

## INTRODUCTION

The attempt to conserve coastal and marine biodiversity (establishment of the MMS), which aimed primarily at the conservation of marine and coastal resources, is also found to be inadequate in view of the management challenges of the region. Despite its existence over two decades, it is yet to evolve a congenial environment for the effective management of the Marine Protected Area in the absence of baseline information on the faunal resources of the area. In order to improve the conservation prospects of the unique flora and fauna along the coast especially that of the Marine Sanctuary, long term solutions need to be anchored in several key areas: establishing a robust database on the biodiversity profile of the region as a foundation for informed decision making.

Malvan is one of the biologically richest coastal regions in Maharashtra on the west coast of India. Due to its high ecological importance, an area of 29.12 km<sup>2</sup> of Malvan coastal waters was designated as the Malvan Marine Sanctuary (MMS) in 1987, under the National Wildlife (Protection) Act, 1972, with subsequent notifications in the following years. With a core zone of 3.182 km<sup>2</sup> and buffer zone of 25.94 km<sup>2</sup> (total area being 29.122 km<sup>2</sup>) includes the Sindhudurg fort, Padamged island and other submerged rocky structures. The north eastern border of the buffer zone is 50 m from the seashore near Malvan port, while on the east it is a semi-circular sandy beach 500 m parallel to the shore of Malvan, in the south it is near Mandel rock, and in the west touches the Malvan rock. The Malvan Marine Sanctuary is extremely rich in coral and other associated marine life. Because of its unique coastal and marine biodiversity, ecological significance and most biologically diverse areas of Maharashtra, Malvan is one of these 11 areas that are ecologically and economically critical habitats identified along west and east coast of India.



The critical habitats of Malvan Marine Sanctuary includes rocky shore, sandy shore, rocky islands, estuaries, mud flats, marshy land, mangrove habitats, coral reefs, sargassum forests, as well as congregation sites for groupers and sharks. The available preliminary report suggests that there are 367 species of marine flora and fauna reported for the Malvan coast which include 73 species of marine algae, 18 species of mangrove trees and shrubs, 11 species of coral, 73 species of mollusc, 47 species each of polychaetes and arthropods, 18 species of sea anemones and 74 species of fish. Additionally, sharks, rays, seahorses and Indo-pacific humpback dolphins have been sighted along the coast. Further, three globally significant species of turtles namely, Olive Ridley (*Lepidochelys olivacea*), Green (*Chelonia mydas*) and Leatherback (*Dermochelys coriacea*), have been reported from the Malvan. 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. Initial studies by various scientific organizations reported occurrence of extensive corals in the region. Angria Bank and surrounding areas and Malvan are reported to be a congregation site for migrating marine animals like whales and whale sharks. The area has significant fish diversity and is a rich spawning and nursery ground for many fish. However, detailed and comprehensive faunal exploration of Sindhudurg coast and especially that of Malvan Marine Sanctuary is yet to be undertaken.



In this background, the Zoological Survey of India proposed to carry out “Assessing the current status of the Coral reef ecosystem and formulating a long term monitoring protocol for Sindhudurg Coast, Maharashtra” with the following objectives.

## **OBJECTIVES OF THE PROJECT**

1. Status and distribution of coral reef and associated species, benthic floral and faunal components along the Sindhudurg coast, based on which conservation measures can be undertaken.
2. Factors influencing the distribution and abundance of corals, seagrass, seaweed, benthic flora, fauna and reef fish communities within the Sindhudurg coastal and marine ecosystem.
3. Effects of anthropogenic activities on the coral reef ecosystem and suggest site specific recommendation with respect to the present scenario.
4. To form a spatial database of corals and associated flora and fauna utilising the geographic information system.
5. Establish a monitoring protocol for coral reef ecosystems with the involvement of local stakeholders across the Sindhudurg coast.

## **MoU AND TERMS OF REFERENCES**

Based on the decision of the State Project Steering Committee of the GoI-UNDP-GEF Project on Mainstreaming Coastal Biodiversity into Production sectors in Sindhudurg Coast decided to award the project of Assessing the current status of the Coral reef ecosystem and formulating a long term monitoring protocol for Sindhudurg Coast, Maharashtra to the Zoological Survey of India, Kolkata and accordingly a Memorandum of Understanding (MoU) between CCF (Mangrove Cell), Mumbai, and the Nodal Officer, GOI-UNDP-GEF project & Zoological Survey of India, Kolkata as per the Terms of Reference was signed for implementation of the project.

The project awarded to Zoological Survey of India, Kolkata commenced from 29<sup>th</sup> November 2013 (date of signing the agreement by ZSI with GOI-GEF-UNDP Malvan Project) for a period of 24 months (Two years). The actual field work for the project however initiated with recruitment of research personnel for the project in January 2014 and continued upto December 2015. For smooth conduct of field work and data collections, two JRFs and one Field Assistant were engaged for the project work and were based at Malvan in Sindhudurg district of Maharashtra which is close proximity to the Malvan Marine Sanctuary.

## **Milestones for the project**

### **1<sup>st</sup> Year**

First Quarter – Permission from Malvan Marine Sanctuary Authority, field base other logistic arrangements, collation and review of literature, equipment procurement etc.

Second Quarter to fourth Quarter – Fieldwork along the Sindhurg coast

Data analysis and report writing & submission of First Year Annual Report to GOI-GEF-UNDP Malvan Project (Fourth Quarter)

### **2<sup>nd</sup> Year**

First Quarter to second Quarter – Fieldwork along the Sindhurg coast

Third Quarter – Capacity Building of Stakeholders

Fourth Quarter – Project Closure Report preparation and submission to GOI-GEF-UNDP Sindhurg Project



## METHODOLOGY

The study conducted was for a duration of two years from January 2014 to December 2015. Although the Terms of Reference by ZSI with GOI-UNDP-GEF-Sindhudurg Project was signed in November 2013, but the project was initiated with recruitment of research personnel in January 2014. For initial survey, field work along the Sindhudurg coast was initiated from mid February 2014 and a base camp was set up in Malvan town for conducting regular field work and also for regular consultation with GOI-UNDP-GEF-Sindhudurg Project staff. A review of literature on information pertaining to corals and associated fauna of Sindhudurg was gathered through available published and unpublished work and reports, was collected through library consultation and internet.



