high potential to develop a NABARD Farmers club<sup>30</sup> with the following functions:

- A co-operative society for marketing the agricultural produce and processed products would be highly desirable to ensure fair market rates for the farmers having marginal land holdings. The transportation cost would also be shared, thus reducing the losses and cuts from the profits. The society could also provide hybrid seeds, fertilizers and technical know-how to farmers.
- The clubs and societies could, in turn, be linked to commodity exchanges like Multi Commodity Exchange (MCX) and portals like "E-Choupal" (initiative of ITC, India), which would facilitate penetration of latest information about market trends and crop dynamics amongst the member farmers.
- Coordinate with banks to ensure credit flow among its members and forge better bank borrower relationship.
- Organize one or more meetings every month.
- Interface with subject matter specialists in the various fields of agriculture and allied activities, personnel of agriculture universities, development departments and other related agencies for technical know-how and up-gradation could be established.
- Liaison with corporate input suppliers to purchase bulk inputs on behalf of members.
- They can also sponsor/ organize joint activities like value addition, processing and collective purchase of inputs and farm produce marketing and so on for the benefit of members.
- Undertake socio-economic developmental activities like community works, education, health,

<sup>30</sup> <http://pibmumbai.gov.in/scripts/detail.asp?releaseId=E2013FR8>



Issue	Recommendations
<p>environment, natural resource management and so on.</p> <ul style="list-style-type: none"> <li>To establish backward and forward market linkages.</li> </ul> <p><b><u>Capacity Building for SHGs</u></b></p> <p>It has been observed that SHG's were present in all the villages but most of them were non-functional due to lack of skilled labor, knowledge of new and innovative livelihood options and absence of market linkage.</p> <p>The EPA's for SHG's could be:</p> <ul style="list-style-type: none"> <li>KVK Kirlos, Malvan, a govt. organization, which can help in SHG training programmes, capacity building and women empowerment.</li> <li>Training workshops may be organized for backyard poultry, quail farming, rabbit farming, fodder production, fruit processing, vegetable cultivation, cowpea cultivation, cashew nut processing, compost unit, vermin-compost production and so on.</li> <li>Preparation and packaging of local snacks, clothes, fruit products, kerni broom of coconut, coconut leaf shades and so on.</li> <li>Recyclable wrapping material, alternative options to plastic carry bags such as cotton bags, recyclable food covers made out of banana leaves, jackfruit leaves and so on.</li> <li>Food processing (especially of traditional food products): traditional snacks, dried vegetables fruits and so on, as well as for the eco-friendly packaging of the same.</li> </ul>	<p><b><u>Recommendations:</u></b></p> <ul style="list-style-type: none"> <li>Introduction of solar pumps at a reasonable price with subsidy is one of the environmentally sustainable options. Maharashtra Energy Development Agency (MEDA) provides up to 30% of initial cost for installing a solar water pump.</li> <li>Under phase I of Jawaharlal Nehru National Solar Mission (JNNSM), solar pumps are being provided for irrigation. There is a provision of community-based drinking water system through financial support in the form of capital subsidy and interest subsidy. Under phase II of JNNSM, target for deployment of 25,000 solar pumps by the end of FY 2017 has been envisaged.<sup>31</sup></li> </ul>
<p><b><u>Ranking 6: Fuel for water pumps:</u></b></p> <p>Few villages have abundant water for irrigation but scarcity and high rate of fuel for irrigation is a major issue.</p>	
<p><b><u>Ranking 7: Low horticultural production e.g. mango, cashew and coconut</u></b></p>	

<sup>31</sup> [http://www.iwmi.cgiar.org/news\\_room/pdf/Iede\\_co\\_uk-Solar Powered\\_Water\\_Pumps\\_Struggle\\_to\\_See\\_the\\_Light.pdf](http://www.iwmi.cgiar.org/news_room/pdf/Iede_co_uk-Solar_Powered_Water_Pumps_Struggle_to_See_the_Light.pdf).

Issue	Recommendations
<p><b><u>Recommendations</u></b></p> <ul style="list-style-type: none"> <li>• Apiculture activity could be started in mango plantations to compliment pollination and increase production.<sup>32</sup> It could also provide a source of additional income generation for farmers. Financial assistance in the form of grant is available from the Ministry of Food Processing Industries, Govt. of India, for technical civil works, plant and machinery for eligible projects, subject to certain terms and conditions. A seven day training programme on bee keeping is provided by “Madh-Sanchalanalay”, Mahabaleshwar at village and block level. The products such as honey and beeswax are purchased by the organization from the farmers at fixed and profitable rates.<sup>33</sup></li> <li>• Another method to manipulate flowering is to use the plant growth regulator, paclobutrazol. The post-harvest application of a small amount of paclobutrazol to the soil significantly promotes flowering and fruiting in the following year.<sup>34</sup></li> </ul>	
<p><b><u>Ranking 8: Unavailability of labour for agriculture and horticulture</u></b></p> <p>Migration of labour to cities in search of employment is a major problem faced by the villagers. Due to less income, youth does not prefer agriculture as a profession.</p>	<p><b><u>Recommendations:</u></b></p> <p>Migration of youth could be checked if modern options of revenue are created at the district level. As apathy towards traditional agriculture and fishery is increasing, newer options like training for ornamental fishery, scuba diving and tourism related activities may be useful in retaining the youth in the district. Similarly, offering them training on modern agricultural practices, cultivation of exotic vegetable, mushrooms and spices may be an attractive alternative. Cultivation of mushroom and bamboo as an EPA has been described in this action plan.</p>
<p><b><u>Ranking 9: Heavy siltation in creeks causing decreased water level for irrigation</u></b></p>	<p><b><u>Recommendations:</u></b></p> <p><b><u>De-siltation of water bodies</u></b></p> <p>During transect and in focussed group discussion, it has been observed that siltation of natural water bodies, due to surface run-offs is increasing day by day. At some places, fresh water streams no longer exist. De-siltation of water bodies, especially fresh water bodies, is of utmost importance.</p>

<sup>32</sup> <http://www.utmt.in/wp-content/uploads/2012/06/Research-Study.pdf>.

<sup>33</sup> [http://www.agric.wa.gov.au/PC\\_91814.html](http://www.agric.wa.gov.au/PC_91814.html)

<sup>34</sup> [http://www.textroad.com/pdf/JAFT/J.%20Agric.%20Food.%20Tech.,%202\(9\)153-158,%202012.pdf](http://www.textroad.com/pdf/JAFT/J.%20Agric.%20Food.%20Tech.,%202(9)153-158,%202012.pdf).

## 3.3 Tourism

### 3.3.1 Background:

Historically, Malvan has always been a tourist attraction in Maharashtra. Presence of Sindhudurg Fort and beaches such as Tarkarli, Devbag, Tondavali, Achare and Chivla have made it the most preferred tourist destination in coastal Maharashtra. In Devgad too, beaches, historical forts and temples such as Kunkeshwar are well-known tourist spots. As compared to Malvan, tourism in Devgad is still in nascent phase with no water sports activities. Based on the preliminary study and community interactions in the villages of Malvan and Devgad, out of selected 78 villages in Malvan and 57 villages in Devgad, 8 and 4 villages respectively pursue tourism-related activities to supplement their monthly income. The peak season for tourism is from April to May and October to December. Families prefer this period as it co-incides with vacations in schools and colleges. From October to December, the region experiences a pleasant weather. Several social festivals also fall during this period. Tourists travel by private vehicles, private buses and trains to reach the tourism places in Malvan and Devgad. Most of the resorts have facilities such as homestays, bed and breakfast and cottages. Some of them only serve food, both vegetarian and non-vegetarian, to tourists staying in nearby resorts.

Other beach villages in Malvan such as Achare, Wayri, Tondavali and Sarjekot are also slowly developing as a tourist destination. Agro-tourism is emerging in villages of Malvan such as Ghumade. Others such as Kalse are willing to start in near future. Mr Bhau Samant who owned the agro tourism centre in Ghumade, was in the process of developing a small housing facility for his agro-tourism centre. Within the premises of the centre, situated on a hilly region close to a river, he has developed a spice garden with placards attached to the respective plants giving information and explaining significance of the plants. It also includes a small cafeteria with eco-friendly material roofing and sanitation material.

Another nascent tourist spot was the 'shell island' in Sarjekot (Picture no. 26 and 27). A small island close to the shore of Sarjekot village has shells dispersed all over the island. The cause of this is unknown but the presence of shells on the island is attracting tourists. There is no inhabitation on this island and no facilities for visitors to stay but tourists enjoy the beauty of the island and surrounding nature by taking strolls across the island. The locals too promote this tourism activity by providing transport facility to this island. Fishermen, who own boats, drop the tourists to the island and bring them back. There is no profit sharing of this activity with any other stakeholder. Though there are several initiatives to undertake tourism activities in an environmental-friendly manner such as generating biogas from solid waste, there is an urgent need for proper orientation and training for sustainable tourism.



**Picture no. 26: Type of shells on shell island**



**Picture no. 26: Shell island near Sarjekot, Malvan**

### 3.3.2 Impacts:

Solid waste generated has a major impact in the tourism villages. Most of the villages which practice tourism lack mechanisms to dispose solid waste and waste water. This is creating unhygienic conditions in the premises of the resorts as well as disturbing the local ecosystems. In some cases, waste water is released into the river running in the backyard or other water bodies, if present. Such areas attract mosquitoes and other pests/ insects. These practices can lead to severe pollution of the water bodies and also cause loss of biodiversity.

Another impact is the loss in areal biodiversity due to increasing conversion of forest or canopied areas into settlements/ construction activities for building resorts. Owing to the booming tourism industry, more land is converted to non-agricultural land and resorts are built to attract the tourist. Though this is helping the tourism industry, it is destroying the nesting sites of rare birds and other terrestrial species. For instance, it is observed in Tarkarli that the Woodpecker and Baya Weaver bird species are decreasing in number.

### 3.3.3 Tourism sector issues and possible recommendations:

Though both Malvan and Devgad are well-established tourist destinations, there are several issues pertaining to development of tourism in the region. Some of the key observations of the villages practicing tourism are listed below based on the respective categories. (Table no. 12)

Table no. 13: Issues and recommendations

Sr. No.	Issues	Recommendations
1.	<b><u>Infrastructural:</u></b>	
	<ul style="list-style-type: none"> <li>Roads are narrow and in bad condition at most of the frequented tourist destinations such as Devbag, Tarkarli, Tondavali and Wayri.</li> <li>No sanitation facility in the form of public toilets and change rooms along the beaches.</li> <li>Unavailability of market at few places such as Tondavali.</li> <li>No infrastructure for water sports activities.</li> </ul>	<ul style="list-style-type: none"> <li>Development of basic infrastructure and amenities such as roads, sanitation facilities, shower facilities at beaches, changing rooms for ladies and so on.</li> <li>Water sports could be a major source of revenue for the youth. Infrastructure and training facilities could be established at key locations like Malvan and Devgad.</li> </ul>
2.	<b><u>Environmental/ Ecological</u></b>	
	<ul style="list-style-type: none"> <li>No solid waste disposal mechanism: FGDs revealed that dry and wet waste is directly burnt. Plastic bottles used for mineral water, juice, soft drinks are mixed and disposed with the kitchen waste.</li> <li>No control over inventory and stock of marine fauna such as collection of shells. (e.g. Shell island near Tondavali)</li> <li>Water quality is threatened due to salt-water intrusion, soil erosion, flooding in monsoon season and so on.</li> <li>Inability to shift to renewable energy applications such as solar application as they are costly.</li> <li>Menace caused by monkey. Damage to physical infrastructure.</li> <li>Both in Malvan and Devgad, the plastic waste such as bottles used for mineral water, juice and soft drinks are disposed together with the kitchen or biodegradable waste. No mechanism is in place to take care of disposal and treatment of plastic waste. Hence, a network of bottle-pickers could be constituted at the village level to go around the resorts located in the villages, collect the plastic waste and bring it to a common point in the outskirts of the village for further processing and responsible disposal. This can help unclogging the sewage and sanitation network in the village and render it clean and hygienic. Some effective models have emerged in the area for effective plastic/ metal waste management. One such case is explained below in the case study 1.</li> <li>Also, a nominal environmental tax should be imposed on tourist vehicles visiting the places and the collected money should be used for beach cleaning activity by employing the locals.</li> </ul>	

Sr. No.	Issues	Recommendations
	<p><b><u>Recommendations:</u></b></p> <ul style="list-style-type: none"> <li>• <b>Setting up of Bio-methanation plants –</b></li> </ul> <p>Solid waste disposal is a significant issue, which needs urgent attention in resorts of both the districts. The kitchen waste is disposed-off in open spaces or backyard. None of the resorts have composting pits or other methods of disposing the biodegradable waste. Hence, 'bio-methanation' plants could be installed and implemented in the villages in Malvan and Devgad. A common facility could be developed in the areas having more number of resorts. All the resort owners could then use this facility to take care of their kitchen waste.</p> <ul style="list-style-type: none"> <li>• <b>Developing 'Root Zone' Technology –</b></li> </ul> <p>Due to the lack of sewage disposal mechanism in the premises of the resorts, it is suggested to develop and install the 'Root Zone' technology<sup>35</sup> in the backyard of the resort premises where the sewage water is released. This can help in treating the waste water before it is released in open spaces or any water bodies. On a long-term basis, this can help control water pollution and degradation of the local environment.</p>	
3.	<b><u>Social/ Financial:</u></b>	<ul style="list-style-type: none"> <li>• Participation of local communities is minimal due to lack of skill.</li> <li>• Less preference for locals in tourism related activities e.g. Scuba diving, Snorkelling.</li> <li>• Only a few SHGs are employed to cook food by some hotels.</li> <li>• No direct linkage between local fishermen and hotel industry.</li> <li>• Villages along creek have strong desire to venture into backwater tourism but are unable to do so due to CRZ restrictions and unavailability of funds.</li> <li>• Mangrove boardwalk: Stakeholders need to be defined. Benefit sharing needs to work out to avoid conflict of interests.</li> <li>• Lack of labour to work in the resorts due to high migration rates.</li> </ul>
4.	<b><u>Untrained villagers for hospitality industry</u></b>	<p><b><u>Capacity building of locals:</u></b></p> <ul style="list-style-type: none"> <li>• The locals need to be trained for hospitality industry by organizing orientation programmes at village level to develop tourism in a sustainable manner.</li> </ul>
5.	<b><u>No proper training for water sports and nature trail activities:</u></b>	<p><b><u>Training of local youth for water sports and nature trail activities:</u></b></p> <p>The locals need to be trained for non-intrusive water sports activities because activities such as snorkelling and scuba diving take place in coral rich areas. Tourists, being unaware of their importance, could harm the coral</p>

<sup>35</sup>More information can be accessed from: <http://www.cpcb.nic.in/divisionsofheadoffice/pci3/pci3handbook.pdf>



Sr. No.	Issues	Recommendations
		ecosystems.
6.	<b><u>No permissions to set up temporary carts along the beach to serve tourists</u></b>	<b><u>Government/ policy level:</u></b> Most of the fishermen complained about permissions not being granted for setting temporary stalls or carts to serve tourists and generate additional income due to CRZ restrictions. Owing to decline in fish catch, this activity could generate additional income for villagers. Some solution for the same should be worked out, they demanded.
7.	<b><u>No livelihood option other than fishery in most of the fishery villages</u></b>	<b><u>Promoting fishery activities related tourism:</u></b> <ul style="list-style-type: none"> <li>• The income of fishermen community could be enhanced by promoting fishery-related tourism.</li> </ul>

### **Financially viable waste collection model at Tondavali, Malvan**

During the PRA exercise at Tondavli, TERI representatives came across with a unique initiative undertaken by local scrap dealers. They are collecting plastic, steel and iron waste from the villagers and instead of offering money in exchange of the waste material they are giving the returns in kind such as groceries, onion, potatoes and grains like wheat and rice. (Picture No 28)

As the villagers get some valuable items in exchange of waste there is a tendency to collect all the plastic, glass and metal waste from the nearby sea shores and beaches.

In this way the scrap dealers and villagers are not only helping in recycling of the useful waste items but also assisting in keeping the area clean. This model is also financially viable and environmentally beneficial; hence it needs to be positively replicated at other villages of the district.



**Picture No. 27 Collection of waste at Tondavali**

## 4. Biodiversity of the district and its significance

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### 4.1 Biodiversity: An overview

Sindhudurg district has 121 kms coastline with specialised marine ecosystems like coral reef, sea grass beds, mangroves, algal communities, mud flats and lagoons as well as moist deciduous forest harbouring enormous diversity. Each of these marine ecosystems with its associated habitats supports a wealth of marine resources. There are 367 species of marine flora and fauna reported for the Malvan coast, which includes 73 species of marine algae (*Ernodemis verticilata*), 18 species of mangrove trees and shrubs, 11 species of coral, 73 species of mollusks, 47 species each of polychaetes and arthropods, 18 species of sea anemones and 74 species of fish and few species of pearl oysters are also found in the area. Sharks (including the Whale shark, which is a globally important species and also listed under Schedule I of India's Wildlife (Protection) Act, 1972), black tipped shark, rays, seahorses and Indo-pacific humpback dolphins have been sighted along the coast.

The Malvan (Marine) Wildlife Sanctuary was designated in 1987 and covers an area of 29.12 sq. kms with a core zone of 3.18 sq. kms. The core zone includes the Sindhudurg fort, Padamged island and other submerged rocky structures. The core zone is used for anchoring fishing vessels and for fishing by a small number of hook-and-line fishermen. The buffer zone has seven villages with a population of over 7,000 that depends on fishing for a livelihood.<sup>36</sup> The rocky coastline of Malvan is primarily composed of sedimentary rocks. These rocks are soft and easily eroded by both wave and wind action, which provides habitat to burrowing animals. Many crevices and cracks in the rocks are ideal for sheltering, feeding and breeding of many invertebrates. They are also as an ideal substratum for harbouring marine algae (seaweed). The inter-tidal zone along the Malvan coast is characterised by the presence of coral species in Rajkot region and mangrove vegetation in Karli, Kolamb and Kalaval backwater river. Forty major faunal taxa including corals and pearl oysters were identified and also 73 species of seaweed and 18 species of mangroves were recorded between 1971 and 1994.<sup>37</sup>

Malvan town is bound by three small creeks viz., Karli, Kolamb and Kalaval whereas Devgad is bound by three creeks viz. Wadatar, Mithmumbhari and Vijaydurg. The most striking feature of the beach is the littoral concrete or beach rock, which stretches over long distances. The rock beach along Malvan gives protection to the coast against strong waves. In some regions, the rocky beach occurs as a rim of banks enclosing marshy islands. The inter-tidal zone along the Malvan coast is characterised by the presence of coral species in Rajkot region and mangrove vegetation in Karli, Kolamb and Kalaval backwaters

The district has three globally significant endangered species of turtles, namely Olive Ridley (*Lepidochelys olivacea*), Green (*Chelonia mydas*) and Leatherback (*Dermochelys coriacea*) turtles. There have been no confirmed records of loggerhead (*Caretta caretta*) and hawksbill turtles (*Eretmochelys imbricata*) on this coast. Green turtles (*Chelonia mydas*) have been seen in offshore waters in the Vengurla and Malvan block. The encounters of green turtles seem to be higher towards the south. One can frequently come across Olive Ridley turtles in the coastal areas of district. Encounters with turtles have been reported mostly in the post-monsoon season after September, although some locals believe there is no particular season

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<sup>36</sup> [http://aquaticcommons.org/1562/1/Samudra\\_mon5.pdf](http://aquaticcommons.org/1562/1/Samudra_mon5.pdf)

<sup>37</sup> <http://www.indiancoastguard.nic.in/Indiancoastguard/NOSDCP/Marine%20Environment%20Security/malvan.pdf>

for nesting.<sup>38</sup> Kunkeshwar and Tarkarli beaches in Sindhudurg used to have relatively good nesting of Olive Ridleys prior to the increase of tourism activities in those areas.

Sahyadri Nisarga Mitra (SNM), an NGO based in Chiplun, Ratnagiri district and the Bombay Natural History Society (BNHS), Mumbai are two agencies that work for the conservation of turtles along the Sindhudurg coast. The nesting frequency is very low on the entire coast of Malvan and Devgad with few potential sites observed during study.

In addition, the avifauna of the area is also rich, with 121 species including 66 residents, 24 true migrant and 28 residents with migratory population. White bellied sea-eagle (*Haliaeetus leucogaster*), an endangered species listed in Schedule I of the Wildlife Protection Act, 1972, is seen here. Also, Vengurla rock is an Important Bird Area (IBA) site and has a good population of edible-nest swiftlet (*Aerodramus fuciphagus*). The nests are considered a delicacy and therefore, their population is at risk. Some populations such as those in the Andaman and Nicobar Islands have been harvested extensively. They are now considered critically threatened under the International Union of Conservation of Nature and Natural Resources (IUCN) criteria.

## 4.2 Biodiversity issues and recommended action plan for conservation:

### 4.2.1 Biodiversity conservation approach and methodology -

The region is home to many species having Red Data book conservation status, as indicated by IUCN. Therefore, special emphasis of the study was on the current conservation status of these species and look at the impacts of -

- Current fishing and other anthropogenic resource utilization practices and examine ways of minimizing impacts that are negative and reinforce, perpetuate and replicate positive impacts.
- Some important species requiring immediate attention from coastal biodiversity point of view were selected for the study. This included 11 coral species such as *Coscinarea* sp., *Cyphastrea* sp., *Favites* sp., *Goniastrea* sp., *Goniopora* sp., *Porites* lichen, *Porites lutea*, *Pseudosiderastrea* sp., *Synerea* sp., *Tubastrea* sp. and *Turbinaria* sp.<sup>39</sup>
- Sea shell species in schedule I and III of Indian wildlife protection act such as *Cassia cornuta*, *Charonia tritonis*, *Conus milneedwardsi*, *Cypraea rufa*, *Hippopus hippopus*, *Nautilus pompilius*, *Tridacna maxima*, *Tridacna squamosa* and *Tudicula spirallus*
- Sea turtle species such as Olive Ridley (*Lepidochelys olivacea*), Green (*Chelonia mydas*) and Leatherback (*Dermochelys coriacea*) turtles
- Shark species such as Whale shark and Black tipped reef shark
- Coastal bird species such as White bellied sea-eagle and edible-nest Swiftlet (*Aerodramus fuciphagus*).

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<sup>38</sup>[http://www.iotn.org/pdf/IOTN3\\_1.pdf](http://www.iotn.org/pdf/IOTN3_1.pdf)

<sup>39</sup><http://www.indiancoastguard.nic.in/Indiancoastguard/NOSDCP/Marine%20Environment%20Security/malvan.pdf>



## 4.2.2 Sea Turtle Species Conservation:



Picture no. 28: Community manages sea turtle conservation

The issues affecting marine turtle species population and breeding success and recommendation to combat the same are given below in Table no. 13.