### **Detail of study area:**

The Sindhudurg coast has a coastline of ~ 180 km from Vijayadurg in north to Reddi in south along the Maharashtra coast. The Sahyadri Mountain range (Western Ghats) forms the eastern boundary of the Sindhudurg, and the Arabian Sea marks the western boundary, thereby the coastal stretch of Sindhudurg is rocky with sandy shores in between and patches of mangroves near Malvan (Fig 1-3).

*Malvan:* Malvan along the Sindhudurg coast is known for the Sindhudurg fort situated in the offshore waters of Malvan town. Malvan is surrounded by creeks viz. Karli, Kolam and Kalavali. Towards the northern end of the Malvan, there are contiguous patches of rocks.

*Chivala:* Chivala is the beach stretch in between the rockyshores along the Malvan coastline. The beach is narrow, backed with Coconut plantation and human habitation including fishing hamlets.

*Achara:* Achara is located at 22 km from Malvan and 36 km from Kankavali along the Sindhudurg coast. The long stretch of beach and the sandy substratum is suitable for many marine organisms and especially mammals viz. dolphins. Migrating birds also can be seen here during seasons. There are some fishing activities around Achara mostly mechanized.

*Tarkarli:* Tarkarli is 6kms south of Malvan. Tarkarli is a narrow stretch of beach with its crystal clear waters is located at the convergence of the Arabian Sea and the Karli River. The nearshore waters of Tarkali is suitable for snorkelling and scuba diving.

*Vijayadurg:* Located in Devgad Taluka along the Sindhudurg coastline, Vijayadurg has a similar fort as that of Sindhudurg fort at Malvan, encompassed a large area and surrounded by sea on all three sides. There is evidence of corals in the intertidal and subtidal region of Vijayadurg.

*Vengurla:* Vengurla beach stretch is the border between Maharashtra and Goa and is surrounded by a semicircular range of hills in the north while Arabian Sea is located on its west. The beaches at Vengurla is wide, with sand dunes and psammophytes, the intertidal region is sandy with rocky bottom in between.

The study conducted involved two components: i) an initial survey all along the Sindhudurg Coast upto 10 fathoms:- to map the current status and distribution of coral reefs and associated species and then intensive sites would be selected so as to understand richness, abundance and factors that influence the distribution of corals and associated species.