Table No. 14 Native marine biodiversity:

<p><b>Species</b></p>	<p>Sea turtle species such as Olive Ridley (<i>Lepidochelys olivacea</i>), Green (<i>Chelonia mydas</i>) and Leatherback (<i>Dermochelys coriacea</i>) turtles.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>Picture no. 29: Olive Ridley Turtle</p> </div> <div style="text-align: center;">  <p>Picture no. 30: Green Turtle</p> </div> </div> <div style="text-align: center; margin-top: 20px;">  <p>Picture no. 31: Leatherback Turtle</p> </div>
<p><b>Conservation</b></p>	<p>Olive Ridley Turtle (<i>Lepidochelys olivacea</i>) is “vulnerable species”, Green</p>



<b>Status</b>	Turtle ( <i>Chelonia mydas</i> ) is “endangered species” and Leatherback ( <i>Dermochelys coriacea</i> ) turtle is “critically endangered species” as per Red Data Books published by IUCN (Please refer Picture nos. 30, 31 and 32)
<b>Issue of Concern</b>	<ul style="list-style-type: none"> <li>• Frequency of turtles visiting the beaches has decreased in recent years at most of the beaches mentioned below due to increased anthropogenic disturbances.</li> <li>• There is no sighting or captured record of leatherback turtles in the past 5-6 years as discussed with the communities and conservationist Mr. Daftrardar (Wildlife Warden &amp; Professor at Dept. of Botany, Devgad College).</li> <li>• The prime cause of mortality of various sea turtle species in Sindhudurg district is illegal gill net and trawl fishing in the offshore waters, where turtles die as incidental catch due to entrapment in fishing nets.</li> <li>• The other major reason documented during study was increased unorganised tourism related activities at few beaches such as infrastructural developments, lighting near beaches by private home-stays e.g. Chivla beach, Tarkarli beach, Tondavali beach etc. and road-lighting near beaches affecting breeding behaviour of sea turtles. Artificial lighting disrupts sea turtle hatchling orientation from the nest to the sea. Artificial lighting dissuades females from coming ashore for nesting. Most of them may return to ocean without laying eggs. Those who come ashore may lay eggs at unsuitable location after several attempts. The lighting along beaches also affects hatchling orientation on the beach in two ways: the turtles may crawl towards light (miss-orientation) or they may be incapable of crawling in any direction (dis-orientation). As a result, the turtles may crawl for hours without reaching the sea and become exhausted and dehydrated. A prolonged beach crawl also increases their exposure to predators. It is well established fact that higher nesting is observed on the dark beaches.<sup>40</sup></li> <li>• During FGD's, most of the fishermen said they released the turtles if caught in nets by chance. However, it was documented from key informants in many fishery villages that sea turtles caught in nets occasionally and their eggs are considered a delicacy and consumed.</li> <li>• Insufficient funds for community-managed conservation initiatives of biodiversity conservation such as Sea turtle conservation by local NGO's.</li> <li>• Lack of awareness amongst local fishermen communities about biodiversity, endangered species and their importance in the ecosystem continues. Also, youth in the region are not scientifically oriented about rich biodiversity of the region and its importance.</li> <li>• Unavailability of banners and hoardings depicting the endangered biodiversity of the region and importance of conservation.</li> <li>• Absence of continuous research and monitoring activities for population monitoring of protected species.</li> </ul>

<sup>40</sup> [Artificial lighting disrupts sea turtle hatchling orientation from the nest to the sea](#)

<p><b>Locations of potential breeding sites</b></p>	<p><b>Malvan:</b> Achare, Wayangani, Tondavali, Talashil, Kolamb, Sarjekot, Deobag, Malvan, Tarkarli</p> <p><b>Devgad:</b> Vijaydurg, Padvane, Kunakeshwar, Katvan, Tambaldeg, Morave</p>
<p><b>Initiatives for conservation</b></p> <p><b>Recommendations</b></p>	<p>Local community-based conservation programmes practiced by forest department, NGOs such as “Sahyadri Nisarga Mitra” includes:</p> <ul style="list-style-type: none"> <li>• Awareness programme for local communities</li> <li>• Guarding the nesting sites by putting the barricades and information banners</li> <li>• Constant monitoring by NGO members as well as forest officials</li> </ul> <p>Voluntary efforts by Mr. Daftardar (Wildlife warden and Professor at Dept. of Botany, Devgad college) and his network of local community members working actively for Sea turtle conservation.</p> <p>Conscious monitoring by local communities to check anthropogenic impacts such as egg collection and nesting site disturbance by tourists, predation by dogs and so on at villagers like Tondavali and Wayangani in Malvan and Tambaldeg village in Devgad.</p> <p><b>Priority Ranking 1</b></p> <p>Local communities should be educated about sea turtle conservation and should be involved in various campaigns.</p> <p><b>Priority Ranking 2</b></p> <p>Turtle deaths, especially occurring due to commercial fishing, could be decreased through enforcement of Turtle Excluder Device (TED) for big trawler fishermen and gill net mesh size regulations.</p> <p><b>Priority Ranking 3</b></p> <p>The protection of nesting beaches by establishing parks and shelters through regulations combined with public education initiatives. The locals at turtle nesting sites should be trained towards viable ecotourism. Also, some of these areas that have less fishing activity and have potential as nesting habitats, should be declared community reserves.</p> <p><b>Priority Ranking 4</b></p> <p>Potential disturbances which could affect the breeding of turtles such as anthropogenic disturbance, excessive artificial lightening along beach and beach armouring should be eliminated. Initiatives would include decreasing artificial lighting, halting beach armouring, regulating beach nourishment (i.e. sand replenishment) and limiting the anthropogenic impacts. Reducing the amount of artificial light that is visible from</p>

	<p>nesting beaches is the first step to reducing light pollution that affects sea turtles.</p> <ul style="list-style-type: none"> <li>• Turn off lights visible on nesting beaches or use special fixtures to shield the lights from the beach</li> <li>• Use low-pressure sodium-vapour lighting (LPS) instead of normal lights</li> <li>• Use Turtle Safe Lighting— these red lights emit a very narrow portion of the visible light spectrum, which is less intrusive to nesting sea turtles and hatchlings</li> <li>• If disoriented hatchlings are found away from the sea, local law enforcement personnel should be approached.</li> <li>• Tint windows that face the beach.</li> <li>• Close opaque curtains or blinds after dark to cover windows visible from the beach.</li> </ul> <p><b>Priority Ranking 5</b></p> <p>The youth should be educated and encouraged to protect turtles and nests near the villages. This action initiative could be linked with National Service Scheme (NSS) and National Cadet Corps (NCC), mandatory programmes conducted by every junior and senior level college of the district. This activity could be linked to NSS' area-based project activities.</p> <p><b>Priority Ranking 6</b></p> <p>There is need for continue research and monitoring to monitor and push conservation efforts for protected species.<sup>41</sup></p> <p><b>Priority Ranking 7</b></p> <p>There is an immediate need to enforce national and international laws to minimize the dumping of pollutants and solid waste into the ocean and near shore waters.<sup>42</sup></p>
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Village-wise Immediate Action Plan for Conservation of Sea Turtle Species at Malvan Block is given below in Table no. 14.

<sup>42</sup> [http://www.gc.noaa.gov/documents/gcil\\_lc.pdf](http://www.gc.noaa.gov/documents/gcil_lc.pdf)

**Table no. 15: Village-wise Immediate Action Plan for Conservation of Sea Turtle Species at Malvan block**

Sr. No.	Village Name/ Area	Issue of Concern	Priority action required for conservation of Sea turtle species
1.	Chivla Beach, Malvan	<p>The tourism industry is growing with homestays coming up alongside beach in these villages. These home stay owners along the beach have set up temporary dining facility on the sand dunes along the beach, which are heavily enlightened with outdoor lighting. This is one of the factors affecting the breeding success of sea turtles.</p> <p><b>Village specific observations:</b></p> <ol style="list-style-type: none"> <li>1. A community conserved olive Ridley turtle breeding site was observed at Tondavli beach and Wayangani beach during transect walk. At Tondavli, about 110 eggs and at Wayangani about 200 eggs hatched successfully during the study period in Malvan. Villagers released them in sea under the supervision of Maharashtra forest department officials and “Sahyadri Nisarga Mitra” volunteers.</li> </ol>	<ul style="list-style-type: none"> <li>• Setting up of temporary dinning facility by the homestays on the sand dunes along the beach should be prohibited. Turn off lights visible on nesting beaches or use special fixtures to shield the lights from the beach.</li> <li>• Recommend use of LPS instead of normal lights as well as Use Turtle Safe Lighting— these red lights emit a very narrow portion of the visible light spectrum, which is less intrusive to nesting sea turtles and hatchlings, at resorts along the beach.</li> <li>• If disoriented hatchlings are found away from the sea, call local law enforcement.</li> <li>• Tint windows that face the beach.</li> <li>• Close opaque curtains or blinds after dark to cover windows visible from the beach.</li> </ul>
2.	Tondavali		
3.	Devbag		
4.	Tarkarli		
5.	Kolamb		
6.	Sarjekot	<p>Infrastructure development in terms of jetty and cold storage facility along the Sarjekot beach has affected the sea turtle visit to beach for breeding in the recent years.</p>	<p>Part of the beach could be reserved for turtle nesting during breeding months.</p>
7.	Wayangani	<p>Wayangani is the major preferred breeding site for Olive Ridley Turtle in entire Sindhudurg from many years since the nesting frequency as well as the hatching rate was found to be higher over the years as recorded during FGD</p>	<p>Govt. of Maharashtra has proposed a Sea world project in Wayangani and Tondavali region in April 2013. Budgetary allocation has been made for the same. Therefore, tourism is expected to increase in the coming years. The planned tourism activities should be mandated for</p>

Sr. No.	Village Name/ Area	Issue of Concern	Priority action required for conservation of Sea turtle species
		with villagers.	the place to conserve this sea turtle breeding hotspot.


#### 4.2.3 White bellied Sea-Eagle Conservation -



Picture no. 32: White bellied sea-eagle nesting at Achare bundar

The issues affecting White Bellied Sea-eagle population and recommendation to combat the same are given below in Table No.15

Table No. 16 About the native species

Species	<p>White Bellied Sea-eagle (<i>Haliaeetus leucogaster</i>) locally known as "Kankan" that belongs to the Accipitridae family. (Picture no. 34)</p>  <p>Picture no. 33: White Bellied Sea-eagle</p>
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<b>Conservation status:</b>	Listed in Schedule I of the Wildlife Protection Act, 1972 and in the IUCN's Red Data Book as a "Least concern" species. <sup>43</sup>
<b>Issue of concern</b>	<ul style="list-style-type: none"> <li>• The FGD's with villagers revealed that these birds used to be in abundance in the past. They preferred to nest on the taller trees. The prime reason for the decline in their population, as observed by locals, is the habitat destruction in the form of tall tree cutting near coastal areas, especially <i>Casurina spp.</i> and <i>Bombax spp.</i> which are the preferred nesting sites for the species.</li> <li>• The habitat destruction has also severely affected the breeding rate of the bird. This could be the result of human disturbance on nesting pairs. The species is particularly sensitive to disturbance during the early stages of the breeding season and may abandon nests and young chicks, if exposed to human activity.</li> <li>• The bird is often poisoned or shot as it occasionally feeds on domestic livestock such as goats and chickens.</li> <li>• The deterioration of inland water resources may also be contributing to the decline of the bird. The other reasons for population decline are egg-shell thinning caused due to use of Dichloro Diphenyl Trichloroethane (DDT) and food chain contamination by heavy metals.<sup>44</sup></li> <li>• Insufficient funds for community managed conservation initiatives of biodiversity conservation by local NGO's.</li> <li>• Lack of awareness amongst local fishermen communities about biodiversity, endangered species and their importance in the ecosystem. Also, youth in the region are not scientifically oriented about rich biodiversity of the region and its importance.</li> <li>• Unavailability of banners and hoardings depicting the endangered biodiversity of the region and importance of conservation.</li> <li>• Absence of continuous research and monitoring activities for population monitoring of protected species.</li> </ul>
<b>Locations of potential breeding sites</b>	<p><b>Malvan:</b> Achare bundar, Jamdulwadi, Wayangani, Tondavali, Talashil, Kolamb, Sarjekot, Devbag, Malvan and Tarkarli.</p> <p><b>Devgad:</b> Vijaydurg, Padvane, Kunkeshwar, Katvan, Tambaldeg.</p>
<b>Initiatives for conservation</b>	<ul style="list-style-type: none"> <li>• Documentation of nests in Sindhudurg district by forest department of Maharashtra and NGO such as "Sahyadri Nisarga Mitra".</li> </ul>

<sup>43</sup> <http://www.iucnredlist.org/details/summary/106003359/0>

<sup>44</sup> <http://www.malleecma.vic.gov.au/resources/fact-sheets/whitebellied-seaeagle.pdf>

	<ul style="list-style-type: none"> <li>• Voluntary efforts by Mr. Daftardar (Wildlife warden and professor at Dept. of Botany, Devgad college) and his network of local community members working actively for Sea-eagle conservation</li> </ul>
<b>Recommendations:</b>	<p><b>Priority Ranking 1</b></p> <p><b><u>Improve and maintain areas of suitable habitat for the species:</u></b></p> <p>The preferred height for nesting is 10 to 30m. The <i>Mangifera indica</i>, <i>Casuarina equisetifolia</i>, <i>Ficus bengalensis</i>, <i>Cocos nucifera</i>, <i>Sterculia foetida</i>, <i>Alstonia scholaris</i> and <i>Bombax malabaricum</i> are the preferred trees for nesting in the study area. <i>Casuarina equisetifolia</i> is the most preferred tree species. Therefore, <i>Casuarina spp</i> tree plantations which are also supposed to be effective wind breaker in coastal belt along the coast should be encouraged.<sup>45</sup></p> <p><b>Priority Ranking 2</b></p> <p><b><u>Protect the coastal sand-dunes:</u></b></p> <p>The coastal dunes are hills adjoining the beach built either by water or air flow. The dunes are the areas where <i>Casuarina spp.</i> trees grow and provide habitat for nesting sites. Rock pitching activity to construct protection wall along beach is taking place at most of the beaches to protect the coastal villages. However, this activity is hampering the dune habitat and ultimately coastal biodiversity. Therefore, the dune ecology should be restored. The natural sand dunes should be left undisturbed.</p> <p><b>Priority Ranking 3</b></p> <p>The local communities should be educated about the bird's conservation and should be involved in various campaigns.</p> <p><b>Priority Ranking 4</b></p> <p>There is need to continue research and monitoring activities so that the protected species populations can be monitored and conservation efforts can be focused where they are most needed.<sup>46</sup></p>

<sup>45</sup>[http://www.preventionweb.net/files/globalplatform/entry\\_bg\\_paper~mangroveimpactreportfinal2011.pdf](http://www.preventionweb.net/files/globalplatform/entry_bg_paper~mangroveimpactreportfinal2011.pdf)

Village-wise Immediate Action Plan for Conservation of White bellied sea-eagle at Malvan and Devgad block is given below in Table no. 16.

**Table no. 17: Village-wise Immediate Action Plan for Conservation of white bellied sea-eagle:**

Sr. No.	Village Name/ Area	Priority action required for Conservation of White bellied sea-eagle.
1.	Chivla Beach, Malvan	<ul style="list-style-type: none"> <li>A pair of White bellied sea-eagle was observed during transect walk along the Chivla beach. There is an immediate need to protect the habitat as well as plantations of <i>Casurina spp.</i> trees along the coast.</li> <li>The road proposed along the beach for better connectivity with Malvan city could affect the coastal dunes and habitat. So an impact assessment should be made before a road is constructed.</li> <li>A proposed protection stone wall all along the beach could affect the coastal dune habitat and nesting.</li> </ul>
2.	Tondavali, Malvan	<ul style="list-style-type: none"> <li>A pair of White bellied sea-eagle was observed during transect walk along the Tondavali beach. There is an immediate need to protect the tall <i>Casurina spp.</i> trees patch along the beach as well as the large plantation of <i>Casurina spp.</i> near village.</li> <li>A protection stone wall is constructed all along the beach. This could affect the coastal dune habitat and nesting. So an impact assessment should be made for the same.</li> </ul>
3.	Devbag, Malvan	<ul style="list-style-type: none"> <li>A proposed protection stone wall all along the beach could affect the coastal dune habitat and hence nesting. The dune habitat should be restored.</li> </ul>
4.	Tarkarli, Malvan	<ul style="list-style-type: none"> <li>A proposed protection stone wall all along the beach could affect the coastal dune habitat and nesting. An impact assessment before actual implementation of the proposed stone wall construction should be undertaken.</li> </ul>
5.	Sarjekot, Malvan	<ul style="list-style-type: none"> <li>An actively-used nest was located at Sarjekot beach on a <i>Bombax spp.</i> Tree, adjacent to the new jetty and cold storage under construction. The nesting site should be protected.</li> </ul>

Sr. No.	Village Name/ Area	Priority action required for Conservation of White bellied sea-eagle.
6.	Achare Bundar, Malvan	<ul style="list-style-type: none"> <li>An actively used nest was located at Achare Bundar Beach on a tall <i>Casurina spp.</i> tree. The nesting site should be protected.</li> </ul>
7.	Wayangani, Malvan	<ul style="list-style-type: none"> <li>Plantations of <i>Casurina spp.</i> trees along the coast.</li> </ul>
8.	Kolamb, Malvan	<ul style="list-style-type: none"> <li>Plantations of <i>Casurina spp.</i> trees along the coast.</li> </ul>
9.	Phanse, Devgad	The Gram Panchayat is planning to cut a large plot of <i>Casuarina spp.</i> Plantation present along the coast in Phanse village since it is old and dried and there is a risk of forest fire. However, an intervention for the same should be proposed to protect the associated biodiversity.

#### 4.2.4 Marine Species Conservation and Anthropogenic Interference:



Picture no. 34: Illegal poaching of black tipped reef shark and whale shark



Picture no. 36: Sea shell collection at an island near Tondavali village

Protected marine species conservation related issues, concerns and possible recommendations are mentioned below in Table no. 17.

**Table no. 18: Protected marine species conservation: Issues and Concerns**

<b>Area of concern</b>	Marine species conservation and sustainable fishing
<b>Issues of Concern</b>	<p>The place is home to many protected marine species such as sea turtles, sharks such as Whale shark and Black tipped reef shark, various sea shells and coral species. It was documented during the study that most of the fishermen are unaware of the protection status of various marine species of the region.</p> <ul style="list-style-type: none"> <li>It was documented during FGD's that the rampant intensive fishing and bottom trawling practices by major commercial trawlers from the state and adjacent states such as Gujarat, Karnataka, Kerala and Goa is affecting the fish population recruitment* resulting in decline of the catch. This is affecting coral species and population severely over the years and severely affecting the livelihood of traditional fishermen. (*Recruitment is the number of new young fish that enter a population in a given year).</li> <li>The coastal dunes are an important feature for maintenance of coastal and marine biodiversity. They act as a barrier, separating beach from the mainland. However, developmental activities going on along the beaches for tourism infrastructure and construction of protection wall along the beach shoreline are severely affecting the coastal dunes.</li> <li>It was documented during the transect walk on major fish landing sites that all types of sharks which are caught are sold under the name of "Mori", irrespective of their protection status. This has drastically affected the endangered species population of sharks such as Whale shark and Black tipped reef shark. Also, shark is on the menu card of all the hotels and restaurants under the name of Mori. Therefore, there is demand for the same and uncontrolled poaching of black tipped reef shark. (picture no. 36)</li> </ul>

	<ul style="list-style-type: none"> <li>• Most of the fishermen are unaware of endangered marine fauna. Illegal poaching of endangered and scheduled marine species such as whale shark, olive Ridley turtles and collection of turtle eggs for delicacy is still in practice at most of the coastal villages.</li> <li>• In recent times, there is an increase in tendency to catch even juvenile fishes, which is affecting spawning and recruitment of fish population. More efforts and working hours spent as well as fishing in the prohibited season is also practiced at most fishing villages.</li> <li>• The fishing nets used by fishermen are of two types: traditional cotton/ Sava nets and nylon nets. The mesh size was recorded by visual random sampling of boats on major fish landing areas. It was recorded that the mesh size was ranging from 50 mm to 250 mm. This is violating the set mesh size norms in terms of ban on nets below mesh size 110 mm. The small mesh size nets killing fingerlings was also documented during study.</li> <li>• Fishing in creek is active all through the year. Monsoon is the peak season of creek fishing, owing to high demand for fish from hotel industry during annual closed fishing season. This is the period when fishing should be ideally banned as it is the season of fish breeding.</li> <li>• Sea shells are found in abundance on an island at Talashil in between Tondavali and Sarjekot beach. During transect walk on this island, tourists were seen collecting sea shells. (Refer picture no. 37)</li> </ul>
<b>Locations</b>	All the coastal fishing villages in Malvan and Devgad block.
<b>Initiatives for Conservation</b>	Voluntary efforts by Mr. Daftardar (Wildlife warden and Professor at Dept. of Botany, Devgad college) and his network of local community members working actively for protected marine species conservation
<b>Recommendations:</b>	<p><b>Priority Ranking 1</b></p> <p>Proper check on tourists visiting for water sports activities such as scuba diving and snorkelling is not maintained. Experts must explain to them the importance of corals before they undertake the water sports.</p> <p><b>Priority Ranking 2</b></p> <p><b><u>Installation of Artificial Reefs / Artificial Floating Fish Aggregating Devices-</u></b></p> <p>Artificial reefs are man-made or natural objects specifically placed to attract fish, provide or improve fish or shellfish habitat and increase fish biomass locally. These occur naturally in the form of floating palms, seaweed, trees and whale carcasses. They have been made artificially by fishermen since the 1950's using bamboo, tyres, oil drums and number of other techniques<sup>47</sup>. The principle objectives in the construction of artificial reefs in the coastal</p>

<sup>47</sup> <http://simontothemax.blogspot.in/2012/05/synthetic-sea-presentationtedx-seapoint.html>



	<p>waters of many countries in the Southeast Asian region are to enhance biological productivity and fisheries resources and to rehabilitate and conserve marine habitats that have been adversely affected by fishing activities.</p> <p>Floating FADs are structures located at the surface or at mid-water depths to take advantage of the attraction of pelagic fish to floating objects. FAD's have been utilised for centuries in the Philippines to attract migrating tuna. Like artificial reefs, FAD's can also reduce fishing effort and conserve fuel. This will eventually increase catch performance of traditional fishermen without causing any possible effect of overfishing in the coastal areas.<sup>48,49</sup></p> <p><b>Priority Ranking 3</b></p> <p><b><u>Educating coast guards about biodiversity and increasing coast guard patrolling -</u></b></p> <p>Coast guards should be educated about the protected species found in the region. There should be an increase in coast guard patrolling to control fishing of the endangered marine species, to enforce a ban on illegal mesh size, fish nets and to ensure that fishing is not conducted/ performed during the breeding season. The guards would also be responsible to stop illegal collection of sea turtle eggs and shells by tourists.</p> <p><b>Priority Ranking 4</b></p> <p><b><u>Optimum fish harvesting -</u></b></p> <p>Optimum harvesting strategy in terms of fishing net mesh-size regulations needs to be implemented strictly. Net manufacturing and trading companies as well as agencies should be restricted from manufacturing and selling banned mesh sizes.</p> <p><b>Priority Ranking 5</b></p> <p><b><u>Awareness workshop/seminars to educate local people -</u></b></p> <p>An awareness workshop/ seminar for cluster of coastal villages pertaining to information about importance of endangered fishes, rules and acts for conservation, ill effects of rampant unsustainable fishing practices, fish net mesh size regulations should be held. They must be encouraged to protect their natural resources.</p> <p><b>Priority Ranking 6</b></p> <p><b><u>Installing information boards at appropriate locations on beaches and</u></b></p>
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<sup>48</sup> [http://www.nap.edu/openbook.php?record\\_id=1024andpage=85](http://www.nap.edu/openbook.php?record_id=1024andpage=85).

<sup>49</sup> <http://www.seafdec.org.my/v13/images/stories/pdf/DownloadPublication/MFRDMD%20Publications/A%20guide%20to%20make%20and%20set%20durable%20artificial%20reef%20fish%20aggregating%20devices%20A%20et%20al.pdf>.

	<p><b><u>shell island -</u></b></p> <p>Information boards stating the endangered biodiversity of the region should be installed at appropriate locations on the beaches for tourists. Information boards stating the importance of sea shells in the coastal ecosystem in terms of sand formation should be displayed for tourists. This would also help educate fishermen involved in tourism-related activities in the vicinity of Shell Island such as Tondavali, Kolamb and Sarjekot to restrict the anthropogenic impact.</p> <p><b>Priority Ranking 7</b></p> <p><b><u>Banning shark meat from the menu list of restaurants -</u></b></p> <p>Shark meat is available in almost all the hotels under the name Mori. Most of the tourists, out of curiosity, order the dish. This is one of the prime reasons for increased demand for shark meat. Fishermen, being unaware of protection status of most shark species, catch and sell the same in the market as documented during the transect walk along major fish auctioning beaches.</p> <p><b>Priority Ranking 8</b></p> <p>GPS (Geographical Positioning System) should be made mandatory on all trawlers and monitoring centre establishment for coast guards.</p> <p>The issue of monsoon fishing could be addressed by mandatory installation of GPS on the trawlers. These could be monitored from a centre by coast guards to keep an active check on movement of trawlers during banned fishing period in monsoon.</p>
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Village-wise Immediate Action Plan for Conservation of protected marine species at Malvan block is given below in Table no. 18.

**Table no. 19: Village-wise Immediate Action Plan for Conservation of other Marine protected species:**

Sr. No.	Village Name/ Area	Immediate Action Plan required for Conservation of other Marine protected species
1.	Chivla Beach, Malvan	<ul style="list-style-type: none"> <li>Installation of Artificial Reefs/ Artificial Floating Fish Aggregating Devices.</li> </ul>

		<ul style="list-style-type: none"> <li>• Implementation of fishing net mesh-size regulations strictly.</li> <li>• Installing information boards at appropriate locations depicting the endangered biodiversity of the region and importance of conservation.</li> </ul>
2.	Malvan Beach, Malvan	<ul style="list-style-type: none"> <li>• <b>Increased coast guard monitoring:</b> Malvan beach is a major fish landing site. Whale shark poaching was documented at this beach. A whale shark measuring about 13 feet and weighing around 400 kg was caught by local fishermen in Malvan, brought to the beach late in the night where it was cut into 3 pieces and transported by tractor. The fishermen did not allow anyone to take photos. This indicates they were well aware for this act being illegal.</li> <li>• Remaining action plan initiatives same as mentioned for Chivla beach.</li> </ul>
3.	Tondavali Beach, Malvan	<ul style="list-style-type: none"> <li>• Installing information boards along the beach, especially on Shell-Island at Talashil depicting the endangered biodiversity of the region and importance of conservation.</li> <li>• The Shell Island site should be banned for tourist visiting since shell collection activity was recorded during study</li> </ul>
4.	Devbag Beach, Malvan	<ul style="list-style-type: none"> <li>• Action plan initiatives same as mentioned for Chivla beach</li> </ul>
5.	Tarkarli Beach, Malvan	
6.	Sarjekot Beach, Malvan	
7.	Achare Beach, Malvan	
8.	Wayangani Beach, Malvan	
9.	Kolamb Beach, Malvan	

Inland biobiodiversity conservation related issues, concerns and possible recommendations are mentioned below in table no. 19.

**Table no. 20: Conservation of inland biodiversity:**

Area of concern	Inland Biodiversity
Issue of concern	<ul style="list-style-type: none"> <li>• Hill slopes along the road are mostly private lands and mono-culturing of Mango or cashew is the general practice. This is affecting the food chain intermediates drastically. For example, increased incidence of hopper infestation on mango plantations due to extinction of local biological control agents such as insect and fungal predators. This can also be correlated to increase in <i>Eryophite</i> mite infestation commonly called as “Koli</li> </ul>

	<p>Rog" of coconut causing 60 to 80 percent decline in annual coconut production.<sup>50</sup></p> <ul style="list-style-type: none"> <li>• Agriculture is majorly traditional with marginal mechanization. It is broadly divided into paddy cultivation and horticulture. Of the two, horticulture was identified to be the most harmful for the environment owing to use of pesticides beyond the prescribed dose to combat increasing pest infestation.</li> <li>• The survey highlighted use of pesticides beyond the prescribed dose to combat increasing pest infestation of horticultural plantations.</li> <li>• Hanuman langur and Bonnet macaque population has increased drastically in past 15 -20 years, which are considered menace by local farmers due to extensive damage to agricultural as well as horticultural crops. The problem is too severe since most of the villages have refrained themselves from summer cultivation due to monkey crop raiding.</li> </ul>
<b>Affected Villages</b>	Entire blocks of Devgad and Malvan
<b>Initiatives</b>	<ul style="list-style-type: none"> <li>• Supply of bio-fertilizers via gram panchayat in few villages.</li> </ul>
<b>Recommendations:</b>	<ul style="list-style-type: none"> <li>• Introducing alternate crops free from monkey menace such as sunflower, turmeric and so on, plantations such as bamboo on wasteland and mushroom cultivation for additional income opportunities.</li> <li>• Training workshops, bank assistance seminars for demonstrating benefits of organic farming and providing marketing linkages for the produce with the retail industry.<sup>1,2</sup></li> <li>• IPM needs to be practiced<sup>51</sup></li> </ul>

<sup>50</sup>[http://faculty.washington.edu/hgwolff/Evans%20UW\\_Request%2065\\_Enviro%20Impacts%20of%20Ag%20Technologies\\_03-17-2010.pdf](http://faculty.washington.edu/hgwolff/Evans%20UW_Request%2065_Enviro%20Impacts%20of%20Ag%20Technologies_03-17-2010.pdf)

<sup>51</sup> <http://www.nhm.nic.in/Horticulture/IPM%20for%20Mango.pdf>.