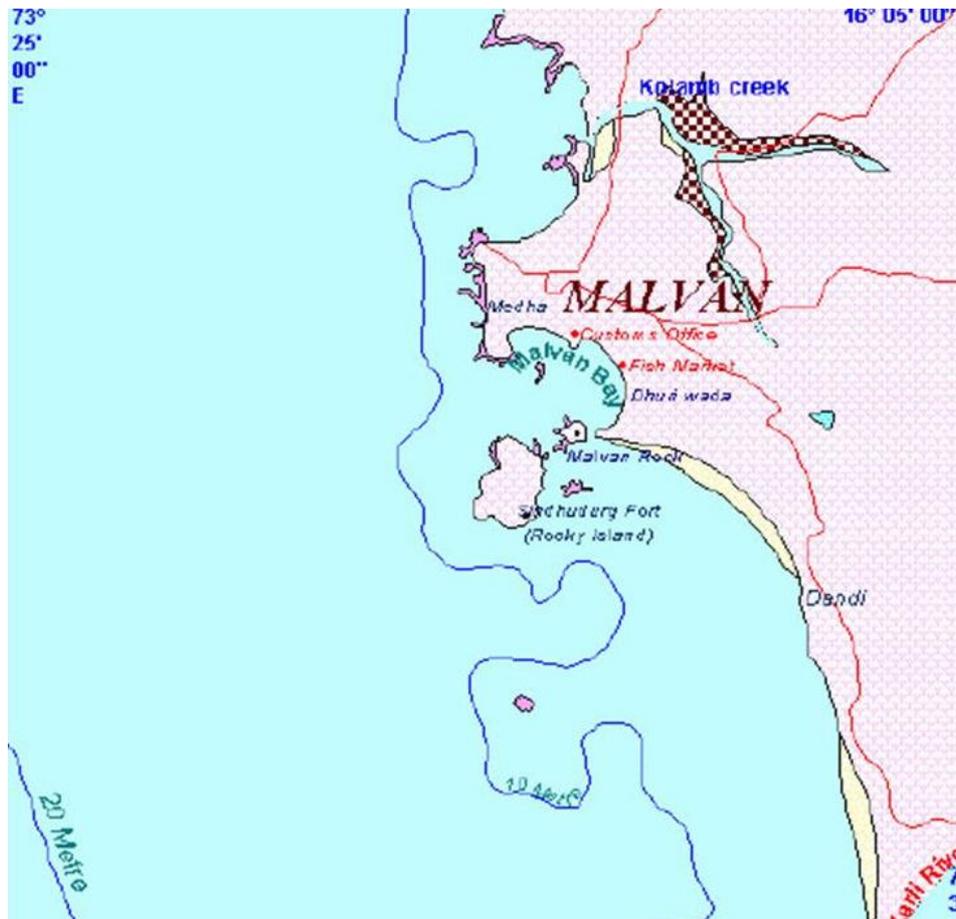
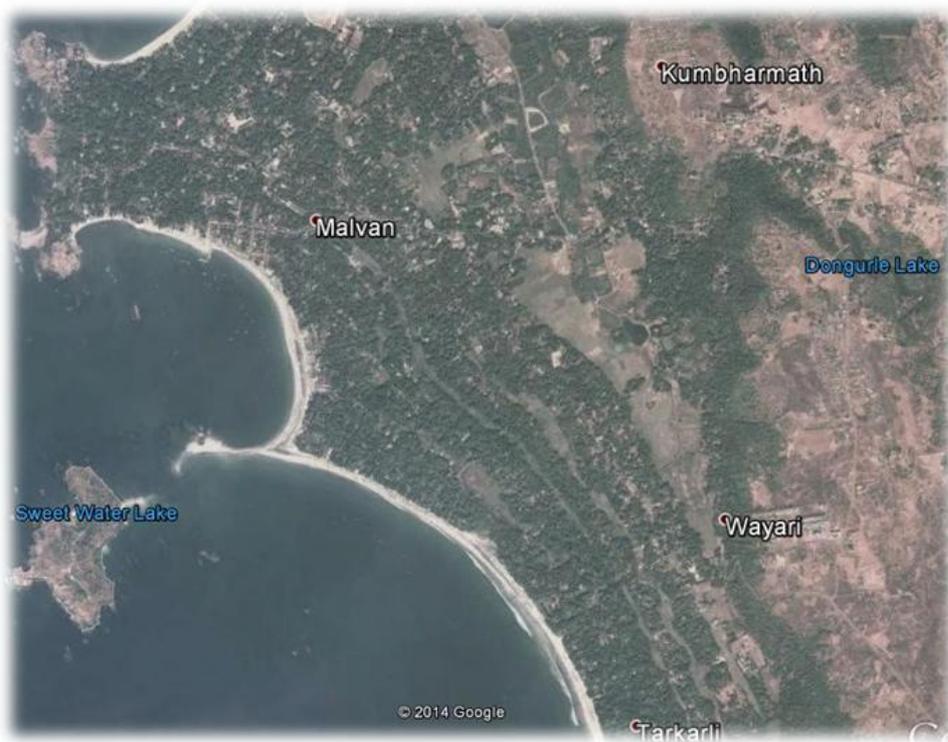
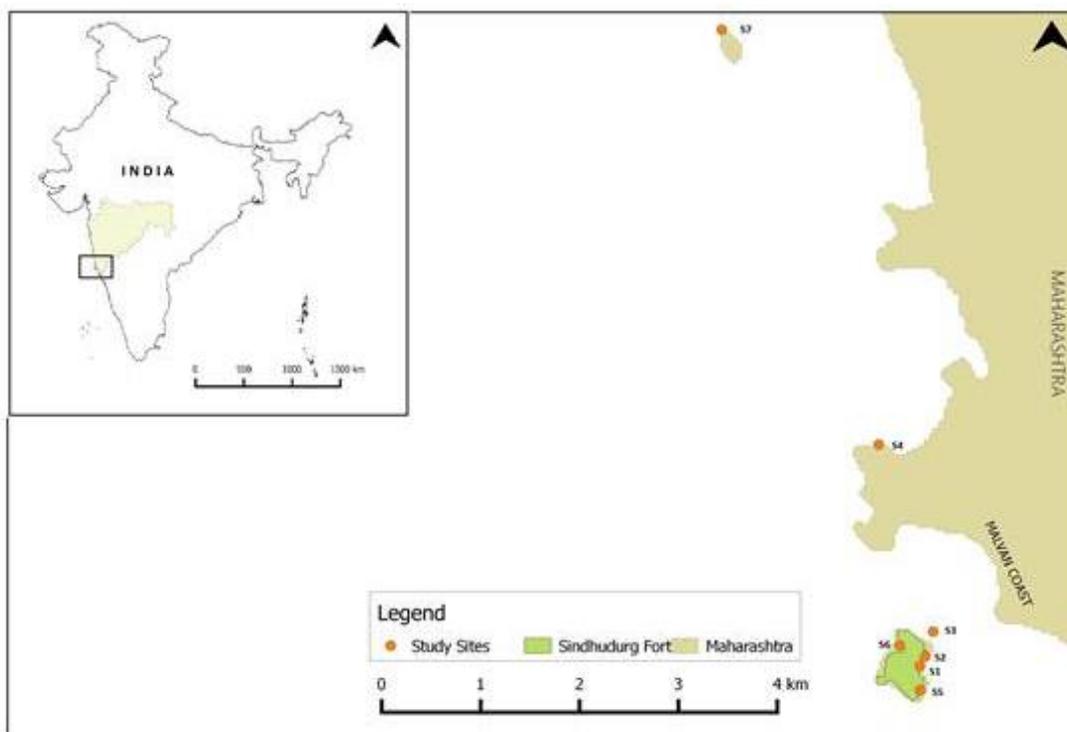


Fig 1. . Map of Sindhudurg coast showing Sindhudurg fort and adjacent rocky shores and beaches  
 (Adopted from ICMAM Report on Critical Habitat Information System of Malvan (Maharashtra-India), 2001)



**Fig 2. Map of Sindhudurg coast in Maharashtra (Source: Google Earth)**



**Fig 3. Map showing Malvan Fort and Stations surveyed and identified for setting up Permanent Monitoring Plots for assessment of health of Corals and associates**

### **Objectives I.**

Status and distribution of coral reef and associated species, benthic floral and faunal components along the Sindhudurg coast, based on which conservation measures can be undertaken.