## 5. Selected Entry Point Activities (EPAs):

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### 5.1 Bamboo cultivation and processing as an EPA

#### 5.1.1 Introduction

Bamboo, belonging to the family Poaceae, is the fastest growing known plant. Its uses for mankind are diverse. From basic tools such as spoons and vessels to construction industry, it is used widely. It is one of the few plants with ecological as well as economic importance with respect to livelihoods of the people.

Several villages in Sindhudurg rely on bamboo as an additional revenue generation option. Women SHGs, particularly of Kudal, Malvan and Vengurla, create toys and other handicraft items from bamboo. These are later sold in the market. TERI has interacted with SHGs during the course of the PRA exercise and found that bamboo is accepted as a potential EPA under the guidance and support from government agencies. This section provides information on the significance of bamboo and the potential to develop an EPA on bamboo as a natural resource of ecological as well as economic significance.

#### 5.1.2 Significant species of bamboo

India is home to over 136 species of bamboo, of which about 10 species are currently being explored for their commercial value, such as *Bambusa arundinacea*, *B.affinis*, *B.balcooa*, *B.tulda*, *Dendrocalamus strictus*, *D.hamiltoni*, *D.asper*, *Oxytenanthera stocksii* and *O.travancorica*. The annual yield of bamboo is over 5 to 12 tonnes per hectare, attaining harvestable height within 3 to 4 months.

#### 5.1.3 Policies on bamboo

Since bamboo provides ecological security to many communities, substitutes timber, is a cheap alternate material for construction, good alternative to non-biodegradable materials such as plastics and provides food and livelihood security, it has received much attention from national as well as international perspectives. One of the main objectives, therefore, is to create sustainable forestry for bamboo by undertaking bamboo afforestation.

**NABARD Bamboo Development Policy:** NABARD in 2003 launched bamboo cultivation project under forestry wasteland category for production of pulpwood. The activity is undertaken in co-operation with the Forest Development Corporations and Forest Departments. The major objective is to commercialize bamboo at the farmer's level, undertake comprehensive development of bamboo resources as a marketable commodity with more emphasis on farmlands, especially revenue wastelands, and establish linkage of bamboo farmers with bamboo artisans to promote bamboo cultivation for development of degraded forest lands.

NABARD promotes and funds bamboo projects under the following models:

- Setting up of bamboo nurseries for quality plant production including Tissue Culture plantlets.
- Wasteland development model through bamboo under farm forestry.

- Bamboo-based agro-forestry model
- Tie -up arrangement with bamboo based industries including handicrafts
- Cluster development for artisans and craft persons for bamboo product development including marketing
- Funding under Ruler Infrastructure Development Fund (RIDF)-JFM model
- Micro-finance through NGOs under SHG model, wherever feasible<sup>52</sup>

**National Bamboo Mission:** The Government of India launched National Bamboo Mission with a view to harness the potential of bamboo crop in the country. The mission is headed by National-level Apex Committee of Minister, Agriculture at national level, State Bamboo Steering Committee at state level and Bamboo Development Agency or Forest Development Agency<sup>53</sup> at district level. Bamboo cultivation is generally undertaken in forest areas or non-forest areas. The overall objectives of the mission are:

- To promote holistic growth of the bamboo sector through area-based regionally differentiated strategies
- To increase the coverage of area under bamboo, both in forest and non-forest areas with appropriate varieties to enhance yields
- To promote marketing of bamboo-based handicrafts
- To establish convergence and synergy among stake-holders for development of bamboo
- To promote, develop and disseminate technologies through a seamless brand of traditional wisdom and modern scientific knowledge
- To generate employment opportunities for skilled and unskilled persons, especially unemployed youths

According to the State Annual Action Plan (2007-2008), the National Steering Committee had approved an amount of INR 219.56 lakh under Mini Mission-II. For the previous financial year (2011-2012), an amount of INR 250 lakh was approved towards post-harvest storage, treatment facilities, marketing infrastructure and area expansion<sup>54</sup>.

**National Mission on Bamboo Applications (NMBA):** The objectives of NMBA are development and scaling up of bamboo-based economic activities in the country to enable enhanced opportunities, generate employment, entrepreneurship, exports and the environment protection. The thrust area of the mission includes<sup>55</sup>:

- Knowledge, information gathering and dissemination
- Technology development and validation

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<sup>52</sup> [http://www.nabard.org/modelbankprojects/forestry\\_bamboo.asp](http://www.nabard.org/modelbankprojects/forestry_bamboo.asp)

<sup>53</sup> <http://nbm.nic.in/guideline.html>

<sup>54</sup> [http://nbm.nic.in/minutes\\_13th.html](http://nbm.nic.in/minutes_13th.html)

<sup>55</sup> [www.bambootech.org](http://www.bambootech.org)



- Demonstration and promotional activities for bamboo-based value-added products and applications
- Support to entrepreneurial projects and commercialization of technologies
- Disaster management

#### 5.1.4 Rationale of bamboo as an EPA in Sindhudurg:

Bamboo is one of the most versatile plant species for its resource significance. Currently, bamboo is mainly used to make toys and handicraft items in Sindhudurg. This district is rich in bamboo flora, with four species viz. *Bambusa bambos*; *Pseudoxytenanthera ritcheyi*; *Pseudoxytenanthera stocksii* and *Dendrocalamus strictus*<sup>56</sup>, all of which are important commercially. However, there is no commercial plantation in Sindhudurg on which livelihoods are completely dependent. Most of the products of bamboo are prepared in their free time exclusively by women via SHGs. They receive around INR 80 to 200 per person per day.

In addition to its economic importance, bamboo is also known to make a significant contribution to restore waste and degraded lands. It has been proved to replenish groundwater level and retain soil. Since Sindhudurg, Malvan and Devgad, have soil mining activities for extracting lateritic stone bricks, bamboo plantation for rehabilitation of the area can be undertaken at village-level.

#### 5.1.5 Uses of bamboo in the context of Sindhudurg:

Bamboo is currently being used as a raw material for designing handicraft materials such as toys and wall-hangings. It can also be used to erect storage structures for agricultural produce, as well as exported as a raw material to other regions.

**As a raw material:** TERI interviewed officials at Native Konkani Bamboo and Cane Products Pvt. Ltd.<sup>57</sup> in Kudal block, where raw bamboo is processed to be used as a construction material, furniture and handicraft items. The raw material is bought directly from farmers within Sindhudurg as well as neighbouring states such as Goa.

**As a food product:** Bamboo shoots are considered a delicacy throughout the world. Shoots of species such as *Bambusa vulgaris* are sold either raw or processed throughout India. Sindhudurg has a high potential for cultivating edible bamboo in lateritic mining sites and government land, which can be sold directly or processed. Given that Sindhudurg is a tourism district and has close proximity to Goa and Ratnagiri which also attract a number of tourists, Sindhudurg has a high potential to establish a market linkage between farmers and markets and/or the hotel industry around.

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<sup>56</sup>[http://www.envirobiotechjournals.com/article\\_abstract.php?aid=4174&andiid=148&andjid=1](http://www.envirobiotechjournals.com/article_abstract.php?aid=4174&andiid=148&andjid=1)

<sup>57</sup><http://www.nativekonbac.com/intro.php#>

### 5.1.6 Market linkages

The unit cost for one acre of plantation is Rs 9400, spread over a period of five years according to NABARD's Bamboo Development Policy<sup>58</sup>. The main components of backward linkages for developing bamboo as an EPA are as follows:

1. **Land:** During the PRA exercise, land constraints were observed as one of the major obstacles for undertaking bamboo plantations. The raw materials currently provided by locals are either on personal lands or in forest areas. Lands under government as well as lateritic soil mines are an ideal site for undertaking bamboo plantations. Most bamboos are found in sandy loamy to loamy clay soil derived from river alluvium or underlying rock.
2. **Water:** Irrigation is important in order to produce a significant yield from bamboo. Under the National Bamboo Mission, an amount of INR 20,000 towards installation of irrigation systems per hectare will be provided depending upon proposals received from the State government<sup>59</sup>.
3. **Fertilizer:** Manure and Diammonium phosphate (DAP) fertilizer can be used as a fertilizer for bamboo cultivation. Fertilizer is required every year. According to Pande et al (2012), fertilizer required for bamboo cultivation in ravine systems in India is 0.02 kg/plant/year<sup>60</sup>. Based upon the soil profile of the chosen site, fertilizer input can be adjusted accordingly.
4. **Maintenance:** The villagers informed that monkeys are potential crop raiders for bamboo plants. Bamboo plantations may, therefore, require maintenance and monitoring in case of water logging or from crop-raiders such as monkeys.

### 5.1.7 Forward linkages:

1. **Harvesting:** Culms of bamboo mature after two-to-three years on an average. According to NABARD, considering a 30-year life cycle of bamboo, one clump may produce 300 culms on the whole.
2. **Processing:** Processing can be a secondary occupation within the village. Processing of specific bamboo species depending upon their properties, can be undertaken under the schemes discussed in *Policies on bamboo section*.
3. **Packaging and marketing:** Packaging of processed bamboo products can be established at village or Block level. Maharashtra State Agricultural Marketing Board (MSAMB) promotes development of infrastructural facilities and amenities for agricultural marketing via Post Harvest technological Institute and provides advice and training to farmers<sup>61</sup>. Local NGOs can be involved in providing training to the SHGs for packaging and marketing of the produce. Marketing linkages with hotel industry, as well as major malls such as Big Bazaar<sup>62</sup> can help sell the products, especially of edible bamboo shoots, by absolving marketing through merchants.

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<sup>58</sup> [http://www.nabard.org/modelbankprojects/forestry\\_bamboo.asp](http://www.nabard.org/modelbankprojects/forestry_bamboo.asp)

<sup>59</sup> [http://nbm.nic.in/guideline.html# Micro Irrigation \(Non Forest Area\)](http://nbm.nic.in/guideline.html#MicroIrrigation(NonForestArea))

<sup>60</sup> <http://ageconsearch.umn.edu/bitstream/126042/1/5-VC-Pande.pdf>

<sup>61</sup> <http://www.msamb.com/english/nipht/default.htm>

<sup>62</sup> <http://www.yashaswini.org/english/bigbazar.php>

### 5.1.8 Commercial viability

In order to be a viable option providing a major portion of the income of a family or community, bamboo plantations need to be undertaken on a large scale. According to NABARD, intensive bamboo cultivation can give profitable income from year six and increasing as per the lifetime of the bamboo. Harvesting is recommended from sixth year onwards. The sale price of green bamboo is approximately INR 500. (Please refer Table no. 20)

**Table no. 21: Yield and income of bamboo plantations (NABARD)<sup>63</sup>**

Year	Yield (Metric Ton per acre)	Income(INR)
VI	9.6	5280
VII	11.2	6160
VIII	12.8	7040
IX onwards	14.4	7920

### 5.1.9 Potential villages for implementing the EPA

#### In Malvan

**Amberi:** Amberi village has several sites where mining for lateritic bricks is being undertaken. Several of the areas are abandoned mining sites with minimum to no vegetative growth.

**Ozar:** Ozar also has sites where mining for lateritic bricks is undertaken. Bamboo plantations to encourage vegetative growth and to prevent further soil erosion can be explored.

**Warad and Bhandarwada:** SHGs in Warad and Bhandarwada have been trained to create handicraft items from bamboo. The bamboo is bought from outside the village. The villagers have expressed their interest in growing bamboo within the village.

**Dhamapur:** The people at Dhamapur also expressed their interest in growing bamboo. Land constraint is the major issue in this village.

**Pendur, Kharare and Parad:** These villages come under Pendur Gram Panchayat. Although it has extensive cashew plantations, there are several areas especially along the river, which are ideal for growing bamboo.

**Mhavlunge:** The people of Mhavlunge also expressed their interest in growing bamboo as an additional crop. Agriculture is the major occupation of the village and the land is under cultivation of rice, groundnut, horse gram, brinjal, tomato and so on. Although there is land constraint, the villagers stated that bamboo can be grown in forested areas around the village.

#### In Devgad

<sup>63</sup> [http://www.nabard.org/modelbankprojects/forestry\\_bamboo.asp](http://www.nabard.org/modelbankprojects/forestry_bamboo.asp)

**Naringre:** Naringre was the only village which expressed interest in bamboo cultivation. The major constraints in Devgad are land availability, which is primarily brought under cultivation of mango, as well as the soil depth which is very low.

The major concerns and constraints for implication in the study blocks is given in table no. 21.

**Table no. 22: Major concerns**

Sr. No.	Constraints	Information	Possible solution
1	Land constraint	Land availability is a major constraint observed in all the villages. Farmers with land available for bamboo plantation appeared hesitant to invest in such a project. In several villages, uncultivable land is under saltwater, where bamboo cannot grow. Furthermore, government land accessible within villages is also left fallow.	Making land under government available on lease for growing bamboo at community or individual level; undertaking soil analysis of potential sites in villages identified above.
2	Monkey menace	Monkeys (Langur and Macaques) are the major crop-raiders in Malvan and Devgad. The villagers informed that monkeys are known to eat shoots of wild-occurring bamboo as well. Therefore, plantation of bamboo is highly vulnerable to damage.	Monitoring of the fields and setting of monkey alarm system as discussed in the EPA section can also be explored by developing a model.
3	Irrigation	Irrigation in Malvan and Devgad is dependent upon monsoon. In case of young mango grafts, water is provided via drip irrigation.	Drip irrigation method can be applied during the initial stage of bamboo growth.
4	People's mindset	Owing to no visible example of successful bamboo plantation in Malvan and Devgad, people are hesitant to invest in the project.	Organizing farmer's field trip to institutes such as Native KONBAC Bamboo Products Private Limited (KONBAC) Ltd. and other areas with successful bamboo plantations.
5	People's perception	The locals believe that bamboo plantations create heat around the plant, which can affect productivity of mango fruits.	Providing scientific knowledge via training. Panwar <sup>64</sup> studied the inter-cropping performance of bamboo with that of mango, Cashew, Kokum and Rubber. It was found that out of the three traditional crops, bamboo was found to be most profitable one.

<sup>64</sup>[http://books.google.co.in/books/about/Agroforestry\\_Systems\\_and\\_Practices.html?id=FaOzbAXsBeQCandredir\\_esc=y](http://books.google.co.in/books/about/Agroforestry_Systems_and_Practices.html?id=FaOzbAXsBeQCandredir_esc=y)





Picture no. 38: Bamboo being carried by a villager for traditional festival of Gudi Padva



Picture no. 37: Polishing bamboo, KONBAC Ltd., Kudal



Picture no. 40: Types of processed bamboo, KONBAC Ltd., Kudal



Picture no. 39: Straightening of bamboo, KONBAC Ltd., Kudal



**Picture no. 41: Treated bamboo, KONBAC Ltd., Kudal**



**Picture no. 41: Untreated bamboo, Konbac Ltd., Kudal**



## 5.2 Mushroom Cultivation as an Entry Point Activity (EPA)

### 5.2.1 Introduction

India is not a major producer of any of the mushroom varieties but in the past decade, mushroom cultivation has found many takers. It has great potential as an important export product in the future. From a production standpoint, the white button mushroom has the highest growth rate and potential for production. However, the cultivation of oyster mushrooms has been easier as it requires very less infrastructure and therefore capital requirements are very less in comparison with the requirements for white button mushroom cultivation.

Few villagers were practicing mushroom cultivation in Sindhudurg but they stopped due to lack of proper linkages. Particularly in Amberi gram panchayat, there was an institute on mushroom training and cultivation providing livelihood option to the villagers but now it is not in working condition due to unavailability of funds.

TERI has interacted with SHGs during the course of the PRA exercise and found that mushroom cultivation is accepted as a potential EPA under the guidance and support from government agencies. This section provides information on the significance of mushroom and the potential to develop an EPA on mushroom as a natural resource of economic significance.

### 5.2.2 Significant species of mushroom

There are three species of Mushrooms presently cultivated in India. Of these, Oyster Mushroom (*Pleurotus florida*) and button mushroom (*Agaricus Bisporus*) is commonly grown in Maharashtra due to favourable atmospheric conditions.

### 5.2.3 Policies on mushroom

Mushroom has already acquired commercial status in developed countries and now many developing economies have also accepted it. India, being a major tourist destination, is a growing market for mushrooms. Government is also promoting it on a large scale. Few of the schemes and major policies for mushroom cultivation are:

#### 1. National Horticulture Mission

National Horticulture Mission is a centrally sponsored scheme launched by Government of India during 2005-06 (Tenth Plan). The objective of this scheme is to provide holistic growth of horticulture sector in India and to enhance horticulture production. For mushrooms, assistance will be provided for setting up of individual spawn production unit, compost making unit and also for integrated mushroom unit.

#### 2. Model Bankable project of NABARD

A model scheme for cultivation of Oyster mushroom (*Pleurotus* spp.) with commercial viability and bankability has been prepared keeping in view the agro-climatic conditions and other related aspects for successful cultivation of the mushroom and its subsequent marketing. Cultivation of mushroom can be taken up on a large scale by individual entrepreneurs. Bank loan of 85-95 % of the total cost of

development shall be available from the financing institution. Bank loan considered in the model is 90%.

### 3. Societal Developmental program by Department of Biotechnology (DBT)

Biotechnology-based programme for societal development has been addressed for implementation of community-based projects with a mission to social development goals to benefit large number of target population in vulnerable section of the society. The interventions undertaken are bio-pesticides, bio-fertilizer application, organic farming, cultivation of mushrooms, medicinal and aromatic plants, sericulture, processed food, floriculture and so on.

## 5.2.4 Rationale of mushroom as an EPA in Sindhudurg

Mushrooms, also called 'white vegetables' or 'boneless vegetarian meat', contain ample amounts of proteins, vitamins and fibre apart from having certain medicinal properties. Mushroom contains 20-35% protein (dry weight) which is higher than those of vegetables and fruits and is of superior quality. Mushrooms are now getting significant importance due to their nutritional and medicinal value. Today, their cultivation is being done in about 100 countries. There is a good domestic market for packaged fresh mushrooms in India, with 2005 predictions stating that the demand for mushroom may grow at 25% per annum. Mushroom cultivation in Sindhudurg has three major advantages:

1. Being a coastal district, Sindhudurg has suitable climate for mushroom cultivation. The tropical conditions are conducive for mushroom cultivation. The ideal temperature is 15-30°C and relative humidity for mushroom cultivation is 70-80% respectively, which is quite similar to Sindhudurg's conditions.
2. Mushroom has a very high demand in hotel industry and Sindhudurg is an upcoming tourism destination. It is situated near Goa, a major tourist destination.
3. It requires little space and inexpensive raw materials. Sindhudurg's primary cultivation is paddy, due to which they have plenty of raw material. Oyster mushroom cultivation is economically efficient for the farmers of other crops, who do not have to buy the raw materials for substrate and can use low cost structures for mushroom cultivation.

## 5.2.5 Backward and forward linkages

In the present model, the unit cost for production of 1000 kg of oyster mushroom per cycle works out to INR 37,000 according to NABARD's Model Bankable project for Mushrooms<sup>65</sup>. The main components of backward linkages for developing mushroom as an EPA are as follows:

1. Land: During the PRA exercise, land constraint was observed to be a major obstacle for undertaking any other kind of plantation but for mushroom cultivation, there is no such specific requirement of land or raw material. A room with less light in their respective houses is enough to start a small cultivation unit.
2. Water: Water is required only during the initial stages. To provide moisture, daily watering of the substrate is required but excessive watering should be avoided.

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<sup>65</sup> [http://nabard.org/modelbankprojects/plant\\_oyster.asp](http://nabard.org/modelbankprojects/plant_oyster.asp)

3. Substrate: Like other mushrooms, *Pleurotus spp.* can be grown on various agricultural waste materials using different technologies. They grow well on different types of lignocellulosic materials, converting them into digestible and protein-rich substances suitable for animal feeds. *Pleurotus spp.* may be produced in the tropics on a mixture of sawdust and rice bran, rice straw and rice bran, sawdust and ipil-ipil leaves and other combinations of tropical wastes.

### 5.2.6 Forward linkages:

1. Yield: Yield ranges from about 100-200% of the dry weight of the substrate and depends on the substrate combination as well as the way in which the substrate has been managed during the fruiting season. The richer the combination and the whiter and denser the mycelium, the greater will be the mushroom yield.
2. Processing: Processing can be a secondary occupation within the village. Mushrooms can be marketed either fresh or after dehydration. There is huge international demand for dried mushroom and the farmers can get better returns by tapping these sources. Also, they can try other options like mushroom powder, pickles and so on.
3. Packaging and marketing: Packaging of processed mushroom products can be established at village or Block level. Maharashtra State Agricultural Marketing Board (MSAMB) promotes development of infrastructural facilities and amenities for agricultural marketing via Post Harvest technological Institute and provides advice and training to farmers<sup>66</sup>. Local NGOs can be involved in providing training to the SHGs for packaging and marketing of the produce. Marketing linkages with hotel industry, major malls such as Big Bazaar<sup>67</sup> can help sell the products by avoiding merchants.

### 5.2.7 Commercial viability:

In order to be a viable option providing a major portion of the income of a family or community, mushroom cultivation can be undertaken at an individual level but processing and marketing needs to be undertaken on a centralized scale to be more resource efficient (Annexure No. XV).

### 5.2.8 Potential villages for implementing the EPA

#### Malvan

Almost all the villages in Malvan are involved in agriculture. Since the primary crop is paddy, raw material is easily available. A common training centre could be established at Malvan, which is the centre point and has access to almost all the major cities in Maharashtra via road transport. It is also a major tourist destination.

Amberi village had a training centre on mushroom cultivation and training. That could be explored as an option for re-establishment.

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<sup>66</sup> <http://www.msamb.com/english/nipht/default.htm>

<sup>67</sup> <http://www.yashaswini.org/english/bigbazar.php>

The major concerns for implementation of this EPA are enlisted below in Table no. 22.

**Table no. 23: Major concerns**

Sr. No.	Constraints	Information	Possible solution
1	Spawn availability	Spawning is carried out aseptically, preferably using the same transfer chamber or the same inoculation room as used in spawn preparation. Grain or sawdust spawn is commonly used to inoculate the substrate in bags.	Proper training should be given to the villagers for spawn production and inoculation.
2	Principle cost	In the present model, the unit cost for production of 1000 kg of oyster mushroom per cycle works out to INR 37,000.	<p>The margin money/ down payment prescribed are 5, 10 and 15% for small, medium and other farmers respectively. The rest of the cost of development will be provided as bank loan. In the present model, 10% of the unit cost i.e. INR 3700 has been considered margin money.</p> <p>Bank loan of 85-95% of the total cost of development shall be available from the financing institution.</p>
3	People's mindset	Owing to no visible example of successful mushroom cultivation in Malvan, people are hesitant to invest in the project.	Organizing a farmer's trip to mushroom producers in Goa like Zuari Foods, Dr. Sangam Kurade's farm may encourage the farmers.



Picture no. 42: Mushroom training centre at Amberi

## 5.3 Mussel, Oyster and Clam culture as an EPA

### 5.3.1 Introduction:

The world has been practicing mussel farming since the thirteenth century. The most common species cultured is Blue Mussel *Mytilus edulis*. China ranks first in the production of cultured mussels in the world, followed by Spain, Italy, Netherlands, Denmark and France. In 1997, 1.1 million tonnes of mussels were produced worldwide, with most production occurring in China (nearly 400,000 tonnes). The Indian mussel industry is relatively small compared with world standards.

In 2008, total production of green mussels in India was about 15,000 tons (CMFRI, 2009)<sup>68</sup>. Similarly, oyster culture in India has received considerable interest only in the last decade. The CMFRI under the Indian Council of Agricultural Research (ICAR) is the main institution involved with bivalve culture. Through applied research aimed at developing suitable and low-cost culture methods, training and demonstration courses, they are trying to popularize oyster farming.

CMFRI has identified Kerala, Karnataka, **Maharashtra**, Goa, Tamil Nadu, Andhra Pradesh, Pondichery, Gujarat, Orissa and Andaman and Nicobar as ideal locations for mussel farming. Out of the two species commercially important, the green mussel *Perna viridis* is widely distributed and found in the beds of Chilka lake, Visakhapatnam, Kakinada, Madras, Pondicherry, Cuddalore and Porto Nova on the East coast and extensively around Quilon, Alleppey, Cochin, Calicut to Kasargod, Manglore, Karwar, Goa, **Malwan**, Ratnagiri and the Gulf of Kutch on the West coast. On the other hand, *P. indica* has restricted distribution and is found along the southwest coast from Varkala near Quilon to Kanyakumari and from there to Tiruchendur along the southeast coast.



Picture no. 43: Green mussel (*P. viridis*)

#### Significant species of Mussel and Oysters:

Mussels are bivalve molluscs and are found

<sup>68</sup> <http://www.fao.org/docrep/field/003/ab737e/AB737E04.htm>

attached to rocks or any other hard substratum by means of byssus thread secreted by the body. They belong to the family Mytilidae. In India, two species of marine mussels namely *Perna viridis* (the Green mussel) and *Perna indica* (the Brown mussel) forms the major part of the fishery (Refer picture no. 45). A number of oyster species occurs in Indian waters. Some are commercially exploited like *Crassostrea madrasensis*, *C. gryphoides*, *C. rivularis* and *Crassostrea cucullata*.