## **RESEARCH METHODOLOGY**

### **I. Diversity and distribution of corals and associated fauna along Sindhudurg coast**

**i. Onshore surveys:** Between February 2014 and July 2014, the coastal stretches viz. Achara, Chivala, Devgarh, Vengurla, Navagarh, Malvan, Nevati and Vijayadurg along the Sindhudurg coastline were visited collected and identified so as to ascertain areas that may host coral reefs along the coast. Live and dead specimens from intertidal and sub-tidal regions from above 8 localities have been collected, preserved, identified, registered and deposited in the National

Zoological Collections of ZSI (details of collections deposited in Western Regional Centre of ZSI at Pune is presented in Appendix-I).

The data on the geo-coordinates of the collection/survey sites was noted using hand-held Global Positioning System. Other physical parameters viz. depth, substratum, distance from HTL, turbidity, land based drainage, boat movement and anchorage etc. were also collected. Each survey sites were photographed for prevailing habitat and identification, distribution and abundance pattern of intertidal fauna. Representative samples by hand picking from their sites of occurrence for physical verifications were collected, measured and preserved using preservatives and brought to the field camp for identification and make them part of the National Zoological Collections of ZSI for future studies.

**ii. Intertidal and underwater surveys:** Scientists involved in the project along with Research personnel carried out a reconnaissance survey for two weeks during first fortnight of March 2014 and thereafter on a monthly basis data collection are being done all along the Sindhudurg coast. The survey and data collection was done from inter tidal zone (by beach/shore/reef walk) to the continental shelf area (sub-tidal region by snorkelling).



The research team (Research Scholars) based at Malvan conducted underwater and

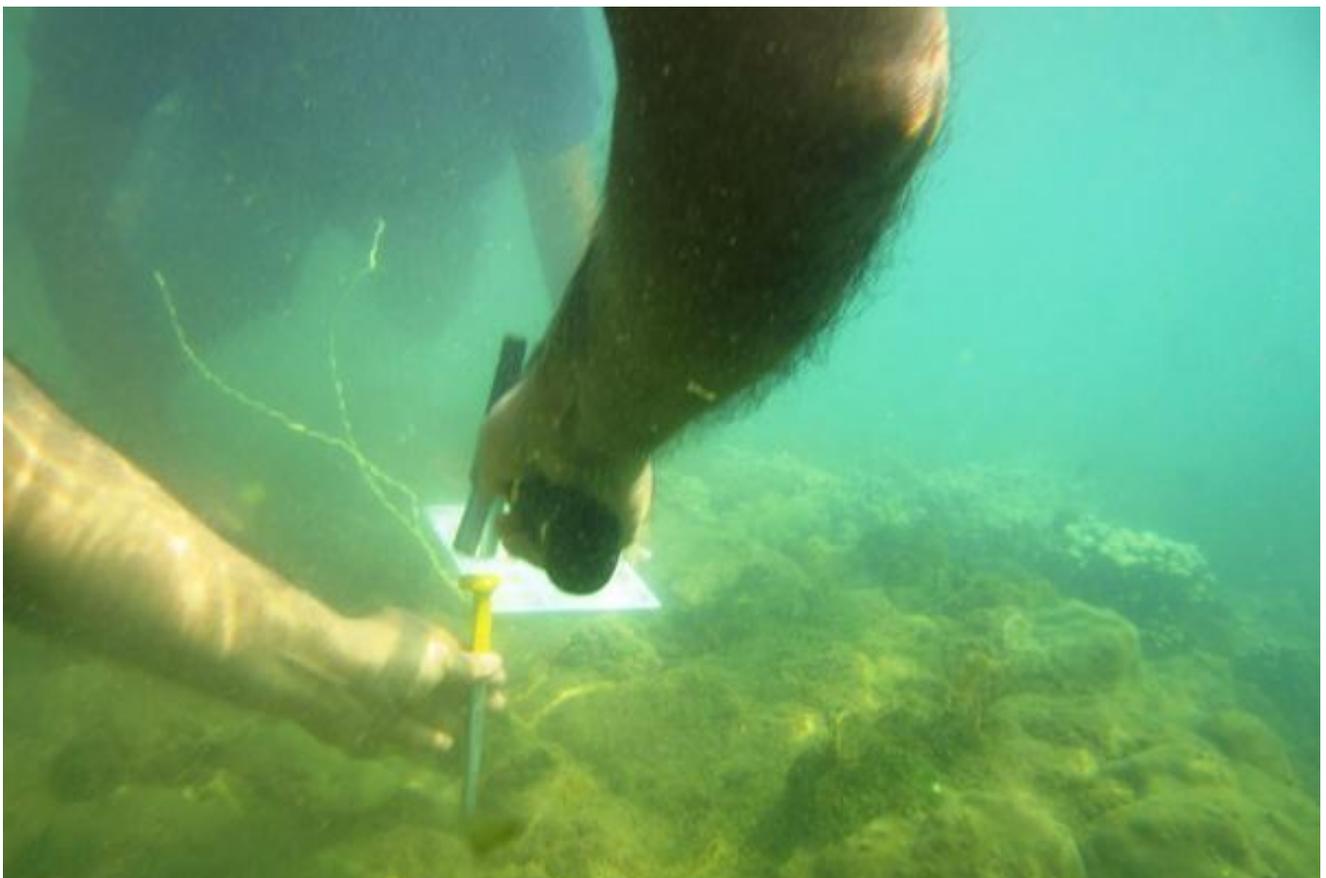
subtidal surveys at Malvan (around the Fort area, for data from permanent monitoring plots), around Rock Garden, around Cowrie Rock and at Chivala, at Vijayadurg (around the Vijayadurg Fort, at ~ 10 fathom depth), Vengurla Rock (around Naval base at 10 fathom depth), Devbaug (at 10 fathom depth) through snorkeling and scuba diving. The underwater survey was carried out by snorkeling and SCUBA diving to estimate the abundance and distribution of faunal species with particular reference to coral patches. Underwater SCUBA diving and subtidal surveys continued throughout the period for field data on corals and associated fauna for spatial database on Sindhudurg coast. The geo-coordinates of the collection/survey sites were noted using hand-held Global Positioning System. Benthic cover categories were assessed by employing photo-quadrats (1 m<sup>2</sup>) and LIT method (30 m length) by English et al. (1994). Survey in intra-littoral zones and inland fringe areas of the sea was done by wading through the water by snorkeling. Photography/videography of each survey sites for habitat identification, distribution and abundance of fauna was also done. Representative samples for physical verifications and measurement by hand picking from their sites of occurrence and release back after the data collection is over. Representative samples of species were collected from the site for proper identification and for deposition at the National Zoological Collections of ZSI for future studies. Information on other physical parameters viz. depth, substratum, distance from HTL, turbidity, land based drainage; recreational boating and anchorage etc. were collected in addition. Additionally, fish landing centres around Malvan Taluka were surveyed for diversity of fishes and fishing practices. At different depth, snorkeling and divers were made to ascertain the presence of corals and their diversity. During October 2015, the ZSI project field team assisted the GOI-UNDP-GEF-Sindhudurg Project team for documentation on corals and associates of Malvan and underwater filming of the Permanent Monitoring Plots established at Malvan.