The first three species occur mainly in estuaries, backwaters and creeks and are all exploited to some extent by local fishermen. On the other hand, *S. cucullata*, a purely marine form, is predominantly found in shallow areas with rocky substratum. Nearly 17 species of edible mussels are harvested or cultured worldwide.

The native Indian oyster (*C. madrasensis*) occurs throughout the coast of India, whereas *C. gryphoides* is mainly present along the Maharashtra coast and in several localities of Goa State. *C. rivularis* occurs along the coast of Gujarat State and to a lesser extent along the coast of Maharashtra State. *C. cucullata* occurs all along the Indian coast. However, only the settlements along Maharashtra and Gujarat coasts are large enough for exploitation.

#### **Success story of Kerala:**

Mussel culture is fast becoming popular in the Malabar area since 1997, following the success of CMFRI in rearing green mussel by rack culture in the backwaters and popularizing through involvement of progressive farmers who took up its culture in the backwaters and found it a profitable venture. As a result, demands came from new entrepreneurs for training.

Mussel farming spread from Kasaragod to Ponnani. Backwaters Mussel culture in Kerala was started first in Padanna and Cheruvattur Panchayats in Hosdurg Taluk of Kasaragod district. Later, it was taken to Elathur in Calicut district and Vallikunnu and Ponnani in Malappuram district. Total mussel production in India is about 20,000 tonnes in 2009-10 (CMFRI, 2009-10).

Initially, the low cost technology developed by CMFRI was transferred to five groups with 15 to 21 members at Cheruvattur and Valiyaparamba. North Malabar Gramin Bank and Cheruvattur Farmers' Co-operative Bank provided financial assistance. A loan of INR 2, 60,200 was provided with a subsidy component of 50 percent. These groups harvested 67.4 tonnes of mussels during May-June 1997.

A portion of the harvested and shucked meat (2000 kg) was sold to the Integrated Fisheries Project, Cochin at a rate INR 45/kg and the rest was sold in the domestic market. The groups could realize INR 3, 34,555 from the harvest with a net profit of INR 1, 04,455 within a period of six months.<sup>1</sup>

### **5.3.2 Policies on Mussel, Clam and Oyster culture:**

**NABARD:**



NABARD is an apex development bank with a mandate for facilitating credit flow for promotion and development of mussel and oyster culture.<sup>69</sup> It is estimated that around 70 tonnes of edible oyster production is possible per hectare of land per year (Table no. 23)

**Table No. 24 Economics of Oyster culture<sup>70</sup>**

1	Unit area	0.4 Ha
2	Culture period	6 to 10 months
3	Survival rate	55%
4	Expected production	70 tonnes/ ha/ year
5	Sale price for meat	INR 50 per kg
6	Sale price of oyster shell	INR 300 per tonne

<sup>69</sup> [http://www.nabard.org/modelbankprojects/fish\\_mussel.asp](http://www.nabard.org/modelbankprojects/fish_mussel.asp)

<sup>70</sup> [http://www.nabard.org/modelbankprojects/fish\\_oysters.asp](http://www.nabard.org/modelbankprojects/fish_oysters.asp)

## NFDB<sup>71</sup>:

NFDB was established to:

- Focus on activities relating to fisheries and aqua-culture and professionally manage them.
- Improve production, processing, storage, transport and marketing of the products of capture and culture fisheries.
- Achieve sustainable management and conservation of natural aquatic resources including the fish stocks.
- Provide modern infrastructure mechanisms for fisheries and ensure their effective management and optimum utilization. A scheme proposed by NFDB is given in Table no. 24.

Table no. 25: Scheme of NFDB

Sr. No.	Name of the activity/ scheme	Unit cost	Pattern of assistance
1.	Assistance to mussel Oyster/ clam culture/ other commercial shellfishes <sup>72</sup>	<ul style="list-style-type: none"> <li>• For Mussel culture (rack culture: 30x20 mtr. rack of 1200 ropes of 1m) INR 1.90 lakhs on capital and Rs 0.49 lakhs as recurring cost)</li> <li>• For Mussel culture (raft culture: 12 units of 5m x5m rafts of 300 sq.mtr (600 ropes of 4m) INR 4.32 lakhs (INR 2.81 lakhs on capital and INR,1.51 lakhs as recurring cost)</li> <li>• For edible Oyster and clam culture (rack culture of 300 sq mtr area) INR 1.27 Lakhs (INR 0.38 lakhs on capital and INR 0.89 lakhs as recurring cost).</li> </ul>	<ul style="list-style-type: none"> <li>• 50% subsidy on the unit cost.</li> <li>• 1.25% back-ended subsidy to women SHGs, entrepreneurs on capital and recurring cost to all farmers and 30%subsidy in case of SC/STs.</li> </ul>

### 5.3.3 Rationale of Mussel, Oyster and Clam culture in Sindhudurg:

1. Mussel fishery is a part time occupation to some fishermen in Sindhudurg. However fairly good numbers of fishermen are engaged full-time in mussel fishing during the peak season.
2. Backwater shell fish collection viz. Oyster, Clams and Mussels is carried out in Sindhudurg for long. However, they are not cultured scientifically. This type of fishing could open immense potential for resource and employment generation among coastal communities, especially women living below poverty line in many villages of Malvan and Devgad.
3. Mussel culture is a low investment activity with very good returns. If promoted properly, mussel farming can be used as a tool for women empowerment in the coastal areas of Sindhudurg and can stimulate a healthy socio-economic development in the area.

<sup>71</sup> <http://nfdb.ap.nic.in/html/objectives.htm>

<sup>72</sup> [http://nfdb.ap.nic.in/pdf/NFDB\\_Guidelines\\_Revised\\_August.pdf](http://nfdb.ap.nic.in/pdf/NFDB_Guidelines_Revised_August.pdf)

4. Better post-harvest technologies can develop attractive value-added products. Since very good export markets are available for mussels, they can be taken up as a challenging opportunity by technicians and scientists.
5. In Sindhudurg, shell fishery can be considered a tool for the up-liftment of the poor people living in the coastal areas.

### 5.3.4 Culture methods

Methods currently used for culturing mussels in the tropical and temperate waters fall into four categories:

**(1) Off bottom culture:**

- Mussel culture on ropes suspended from raft
- Long line culture

**(2) On bottom culture:**

- Sea bottom culture
- Pole culture or "Bouchot" culture

### 5.3.5 Uses of Mussels:

**Markets, marketing channels and nature of product:**

Mussel meat is highly nutritious and is even considered a delicious item of food by the people of west coast of India. Nutritive profile of the meat is given in Table no. 25.

**Table No. 26 Approximate meat composition of Mussels**

Moisture	80.00 %
Protein	13.00 %
Fat	1.50 %
Glycogen	3.50 %
Minerals	1.50 %

The mussels are sold with shell-on or shucked (by removing the shells) by weight or numbers and are mainly consumed in Sindhudurg without depuration (cleansing or purification). The mussels are mainly cooked or fried. The cost of shucked meat is about INR 60 to 70 per kg. The shell on mussel is sold at INR 8-10 per kg and INR 60-70 per 100 nos. depending upon the size. There is only limited demand for the mussel meat due to lack of awareness among the consumers. However, there is scope for its export to Southeast Asian countries. A marketing tie-up with the processing plants will be useful for marketing of the product.

**Mussel products (processed products)**

Mussels are not only eaten raw but are also processed for longer preservation and to get higher market value. Some of the popular products are listed below:

- Iced and frozen mussel meat
- Canned mussel meat

- Smoked mussel meat
- Dried mussel meat
- Marinated mussel meat
- Mussel meat pickle
- Mussel chutney powder
- The condiment incorporated ready-to-eat fried mussel meat.
- Value-added products of mussels like seafood cocktails are prepared and marketed by seafood export firms in India. The export of these items from India has been showing an increasing trend.

### Diversified products from mussel together with their successful marketing

#### A) Pharmaceutical Health Products

Medicines produced from the tissue of mussels have distinct immunity protection features. Natural antioxidants have been found in the lipid fraction of mussels. Mussels are rich in Omega-3 fatty acid and have more of Omega-3 than any other shellfish, which helps to prevent risk factors associated with cardiovascular and heart disease. Zinc in meat is a proven immunity booster. Optimal intake of Zinc promotes growth, mental alertness and aids in proper brain function. Recent research on a specific protein derived from mussels called Lyprisol is believed to have benefits in deterring from cancer.<sup>73</sup> Hence several products are developed having pharmaceutical values from the Mussels. Some of the examples are given below.

- **Joint Complex:** Used for treating specific forms of arthritis.
- **Sinu-X:** One of the main ingredients is sea mussel 50mg, used for Sinusitis.
- **Food Science of Vermont Sea mussel90c:** Sea mussel Caps (Green Lipped Mussel 500mg.) are a natural source of protein, chelated minerals and glycosamino glycans, which play a beneficial role in joint health and function.
- **Mussel Hydrosate BIPOLAN:** Mussel Hydrolysate is used in medical prophylactic feed.

### 5.3.6 Potential villages for mussel, oyster and clam culture:

In order to be a viable option providing a major portion of income for a family or community, mussel culture needs to be undertaken on a large scale. According to NABARD, mussel culture can give profitable income from second year onwards. Harvesting is recommended from first year itself where the loan amount can be repaid in five years starting from first year onwards as the culture period is for 6 months<sup>74</sup>. Estimated financial outlay and production for culture of *Perna viridis* (Green mussel) as estimated by NABARD<sup>75</sup> suggests that investment of INR 41,575 would give return of INR 44,500. Hence, it would be profitable. NABARD has developed bankable projects and mussel culture has also been regarded as a model bankable project. Copy of the proposal prepared by NABARD is attached as Annexure No. XIII. Given that the activity holds good potential as an option for

<sup>73</sup> <http://www.icargoa.res.in/TB%20No.3.pdf>

<sup>74</sup> [http://www.nabard.org/modelbankprojects/fish\\_mussel.asp](http://www.nabard.org/modelbankprojects/fish_mussel.asp)

<sup>75</sup> [http://www.nabard.org/modelbankprojects/fish\\_mussel.asp](http://www.nabard.org/modelbankprojects/fish_mussel.asp)

revenue generation, we have tabulated (Table nos. 26, 27,28,29,30 and 31) for the villages in Malvan and Devgad, where this activity could be undertaken.

**Table no. 27: Villages in Malvan suitable for Oyster and Clam (Locally called “Kalava” and “Mule”) culture**

Sr. No.	Village Name	Principle Occupation	Priority Occupation		Distance from creek (in Kms)	Distance from Sea (in Kms)
			Second	Third		
Achare Creek						
1	Jamdul	Fishery (Creek)	Nil	Nil	0.2	0.88
2	Pirawadi	Fishery (Coastal/Creek)	Nil	Nil	0.4	0.27
Kalaval creek:						
3	Revandi	Agriculture	Fishery (Creek)	Nil	0.18	0.18
4	Kolamb	Fishery (Coastal and Creek)	Agriculture	Tourism	0.63	1
5	Sarjekot	Fishery (Coastal)	Tourism	Nil	0.17	1
6	Tondavali	Fishery (Coastal)	Tourism	Nil	1.6	0.87
7	Kavawadi	Agriculture	Fishery (Creek)	Nil	0.6	More than 10 Kms
8	Khanjanwadi	Agriculture	Labour	Nil	0.6	More than 10 Kms
Karli creek:						
9	Devbag	Fishery (Coastal)	Agriculture	Tourism	0.13	0.14
10	Tarkarli	Fishery (Coastal)	Tourism	Nil	0.68	0.13
11	Khand	Agriculture	Fishery	Nil	1.9	More than 10 Kms

**Table No. 28: Villages in Malvan suitable for Mussel (Locally called “Kulche”/ “Shinane”) culture**

Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Third Priority Occupation	Dist. from creek (in Kms)	Dist. from Sea (in Kms)
<b>Creek: Achare</b>						
1.	Pirawadi	Fishery (Coastal/Creek)	Nil	Nil	0.4	0.27
<b>Creek: Kalaval</b>						
2.	Kolamb	Fishery (Coastal and Creek)	Agriculture	Tourism	0.63	1
3.	Revandi	Agriculture	Fishery (Creek)	Nil	0.18	0.18
4.	Sarjekot	Fishery (Coastal)	Tourism	Nil	0.17	1
<b>Creek: Karli</b>						
5.	Devbag	Fishery (Coastal)	Agriculture	Tourism	0.13	0.14

**Table No. 29 Villages in Malvan suitable for estuarine cage fish culture**

Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Dist. from creek (Kms)	Dist. from Sea (Kms)
<b>Creek: Achare</b>					
1	Jamdul	Fishery (Creek)	Nil	0.2	0.88
2	Pirawadi	Fishery (Coastal/Creek)	Nil	0.4	0.27
<b>Creek: Kalaval</b>					
3	Revandi	Agriculture	Fishery (Creek)	0.18	0.18
4	Kolamb	Fishery (Coastal and Creek)	Agriculture	0.63	1
5	Sarjekot	Fishery (Coastal)	Tourism	0.17	1
6	Tondavali	Fishery (Coastal)	Tourism	1.6	0.87



Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Dist. from creek (Kms)	Dist. from Sea (Kms)
7	Devbag	Fishery (Coastal)	Agriculture	0.13	0.14
8	Tarkarli	Fishery (Coastal)	Tourism	0.68	0.13
9	Khand	Agriculture	Nil	1.9	More than 10 Kms
10	Wayangani	Agriculture	Fishery (Creek)	2.24	1.77
11	Juva Pankhol	Fishery (Creek)	Agriculture	0.14	1.26
12	Bagwadi	Agriculture	Fishery (Creek)	2.5	More than 10 Kms
13	Kavawadi	Agriculture	Fishery (Creek)	0.6	More than 10 Kms

**Table no. 30: Villages in Devgad suitable for oyster and Clam (Locally called “Kalava” and “Mule”) culture**

Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Dist. from creek (in Kms)	Name of creek	Dist. from Sea (in Kms)
1	Mithbav	Fishery	Agriculture	0.15	Mithbav creek	More than 10 Kms
2	Rahateshwar	Agriculture	Fishery	0.5	Wadatar creek	More than 10 Kms
3	Mond	Agriculture	Fishery	0.7	Wadatar creek	More than 10 Kms
4	Chinchwad	Fishery	Agriculture	0.7	Wadatar creek	More than 10 Kms
5	Virwadi	Fishery	Agriculture	0.5	Wadatar creek	6
6	Wadatar	Fishery	Agriculture	0.25	Wadatar creek	4
7	Jamsande	Agriculture	Fishery(Coastal/ Creek)	1.25	Wadatar creek	4
8	Mithmumbri	Fishery	Agriculture	0.34	Mithmumbri creek	1.2
9	Padvane	Fishery	Agriculture	1.1	Wadatar creek	1.1
10	Girye	Agriculture	Fishery (Creek)	2.26	Vijaydurg Creek	1.16
11	Tirlot	Agriculture	Fishery	4.4		More than

Sr No.	Village Name	Principle Occupation	Second Priority Occupation	Dist. from creek (in Kms)	Name of creek	Dist. from Sea (in Kms)
			(Creek)			10 Kms
12	Kalvi	Agriculture	Nil	0.1	Wadatar creek	8
13	Tembavali	Agriculture	Nil	0.1	Wadatar creek	8
14	Dahibav	Agriculture	Nil	0.11	Mithbav creek	More than 10 Kms
15	Phanse	Agriculture	Nil	NA	NA	0.93

Table no. 31: Villages in Devgad suitable for mussel (Locally called as “Kulche”/ “Shinane”) culture

Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Third Priority Occupatio n	Dist. from creek (in Kms)	Name of creek	Dist. from Sea (in Kms)
1	Mithbav	Fishery	Agriculture	Nil	0.15	Mithbav creek	More than 10 Kms
2	Mond	Agriculture	Fishery	Nil	0.7	Wadatar creek	More than 10 Kms
3	Chinchwad	Fishery	Agriculture	Nil	0.7	Wadatar creek	More than 10 Kms
4	Virwadi	Fishery	Agriculture	Nil	0.5	Wadatar creek	6
5	Wadatar	Fishery	Agriculture	Tourism	0.25	Wadatar creek	4
6	Jamsande	Agriculture	Fishery(Coastal / Creek)	Tourism	1.25	Wadatar creek	4
7	Mithmumbri	Fishery	Agriculture	Nil	0.34	Mithmu mbari creek	1.2
8	Padvane	Fishery	Agriculture	Nil	1.1	Wadatar creek	1.1
9	Girye	Agriculture	Fishery (Creek)		2.26	Vijaydur g Creek	1.16
1	Pural	Agriculture			0.6	Vijaydur g Creek	1.62
1	Tirlot	Agriculture Fishery			0.3	Vijaydur g Creek	4.4

Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Third Priority Occupation	Dist. from creek (in Kms)	Name of creek	Dist. from Sea (in Kms)
1	Kalvi	Agriculture	Nil	Nil	0.1	Wadatar creek	8
1	Tembavali	Agriculture	Nil	Nil	0.1	Wadatar creek	8
1	Dahibav	Agriculture	Nil	Nil	0.11	Mithbav creek	More than 10 Kms
1	Phanse	Agriculture	Nil	Nil	NA	NA	0.93

Table No. 32 Villages in Devgad suitable for estuarine cage fish culture

Sr. No.	Village Name	Principle Occupation	Second Priority Occupation	Third Priority Occupation	Dist. from creek (in Kms)	Name of creek	Dist. from Sea (Kms)
1	Mithbav	Fishery	Agriculture	Nil	0.15	Mithbav creek	More than 10 Kms
2	Rahateshwar	Agriculture	Fishery	Nil	0.5	Wadatar creek	More than 10 Kms
3	Mond	Agriculture	Fishery	Nil	0.7	Wadatar creek	More than 10 Kms
4	Chinchwad	Fishery	Agriculture	Nil	0.7	Wadatar creek	More than 10 Kms
5	Kalvi	Agriculture	Fishery	Nil	0.1	Wadatar creek	8
6	Tembavali	Agriculture	Fishery	Nil	0.1	Wadatar creek	8
7	Thakurwadi	Agriculture	Fishery	Nil	0.1	Vijaydurg creek	4

The limitations and major constraints, which may hinder the progress of Mussel cultivation are listed below in Table no. 32

**Table no. 33: Limitations**

Sr. No.	Constraints	Information	Possible solution
1	<b>Availability of seed:</b>	The seeds required for culture is presently collected from traditional fishing areas and these are often causing conflicts between farmers and shell fish culture fishermen. Hence it is essential that additional spat collectors have to be established along the coast to ensure supply of seeds to the farmers.	The seed should be made available for initial culture. Seed spats need to be established at various places.
2	<b>Marketing:</b>	The harvesting seasons of cultured mussels is mostly during April - May and farmers are forced to sell their harvest before the onset of monsoon to avoid mass mortality of mussels due to freshwater influx into the backwater system. At present, only a few processing plants purchase cultured mussels from the farmers. As a result, local market is flooded with cultured mussels during these months, resulting in a fall in the prices and thereby affecting the profitability of the operation.	Market linkages need to be established for the fishermen to sell the harvest.
3	<b>Depuration system:</b>	The main constraint in the export of cultured mussels is the lack of proper depuration techniques. Depuration plants are needed at regular intervals along the coast so as to depurate the cultured mussels for export processing.	Depuration plants need to be established at central places in clusters of shell fishery villages.
4	<b>Storage facility:</b>	If sufficient cold storage facility is provided, cultured mussels can be depurated, shucked and stored not only for export market but also for local market throughout the year. This will increase the profitability of the culture operation.	Cold storage units need to be established at central locations.
5	<b>Post-harvest technology:</b>	Value added products of longer shelf life need to be developed from mussel meat to increase the revenue realization from cultured mussels. Mussel fry, mussel pickle and so on are some of the best examples for value-added products. More studies are needed to develop ethnic cuisines with longer shelf life.	Post harvesting unit could be established for products such as Mussel fry, mussel pickle and so on
6	<b>Siltation of backwaters:</b>	Most areas in backwater in Sindhudurg system have very high siltation levels, especially	This is the major issue since most of the

Sr. No.	Constraints	Information	Possible solution
		during rainy season. This often results in mortality of mussels in the farms. Hence, scientific feasibility studies are required to demarcate potential culture sites. Silting of the bottoms, where culture is done, may induce a problem for the benthic communities located underneath. This should be solved by strong policies directed towards correct management of the fouling and silt accumulated by the hanging ropes.	creeks have undergone heavy siltation therefore there is an immediate need to undertake desiltation of the creeks.
7	<b>People's mindset</b>	Owing to lack of example of shell fishery culture in Malvan and Devgad, people are hesitant to invest in the project.	Organizing seminars and workshop on shell fishery culture would be necessary.

## 5.4 Introduction and promotion of Fish Aggregation Devices and Artificial Reefs as an EPA

### 5.4.1 Introduction:

In Malvan and Devgad, all the fishery villages complained of decline in fish catch and fish species as well as the increase in fuel price and efforts required to get the catch. Artificial Reef Fish Aggregating Devices (ARFAD's) and AR's could be one possible solution to address this issue. (Please refer Picture no. 46)

Artificial reefs are basically man-made or natural objects specifically placed to attract fish, provide or improve fish or shellfish habitat and increase fish biomass locally. The principle objectives in the construction of artificial reefs in the coastal waters is to enhance biological productivity and fisheries resources, to rehabilitate and conserve marine habitats that have been adversely affected by fishing activities and to generate the recovery, conservation and increase the fisheries resources.

Floating FADs are structures located at the surface or at mid-water depths to take advantage of the attraction of pelagic fish to floating objects.<sup>76</sup> The principle of fish aggregation is based on the tendency of fish to concentrate around floating and sunken structures for food, shade and shelter (hide-out from predators). The technology is quite popular in Japan, Philippines, United States of America and the Pacific Island countries and has been in vogue for a long period. For the first time in India, this technology was introduced through the pioneering efforts of Raja (1986), who designed and fabricated an indigenous Synthetic FAD/AR made from High Density Polyethylene (HDPE). The results of preliminary experiments were highly encouraging and were presented by Raja (1986).<sup>77</sup>

In India, traditional artificial fish habitats are seen on the Coromandel coast of India. Some of these traditional practices to attract fishes are practiced even today. The traditional fishermen on the coast of Tamilnadu use branches of trees weighted with rocks as anchors, which are dumped into the sea. They serve as artificial reefs (ARs) called Mullom in Tamil and are fished with a hook and line method of fishing. Similarly, coconut fronds tied at 1 m intervals along a rope, like a bottle-brush, are suspended from a float and anchored to the seabed with a weight. They are called "Kambi" in Tamil and they serve as a FAD. The trials

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<sup>76</sup> [www.nap.edu/openbook.php?record\\_id=1024&page=85](http://www.nap.edu/openbook.php?record_id=1024&page=85).

<sup>77</sup> [http://eprints.cmfri.org.in/2805/1/Article\\_04.pdf](http://eprints.cmfri.org.in/2805/1/Article_04.pdf).



have shown that the installation of FADs enabled thousands of cephalopodes to colonise on these submerged objects and algae also proliferated over them. This provides an excellent environment for various types of marine organisms to grow and thrive, producing further link in the food chain. Moreover, these structures in due course of time become good fish habitats enabling a variety of fishes to use it as a safe breeding ground. Observations have shown that about 18 species of fish, which were not found in the inshore waters have been attracted and captured around these structures. Most of them were predatory bigger fishes and commercially important varieties.



**Picture no. 44: Artificial reef for fish breeding**

#### **5.4.2 Construction and maintenance:**

The design models of artificial reefs range from traditional designs frequently made from local scrap materials to modern Japanese style artificial reefs that are highly sophisticated modules built of concrete, fibreglass or steel. Different structures such as wrecks, offshore oil rigs and pipelines on the sea bottom, heaps of oyster shells and so on as well as specifically designed modules can be used as artificial reefs.

Constructions covering a large area can be composed of individual modules, of which there are many models depending on the purpose. For instance, to prevent trawling, a model might consist only of slabs of concrete with stakes. To enhance resources, that is to provide shelters for certain fishes and fish aggregation in general, modules should include holes (big enough to avoid being quickly sealed by marine organisms) where the material can facilitate the fixing of "fouling" organisms as food for aggregating fish.

The overall dimensions of the reef and numbers and sizes of the holes for shelter are critical factors. Modules should not bury themselves in bottom sediment and should be bulky enough to project from the ocean bottom and massive enough to remain in place (even during severe storms). Anchoring the modules of the artificial reef, particularly in shallow waters, can help.

Material should resist rapid corrosion and should not introduce harmful substances into the marine environment. Various elements can be used to create artificial reefs, including scrap material (car, old ships and barges, scrap concrete, household appliances, rock and rubble from excavations, and so on). Even urban solid waste, products such as sandbags and bamboo frames to construct temporary "reefs", large concrete blocks, elements made from Fibre-Reinforced plastic (FRP's) and Poly Vinyl Chloride (PVC) and offshore structures for oil or gas exploitation can also serve as artificial reefs and fish aggregating devices. Building costs and installation factors (if a very large number of artificial reefs must be set up) are also considerations in the choice of modules used. In shallower waters, setting FADs in conjunction with an artificial reef has proven profitable in several places. It has not been possible to identify a single model, which could be universally recommended. The modern newly designed ARFAD's are made up of 3.2 tones concrete anchor, plastic appendages and floats. After a few years of deployment, this structure has turned into new habitats that resemble natural habitat for several demersal fish species as well as sanctuaries for fish and other marine life. The concrete anchor may also act as hindrance from illegal trawlers encroaching in the areas as well as creating new fishing spots close to villages for subsistence or recreational purposes.

The aggregation, enhancement and diversification of pelagic and demersal fish resources resulting from this ARFADs structure could, in many cases, lead to economic gains of the coastal fishermen. These environmental friendly ARFADs are applicable to traditional fishermen using selective gear only, especially hook and lines. The catch from this fishing gear is known to be very selective and only marketable sized fish is being caught. This will eventually increase catch performance of traditional fishermen without causing any possible effect of overfishing in the coastal areas.