During monsoon (June to September), no offshore field work/underwater data could be collected due to heavy rains, rough sea conditions and non-availability of boat for field work. However, information on other aspects viz. effect of anthropogenic activities on the coral reef ecosystems of Sindhudurg and factor influencing the distribution and abundance of corals and associated fauna/flora within the Sindhudurg coast was collected during June-September.

## RESEARCH METHODOLOGY

**II. Monitoring of health of Corals and associates at the Permanent Monitoring Plots:** The experts from Zoological Survey of India (Dr. K. Venkataraman, Director of ZSI, Dr. Rajkumar Rajan, Dr. Basudev Tripathy, and Dr. Ch. Satyanarayana, Scientists involved in the project) visited Malvan, from 21<sup>st</sup> February 2015 to 27<sup>th</sup> February 2015 to conduct an intensive faunal inventerisation in and around Malvan coastal waters for setting up *Permanent Monitoring Plots* for long term monitoring of the health of corals and associated fauna in Malvan.



Four sites (Station-01, Station-02, Station-03 and Station-04) were identified based on the status of presence/absence of corals for monitoring of coral health and that were establishment as PERMANENT MONITORING PLOTS in February 2015. Accordingly, at each site, an approximately

100 sq m. plot area marked with GPS and physical demarcations on the rock/outcrop were surveyed. Inside the 100 sq. Plot, the earlier marked permanent transects (LITs) of 30 m. length laid parallel to the Fort/shore were surveyed and data collected on the transect through LITs. Information was noted down on the LIT at 5 m interval and quadrat of 1 m<sup>2</sup> with plastic PVC pipe. The other three sites which did not have corals but are with associated fauna/flora marked during February 2015 were also visited during April-May 2015 and Mid-September-November 2015. All the sites were photographed for evidence of presence/absence of coral and associated fauna/flora coverage. Also, permanent marked buoys were redeployed for better visibility by fisherfolks and tourist boat operators as not to disturb the sites. Wherever possible corals and associated fauna were collected and preserved for adding them as National Zoological Collections and are deposited in WRC, ZSI, Pune. During October 2015, the ZSI research team assisted the GOI-UNDP-GEF-Sindhudurg Project team in documentation of permanent monitoring plots and corals/associated fauna at Malvan. These permanent monitoring plots were visited on a fortnight and data on coral and other associates coverage on the LITs and quadrats were taken regularly including videography of the LITs and quadrats to observe any changes.



## Objectives II

### 2. Effects of anthropogenic activities on the coral reef ecosystem and suggest site specific recommendation with respect to the present scenario.

#### Effect of anthropogenic activities on coral reef ecosystems along the Sindhudurg coast

During June – September 2015, information from secondary sources on sewage points draining into the Sindhudurg coastal stretch was gathered from Nagarpalika (Municipality) office of Malvan and Devgarh Talukas. Information was also gathered on number of coast based industries (Cashew nuts/Mango pulp processing units) and their effluents draining into the coral abundant areas. Information was also collected from Fishery Department (Malvan) on fisheries of Sindhudurg coast (no. of boat operating along the coast). The coastal stretch between Redi and Vijayadurg was visited during August – September 2015 for ground truth information on effect of anthropogenic activities and their possible impact on coral reef ecosystems along the Sindhudurg coast. During the above period, the coastal stretches of Vijaydurg Taluka i.e. Vijaydurg Fort area, Girye beach, Padavane beach, Kunkeshwar beach and Aachara beach and along the Vengurla Taluka, Redi beach, Shiroda beach, Sagreshwar beach, Navabuag beach, Paradise beach and Nivati jetty was visited sources of land-based effluents were identified and marked with GPS and plotted on the map (Fig 4).