### 5.4.3 Rationale of artificial reef and fish aggregating devices installation:

The extent to which artificial reefs increase fish biomass or redistribute existing stocks of fish is not clear. However, even if they do not substantially increase fish production, they can be used as effective fisheries management tools. The increased standing fish crop around artificial reefs reduces fishing efforts and therefore, saves time and fuel. Furthermore, artificial reefs can be used to create fishing grounds for artisanal fishermen, who use traps and hook and line gear. FAD's have been utilised for centuries in the Philippines to attract migrating tuna. Like artificial reefs, FAD's can also reduce fishing effort and conserve fuel.

**Installation of ARFAD's and AR's in Sindhudurg has following advantages:**

1. Fishermen's catch and thus income will increase.
2. It will result in minimisation of bottom trawling activity, which is negatively affecting coral population, searching time and hazards for fishermen.
3. It will reduce fuel-consumption of mechanized fishing boats, which is the major issue for the fishery villages.
4. Increases variety of catch since different species of fish (including predatory fish and those from deeper waters) converge at the AR/FAD.
5. Helps demarcate territorial waters for traditional fishermen and assists in enforcing the Marine Fishing Regulation Act.

### 5.4.4 Policies on Artificial Reefs and Floating fish aggregation devices:

As per the literature review, currently there are no set policies by central government or state government for installation and maintenance of ARFAD's and AR's in India.

### 5.4.5 Backward and forward linkages

The unit cost for artificial reef ranges from 2 to 6 lakhs, depending upon the raw materials used for the construction of artificial reefs or fish aggregating devices. The local scrap materials such as old tyres, metal scrap, if used, could minimise the cost of the same.

### 5.4.6 Commercial viability:

Installation of artificial reefs and fish aggregation devices at appropriate locations could provide major relief to local fishermen. Considering the potential socio-economic impact, currently there is a lack of thorough economic analysis of the costs and benefits of artificial reefs.

### 5.4.7 Potential villages for implementing the EPA:

Most of the fishery villages will be benefited by this activity. However, most of the coastal villages are located in close vicinity. Therefore, a common structure for adjacent villages could be worked out. Also, the minimum distance between two Artificial Reefs/Fish Aggregating Devices installations should be around 5-10 kms apart so as to maximize their impact and benefits.<sup>78</sup>

The limitations and major constraints hindering the progress of artificial reef are listed below in Table no. 33.

**Table no. 34: Major concerns**

Sr. No.	Constraints	Information	Possible solution
1	Fishing conflict	This could lead to competition between mechanised and non-mechanised fishermen.	Coast guard monitoring for surveillance for defining fishing areas.
2	Conflicts with existing fishing operations	There should not be any conflict in selection of sites for artificial reefs with fishing communities.	The fishing grounds currently in use on which fishermen are dependant should not be selected for installation of artificial reefs.
3	Community support	Success of managing marine habitat is greatly dependent on the support of local fishing community.	The local community should be involved and educated about the implications of this activity.

<sup>78</sup><file:///Z:/MANGROVE/Malvan/Interim%20report%20for%2090%20villages/Artificial%20reefs/Science%20and%20Society%20Division%20Home%20Page.html1.htm>

## 6. Credit Plan for Fishery Related Activities:

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### 6.1 Introduction

Financial assistance for various fishery-related activities in Sindhudurg would be available from:

1. National fisheries Development Board (NFDB)
2. National Co-operative Development Corporation (NCDC) and
3. Department of Fisheries, Government of Maharashtra

**NFDB provides financial assistance for following activities related to fishery:**

1. Intensive aquaculture in ponds and tanks
2. Fisheries development in reservoirs
3. Coastal aqua-culture
4. Mari-culture
5. Sea-weeds cultivation
6. Infrastructure: Fishing harbours and landing centres
7. Fish drying centre and solar drying of fish
8. Domestic marketing
9. Technology upgradation
10. Deep sea fishing and Tuna processing

**NCDC provides assistance to fishery co-operatives for the following purposes:**

1. Purchase of operational inputs such as fishing boats, nets and engines.
2. Creation of infrastructure facilities for marketing, transport vehicles, ice-plants, cold storages, retail outlets, processing units and so on
3. Development of inland fisheries, seed farms, hatcheries and so on
4. Preparation of feasibility reports
5. Integrated Fisheries Projects (Marine, Inland and Brackish Water)

**Department of Fisheries, Government of Maharashtra provides following schemes for fishery sector:**

1. Establishment of national fish seed centre
2. Fisheries training and extension
3. Assistance in purchase of modern equipment's for marine fishing vessels
4. Establishment of fishing harbours and fish landing centres

5. National scheme on welfare of fishermen

## 6.2 Mussel Farming<sup>79</sup>:

Few fishery villages in Malvan and Devgad block are involved in mussel collection. However, they are unaware of mussel culture techniques and financial assistance availability for the same. Malvan has access to three creeks: Karli, Kalval and Achare whereas Devgad has four creeks: Wadatar, Waghotan, Mithbav and Mithmumbhari. Based on the hydro-graphic condition in most estuaries, a marine phase from December to May and a brackish water phase from June to November has been observed. The ecosystem becomes conducive for mussel culture during the marine phase. During 2005-06, the estimated farmed mussel production in the country was about 10,060 tonnes. The NFDB envisages promotion of mussel farming in the coastal states of India through development fund assistance.

### I. Eligibility criteria:

The criteria for selection of farmers/ fishermen for grants for estuarine/ open sea mussel farming are as follows -

- a. Proximity of fishermen/ farmers homestead to an estuarine water body with marine conditions during summer months or proximity of fishermen/ farmers homestead to calm seas
- b. Proximity to sea, where seed mussels will be available during post-monsoon months
- c. Necessary clearances for undertaking mussel farming in coastal waters

### II. Type of Assistance:

The components of a mussel farming unit include rack/ raft holding mussel ropes with semi-automatic seeder, de-clumper and post-harvest and depuration facilities. The unit cost for operation and demonstration as well as subsidy details are indicated in ANNEXURE-I and ANNEXURE-VI.

## 6.3 Edible Oyster and Clam Farming<sup>80</sup> :

Most of the villages in Malvan and Devgad are involved in oyster and clam collection. However, they are unaware of mussel culture techniques and financial assistance availability for the same. The oyster species found in these two blocks are *Crassostera spp.* locally known as "Bud-kalava" and *Crassostera cuculata* locally known as "Kalva", whereas various species of clams like *Villorita cyprinoides*, *Meretrix casta* which are locally known as Lalde, Karmale, Tisre and so on are found on the southern western Indian coast. Cultivation of edible oyster (*Crassostrea madrasensis*) is being undertaken by small scale farmers in shallow estuaries, bays and backwaters in a big way.

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<sup>79</sup> <http://nfdb.ap.nic.in/pdf/4.Guidelines%20for%20Mariculture.pdf>

<sup>80</sup> <http://nfdb.ap.nic.in/pdf/4.Guidelines%20for%20Mariculture.pdf>



### **I. Eligibility Criteria:**

The criteria for selection of farmers/ fishermen for grants for mussel farming are as follows -

- a. Proximity of fishermen/ farmers homestead to an estuarine water body with marine conditions during summer months
- b. Willingness of the entrepreneur to take up oyster farming
- c. Necessary clearances for undertaking oyster farming in coastal waters

### **II. Type of Assistance:**

The components of one unit include rack and ren unit holding oyster rens with post-harvest and depuration facilities and the costs for operation and demonstration are indicated in ANNEXURE-I and ANNEXURE-VI.

## **6.4 Estuarine/Open-sea cage fin fish culture<sup>81</sup>:**

Most of the villages in Malvan and Devgad are along the coast or creek involved in fishing activities. However, they are unaware of estuarine/open sea cage fin fish farming techniques and financial assistance availability for the same. Introduction of the same will benefit most of the fishermen in great sense to supplement their income.

### **I. Objectives of the scheme:**

- a. To supplement the marine fish production through:
  - Production of fin fish seed by diversification of shrimp hatcheries
  - Open sea cage culture
  - Diversified mari-culture through molluscan farming
- b. Popularization of concept of the cage culture through setting of model demonstration and units and imparting training to the traditional fishermen.

### **II. Components of Assistance:**

The NFDB will assist the following components:

- a. Production of finfish seed in shrimp hatcheries
- b. Setting up of open sea cage culture
- c. Demonstration of model sea cage culture to traditional fishermen
- d. Marine ornamental fish culture
- e. Molluscan farming including pearl culture

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<sup>81</sup> <http://nfdb.ap.nic.in/pdf/4.Guidelines%20for%20Mariculture.pdf>

**a. Production of finfish seed from shrimp hatcheries:**

In view of the need for diversification of the shrimp hatcheries, the scheme provides for production of finfish seed.

**I. Eligibility criteria:**

- Individuals/organizations with the ownership of shrimp/scampi hatcheries located in coastal areas, where the water resource is suitable for marine finfish seed production with clear title of land, where the hatchery is situated
- Commitment of entrepreneur to bear 80 percent of the cost towards diversification
- Prospective entrepreneur should have received training, preferably in finfish hatchery operations

**II. Type of Assistance:**

The cost for development of shrimp hatchery includes repair/ renovation/modification of the existing structures, additional tanks/facilities for live feed culture, larval rearing, and so on and tentative unit cost and economics are indicated in **ANNEXURE-II and ANNEXURE-III**. The assistance from NFDB will be to the tune of 20 percent of the cost of diversification, as a back-ended subsidy.

**b. Setting up of open sea cage culture:**

In view of the potential for open sea cage culture at several locations along the Indian coastline, the scheme provides for the activity.

**I. Eligibility criteria:**

- Entrepreneurs/companies with a previous record of undertaking large-scale aquaculture operations and having adequate on-shore facilities for seed rearing
- Fishermen groups operating the scheme through fishery federations/ corporations
- Availability of necessary clearances for undertaking the cage culture activity in the coastal areas
- Commitment of state fishery federations/ corporations, entrepreneur to bear 80 percent of the cost

**II. Type of assistance:**

The unit cost of a modern fish net cage system includes the cost of net material, HDPE frames, floats, anchors, establishment of on-shore facilities and tentative unit cost. Economics for both large scale and small scale operations are indicated in **ANNEXURE-II and ANNEXURE-VI**. The companies willing to set up open sea cage culture in a big way shall be supported by NFDB through equity participation at 20 percent of the investments.

**c. Demonstration of model cage culture to traditional fishermen:**

In order to train fishermen in cage farming, it is proposed to set up model cage demonstration farms with a battery of cage units. Each unit would consist of HDPE framed cage with nylon net enclosures of different mesh sizes. High value fish seed will be stocked in these cages and reared for 6–8 months, till they reach marketable size. This would form a production-cum-demonstration facility, wherein the fisherman co-operatives/SHGs will benefit.

**I. Eligibility criteria:**

**(i) For setting up demonstration farms -**

The following criteria shall be applicable for the selection of organization/agency to set up demonstration farms:

- ICAR research institutes/ state fisheries departments/ state fisheries federations/ corporations, fishery colleges, with adequate facilities and background in coastal aquaculture and mari-culture
- Possessing adequate manpower and expertise to conduct frontline demonstration to traditional fishermen

**(ii) Selection of farmers/ fisherman for receiving the demonstration -**

The following criteria shall be applicable for the selection of farmer/fisherman for receiving the demonstration:

- Fishing/fish farming should be his/ her main occupation
- Should be sponsored by state government/fishermen co-operatives/ SHGs/ fisheries development agencies
- Priority should be given to fishermen affected by marine protected areas/natural calamities.

**II. Type of assistance:**

The duration of each demonstration/training is a total of 10 days in three spells, for a batch of about 25 trainees. The details of the assistance for training are given in ANNEXURE-VI.

## 6.5 Infrastructure: Fishing harbours and landing centres<sup>82</sup>:

The NFDB assists in infrastructure development at fishing harbours and landing centres for providing facilities at fishing harbours and landing centres. Annexure No.IV

### a. Fishing harbours:

#### I. Eligibility criteria:

Existing fishing harbours owned by state/ central govt. departments, boat owners' associations and co-operatives will be eligible for the support.

#### II. Type of assistance:

Need-based financial support is provided to incomplete harbours for completion of works, provided the same can be completed within a reasonable period, an effective arrangement is put in place for the management of the facility and the agency agrees to pay to the Board 10 to 30 percent (depending on the extent of financing done by the board for completion of the project) of the gross income from landing and service charges collected.

### b. Landing centres:

Most of the villages in Malvan and Devgad along the coast or creek are involved in fishing activities. However, the unavailability of basic infrastructure in terms of landing jetties is the major constraint documented for most of the coastal villages. Landing centres are comparatively small facilities for landing the catch from traditional fishing crafts. On an average, about 25 to 100 traditional crafts are expected to land their catch in a landing centre. A traditional craft can catch about 500 kg fish/day. There can be landing simultaneously from 10 crafts, necessitating a handling facility for 5 tonnes at a time and 50 tonnes per day. Accordingly, there shall be water, ice and insulated store to take care of landed fish so that the catch is safe and prime in quality. Following villages in Malvan complained of lack of jetty as a key infrastructure gap for fishery. (Table no. 34)

**Table No. 35 Villages with immediate need of a jetty**

Sr. No	Block	Villages
1.	Malvan	Kolamb, Sarjekot, Makrebag, Revandi, Achare, Pirawadi, Wayri, Wayangani, Tondavali and Devbag.
2.	Devgad	Devgad, Tambaldeg, Vijaydurg, Wadatar, Bandewadi, Mithmumbari and Virwadi.

<sup>82</sup><http://nfdb.ap.nic.in/pdf/6.Guidelines%20for%20Infrastructure%20for%20Post%20Harvest%20Processing.pdf>

**Proposed jetties for Sindhudurg district by Maharashtra Fisheries**

**Department:** As per the order passed on August 26, 2009, construction of jetty is proposed by Fisheries Department of Maharashtra at Wayri, Sarjekot, Makrebag, Nivati Medha, Tambaldeg and Vengurla in Sindhudurg district. The construction of jetty and cold storage centre has started in Sarjekot but development hasn't started yet at other above mentioned places.

**I. Eligibility criteria:**

Existing landing centres established by the govt. sector/ co-operative societies, which are incomplete and lack the required facilities.

**II. Type of assistance:**

Need-based financial support will be provided to incomplete landing centres for completion of works, provided the same can be completed within a reasonable period, an effective arrangement is put in place for the management of the facility and the agency agrees to pay to the Board 10 to 30% (depending on the extent of financing done by the Board for completion of the project) of the gross income from landing and service charges collected. Please refer to ANNEXURE-VI.

## 6.6 Fish drying centre and solar drying of fish<sup>83</sup>:

The villages with requirement of fish drying centres are given below in Table no. 35.

**Table no. 36: Villages with need of a fish drying centre**

Sr. No	Block	Villages
1.	Malvan	Kolamb, Sarjekot, Makrebag, Revandi, Achare, Pirawadi, Wayri, Wayangani, Tondavali and Devbag.
2.	Devgad	Devgad, Tambaldeg, Thakurwadi, Girye (Bandewadi), Mithmumbhari, Morve, Vijaydurg, Katwaneshwar and Virwadi.

NFDB supports setting up of fish dressing centres near the major fish production/landing centres, with facilities to handle, process and pack fish hygienically for sale through retail outlets. It also imparts training, particularly to fisherwomen, on a much large scale. Since the traditional method of fish drying for preservation is unhygienic, NFDB proposes to set up hygienic solar fish drying units and fish drying platforms for sun drying all over India.

<sup>83</sup><http://nfdb.ap.nic.in/pdf/7.Guidelines%20for%20Fish%20Dressing%20Centres%20and%20Solar%20Drying.pdf>

These units will provide practical models for fishermen to adopt, resulting in safe and quality, dried fishery products and significant reduction in post-harvest losses.

- a. Setting up of model fish dressing centres
- b. Training and demonstration
- c. Setting up of solar drying units
- d. Platforms for sun drying of fish

**a. Fish dressing/ processing centres:**

NFDB proposes to support setting up of fish dressing centres near the major fish production/ landing centres, with facilities to handle, process and pack fish hygienically for sale through retail outlets and impart training, particularly to fisherwomen, on a much large scale.

**Components of assistance:**

The NFDB will assist the following components to support fish dressing centres:

- Setting up of fish dressing centres
- Training and demonstrations to fisherwomen

**b. Setting up fish dressing centres:**

**I. Eligibility criteria:**

The following criteria will be used for setting fish dressing centres:

- State departments/ Research and Development (R&D) institutes/ corporate houses / co-operative societies/ women SHGs / private entrepreneurs engaged in fisheries
- Past experience and performance in the field
- Willingness to adopt modern methods of fish utilization
- Land and other immovable property required for implementation of the project showing title deed/ lease agreement (for 10 years) in case of non-availability of land especially for women SHGs. Autonomous fishery bodies such as State Fisheries Corporation/ federation and so on may have to intervene to provide land and other facilities and the scheme will be implemented through these autonomous bodies
- In the case of co-operative societies, women self-help groups or private entrepreneurs and corporate bodies, the proposal has to be submitted through the respective state fisheries departments.

**II. Type of assistance**

The NFDB assistance will be to the extent of 20% subsidy to the government organizations, R&D institutes, women SHGs and co-operative societies engaged in fisheries and 20% equity for the private sector corporate houses and entrepreneurs.



**c. Training and demonstration:**

**I. Eligibility criteria:**

**• Developmental organizations with proven track record in training –**

State and central agencies/R&D departments/ institutes, state fishery corporations/ fishery federations, women SHGs engaged in fisheries sponsored by state fisheries department/fisheries corporation, fishermen federation and other alike fisheries apex bodies and other rural development departments with background of fish processing and value addition

- Proven expertise in processing of fish and fishery products

**II. Type of assistance**

Details of the NFDB assistance for the purpose is provided in ANNEXURE-V.

**d. Solar drying of fish:**

**Components of assistance**

The NFDB will assist the following two components to support solar drying of fish:

- Setting up of solar drying units
- Platforms for sun drying of fish

**Setting up of solar drying units**

Under this category, the NFDB will support setting solar drying units with a capacity 1,000 kg or above wet fish per load. Solar driers or solar driers with LPG back-up depending up on the climatic condition of the region where the facility is set up are used.

**I. Eligibility criteria**

Fisheries departments/ R&D institutions/ individuals/ fishermen/ fisherwomen co-operative societies and SHGs engaged in fish drying and dry fish marketing shall be eligible to receive the assistance.

**II. Requirements:**

- Building for receiving, cleaning and Washing, drying facility – 1500 sq.ft.
- Insulated boxes 100 kg X 4
- Utensils, weighing balances, trays, cutlery, cutting board and so on
- Pre-processing table (4)
- Water purification system
- Sanitary facilities, toilet and so on
- Effluent Treatment System (ETS)

- Atleast four driers with 500 kg/load
- Vacuum packing unit
- Packing materials

### III. Type of assistance

The NFDB assistance will be to the extent of 20% subsidy to the beneficiaries sponsored by government organizations, women SHGs engaged in fisheries sponsored by state fisheries department/fisheries corporation, fishermen federation and other similar fisheries apex bodies and 20% equity for the corporate bodies and private entrepreneurs.

#### a. Platforms for sun drying of fish:

The platforms for drying of fish can be prepared from SS mesh on SS frame so that proper sanitation and hygiene can be maintained on a daily basis. The capacity shall be 100 kg wet fish or its multiples. This will enable better quality dry fish production to improve consumer appeal and marketing with significant reduction in post-harvest losses.

#### **Eligibility criteria:**

Individual fishermen/ fishermen's co-operative societies/ central and state agencies/ non-governmental organizations (NGOs)/ SHGs engaged in fish drying/curing and marketing.

#### **Requirements:**

- Utensils
- SS frame and mesh platform (150 Sq. ft.) with fly proof facility
- 2 sealing machines
- Cutting board and cutlery
- 2 SS tables
- Semi-permanent fly proof shed

#### **Type of assistance**

The NFDB assistance will be to the extent of 20% subsidy to the beneficiaries sponsored by government organizations, women SHGs engaged in fisheries sponsored by state fisheries department/fisheries Corporation, fishermen federations, other fisheries apex bodies and 20% equity for the corporate bodies and private entrepreneurs.

## ANNEXURE:

### ANNEXURE I : NFDB Scheme for coastal Aquaculture: Mari-culture - Mussel, oyster and clam culture<sup>84</sup>

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
1.	Assistance to mussel/ oyster/ clam culture/ other commercial shellfishes	<ul style="list-style-type: none"> <li>For mussel culture (rack culture: 30x20m.rack of 1200 ropes of 1.m) INR 1.90 lakhs on capital and INR 0.49 lakhs as recurring cost)</li> <li>For mussel culture (raft culture: 12 units of 5m x5m rafts of 300 sq.m (600 ropes of 4m): INR 4.32 lakhs (INR 2.81 lakhs on capital and INR 1.51 lakhs as recurring cost)</li> <li>For edible oyster and clam culture (rack culture of 300 sq. m. area) INR 1.27 lakhs (INR.0.38 lakhs on capital and INR 0.89 lakhs as recurring cost)</li> </ul>	50% subsidy on the unit cost
2.	<b>Training and Demonstration -</b>  (i) Assistance to farmers for participation in 10 days training programme (batch of 25 – 30). (ii) Honorarium to Resource Persons (iii) Assistance to Implementing agency for training and demonstration	<ul style="list-style-type: none"> <li>a. Daily allowance of INR 125/ day/trainee and reimbursement of actual to and fro travel, subject to a maximum of INR 500 per trainee</li> <li>b. Honorarium of INR 1250 and actual to and fro travels expenses, subject to a maximum of INR 1000</li> <li>c. INR 75/ trainee/ day to the implementing agency towards identification, mobilization of beneficiaries, supply of training material and so on</li> <li>d. (iv) Development of demonstration unit @ INR 1,00,000 (one time grant) to the implementing agency to conduct regular training/ demonstration activities</li> <li>e. In absence of own facility, grant of INR 50,000 shall be available to the state government to lease private unit and its development for conduct of training/ demonstration and so on</li> <li>f. In the absence of (d) and (e) above, INR 5,000 per training program for hiring suitable facility from private farmer</li> <li>g. ICAR Fisheries Institutes/ Colleges of</li> </ul>	

<sup>84</sup> <http://nfdb.ap.nic.in/pdf/4.Guidelines%20for%20Mariculture.pdf>

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
		Fisheries under State Agriculture Universities/ Other Agencies using their own facilities will get a lump sum amount of INR 5,000 per training programme for this purpose	

## ANNEXURE II: Schemes for Estuarine/ Open Sea cage culture of Fin fish for Individuals<sup>85</sup>

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
1.	Construction of ponds for brackish water fin fish culture	INR. 2.40 lakhs/ha	• 25% cost subject to a maximum of INR. 0.60 lakhs/ha as subsidy
2.	Additional infrastructure for brackish water finfish Culture for modification of existing farms	INR. 2.00 lakhs/ha	• 25% cost subject to a maximum of INR. 0.50 lakhs/ha as subsidy
3.	Input assistance for brackish water fin fish culture	INR 3 lakhs/ ha. (subject to the approval of CIBA based on the production levels)	<ul style="list-style-type: none"> <li>• One time back ended subsidy of 25% to all farmers to a maximum of 0.75 lakhs/ha</li> <li>• 30% subsidy in case of Schedule Caste (SCs)/ STs to a maximum of INR 0.90 lakhs/ha</li> </ul>
4.	Cage culture of fin fishes in ponds	Capital cost of INR 10 lakhs / ha (Subject to the approval of CIBA/ RGCA based on the production levels)	<ul style="list-style-type: none"> <li>• Back-ended subsidy of 25% on the capital cost not exceeding INR 2.50 lakhs/ha</li> <li>• Back-ended subsidy of 30% on the capital cost to SC/ STs not exceeding INR 3 lakhs/ha</li> </ul>
5.	Input assistance for cage culture of brackish water fin fish	INR 7 lakhs / ha (Subject to the approval of CIBA/ RGCA based on the production levels)	<ul style="list-style-type: none"> <li>• Back-ended subsidy of 25% on the working capital for first crop with a ceiling of INR. 1.75 lakhs/ha</li> <li>• Back-ended subsidy of 30% on the working capital for first crop to SCs/STs with a ceiling of INR 2.10 lakhs/ha</li> </ul>

<sup>85</sup> <http://nfdb.ap.nic.in/pdf/4.Guidelines%20for%20Mariculture.pdf>

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
6.	Input assistance for cage culture of brackish water fin fish	INR 7 lakhs / ha (Subject to the approval of CIBA/ RGCA based on the production levels)	<ul style="list-style-type: none"> <li>• Back-ended subsidy of 25% on the working capital for first crop with a ceiling of INR 1.75 lakhs/ha</li> <li>• Back-ended subsidy of 30% on the working capital for first crop to SCs/STs with a ceiling of INR 2.10 lakhs/ha</li> </ul>

### ANNEXURE III: Schemes for Estuarine/ Open Sea cage culture of Fin fish for Commercial set ups/ Companies

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
1.	Setting up of open sea cage culture by companies	INR 2 crores per unit	<ul style="list-style-type: none"> <li>• 20% equity participation on investment</li> </ul>
2.	Setting up of new hatcheries for brackish water fin fish seed production	INR 72 lakhs	<ul style="list-style-type: none"> <li>• 40% subsidy on the unit cost not exceeding INR 28.80 lakhs/unit</li> </ul>
3.	Diversification by shrimp hatcheries to brackish water fin fish seed production	INR 70 lakhs	<ul style="list-style-type: none"> <li>• 20% subsidy on the unit cost not exceeding INR 28.0 lakhs/unit</li> </ul>
4.	Assistance for setting up of Open Sea cage culture units	Capital cost of INR 6 lakhs /cage and working capital of INR 4.15 lakhs/ cage of 12 meter dia	<ul style="list-style-type: none"> <li>• 40% back-ended subsidy on capital and working capital to fishermen groups and entrepreneurs</li> </ul>
5.	Assistance for setting up of open sea cage culture units by fishermen societies and SHGs	Capital cost of INR 1.25 lakhs/ cage of 6 meter diameter	<ul style="list-style-type: none"> <li>• 40% back-ended subsidy on capital cost to fishermen societies and groups</li> </ul>
6.	Training on marine ornamental fish culture	100% grant	<ul style="list-style-type: none"> <li>• 100% financial assistance to govt. institutions as per the guidelines of NFDB</li> </ul>