### Objectives III

3. To form a spatial database of corals and associated flora and fauna utilising the geographic information system.

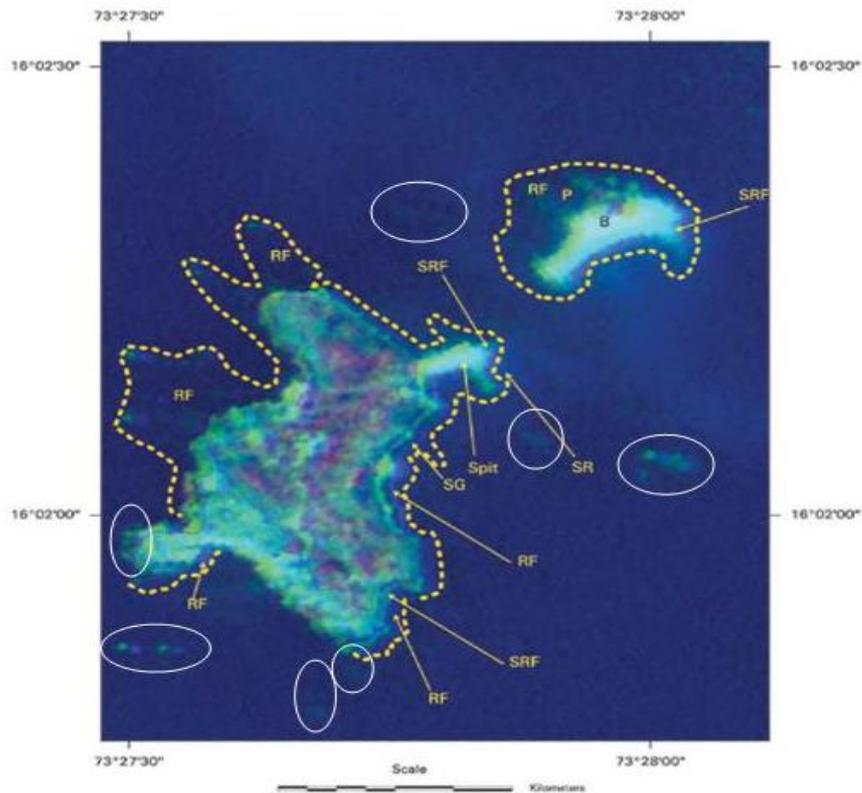
#### I. Geographical Information based biodiversity data with species level abundance for Sindhudurg coast, using sonar/satellite imagery/ diving

The description of Sindhudurg coral by ICMAM through use of IRS LISS III satellite imagery suggests that from Malvan bay a chain of submerged and exposed rocky islands extend straight towards south. In this chain, several islands exist including Vengurla Rocks at the southern tip and Sindhudurg Fort at the northern tip. Other small islets around Sindhudurg Fort are Mandal Rock, Malvan Rock etc. Here the reef is of fringing type and greatly damaged and less diverse. Sindhudurg is a low fortified island on the coastal fringing reef (ICMAM-PD, 2001).

Malvan recorded the smallest regional area with patchy corals with is evident from the very low diversity of the coral environment. This area is also under stress due to turbid waters and probably due to human activities such as dredging and the sediment flux from the mainland. The coral reefs of these areas have been largely affected by the natural processes than the anthropogenic activities.



Fig 4. LISS III Satellite Imagery indicating coral patches along Sindhudurg, Source: ICMAM, 2001



**Fig. 5 Satellite imagery showing coral reef of Malvan. Source: SAC, Ahmedabad**

Coral reef mapping for the Indian coast carried out recently by Space Applications Centre (SAC) using IRS data of 2004-07 (Navalgund et al 2010; Fig.5) suggests that Malvan has 00.28 sq km based on eco-morphological zonations of the coral reefs on the off-shore reef of Malvan. Accordingly to the report of SAC (Coastal Zones of India, 2012), coral reef of Malvan has recorded four eco-morphological classes. The dominant class is Reef Flat followed by Sanded Reef Flat, Submerged Reef and Sand Cays. Major coral reef classes of Malvan are Reef Flat (76.20 %), Sanded Reef Flat (18.42 %) and the minor class is Submerged Reef (5.38 %).

Considering the observations and findings of the above studies and based on the available published literature on extent of coral patches along the Sindhudurg coast, the underwater field work was conducted from Vengurla to Vijayadurg.

During April-May 2015, offshore field work was mostly confined to Malvan and adjacent coastal areas. Although field work initiated once again from mid September 2015, subtidal surveys by

snorkeling was done on the nearshore areas of Sarjekot area, adjacent to Fort and nearshore waters of Rock Garden, due to poor visibility and rough condition, no underwater could be done data collected. However, from October 2015 onwards, proper data from on underwater sampling from Permanent Monitoring Plots at Malvan and documentation of corals and associated fauna along Sindhudurg coast was done. The coastal waters of Vijayadurg, Devgad, Kunkeswar, Tarkarli, Devbaug and Vengurla rock was visited and sub-tidal survey/underwater survey was done by snorkeling and SCUBA diving for documentation of corals and associated fauna.



During April-May 2015, offshore field work was mostly confined to Malvan and adjacent coastal areas. Although field work initiated once again from mid-September 2015, sub-tidal surveys by snorkeling was done on the nearshore areas of Sarjekot area, adjacent to Fort and nearshore waters of Rock Garden, due to poor visibility and rough condition, no underwater could be done data collected. However, from October 2015 onwards, proper data from on underwater sampling from Permanent Monitoring Plots at Malvan and documentation of corals and associated fauna along Sindhudurg coast was done. The coastal waters of Vijayadurg, Devgad, Kunkeswar, Tarkarli, Devbaug and Vengurla rock was visited and sub-tidal survey/underwater survey was done by snorkeling and SCUBA diving for documentation of corals and associated fauna. The graphical representations of substratum specific coral abundance at different sites surveyed are presented below.