## ANNEXURE IV: Schemes for Infrastructure Development for Harbours and Landing Centres

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
1.	Renovation/ upgradation of existing fishing harbour	As per the recommendation of CICEF, Bangalore	• 100% grant to state governments/ port trusts
2.	Renovation/ upgradation of existing fish landing centres	As per the recommendation of CICEF, Bangalore	• 100% grant to state governments/ port trusts

## ANNEXURE V: Development of Domestic Fish Marketing, Solar drying of fish

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
1.	Modernization of wholesale fish markets	INR 250 lakhs/50 stalls	• 90% of capital cost as grant to government fisheries departments, quasi-government organizations, local civic bodies and research institutes
2.	Development/ construction of new retail markets complexes and retail outlets	INR 50 to 100 lakhs for establishment of major retail markets (20 outlets) and up-to INR 50 lakhs for minor retail market (10 outlets)	• 90% of capital cost as grant to government fisheries departments, quasi-government organizations, local civic bodies, research institutes, 25% of capital cost as subsidy to entrepreneurs and 30% to SC/ST, women and NE beneficiaries
3.	Establishment of modern fish retail outlet by NFDB	To be decided and appraised on case to case basis and on the local conditions	• NFDB will establish the retail outlets and they will be leased/ rented to eligible entrepreneurs/ self-help groups/ ex-servicemen to manage the unit under PPP mode
4.	Setting up of retail fish outlets	Up to INR 10 lakhs	• 40% subsidy on the project cost to fisherwomen are involved in



Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
			fish marketing and members of local fishermen or fisherwomen co-operative societies
5.	Cold chain development and processing of value added and products	Unit cost has to be decided appraised on case to case basis	<ul style="list-style-type: none"> <li>90% of capital cost as grant to government fisheries departments, fisheries corporations/ federations and 40% of capital cost as subsidy to entrepreneurs</li> </ul>
6.	Campaign for promotion of fish products and consumption	Each proposal will be examined and appraised on case to case basis	<ul style="list-style-type: none"> <li>100% grant to government departments, research institutions and quasi-government organizations</li> </ul>
7.	Model Fish Dressing Centre	Up to INR 150 lakhs	<ul style="list-style-type: none"> <li>90% grant to the govt. departments/ quasi-govt. organizations/ research institutes</li> </ul>
8.	Developing working model/ branding /bench marking / certification	Case to case basis	<ul style="list-style-type: none"> <li>90% grant to the Govt. Departments/Quasi Govt. Organizations /Research Institutes</li> </ul>
9.	Setting up of Solar Drying of fish units	<ul style="list-style-type: none"> <li>Unit cost up to INR 6.0 lakhs for 100 Kg/day</li> <li>Case to case basis for 500 kg./day and above</li> </ul>	<ul style="list-style-type: none"> <li>90% grant to the govt. departments/ quasi-govt. research institutes</li> <li>25% subsidy (30% for SC/ST and NE regions) to fishermen/ fisher women/ SHGs/ entrepreneurs</li> </ul>
10.	Platform for sun drying of fish	Unit cost limited to INR 35,000 per platform of min 150 sq. ft.	<ul style="list-style-type: none"> <li>90% grant to the govt. departments/ quasi-govt. research institutes</li> <li>25% subsidy (30% for SC/ ST</li> </ul>

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
			and NE regions) to fishermen/ fisher women/SHGs/ entrepreneurs

## ANNEXURE VI: Human Resource Development Programmes-Training

Sr. No.	Name of the Activity/ Scheme	Unit Cost	Pattern of assistance
1.	Training programme on different aquaculture practices, processing and extension activities to formers / master trainers/ government officers at induction level.	To be decided on case to case basis	<ul style="list-style-type: none"> <li>• 20 participants per batch</li> <li>• Period of training 10 days/training</li> <li>• TA will be provided on request from the organizing institute after submission of travel documents</li> <li>• No DA is eligible to the participants since boarding and lodging facilities is provided by the concerned training institutes with the funding support of NFDB</li> <li>• Funding support will be provided to the training organizing institutes towards course fee, honorarium and the resource personnel, publication, local visit and miscellaneous expenditure, where justified</li> <li>• 100% financial assistance to government as per the guidelines of NFDB</li> </ul>

## ANNEXURE VII: Fish Species Local and Scientific Names

Sr. No.	Common name	Konkani	Malvani	Scientific Name
1.	Ribbon fish	Bale	Bale	<i>Lepturacanthus sp</i>
2.	Mackerel	Bangdo	Bangda	<i>Rastrelliger kanagurta</i>
3.	Shrimps	Galmo	Kolambi	<i>Penaeus indicus</i>
4.	Tiger Prawns	Vagheo	Vaghol	<i>Penaeus monodon</i>
5.	Jew fish	Ghol	Ghol	<i>Protonibea diacanthus</i>

Sr. No.	Common name	Konkani	Malvani	Scientific Name
6.	Rock fish/ Reef Cod	Gobro	Gobra	<i>Epinephelus sp. (E. malabaricus)</i>
7.	Black pomfret	Halwo	Halwa/ Saranga	<i>Parastromateus niger</i>
8.	Gizzard shad	Jibra		<i>Anodontostoma sp</i>
9.	Pearl spot/ Green Chromide	Kalunder	Kalunder	<i>Etroplus suratensis</i>
10.	Golden anchovy	Kapsali	Mandeli	<i>Coilia dussumieri</i>
11.	Silver Belly	Khampi	velli	<i>Leiognathus bindus</i>
12.	Mussels	Shinaneo	Shinane	<i>Perna viridis (Green Mussel)</i>
13.	Silver bar	Korli	Karli	<i>Chirocentrus sp.</i>
14.	Crab	Kurli	Kurle, Khekde	<i>Scylla serrate</i> <i>Portunus sanguinolentus</i> <i>Portunus pelagicus</i> <i>Charybdis feriatus (C. cruciata)</i>
15.	Indian Spiny Turbot/ Indian Halibut	Lepo	Lep	<i>Psettodes erumei</i>
	Tongue Sole	NA	Lep	<i>Paraplagusia sp. or Cynoglossus sp.</i>
16.	Sawfish	mushi	Kandere	<i>Pristis pectinata</i>
17.	Squids	Mankio	Mhakul	<i>Loligo duvauceli</i>
18.	Indian Dog Shark	Mori	Mori	<i>Scoliodon laticaudus</i>
19.	Blacktip Reef Shark	Mori	Mori	<i>Carcharhinus melanopterus</i>
20.	Goatfish	Rane	Rane	<i>Parupeneus indicus</i>
21.	Indian salmon	Rawans	Rawas	<i>Eleutheronema tetradactylum</i>
22.	Cat fish	Sangott	Khaapi	<i>Arius maculatus</i>
23.	Lobster	Shivod kurli	shevand	
24.	Silver pomfret	Surgunti	Paplet	<i>Pampus argenteus</i>
25.	Mangrove Red Snapper	Tambuso	Tamboshi	<i>Lutjanus argentimaculatus</i>
26.	Sardines	Thalle	Pedave	
27.	Clams	Tisreo	Tisre	
28.	Clam species	Mule	Karmale	<i>Villorita cyprinoides</i>
29.	Clam species	Mule	Laal mule	<i>Meretrix casta</i>

Sr. No.	Common name	Konkani	Malvani	Scientific Name
30.	Mangrove clam	Mule	Mule	<i>Polymedosa erosa</i>
31.	Ray fish	Vagolem	Waghale	
32.	Indo Pacific King Mackrel/Seer fish	Visvon	Surmai	<i>Scomberomorus guttatus</i>
33.	Malabar Anchovy	NA	Sonam	<i>Thryssa malabarica</i>
34.	Indian Whiting	NA	Sule	<i>Sillago sp</i>
35.	Indian Oil Sardine	NA	Tarli	<i>Sardinella longiceps</i>
36.	Needlefish	NA	Tol	<i>Xenentodon cancila</i>
37.	Scat fish	NA	Wada	<i>Scatophagus argus</i>
38.	Eel	Wam	Wam	<i>Muraenesox talabonoides</i>
39.	Indian Pompano	NA	NA	<i>Trachinotus mookalee</i>
40.	Target fish	-	-	<i>Crescent perch/ Terapon jaruba</i>
41.	Edible Oyster	Kalava	Bud Kalva	<i>Crassostera sp.</i>
42.			Kalva	<i>Crassostera cuculata</i>
43.	Indian salmon	NA	Rawas	<i>Eleutheronema tetradactylum</i>
44.	Whip fin majarra	NA	Shetaki	<i>Gerres sp.</i>
45.	Croaker Dodyaro	NA	Dhoma	<i>Otolithes sp.</i>
46.	Finned Bulleye		Rani masa	<i>Cookeolus spp.</i>
47.	False travelly		Saundala	<i>Lactarius lactarius</i>
48.	Mangrove snail	NA	NA	<i>Telescopium telescopium</i>
49.	Spotted sicklefish	NA	NA	<i>Drepane punctate</i>
50.	Mullet	NA	NA	<i>Mugil sp.</i>

**ANNEXURE VIII: Priority EPA's for Sindhudurg villages****Malvan Block (A)****Note:**

- This priority ranking for EPAs is based on feedback and suggestions from various stakeholders.
- The EPAs and ranking given for biodiversity conservation is an outcome of TERI's interpretation based on several FGDs and transect walk conducted with the stakeholders.
- In villages, where no particular EPA was identified as a priority, it is mentioned as 'Not identified'.

Sr. No.	Village Name	ENTRY POINT ACTIVITY			Priority Ranking		
		Key Infrastructure Intervention	Initiatives for Revenue Generation	Biodiversity Conservation			
		1	2	3			
Achare G.P.							
1	Achare	Cold storage facility for fishery sector. Need small, check bunds at appropriate distance on the Achare creek for irrigation	Establishing market linkages for fishery and SHG's. Mussel, oyster and clam culture	Establishing nursery for native/ traditional medicinal plants	2	1	3
2	Dongrewadi	Need small, cement check bunds at appropriate distance on the Achare creek for irrigation	Introducing salt-tolerant rice varieties in Khajan land	Not identified	1	2	-
3	Gaudwadi	Need for community cold storage facilities (A common unit for Achare, Gaudwadi and Pirawadi village)	Food processing centre for agriculture produce	Not identified	1	2	-
4	Hirlewadi	Need small cement check bunds at appropriate distance on the Achare creek for irrigation		Not identified	1	2	-
5	Jamdulwadi	Not identified	Market linkages for tourism promotion activity	Not identified	2	-	-
6	Parwadi	Khar bandhara/bund to control salt water intrusion and water conservation Structures	Introducing salt tolerant rice varieties	Not identified	2	1	-
7	Pirawadi	Need for community cold storage facilities (A common unit for Achare, Gaudwadi and Pirawadi village).	Mussel, oyster and clam culture	Sea turtle nesting sites were located in this village so protection for the same should be	1	2	3

				provided			
8	Varchiwadi	Not identified	Crash courses on hospitality for youth for tourism development	Not identified	2	-	-
Adavali-Maladi G.P.							
9	Advali	Lift irrigation for summer agriculture on Gad River	Formation of farmers' club/ co-operative societies for efficient marketing of produce	Conservation of small sacred groves along the Gad river	1	2	3
10	Ghadiwadi						
11	Maladi						
Amberi G.P.							
12	Amberi	Farm ponds in the agriculture areas	Not identified	Not identified	1	-	-
13	Mala	Desiltation of freshwater stream	Establishing market linkages for processed foods for SHG's	Conservation of freshwater tortoise in Mala stream	1	2	3
14	Wak	Farm ponds in the agriculture areas	Establishing market linkages for processed foods for SHG's	Not identified	1	2	-
Bandivade Budruk G.P.							
15	Bandiwade Budruk	Water conservation structures: A lake, if managed properly, could provide water for irrigation in summer	A jatropa plantation by a farmer, who wishes to start a bio-diesel plant. Providing market linkage and promoting this to other farmers	Not identified	1	2	-
16	Malewadi	Permanent check dams in place of the existing temporary sand bag bunds on Kalaval river stream	Not identified	Not identified	1	2	-
17	Palayewadi	Water conservation structures in form of small check bunds on Kalaval river	Not identified	Not identified	1	2	-
18	Bandiwade Khurd	Restoration of a lake on hillock for irrigation purposes	Training for new agro-techniques, cultivation of vegetables, poly-house, green house and so on	Not identified	1	2	-
19	Koil						
Budavle-Kudopi G.P.							
20	Kudopi	Not identified	• Implementation of pilot-scale solar fencing or	Not identified	2	-	-



			<p>other alternatives to tackle the monkey menace for crops since no water scarcity for irrigation</p> <ul style="list-style-type: none"> <li>Plantation and market linkages for economically-important alternate crops such as sunflower, turmeric and so on</li> </ul>			
<b>Chindar G.P.</b>						
21	Aparajwadi	Maintenance of a stream on hillock providing drinking water for village	Development of infrastructure for promotion of milk co-operatives. Currently efforts taken to implement but additional support would help	Not identified	1	2 -
22	Bhagawantgad	Water storage structures such as check bunds on Karli river	Poultry operations can also be implemented		1	2 -
23	Bhatwadi	Not identified	Alternate crops such as pineapple, banana, sunflower, turmeric and vanilla. These crops are currently successfully grown by individual farmers on pilot scale. Can be replicated among other farmers too.		1	2 -
24	Chindar	Water storage structures such as check bunds on Karli river	Training for new agro-techniques, cultivation of vegetables, poly-house, green house and so on		1	2 -
25	Gavthanwadi	De-siltation of lake to increase water storing capacity		Villagers identified that several wetland birds visit the lake during winter. These sites need to be conservation	1	2 3
26	Palkarwadi	Watershed management structures to provide water for irrigation	Training for new agro-techniques, cultivation of vegetables, poly-house, green house	Not identified	1	2 -

27	Sadewadi	Watershed management structures to provide water for irrigation	and so on		1	2	-
28	Teraiwadi		In addition to the above mentioned options for Chinder, prawn culture in the river can also be implemented in Teraiwadi	Not identified	1	2	-
Devbag G.P.							
29	Devbag	Need for community cold storage unit and low value fish processing centre (a common unit for Tarkarli, Devbag and Wayri village could be provided)	Training and financial assistance for oyster and clam culture	<ul style="list-style-type: none"><li>Ban the dining facilities set up for tourists along the beach on sand dunes with excessive lighting</li><li>Installation of artificial reefs and floating fish aggregation devices to increase the fish density and diversity</li></ul>	1	3	2
Devli G.P.							
30	Devli	Water conservation structures - village has few perennial streams that need to be channelized	Introducing bamboo plantations and establishing market linkages with involvement of SHGs	Privately-owned island, where a bird watching centre could be established	1	2	3
31	Kalethar		Training and financial assistance for prawn culture as there already exists a private prawn culture unit	Not identified	1	2	-
32	Waghavane	Immediate need for watershed management to provide water for irrigation	Introduction of crab and prawn farming as an alternative source of income	Not identified	2	1	-
Dhamapur G.P.							
33	Dhamapur	Existing infrastructure near Dhamapur lake could be developed for biodiversity conservation	Training to the local youth to interpret the local wealth of biodiversity. Training as a local guide for the interpretation centre, bird trails and so on	<ul style="list-style-type: none"><li>Lake has potential to be developed as a Ramsar site. However, the wetland needs to be studied to assess biodiversity</li><li>Revamping of the already existing staying facilities</li></ul>	2	1	3

				set up by forest department • Bird watching and interpretation centre could be developed			
Ghumade G.P.							
34	Ghumade	De-siltation of river bed to enhance flow of the river	Spice gardens, spice nursery and agri tourism. Potential for water sports	Introduction of exotic spices and preservation of local species	1	2	3
Hadi G.P.							
35	Gaonkarwada	A small check bund on Kalaval river needs immediate repair work	Hadi lies along Kalaval creek with deep waters, which offers potential for houseboat tourism as developed at Tarkarli	Hadi has patches of mangroves along Kalaval creek, which need conservation	1	2	3
36	Hadi						
37	Juva Pankhol	Absence of bridge/ jetty to enable safe and convenient transit to the mainland village of Hadi, permanent embankment to avoid salt water intrusion in paddy fields.	Cage fish culture	Not identified	1	2	-
38	Kothewada	Construction of proper roads for connectivity inside the village	Training and establishment of tourism related activities	Not identified	2	1	-
Kalase G.P.							
39	Bagwadi	Not identified	• Implementation of pilot-scale solar fencing or other alternatives to tackle the monkey menace for crops • Plantation and market linkages for economically important alternate crops such as sunflower, turmeric and so on	Not identified	2	-	-
40	Kalase	Flood-resistant bund to control flooding during monsoon			1	2	
41	Malkewadi	Not identified		Not identified	2	-	-
42	Parabwada	Not identified			2	-	-
Kandalgaon G.P.							
43	Kandalgaon	Khar bandhara /bund to control salt water intrusion	Training for new agro-techniques, cultivation of	Not identified	1	2	-
44	Shemadranewadi						

			vegetables, poly-house, green house and so on			
<b>Kolamb G.P.</b>						
45	Kolamb	Common facility centre for low value fish processing (common unit for Sarjekot, Kolamb and Malvan)	<ul style="list-style-type: none"> <li>Regulation of bottom trawler and fishermen from other states</li> <li>Certified training course for scuba-diving and water sports activity</li> </ul>	<ul style="list-style-type: none"> <li>Installation of artificial reefs and floating fish aggregation devices to increase the fish density and diversity</li> <li>Sea turtle conservation program to be implemented</li> </ul>	1	2 3
46	Nhive	De-siltation of private wells and urgent need of construction of new and repair of existing check dam	<ul style="list-style-type: none"> <li>Training for new agro-techniques, cultivation of vegetables, poly-house, green house and so on</li> <li>Introduction of bamboo plantation</li> </ul>	Conservation of wild Parakeet bird species. They are illegally captivated in households and sold as and when there is demand	1	2 3
<b>Kumbharmath G.P.</b>						
47	Kumbharmath	Desiltation of lake for irrigation water availability	Bamboo plantation, mushroom cultivation, apiculture	Owing to its proximity to Malvan city, Kumbharmath has the potential to be developed as an interpretation center on biodiversity of Sindhudurg	1	2 3
<b>Malond G.P.</b>						
48	Malond	Need to construct permanent embankment on the bank of river Gad as there is salt-water intrusion during summer.	Introduction and promotion of bamboo plantation and processing	Not identified	1	2 -
<b>Masade G.P.</b>						
49	Chunavare	Imparting knowledge for efficient agricultural practices, such as organic farming via training or through Krushi Sahayak	Training in efficient agricultural practices	Not identified	2	1 3
<b>Masure Dangmode G.P.</b>						
50	Marde	Need to install gates on K. T. Weir	Training for new agro-techniques,	Not identified	1	2 -

51	Masure		cultivation of vegetables, polyhouse, green house and so on				
52	Kava	Providing solar water pumps at subsidised rate for irrigation purposes	<ul style="list-style-type: none"> <li>• Implementation of pilot-scale solar fencing or other alternatives to tackle the monkey menace for crops</li> <li>• Plantation and market linkages for economically-important alternate crops such as sunflower, turmeric and so on</li> </ul>	Not identified	1	2	-
53	Chander	Need for Khar bandhara/ bund to control salt water intrusion	<ul style="list-style-type: none"> <li>• Introducing salt tolerant rice varieties</li> <li>• Possibility of introducing shrimp culture or crab culture</li> </ul>	Chander has a good density of mangroves along the village with a potential to develop mangrove boardwalk	1	2	3
54	Dangmode	Providing solar water pumps at subsidised rate for irrigation purposes	Market linkages for alternate crops such as sunflower, sugarcane	Not identified	1	2	-
55	Khanjanwadi	Need for Khar bandhara/ bund to control salt water intrusion	Introducing salt tolerant rice varieties, clam and oyster culture	Not identified	1	2	-
56	Magvane	Need for Khar bandhara/ bund to control salt water intrusion/ to avoid soil erosion/ to collect freshwater from the river	Establishing dairy co-operatives and setting up market linkages for milk	Not identified	1	2	-
57	Margachi tad	<ul style="list-style-type: none"> <li>• Need to install gates for K. T. Weir</li> <li>• Providing solar water pumps at subsidised rate for irrigation purposes</li> </ul>	Training for new agro-techniques, cultivation of vegetables, poly-house, green house and so on	Not identified	1	2	-
58	Sayyad Juva	Creek desiltation and well desiltation	Not identified	Not identified	1	-	-
59	Wadi-Dangmode	Providing solar water pumps at subsidised rate for irrigation purposes	Market linkages for alternate crops such as sunflower, sugarcane	Not identified	1	2	-

Pendur-Kharare G.P.							
60	Kharare	Need to construct Khar bandhara/bund to control salt water intrusion	<ul style="list-style-type: none"><li>• Training for new agro-techniques, cultivation of vegetables, polyhouse, green house and so on</li><li>• Potential for mushroom and bamboo cultivation</li></ul>	Not identified	1	2	-
61	Parad						
62	Pendur						
Rathivade G.P.							
63	Rathivade	Irrigation system for growing crops in summer	<ul style="list-style-type: none"><li>• Market linkage for selling of agriculture produce</li><li>• Formation of farmers' club to promote organic farming</li></ul>	Not identified	1	2	-
Revandi G.P.							
64	Ozar	<ul style="list-style-type: none"><li>• Development of irrigation system for growing crops in summer</li><li>• Implementation of solid waste management techniques near Ozar caves</li></ul>	Poultry farming and food processing training	Information panels near Ozar cave and Bhadrakali temple sacred grove	1	2	3
65	Revandi	<ul style="list-style-type: none"><li>• Loan and subsidy for small fishermen</li><li>• Cold storage units for fish preservation</li><li>• Repairing and maintenance of dams, which are leaking</li><li>• Potential for micro watershed project</li></ul>	<ul style="list-style-type: none"><li>• Villagers showed interest in fish cage-fish culture in Kalaval creek</li><li>• Poultry farming and food processing training</li></ul>	Not identified	1	2	-
Sarjekot-Miryabanda G.P.							
66	Sarjekot	Common facility centre for low-value fish processing (common unit for Sarjekot, Kolamb and Malvan)	<ul style="list-style-type: none"><li>• Development of infrastructure and market linkages for existing boat making centre</li><li>• Potential for development of bird watching</li></ul>	Installation of artificial reefs and floating fish aggregation devices to increase the fish density and diversity since it's a major trawler fishery village	2	3	1



			centre along Sarjekot beach				
Shrawan G.P.							
67	Shrawan	Irrigation system is not in place. However, water is available throughout the year from Gad river downstream. Villagers are recommended lift irrigation	<ul style="list-style-type: none"><li>SHGs have already undertaken training for kokum and cashew processing, poultry, candle-making and dairy. However, there is lack of market linkages</li><li>Shrawan has a potential of tourism since Gad River offers a promising view. The forests in patches along the river are also intact</li></ul>	The forest and riverine ecology of Gad river near Shrawan is ideal to promote community-based conservation activities	1	2	3
Talgaon G.P.							
68	Khand	Construction of road and jetty	Training to SHG's to utilize agriculture waste like Supari trunk and coconut	Not identified	1	2	-
69	Mhavlunge	De-siltation of fresh water stream	poultry farming		1	2	-
70	Pedave	Construction of road	Medicinal plant nursery and training		1	2	-
Tarkarli G.P.							
71	Tarkarli	Need for community cold storage unit and low-value fish processing centre (common unit for Tarkarli, Devbag and Wayri villages could be provided)	Introducing clam and oyster culture	<ul style="list-style-type: none"><li>Ban the dining facilities set up for tourists on the sand dunes to conserve turtle breeding sites</li><li>Installation of artificial reefs</li></ul>	1	2	3
Tondavali G.P.							
72	Tondavali	Inappropriate height of bund wall, causing salt water intrusion and flooding in farms in monsoon	<ul style="list-style-type: none"><li>Mussel culture, clam and oyster culture</li><li>Introducing salt-tolerant rice varieties</li></ul>	Ban the dining facilities set up for tourists along the beach on sand dunes with excessive lighting	2	1	3

Trimbak G.P.							
73	Bagavewadi	<ul style="list-style-type: none"><li>Absence of Khar bandhara/ bund to control salt water intrusion</li><li>De-siltation of traditional water harvest structures such as “Brahmin-Tali” i.e. ponds and canal for irrigation</li></ul>	<ul style="list-style-type: none"><li>Introducing salt tolerant rice varieties</li><li>Introducing prawn culture in Khajan land</li></ul>	Not identified	1	2	-
74	Palikadilwadi			Not identified	1	2	-
Warad G.P.							
75	Bhandarwada	Need of Khar bandhara/ bund to control salt water intrusion	Introducing bamboo plantations and establishing market linkages with involvement of SHGs	Not identified	2	1	-
76	Warad						
Wayangani G.P.							
77	Wayangani	<ul style="list-style-type: none"><li>Bund on Kalaval creek for irrigation</li><li>Solar interventions such as solar lighting systems and solar pumps.</li></ul>	<ul style="list-style-type: none"><li>Establishing linkages between traditional fishermen and tourism</li><li>Market linkages for SHGs</li></ul>	<ul style="list-style-type: none"><li>Protect the potential turtle breeding sites with the help of local NGOs</li><li>Potential for tourism activities along the beach</li></ul>	1	2	3
Wayri-Bhootnath G.P.							
78	Wayri	Need for community cold storage unit and low value fish processing centre (a common unit for Tarkarli, Devbag and Wayri village could be provided)	Clam and oyster culture training	Sea turtle conservation program to be implemented	1	2	3

## Devgad Block (B)

### Note:

- This priority ranking for EPAs is based on feedback and suggestions from various stakeholders
- The EPAs and ranking given for biodiversity conservation is an outcome of TERI's interpretation based on several FGDs and transect walk conducted with the stakeholders
- In villages, where no particular EPA was identified as a priority, it is mentioned as 'No specific observation'.