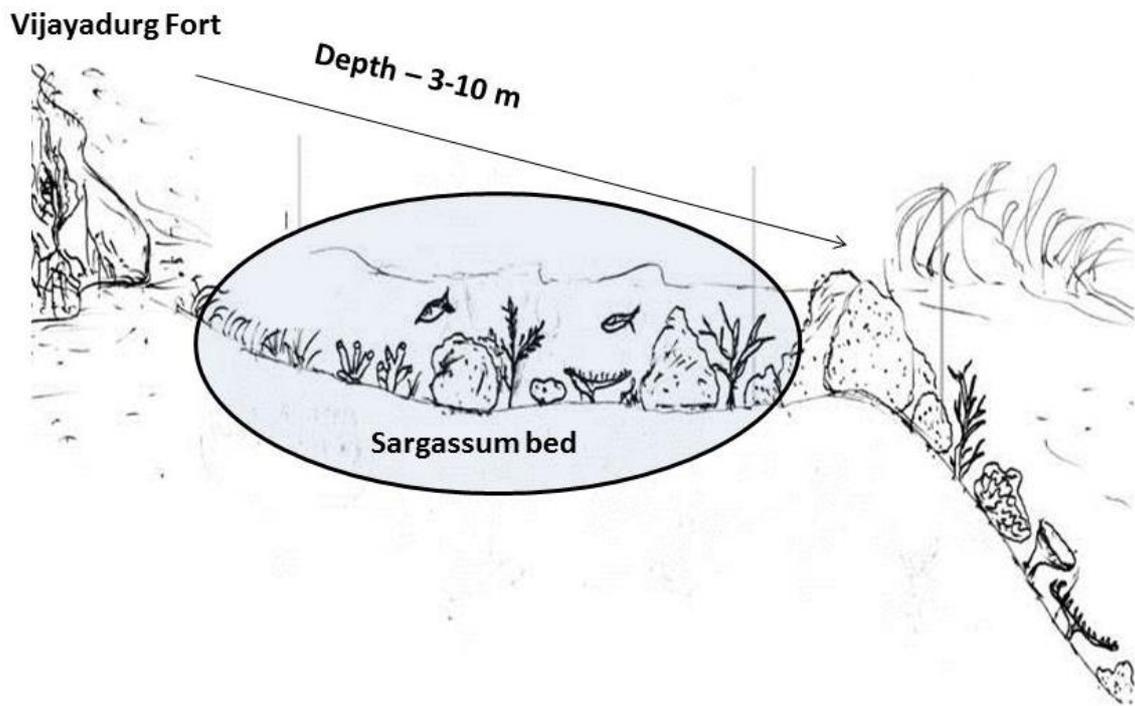


Fig. 6. Substratum specific coral associated flora/fauna at Vijayadurg

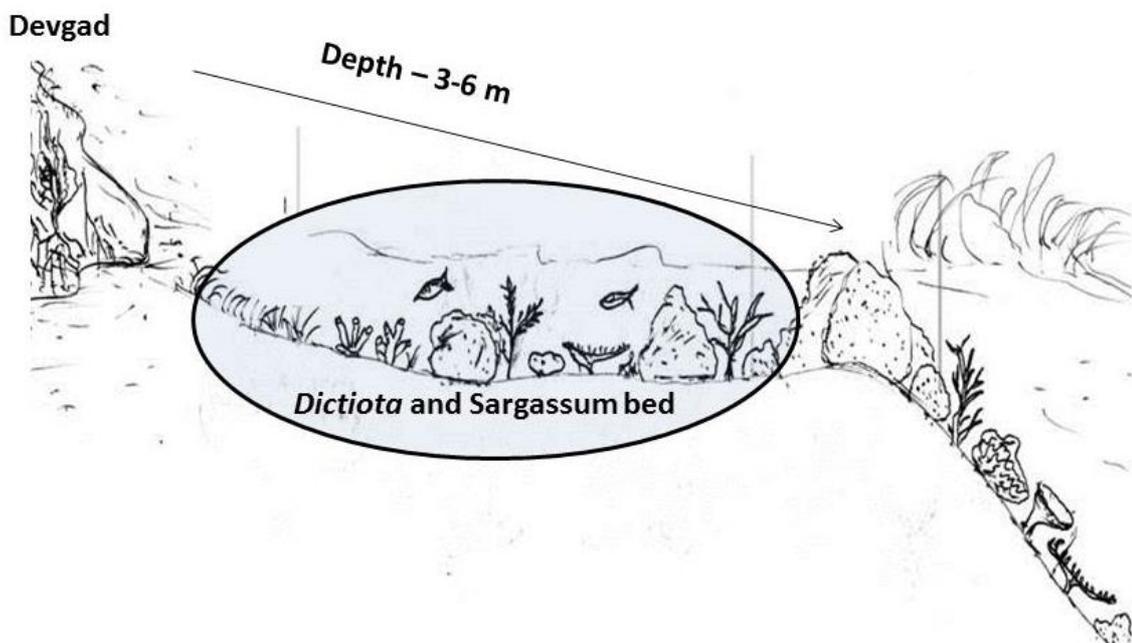


Fig. 7. Substratum specific coral associated flora/fauna at Devgad

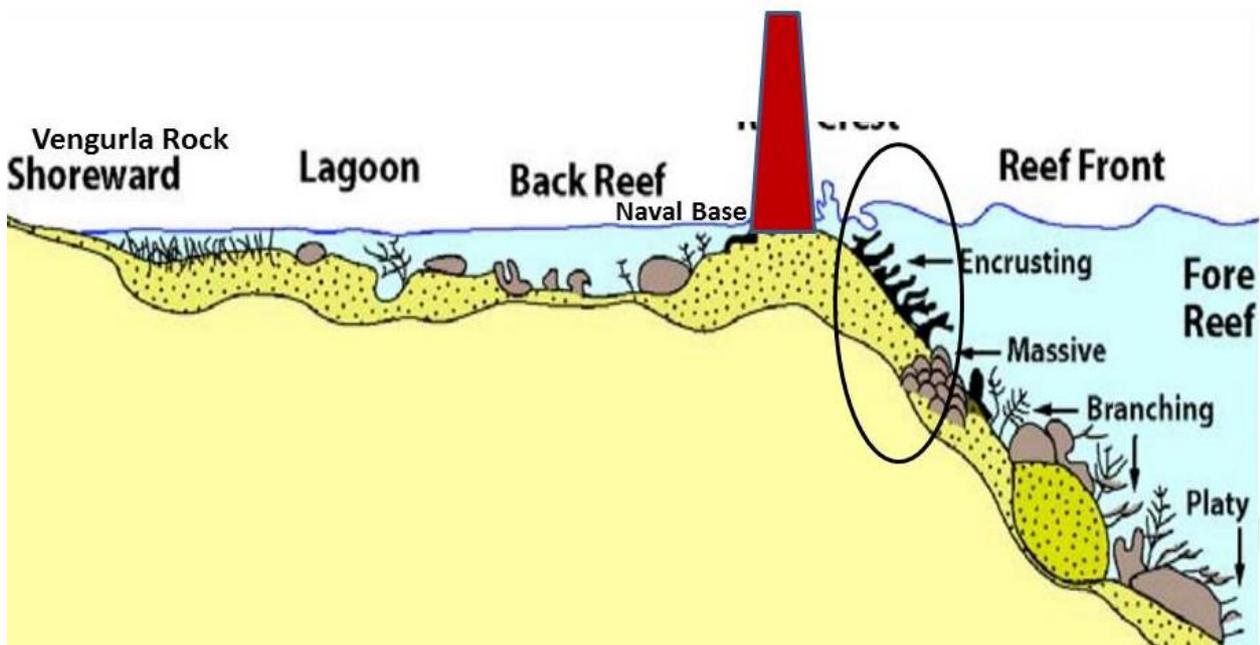


Fig. 8. Substratum specific coral associated flora/fauna at Vengurla Rock

## RESULTS

Substratum maps for the area and habitats of coral reef associated flora and fauna in Sindhudurg:

### Substratum specific coral abundance along the Sindhudurg coast

Corals are found attached on the rocky substratum in inter-tidal and sub-tidal regions. The density was sparse, hardly exceeding 1-2 colonies per sq.m. in any of the sites surveyed along the coast. All the colonies were of encrusting type and the height of the colonies rarely exceeded 5 cm. Only hermotypic corals were encountered during the sub-tidal/underwater surveys conducted during October-November 2015 at Vijayadurg (Table 1), Devgad, Kunkeswar, Tarkarli, Devbaug and Vengurla rock.

Table 1. Underwater survey sites in Vijayadurg

L no.	Location	GPS Points
1	Vijaydurg site 1	16°33'43.62"N 73°20'3.15"E
2	Vijaydurg site 2	16°33'44.53"N 73°19'54.99"E
3	Vijaydurg site 3	16°33'36.97"N 73°19'53.67"E
4	Vijaydurg site 4	16°33'27.20"N 73°19'43.37"E

**Vijayadurg:** Diving was made at 4 locations in Vijayadurg (Table 2). However, no coral assemblage was recorded, but Zooxanthaelate patches were dominant on rocky substratum. This indicates that the coral assemblages if any at Vijayadurg could be very patchy and recent. Large patch of Sargassum was observed at all diving points. Along with fishes known to occur in coral areas seen, large school of dolphins (>15) also observed swimming close to the shore.

**Table 2. Checklist of coral associates at Vijayadurg**

Mollusca	Fishes	Mammal	Seaweeds/ Algae
<i>Meretrix meretrix</i>	<i>Cephalopholis formosa</i>	Humpback dolphin	<i>Sargassum sp.</i>
<i>Cellana radiata</i>	<i>Siganus vermiculatus</i>		<i>Caulerpa scalpelliformis</i>