1	Village Name	ENTRY POINT ACTIVITY			Prominent Features of village	Priority Ranking		
		Key Infrastructure Intervention	Initiatives for Revenue Generation	Biodiversity Conservation				
		1	2	3				
Bagtalwade G.P								
1.	Talawade	<ul style="list-style-type: none"><li>• Construction of small check dam for water conservation.</li></ul>	<ul style="list-style-type: none"><li>• Construction of mangrove boardwalk in present mangrove patches</li><li>• The wild variety of ladies finger vegetable is abundant in this area. The flowers of this particular plant are used as clarifier during jaggery manufacture<sup>86</sup>. Selling of these flowers to sugar industries can help generate revenue</li></ul>	No specific observation	No specific observation	1	2	-
2.	Bagtalawade							

<sup>86</sup> <http://www.angrau.ac.in/media/7426/hort281.pdf>

3.	Talebazar	Maintenance of Talebazar lake through restoration activities like cleaning and so on	<ul style="list-style-type: none"> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	There is a huge water body of 17 acres. Currently, the water body is on the verge of degradation due to ignorance of villagers and administration	1	2	-
<b>Baparde G.P</b>								
4.	Baparde	<ul style="list-style-type: none"> <li>Small scale mango processing unit</li> <li>Fixed rate for Mango produce</li> </ul>	<ul style="list-style-type: none"> <li>Mushroom cultivation for farmers and SHGs</li> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Chandoshi G.P</b>								
5.	Chandoshi	Immediate need for watershed management in terms of check bund on Karli river	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Dabhole G.P</b>								
6.	Dabhole	No requirement	<ul style="list-style-type: none"> <li>Fixed rate for Mango produce</li> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	2	-	-
<b>Dahibav G.P</b>								

7.	Dahibav	<ul style="list-style-type: none"> <li>Construction of bund along Annapoor na river for irrigation</li> </ul>	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Fixed rate for mango produce</li> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	1	2	-
8.	Bagmala							
<b>Devgad G.P.</b>								
9.	Devgad	<ul style="list-style-type: none"> <li>Anandwadi Jetty project proposed by Fisheries Dept. should be completed on priority</li> <li>Cold storage unit</li> <li>Fish drying platforms</li> <li>Low-value fish processing unit</li> <li>Rope way at Devgad beach to attract tourists</li> <li>Infrastructure for fish auctioning</li> </ul>	<ul style="list-style-type: none"> <li>Oyster and clam culture</li> <li>Training for scuba diving and snorkelling</li> <li>Licence for boats for tourist</li> </ul>	White bellied sea-eagles are seen along Devgad beach. The <i>Casurina spp.</i> plantations should be conserved, as it proves to be a good nesting habitat for these birds	No specific observation	1	2	-
<b>Eaye G.P.</b>								
10.	Elaye	Management of lake in the village for domestic and irrigation purposes	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Cage fish culture</li> </ul>	No specific observation	No specific observation	1	2	-

<b>Gaditamhane G.P.</b>								
11	Gaditamhane	<ul style="list-style-type: none"> <li>Construction of bund along Kharada river for irrigation</li> <li>De-siltation required since it is causing flooding</li> </ul>	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Fixed rate for mango produce</li> <li>Issue of mango pest infestation especially, Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Girye G.P.</b>								
12	Girye	<ul style="list-style-type: none"> <li>Fish drying platform construction</li> </ul>	<ul style="list-style-type: none"> <li>Mangrove apiculture</li> <li>Training for tourism-related activities like homestays, boating, snorkelling and scuba-diving</li> <li>Crab and cage culture</li> </ul>	No specific observation	The place is blessed with natural beauty, which needs to be portrayed effectively	1	2	-
<b>Hindale G.P.</b>								
13	Hindale	<ul style="list-style-type: none"> <li>Mango processing unit</li> </ul>	<ul style="list-style-type: none"> <li>Direct market linkages for mango and mango products</li> </ul>	No specific observation	No specific observation	1	-	-



14.	Morave	<ul style="list-style-type: none"> <li>There is heavy siltation in the area adjoining sea and creek at the village. Due to this siltation, the fishermen are unable to get their catch to the shore during low tide. Earlier, fish would breed in the creek area during monsoon. However, due to the accumulation of silt, fish breeding is seriously hampered</li> <li>Ice factory and cold storage units for fish catch preservation</li> <li>Maintenance of existing bridge connecting the beach and village to promote tourism</li> </ul>	<ul style="list-style-type: none"> <li>Oyster and clam culture</li> <li>Crab and cage culture</li> </ul>	<ul style="list-style-type: none"> <li>Turtle nesting sites on beach need to be conserved</li> <li>The beach proves to be an important habitat for migratory birds like gulls, terns and so on</li> <li>Fish breeding affected due to siltation</li> </ul>	Siltation at the junction of creek and sea is a major issue	1	2	3
Jamsande G.P.								

15.	Jamsande	<ul style="list-style-type: none"> <li>De-siltation of Wadatar creek</li> <li>Need of Sewage disposal system in the form of sewer channels</li> </ul>	<ul style="list-style-type: none"> <li>Training for scuba-diving and snorkelling.</li> <li>Crab and cage fish culture</li> </ul>	No specific observation	Siltation of creek areas has been highlighted in the past. The GoM had announced provision of funds for dredging of the creek areas <sup>87</sup>	2	1	-
<b>Katvan G.P</b>								
16.	Katvan	Cold storage units for storage of fish catch	Introduction of crab, clam and edible oyster farming	Dolphins were seen during transect walk, but not very frequently. Dolphin sighting will not guarantee revenue generation	No specific observation	1	2	
<b>Katwaneshwar G.P</b>								
17.	Katwaneshwar	Small-scale mango processing unit	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Fixed rate for mango produce</li> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Khudi G.P.</b>								
18.	Khudi	<ul style="list-style-type: none"> <li>Direct Market linkages for mango</li> <li>Mango processing unit</li> </ul>	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Fixed rate for mango produce</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Kunkeshwar G.P.</b>								

<sup>87</sup> [http://articles.timesofindia.indiatimes.com/2011-03-02/mumbai/28646395\\_1\\_dredgers-ajit-pawar-deputy-chief-minister](http://articles.timesofindia.indiatimes.com/2011-03-02/mumbai/28646395_1_dredgers-ajit-pawar-deputy-chief-minister)

19.	Kunkeshwar	<ul style="list-style-type: none"> <li>• Cold storage facility for fish preservation</li> <li>• Common facility centre for processing of low-value fish</li> <li>• Fish export linkages</li> </ul>	Involving traditional fishermen in tourism by providing licence for tourist boats	Olive Ridley Turtle breeding sites are located and protected by communities. The initiative needs to be further strengthened. A linkage with other groups engaged in protecting the turtles may be established for exchange of information, issues, status and ideas	No specific observation	1	2	3
<b>Malegaon G.P.</b>								
20.	Malegaon	<ul style="list-style-type: none"> <li>• Construction of check bund for water conservation through micro watershed development activities</li> </ul>	<ul style="list-style-type: none"> <li>• Training villagers for mushroom cultivation</li> <li>• Training for apiculture, which can be set up in mango orchards</li> </ul>	No specific observation	No specific observation			
<b>Mithbav G.P.</b>								

21.	Mithbav	<ul style="list-style-type: none"> <li>Watershed management in terms of check bunds</li> <li>De-siltation of wells</li> <li>Cold storage and common facility centre for processing of low-value fish for cluster of Mithbav &amp; Tambalde g villages</li> </ul>	<ul style="list-style-type: none"> <li>Edible oyster, mussel, crab culture</li> </ul>	Olive Ridley turtle nesting sites are conserved via community participation, which needs to be strengthened	No specific observation	1	2	3
<b>Mithmumbari G.P.</b>								
22.	Mithmumbari	<ul style="list-style-type: none"> <li>Cold storage facility for fish</li> <li>De-siltation of creek as siltation is causing casualties due to boat accidents during monsoon</li> </ul>	<ul style="list-style-type: none"> <li>Apiculture in mangroves patches</li> <li>Oyster, clam and cage fish culture</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Mondpar G.P.</b>								

23.	Mondpar	Check bund for irrigation and water storage	<ul style="list-style-type: none"><li>• Mushroom cultivation</li><li>• Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li></ul>	No specific observation	No specific observation			
Mond G.P.								
24.	Mond	Check bund for irrigation and water storage	Mushroom cultivation	No specific observation	No specific observation	1	2	-
25.	Chinchwad		<ul style="list-style-type: none"><li>• Mussel, oyster culture</li><li>• Cage culture and prawn culture</li><li>• Mushroom cultivation</li></ul>			1	2	-
Munage G.P.								
26.	Munage	Need of proper market linkage for fisheries	<ul style="list-style-type: none"><li>• Training for cage fish culture</li><li>• Training for tourism-related activities like homestays, boating, snorkelling and so on</li></ul>	No specific observation	No specific observation	1	2	-
Mutat G.P.								
27.	Mutat	Need of a bund to restrict salt water intrusion	<ul style="list-style-type: none"><li>• Tourism activity like boating and sightseeing can be carried out due to presence of jetty</li><li>• Mushroom cultivation</li></ul>	No specific observation	No specific observation	1	2	-
Nadan G.P.								

28.	Nadan	Proper watershed management through management of available check dam for conservation of water	<ul style="list-style-type: none"> <li>• Training workshop for use of organic fertilizers and pesticides</li> <li>• Apiculture in mango plantation</li> </ul>	No specific observation	No specific observation	1	2	
29.	Virwadi	Virwadi village falls along the Wadatar creek. Since heavy siltation has resulted in decline of the fish catch and boat trafficking, de-siltation of Wadatar creek is recommended	<ul style="list-style-type: none"> <li>• Oyster and clam culture</li> <li>• Permission for setting up of floating jetty along Wadatar creek to attract tourists</li> <li>• Boat licence to undertake tourist activities</li> </ul>	Flying fox (Bats) colony was observed on the island in Wadatar creek in the village	No specific observation	1	2	-
<b>Naringre G.P.</b>								
30.	Naringre	Development of common water storage facility through rain water harvesting	Training and capacity of farmers to new cultivation practices such as exotic vegetables. Spice gardens may be established. Intercropping of spices such as pepper and nutmeg may also be promoted	No specific observation	No specific observation	1	2	-
<b>Padavane G.P.</b>								

31.	Padavane	Cold storage facility for storage of fish catch	Introduction of crab, clam and edible oyster farming	<ul style="list-style-type: none"> <li>• Conservation of turtle nesting sites</li> <li>• Creation of awareness amongst the villagers about significance of turtle conservation programme</li> <li>• White bellied sea-eagle nesting sites have been spotted by villagers but not during the transect walk</li> </ul>	Beautiful beach, high tourism development potential			
<b>Padel G.P.</b>								
32.	Padel	<ul style="list-style-type: none"> <li>• Existing facilities at the market are random/haphazard</li> <li>• Proper sections may be established as per the categories of the produce such as grains, vegetables and fish</li> </ul>	<ul style="list-style-type: none"> <li>• Training for apiculture and mushroom cultivation</li> <li>• Training to SHGs for mango processing and related food items</li> </ul>	No specific observation	Village has done proper inter-cropping using spices. Some people have also developed banana orchards. Prawn culture is also present in the village. This village can be used as a case study for other villages. Due to less monoculture in village, pest infestation is lesser as compared to the villages in the vicinity	1	2	-
<b>Patthar G.P.</b>								



33.	Patthar	Check bund for irrigation and water storage	Mushroom cultivation	No specific observation	No specific observation	1	2	-
<b>Palekarwadi G.P.</b>								
34.	Palekarwadi	<ul style="list-style-type: none"> <li>Proper management of present lake on the plateau to conserve more water</li> </ul>	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Pavnai G.P.</b>								
35.	Pavnai	Khar bunds to reduce salt water intrusion, ultimately conserving fresh water wells	<ul style="list-style-type: none"> <li>Prawn culture and mussel culture projects</li> </ul>	No specific observation	Prawn culture is practiced at present in the village. Scope for further replication	1	2	-
<b>Phanase G.P.</b>								
36.	Phanase	<ul style="list-style-type: none"> <li>De-siltation of stream to increase water level</li> <li>No connectivity of village with the beach. Thus, access road to the beach needs to be established to encourage tourism.</li> </ul>	<ul style="list-style-type: none"> <li>Apiculture in mango plantations</li> <li>Summer agriculture to be promoted</li> <li>Exotic vegetable cultivation workshops may be conducted</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Poyre G.P.</b>								

37.	Poyre	No requirement	Apiculture in mango plantations	No specific observation	Special Remark: Villagers were not very enthusiastic to respond to the FGD questionnaire	2	-	-
Pural G.P.								
38.	Pural	<ul style="list-style-type: none"> <li>The villagers feel there is good area along Pural beach for construction of dam, which will serve water for agriculture for 5 villages in the vicinity</li> <li>Awareness about serene beach at Pural amongst tourists</li> </ul>	<ul style="list-style-type: none"> <li>Apiculture in mangrove</li> <li>Mangrove boardwalk</li> <li>Allowing quarrying to limited extent since most of the villagers are dependent on it in some or the other way</li> </ul>	White bellied sea-eagles are seen along the Pural beach along the <i>Casurina spp.</i> plantations which needs special attention	Serene mangrove patch along the Pural beach spread for several hectares needs to be protected	1	2	3
39.	Kalambai							
40.	Hurshi							
Rahateshwar G.P.								
41.	Rahateshwar	Watershed management to support agriculture during summers	Food processing and packaging training for the self-help groups related to kokum, mango and cashews and market linkages for the same.	No specific observation	No specific observation	1	2	
Rameshwar G.P.								

42.	Rameshwar	<ul style="list-style-type: none"> <li>Managing the existing stream through micro watershed techniques for conservation during dry season of March to May. Currently, the water is conserved with the help of a bund</li> </ul>	<ul style="list-style-type: none"> <li>Vijaydurg being nearby, people can be trained for tourism activities like local sightseeing guides, boating, scuba-diving, snorkelling and so on</li> </ul>	No specific observation	No specific observation	1	2	-
Saundale G.P.								
43.	Saundale	<ul style="list-style-type: none"> <li>Managing the existing lake at Saundale village through activities like regular de-siltation and bund construction along the border of lake for conservation of water</li> </ul>	<ul style="list-style-type: none"> <li>Training of farmers to new cultivation practices such as exotic vegetables</li> </ul>	No specific observation	No specific observation	1	2	-
44.	Wadekar Poi		<ul style="list-style-type: none"> <li>Spice gardens may be established. Inter-cropping of spices such as pepper and nutmeg may also be promoted. Training may also include sustainable use of chemical fertilizers and pesticides</li> </ul>	No specific observation	No specific observation	1	2	-
Shirgaon G.P.								

45.	Dhoptewadi	<ul style="list-style-type: none"> <li>Mango processing unit</li> <li>Watershed management in terms of check bund on Ambekhol reservoir</li> </ul>	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li> </ul>	No specific observation	No specific observation	1	2	-
Tambaldeg G.P.								
46.	Tambaldeg	<ul style="list-style-type: none"> <li>Private or community storage units to help reduce fish damage</li> <li>Common facility centre for processing of low-value fish</li> </ul>	<ul style="list-style-type: none"> <li>Clam/ edible oyster, mussel culture.</li> <li>Training and market linkages for selling of the product, currently produced (e.g. dry fish, pickled fish).</li> </ul>	Sea turtle conservation programme conducted through local community participation needs to be promoted and strengthened	A prime hotspot in terms of Sea turtle conservation programme conducted through local community participation	1	2	3
Tembavali G.P.								
47.	Tembavali	Repairing of available check dam	<ul style="list-style-type: none"> <li>Training for organic farming and use of salt tolerant varieties of rice</li> <li>Training for apiculture</li> </ul>	No specific observation	No specific observation	1	2	-
48.	Kalvi							
Thakurwadi G.P.								

49.	Thakurwadi	<ul style="list-style-type: none"> <li>Urgent repairing of the current bund along the creek for conservation of fresh water wells, which are currently affected by salt water intrusion</li> <li>Drying platform for fish as fishermen dry their fish on road due to lack of drying space</li> </ul>	<ul style="list-style-type: none"> <li>Tourism-related activities like homestays and boating</li> <li>Training for cage culture, clam and mussel culture</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Tirlot G.P.</b>								
50.	Tirlot	Small-scale mango processing unit for the village cluster.	<ul style="list-style-type: none"> <li>Issue of mango pest infestation especially, Thrips infestation, may be addressed to enhance revenues</li> <li>Mushroom cultivation</li> </ul>	No specific observation	No specific observation	1	2	-
<b>Vijaydurg G.P.</b>								
51.	Vijaydurg	<ul style="list-style-type: none"> <li>Cold storage unit</li> <li>Fish drying platforms</li> <li>Mango processing unit</li> </ul>	<ul style="list-style-type: none"> <li>Oyster and clam culture</li> <li>Training for scuba diving and snorkelling</li> <li>Licence for boats for tourist</li> </ul>	No specific observation	Vijaydurg fort attracts many tourists	1	2	-
<b>Wada G.P.</b>								

52.	Wada	Mango processing unit	Mushroom cultivation	No specific observation	No specific observation	1	2	-
53.	Wadatar	De-siltation of Wadatar creek, since heavy siltation has declined the fish catch and boat trafficking has increased	<ul style="list-style-type: none"><li>• Clam and Oyster culture</li><li>• Crab culture and cage fish culture</li></ul>	No specific observation	No specific observation	1	2	
Waghotan G.P.								
54.	Kasaba Waghota n	Villagers need permission for limited extent quarrying since majority of villagers are dependent on this business	<ul style="list-style-type: none"><li>• Mango processing unit in the cluster</li><li>• Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li></ul>	No specific observation	The village is dependant heavily on quarrying for construction purposes	1	2	-
55.	Mouje Waghota n	Permission for limited extent quarrying since majority of villagers are dependent on this business						
Waliwande G.P.								
56.	Waliwan de	Watershed Management in terms of farm ponds	<ul style="list-style-type: none"><li>• Training to SHG's for food processing and packaging</li><li>• Issue of mango pest infestation, especially Thrips infestation, may be addressed to enhance revenues</li></ul>	No specific observation	No specific observation	1	2	-
Waniwade G.P.								

57.	Waniwade	Khar bunds to reduce salt water intrusion, ultimately conserving fresh water wells, which lie near creek.	<ul style="list-style-type: none"> <li>Mushroom cultivation</li> <li>Training for use of salt-tolerant varieties of rice</li> </ul>	No specific observation	No specific observation	1	2	-
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#### ANNEXURE IX: Malvan Villages covered for the study of PRA/RRA.

Sr. No.	Grampanchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Distance from creek (in Kms)	Distance from sea (in Kms)
<b>Achare Creek</b>						
1	Achare	Achare	Agriculture	Fishery (Coastal & Creek)	0.92	4.39
2	Achare	Dongrewadi	Agriculture	Nil	0.9	3.18
3	Achare	Gaudwadi	Agriculture	Nil	0.14	1.06
4	Achare	Hirlewadi	Agriculture	Nil	1.02	1.42
5	Achare	Jamdul	Fishery (Creek)	Nil	0.2	0.88
6	Achare	Parwadi	Agriculture	Nil	0.34	4.3
7	Achare	Pirawadi	Fishery (Coastal /Creek)	Nil	0.4	0.27
8	Achare	Varachiwadi	Agriculture	Tourism	1.85	3.5
9	Chindar	Chindar	Agriculture	Nil	1.04	6.9
<b>Achare tributary</b>						
10	Budavle-Kudopi	Kudopi	Agriculture	Nil	1.43	More than 8 Kms
11	Chindar	Aparajwadi	Agriculture	Nil	1.79	More than 8 Kms
12	Shravan	Shrawan	Agriculture	Nil	6.85	More than 8 Kms
<b>Chivala beech creek</b>						



Sr. No.	Grampanchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Distance from creek (in Kms)	Distance from sea (in Kms)
13	Ghumade	Ghumade	Agriculture	Nil	1.53	3.44
14	Kumbharmath	Kumbharmath	Agriculture	Construction Labour	0.92	2.6
<b>Devbag creek</b>						
15	Devli	Kalethar	Agriculture	Nil	3.4	0.4
<b>Kalaval creek / tributary</b>						
16	Bandivade Budruk	Malewadi	Agriculture	Nil	0.11	More than 8 Kms
17	Bandivade Budruk	Palayewadi	Agriculture	Nil	1.4	More than 8 Kms
18	Bandivade Khurd	Bandiwade Khurd	Agriculture	Nil	0.2	More than 8 Kms
19	Bandivade Khurd	Koil	Agriculture	Nil	0.2	More than 8 Kms
20	Chindar	Bhagawantgad	Agriculture	Nil	0.2	More than 8 Kms
21	Chindar	Bhatwadi	Agriculture	Nil	2.6	More than 8 Kms
22	Chindar	Gavthanwadi	Agriculture	Nil	1.93	More than 8 Kms
23	Chindar	Sadewadi	Agriculture	Nil	1.75	More than 8 Kms
24	Chindar	Teraiwadi	Agriculture	Nil	0.6	More than 8 Kms
25	Hadi	Gaonkarwada	Agriculture	Nil	0.63	1.53
26	Hadi	Hadi	Agriculture	Nil	0.14	More than 8 Kms
27	Hadi	Juva Pankhol	Agriculture	Nil	0.14	1.26
28	Hadi	Kothewada	Agriculture	Nil	1.22	More than 8 Kms
29	Kolamb	Kolamb	Fishery (Coastal)	Agriculture	0.63	1

Sr. No.	Grampanchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Distance from creek (in Kms)	Distance from sea (in Kms)
30	Kolamb	Nhive	Agriculture	Construction Labour	1.41	2.28
31	Malond	Malond	Agriculture	Nil	0.11	More than 8 Kms
32	Masade	Chunavare	Agriculture	Nil	0.38	More than 8 Kms
33	Masure Dangmode	Kava	Agriculture	Nil	0.6	More than 8 Kms
34	Masure Dangmode	Marde	Agriculture	Nil	0.07	More than 8 Kms
35	Masure Dangmode	Masure	Agriculture	Nil	0.6	More than 8 Kms
36	Rathivade	Rathivade	Agriculture	Nil	1.12	More than 8 Kms
37	Revandi	Ozar	Agriculture	Fishery (Creek)	0.1	0.98
38	Revandi	Revandi	Agriculture	Fishery (Creek)	0.18	0.18
39	Sarjekot-Miryabanda	Sarjekot	Fishery (Coastal)	Tourism	0.17	1
40	Tondavali	Tondavali	Fishery (Coastal)	Tourism	1.6	0.87
41	Trimbak	Bagavewadi	Agriculture	Nil	2.6	More than 8 Kms
42	Trimbak	Palikalwadi	Agriculture	Nil	2.42	More than 8 Kms
43	Wayangani	Wayangani	Agriculture	Fishery (Creek)	2.24	1.77
44	Kandalgaon	Shemadranewadi	Agriculture	Construction Labour	0.26	More than 8 Kms
45	Masure-Dangmode	Chander	Agriculture	Nil	0.21	More than 8 Kms
46	Masure-Dangmode	Dangmode	Agriculture	Nil	1.57	More than 8 Kms

Sr. No.	Grampanchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Distance from creek (in Kms)	Distance from sea (in Kms)
47	Masure-Dangmode	Magvane	Agriculture	Nil	2.2	More than 8 Kms
48	Masure-Dangmode	Margachi tad	Agriculture	Nil	0.2	More than 8 Kms
49	Masure-Dangmode	Sayyad Juva	Agriculture	Fishery	0.01	More than 8 Kms
50	Masure-Dangmode	Wadi-Dangmode	Agriculture	Nil	4.4	More than 8 Kms
51	Adavali-Maladi	Advali	Agriculture	Nil	0.85	More than 8 Kms
52	Adavali-Maladi	Ghadiwadi	Agriculture	Nil	0.8	More than 8 Kms
53	Adavali-Maladi	Malandi	Agriculture	Nil	1.4	More than 8 Kms
54	Bandivade Budruk	Bandiwade Bk.	Agriculture	Labour	0.07	More than 8 Kms
55	Kandalgaon	Kandalgaon	Agriculture	Construction Labour	0.7	More than 8 Kms
56	Masure-Dangmode	Khanjanwadi	Agriculture	Labour	0.6	More than 8 Kms
57	Chindar	Palkarwadi	Agriculture	Nil	1.9	More than 8 Kms
<b>Karli river estuary</b>						
58	Amberi	Amberi	Agriculture	Nil	2	More than 8 Kms
59	Amberi	Mala	Agriculture	Nil	2	More than 8 Kms
60	Amberi	Wak	Agriculture	Nil	2.06	More than 8 Kms
61	Devbag	Devbag	Fishery (Coastal)	Agriculture	0.13	0.14

Sr. No.	Grampanchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Distance from creek (in Kms)	Distance from sea (in Kms)
62	Devli	Devli	Agriculture	Nil	1.45	2.9
63	Devli	Waghavane	Agriculture	Nil	0.8	5
64	Dhampur	Dhamapur	Agriculture	Fishery (Creek)	2.91	More than 8 Kms
65	Kalase	Bagwadi	Agriculture	Fishery (Creek)	2.5	More than 8 Kms
66	Kalase	Kalse	Agriculture	Nil	1	More than 8 Kms
67	Kalase	Malkewadi	Agriculture	Nil	2.67	More than 8 Kms
68	Kalase	Parabwada	Agriculture	Nil	1.33	More than 8 Kms
69	Pendur-Kharare	Kharare	Agriculture	Nil	2.2	More than 8 Kms
70	Pendur-Kharare	Parad	Agriculture	Nil	1.6	More than 8 Kms
71	Pendur-Kharare	Pendur	Agriculture	Nil	2.2	More than 8 km
72	Talgaon	Khand	Agriculture	Nil	1.9	More than 8 km
73	Talgaon	Mhavlunge	Agriculture	Nil	3.1	More than 8 km
74	Talgaon	Pedave	Agriculture	Nil	1.4	More than 8 km
75	Tarkarli	Tarkarli	Fishery (Coastal)	Tourism	0.68	0.13
76	Varad	Bhandarwada	Agriculture	Nil	1.43	More than 8 km
77	Varad	Warad	Agriculture	Nil	3.42	More than 8 km
78	Wairy-Bhutnath	Wayari	Fishery (Coastal)	Agriculture	3.5	0.63

# ANNEXURE X: Devgad Villages covered for the study of PRA/RRA

Sr. No.	Gram panchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Dist from creek (in km)	Distance from sea (in km)
<b>Achare Creek</b>						
1	Khudi	Khudi	Agriculture	Nil	2.42	More than 8 kms
2	Poyare	Poyare	Agriculture	Nil	1.78	6
	Mithbav creek				0.32	
3	Dahibav	Bagamala	Agriculture	Nil	0.11	More than 8 kms
4	Dahibav	Dahibav	Agriculture	Nil	0.34	More than 8 kms
5	Hindale	Hindale	Agriculture	Nil	0.2	2.67
6	Hindale	Morave	Fishery	Agriculture	0.15	1
7	Mithbav	Mithbav	Fishery	Agriculture	0.19	More than 8 kms
8	Naringre	Naringre	Agriculture	Nil	1.78	More than 8 kms
<b>Mithmumbari creek</b>						
9	Elaye	Elaye	Agriculture	Nil	1.21	4.1
10	Katwaneshwar	Katawaneshwar	Fishery	Agriculture	2.06	1.6
11	Mithmumbari	Mithmumbri	Fishery	Agriculture	0.34	1.2
12	Patthar	Pathar	Agriculture	Nil	0.6	More than 8 kms
<b>NA</b>						
13	Katwan	Katvan	Agriculture	Fishery(Creek)	NA	0.27
14	Kunkeshwar	Kunkeshwar	Fishery	Agriculture	NA	0.58
15	Munage	Munage	Agriculture	Fishery(Creek)	NA	1.38
16	Phanase	Phanase	Agriculture	Nil	NA	0.93
17	Shirgaon	Dhoptewadi	Agriculture	Market	NA	More than 8 kms
18	Tambaldeg	Tambaldeg	Fishery	Nil	NA	0.13
<b>Vijaydurg Creek</b>						

Sr. No.	Gram panchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Dist from creek (in km)	Distance from sea (in km)
19	Girye	Girye	Agriculture	Fishery (Creek)/ Sea)	2.26	1.16
20	Mutat	Mutat	-		0.45	More than 8 km
21	Padel	Padel	Agriculture	Nil	1.8	4.55
22	Palekarwadi	Palekarwadi	-		2.4	More than 8 km
23	Pural	Hurshi	-		2.23	0.2
24	Pural	Kalambai	-		2.3	0.2
25	Pural	Pural	Agriculture	Nil	0.6	1.62
26	Rameshwar	Rameshwar	-		2.13	1.47
27	Saundale	Saundale	-		1.06	More than 8 km
28	Saundale	Wadaker Poi	-		1.25	7
29	Thakurwadi	Thakurwadi	-		0.16	4
30	Tirlot	Tirlot	-		0.3	4.4
31	Vijaydurg	Vijaydurg	Fishery	Agriculture	0.7	0.14
32	Waghotan	Kasaba Waghotan	-		4.47	More than 8 km
33	Waghotan	Mouje Waghotan	-		2.8	More than 8 km
<b>Wadatar creek</b>						
34	Baparde	Baparde	Agriculture	Nil	3.91	More than 8 km
35	Chandoshi	Chandoshi	Agriculture	Nil	0.2	More than 8 km
36	Dabhole	Dabhole	Agriculture	Nil	3.98	More than 8 km
37	Devgad	Devgad	Fishery (coastal)	Agriculture	0.5	0.75
38	Gadhitamhane	Gadhitamhane	Agriculture	Fishery (creek)	0.32	More than 8 km
39	Jamsande	Jamsande	Agriculture	Fishery (coastal/creek)	1.25	4
40	Malegaon	Malegaon	Agriculture	Nil	4.65	More than 8 km
41	Mond	Chinchwad	Fishery	Agriculture	0.7	10

Sr. No.	Gram panchayat Name	Village Name	Principle Occupation	Second Priority Occupation	Dist from creek (in km)	Distance from sea (in km)
42	Mond	Mond	Agriculture	Fishery (Creek)	0.7	More than 8 km
43	Mondpar	Mondpar	Agriculture	Nil	3.25	More than 8 km
44	Nadan	Virwadi	Fishery	Agriculture	0.5	6
45	Nadan	Nadan	Agriculture	Nil	3.58	4.15
46	Padavane	Padvane	Fishery	Agriculture	1.1	1.1
47	Pavanai	Pavnai	Agriculture	Fishery	0.5	More than 8 km
48	Rahateshwar	Rahateshwar	Agriculture	Fishery	0.5	More than 8 kms
49	Talavade	Talavade	Agriculture	Nil	0.25	More than 8 kms
50	Talavade	Bagtalav	Agriculture	Nil	0.25	More than 8 kms
51	Talavade	Talebajar	Agriculture	Market	2.16	More than 8 kms
52	Tembavali	Kalvi	Agriculture	Nil	0.1	8
53	Tembavali	Tembavali	Agriculture	Nil	0.5	8
54	Wada	Wada	-		1.4	2.8
55	Wada	Wadetar	Fishery	Agriculture	0.25	4
56	Walivande	Waliwande	Agriculture	Nil	2.03	More than 8 km
57	Wanivade	Wanivade	Agriculture	Nil	More than 8Kms	More than 8 kms
58	Muthgaon	This village was not found on the map as well as in the Gram-Panchayat list provided by Devgad Panchayat Samiti office.				



## ANNEXURE XI: Quotation for ultrasonic monkey repeller instrument

### MONKEY REPELLERS



#### Product Code: JWP-315-M

Ultrasonic radiation gets rid of Monkeys and many other pests.  
Ultrasonic pest controlling system with multi-frequency modulated sounds.  
Doesn't kill Monkey -- it drives them out!  
No toxic chemicals or messy traps, SAFE and CLEAN.

**Harmless to humans and most household pets.**

#### Theory:

The only high-powered ultrasonic pest Repeller with special "Multiplex Modulated Sweeping Ultrasonic Sounds" available in India with us.

These high intensity ultrasonic sound waves (10-65 KHz) are out of the range of hearing of humans and most household pets, except pests. These nerve-crushing sounds directly penetrate their brain and nervous systems causing them and discomfort, and make them uneasy and act abnormally-such as frantic jumping, stampeding which result in the voluntary repulsion against ultrasonic wave areas and Monkeys find it impossible to stay in such radiated areas.

#### USEPA EST. NO. 075162-TWN-001

#### Features:

- These devices automatically changes the frequency 1-60 times a second, assuring complete coverage of all the communication frequencies of monkeys and many other pests, and make them not get used to the ultrasonic waves.
- It eliminates pests by using electronic method, which is more sanitary and economical than any other method used.
- These remarkable units will not interfere with any electronic burglar alarms, fire or smoke detectors, radio, TV reception or other electronic equipments.
- It emits the modulated frequencies, which sweep automatically from 10 KHz to 65 KHz that repulses pests.

#### Technical Specifications :

Model No.	Multiplex Frequency	Sound Pressure	Rated Output	Effective Area	Dimension
JWP-315-M	10-65 KHz	115 dB	4 watts	5,000 to 6,000 sq.ft	22x17.7x8.6cm

**Ultrasonic Frequency Response Table:**

1	10 KHz	MONKEY REPELLING ZONE
2	14 KHz	
3	18 KHz	
4	20 KHz	
5	25 KHz	
5-9	25-50 KHz	OTHER PESTS
10	65 KHz	

**Operation:**

1. Plug into electrical source.
2. Set the "SWEEP SPEED" dial at 1-10. A red Light indicates the power is on.
3. Set the "CONTROL" knob to "MONKEY" range, this sound effectively repels monkeys, and other **large animals**.

**Installation :**

1. It should be placed at least twenty feet above the ground or floor for best results.
2. Do not place it near to your ears before performing check.
3. Order extra units if your plant or establishment is broken up with thick wall partitions which can inhibit transmission of ultrasonic sound. Order extra units if your plant has an open dock entry or exit-way where Monkeys can gain access to premises.

**Applications:**

The Monkey Repeller, JWP-315-M can be used for : Farm houses, restaurants, supermarkets, schools, hospitals, granaries, warehouses, food and beverage industries, feed producing mills, poultry farms, public institutions, Govt. building, animal conservatories, agricultural store houses, flour mills, malts factories, sugar industries... etc.

**ANNEXURE XII: Quotation for solar powered fencing system to combat monkey menace.**



**TECHNICAL  
OFFER**  
*Solar Security Fencing*



## FIELD DATA SHEET

Total perimeter length	=	88 Mtrs (Approximately)
Number of Corners	=	4 Nos
Gate (gate top fence)	=	01 Nos
Height	=	7 feet
Strands	=	10 Nos

**NOTE: FINAL INVOICE WILL BE RAISED AS PER ACTUAL MEASUREMENTS.**



## FEATURES & BENEFITS



- |  |
|--|
| • Perimeter deterrent & Detection System with Solar Security Fencing.                |
| • Sounds alerts & alarms according to user escalation procedures                     |
| • Reduces the expenditure on security guards   |
| • Provides a quantifiable increase in security                                       |
| • Increases public/employee confidence   |
| • Provides 24x7 protection without delays or inconvenience to customers or employees |
| • Quick actions can be taken in case of attempt of security breach                   |
| • Increases operational efficiency   |
| • Reduces risks of liability   |



### TECHNICAL DETAILS OF SYSTEM

#### PERIMETER SECURITY

##### SOLAR FENCE

- The power pack with 12V Solar PVM and 12VDC 85AH SMF Battery.
- Back bone network connectivity will facilitate for the interfacing of FCUs.
- Solar Security Fence will interface with intelligent looping detection.
- A Pulsed Electric current will be sent, about one pulse per two seconds, from an energizer so that when intruder comes in contact with energized wire it completes the circuit between fence and ground and a short, sharp but safe high voltage pulse administered.
- Shock is sufficient to deter the intruder from proceeding further.

#### **Accessories will comprise as under:**

- Intermediate insulators suitable for outdoor application with UV protection and suitable to withstand impulse voltage of more than 10kv. At least 10 KV on one end and tensioning arrangement at other end for tensioning of wire.
- Lightning Diverter to bypass effects of induced lightning made of high grade UV treated plastic with nuts for fixing attaching the wires.
- Super Earth Kits for retaining high moisture will be used for system and fence earthing
- 2.59 mm GI Wire high tensile strength as per IS 280-1972.
- Electronic Loop Sensor for sensing the looping attempt in fence between two wires of same potential.



#### **Fence Energizer**

- Will one independent high voltage and one low voltage zones. The specifications as under:
- **Out Voltage:** OFF 4to 8 kV.
- **Output Energy:** > 5 < Joules
- **Pulse interval:** More than 1 second (normal 100 micro sec)
- **Pulse duration:** Less than 300 micro second (normal 100 micro sec0
- **HV output zones: One**
- Input power for Energizer unit: 12V DC, < 1.5 A, nominal.
- Energizer monitoring cabinet suitable for outdoor installation.

#### **The cabinet will house:**

- Energizer unit (as described above)
- Power pack with charger 1.5 A
- Battery 12V/65 AH SMF/Tubular.

#### **Alarm will get activated if,**

- Cut in Fence Wires.
- Looping attempts in fence.
- Shorting of fence wires to ground.
- Shock (equivalent to short via 1000 ohm resistor).

#### **INSTALLATION OF SYSTEM:**

- The Assignment of Supply & Installation will be on turnkey basis and accordingly Rate is quoted.





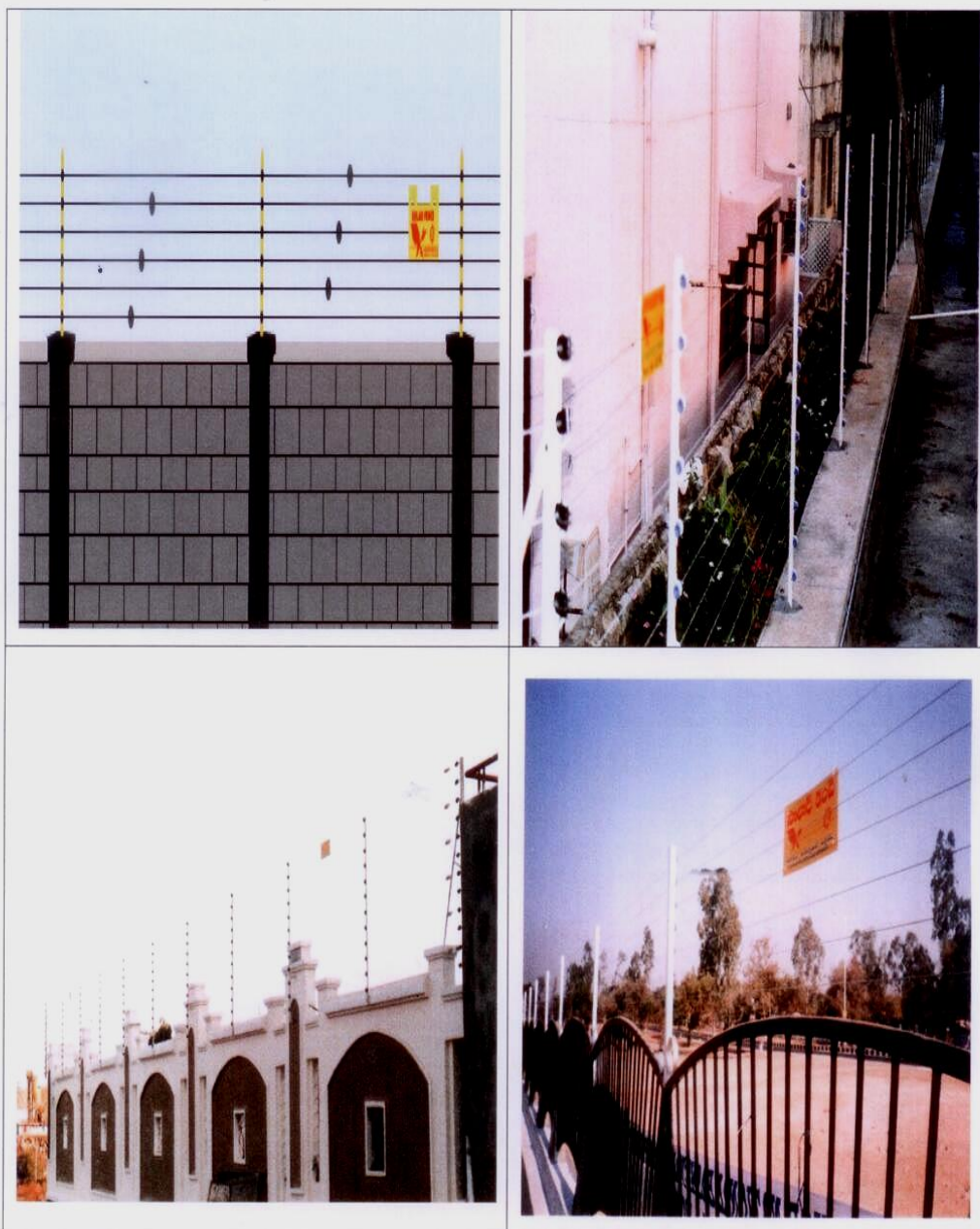
## FENCE PHOTO



M/s. Twincity Sunlife Pvt. Ltd., 2-22, EverGreen Industrial Estate, Shakti Mill Lane, Mahalaxmi, Mumbai – 400 011. Tel # 022- 24954596 / 24939644; E-mail: info@twincity.co.in; web: www.twincity.co.in.



## FENCE PHOTO





# COMMERCIAL OFFER

## *Solar Security Fencing*

M/s. Twincity Sunlife Pvt. Ltd., 2-22, EverGreen Industrial Estate, Shakti Mill Lane, Mahalaxmi, Mumbai – 400 011, Tel # 022- 24954596 / 24939644; E-mail: [info@twincity.co.in](mailto:info@twincity.co.in); web: [www.twincity.co.in](http://www.twincity.co.in).









## Annexure – B

### Technical offer of the components

<p><i>Fence wire</i></p> 	<ul style="list-style-type: none"> <li>• ISI standard confirmed High carbon, high tensile GI wires.</li> <li>• Fence wire of 2.50 mm to 2.0 mm dia cold drawn HT galvanized wire</li> <li>• Mass of zinc coating to measure between 230 grams per to 280 grams per sq. meter.</li> <li>• Thickness of zinc coating 30 microns (minimum)</li> <li>• Conductor resistance 33 ohms / Km</li> <li>• Tensile Strength of 90Kg/mm sq. minimum</li> </ul>
<p><i>Insulators for Fence Post</i></p> 	<ul style="list-style-type: none"> <li>• Confirmed High quality glass filled polyester plastic material made.</li> <li>• Will be used for intermediate poles</li> <li>• Will have very high breakdown voltage 15 KV minimum</li> </ul>
<p><i>Strain Insulator</i></p> 	<ul style="list-style-type: none"> <li>• Confirmed High quality glass filled polyester plastic material made.</li> <li>• Will be used for corner, section and end pole applications</li> <li>• Will be made of high impact, high strength UV stabilized material</li> <li>• Will have high breakdown voltage not less than 15 KV</li> <li>• Confirms to 143R-111 Grade</li> </ul>
<p><i>Wire Strainer</i></p> 	<ul style="list-style-type: none"> <li>• confirmed strong, light weight corrosion resistant construction</li> <li>• Will have gripples for tensioning the fence wire</li> </ul>
<p><i>Lead out Cable</i></p> 	<ul style="list-style-type: none"> <li>• Will be Heavy Duty, high impact double insulated aluminum alloy or fence core wire. The insulation thickness will be 1.00 mm (approx) sheath thickness 0.90 mm (approx)</li> <li>• Lead out cable will be double insulated with outer insulation is fully UV stabilized for abrasion resistance</li> <li>• The minimum breakdown voltage will be 15 KV</li> </ul>



Sl. No	Description of design	Qty.	Price	Amount
1	<i>Renewable Energy System and spare parts of Solar Power Generating System of Solar Fence</i>			
	 <p><b>Grade - II</b>  Length : 88Mtrs  Height : 7 feet  No. of strands : 10  Gap between lines : 6"  Includes Annexure-B material</p>	88Mtrs	900.0	79,200.00
2	<b>Gate Fencing</b> 	1 No	19,000.0	19,000.00
3	<b>Corner pole</b> 	4 No	7,000.0	28,000.00
4	<b>Standard Control Unit</b> 	1 No	90,000.0	90,000.00
<b>Sub Total</b>			A	2,16,200.00
5	Packing Forwarding and Transportation Charges	1 Job	10,000	10,000.00
6	Fence Erection, Testing ,Commissioning & Training Charges	1 Job	20,000	20,000.00
7	Civil Works Poles grouting, Earth Kits Planting, Cable Concealing etc		Customer Scope	Customer Scope
	Sub Total		B	30,000.00
	<b>FINAL COST OF PROJECT (All Inclusive)</b>			2,46,200.00



Annexure –A

COMMERCIAL TERMS AND CONDITIONS

1.	Prices	Prices quoted are All – Inclusive
2.	Taxes and Duties	VAT applicable on material cost is included.
3.	Packing & Forwarding Charges	Included
4.	Freight & Insurance	Included
5.	Octroi	Included
6.	Road Permit	Necessary Road permit wherever applicable to be provided by you
7.	Erection and Commissioning	<ul style="list-style-type: none"> <li>Charges for fence Erection and commissioning are included.</li> <li>Necessary tools and tackles to be provided by you for unloading, handling and transportation from storage point to the site is included.</li> <li>Necessary adequate storage space with lock and key arrangement to be provided by you for keeping the material, tools etc..</li> <li>Boarding and lodging facility nearby site for our crew to be provided by you free of cost.</li> <li>Total site clearance shall be provided by you.</li> <li>All civil related works will be under customer scope.</li> <li>All poles will be painted according to the site conditions.</li> </ul>
8.	Guarantee	<ul style="list-style-type: none"> <li>One Year guaranty for <del>all</del> Fence Components ( excluding battery )</li> <li>Though batteries are guaranteed for 1 year they are only against manufacturing defects and with normal operational working conditions i.e., if the batteries are down due to vegetative growth on fence and any leakages of voltage due to poor maintenance of fence, physical dislocation of Solar PV Module Charge wires will void the guaranty.</li> <li>Solar PV Modules are warranted for 5 years against all manufacturing</li> </ul>

Note : Guarantee offered is in good faith and is subject to proper and periodical maintenance



9	Validity	15 days from the date of quotation
10	Delivery	<u>Supply:</u> Within 30 days from date of receipt of confirmed order with advance payment. <u>Installation:</u> Within 2-3 weeks after subject to completion of civil works.
14	Payment	We request for payment terms as: <ul style="list-style-type: none"> <li>• 70% Advance Along with P.O.</li> <li>• 20% against material delivery.</li> <li>• 10% on Commissioning &amp; Hand-over</li> </ul>
12	Training	We will impart training to operation person during commissioning
13	Specifications	Complete specifications are furnished

Note: If any delay from the customer side in completing the project 100% amount for the Supplied material shall be paid including Erecting charges for the balance work.

Yours sincerely,  
 Sunil Panigrahi  
 Twincity Sunlife Pvt. Ltd.



## ANNEXURE XIII: NABARD Model bankable project proposal for mussel farming.

Estimated financial outlay for culture of Green mussel *P.viridis* in 400 sq m area rack culture unit

### A. Capital cost

Sr. No.	Particulars	Amount ( INR )
1	Small dugout canoe	5,000
2	Bamboo poles	3,000
3	Polypropylene rope ( 10 mm thickness)	9,450
4	Coir rope ( 10 mm thickness )	1,950
5	Tarpaulin	1,500
6	Nylon net	500
7	Lease amount ( for 5 years )	125
	Total	21,525

### B. Recurring cost

Sr. No.	Particulars	Amount ( INR )
1	Seed cost 70 bags @ INR 215 per bag ( including transportation )	15,050
2	Cloth for seeding	1,000
3	Labour charges	3,000
4	Miscellaneous (including basket , twine and so on )	1,000
	Total	20,050

**C. Total cost** ( A + B ) = ( INR 21525 + 20050 ) = INR 41,575

### D. Income

Sr. No.	Particulars	
1	Total production	2,00,000 Nos
2	Sale price	INR 22 per 100 mussels
3	Gross income	INR 44,000

### Financial analysis

Items	Years				
	1	2	3	4	5
Capital cost	21525	-	-	-	-
Recurring cost	20050	20050	20050	20050	20050
Total	41575	20050	20050	20050	20050
Income	30800	35200	44000	44000	44000
Net benefits	-10775	15150	23950	23950	23950
PW of costs @ 15 % DF	85928				
PW of benefits @ 15 % DF	129362				
NPW	85928				
BCR	1.51 : 1				
IRR	169%				

### Estimated Bank Loan and Repayment Period ( Illustrative )

Total outlay = INR 41,575

Margin 5 % = INR 2,080

Bank loan = INR 39,500

( In INR )

Year	Bank Loan	Net Income	Repayment			Bank Loan Outstanding	Net Surplus
			Interest @ 12 %	Principal	Total		
1	2	3	4	5	6	7	8
1	39500	30800	4740	3480	8220	36020	22580
2	36020	15150	4322	4768	9090	31252	6060
3	31252	23950	3750	10620	14370	20633	9580
4	20633	23950	2476	11894	14370	8739	9580
5	8739	23950	1049	8739	9788	0	14162

### ANNEXURE 14: Project cost\* - Oyster Mushroom (1000 kg/cycle)<sup>88</sup>

A	Fixed costs	(Amount INR.)
1	Temporary shed: 20'x12'x6' (240 sq. ft.)	12000
2	Equipments	
a.	Racks	2000
b.	Bamboos for racks	1600
c.	Knap sack sprayer : One	2000
d.	Vessels, heating equipment	500
e.	Miscellaneous (for knives, trays, rope and so on)	500
	<b>Sub-total</b>	<b>18600</b>
B	<b>Operational cost (per cycle)</b>	
	Paddy straw	1800
	Cost of bags	2400
	Cost of pasteurisation	1200
	Cost of Bavistin and Formaldehyde	750
	Spawn cost	6000
	Labour charges	2250
	Fuel/ power cost lump sum	4000
	<b>Sub-total</b>	<b>18400</b>
C	<b>Total cost (A + B)</b>	<b>37000</b>

### Financial analysis - Oyster Mushroom<sup>89</sup>

	(Amount INR)					
Particulars	Year I	Year II	Year III	Year IV	Year V	Year VI
<b>Investment cost</b>	37000					
<b>Recurring cost</b>	18400	55200	55200	55200	55200	55200
<b>Total cost</b>	55400	55200	55200	55200	55200	55200
<b>Benefits</b>	25000	75000	75000	75000	75000	75000
<b>Net income</b>	-30400	19800	19800	19800	19800	19800
<b>D.F @15%</b>	0.870	0.756	0.658	0.572	0.497	0.432
<b>Discounted costs</b>	48198	41731	36322	31574	27434	23846
<b>Discounted benefits</b>	21750	56700	49350	42900	37275	32400
<b>Net Present worth</b>	-26448	14969	13028	11326	9841	8554
<b>Net Present Value (NPV)</b>	31269					
<b>Benefit Cost Ratio (BCR)</b>	1.15	1				
<b>IRR (Internal Rate of Return)</b>	> 50%					

<sup>88</sup> [http://nabard.org/modelbankprojects/plant\\_oyster.asp](http://nabard.org/modelbankprojects/plant_oyster.asp)

\*This may be modified to suit the local conditions taking into account the different techno-economic parameters prevailing in the locality.

<sup>89</sup> [http://nabard.org/modelbankprojects/plant\\_oyster.asp](http://nabard.org/modelbankprojects/plant_oyster.asp)

*Concerned divisions / project related brief note to be included here*



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