<i>Bursa tuberculata</i>	<i>Abudefduf bengalensis</i>		<i>Padina sp.</i>
<i>Drupa konkanensis</i>	<i>Scarus ghobbon</i>		
<i>Trochus radiatus</i>	<i>Mugil cephalus</i>		
<i>Cardium flavum</i>	<i>Lutjanjanus rivulatus</i>		
	<i>Scatophagus argus</i>		
	<i>Acanthopargus berda</i>		
	<i>Abudefduf septemfasciatus</i>		

**Devgad:** Diving was made at 3 locations in Devgad close to the Fort (Table 3). At Devgad, no coral patches were encountered during the divers made. However, large school of fishes along with seaweed beds of sargassum were observed in patches of more than 50 m<sup>2</sup> in two of the three locations surveyed. A list of coral associated recorded underwater at Devgad are presented in Table 4.

**Table 3. Underwater survey sites in Devgad**

Sl. no.	Location	GPS Points
1	Devgad Site 1	16°23'22.64"N 73°22'11.82"E
2	Devgad Site 2	16°23'22.86"N 73°22'27.13"E
3	Devgad Site 3	16°23'21.84"N 73°22'26.46"E

**Table 4. Checklist of coral associates at Devgad**

Fishes	Crustacean	Mollusca	Echinoderms	Seaweed
<i>Aetomylaeus maculatus</i>	<i>Calappa lophos</i>	<i>Arca sp.</i>	<i>Astropecten indica</i>	<i>Dictyota sp.</i>
<i>Anoxypristis cuspidata</i>	<i>Penaeus indicus</i>	<i>Hemifusus pugilinus</i>		Sargassum
<i>Mugil Cephalus</i>	<i>Penaeus monodon</i>	<i>Murex tribulus</i>		
<i>Osteogeneiosus militaris</i>	<i>Penaeus sp.</i>	<i>Tibia curta</i>		
<i>Platycephalus indicus</i>	<i>Portunus pelagicus</i>	<i>Tonna sp.</i>		
	Sand crab	<i>Turritella duplicata</i>		

**Vengurla Rock:** Diving and snorkeling was made from 02 m to 15 m depth at Vengurla rock near the Naval Base Light. Dives were made at three different locations at different depths (Table 5). The underwater substratum is sloppy with gradient changing from 3 m to 15 m depth and more also. Besides, the presence of *Dendrophyllia* (belonging to family Dendrophyllidae) from Vengurla rocks (near Naval based), there was interesting corals and associates observed at the site (Table 6). Further surveys may revealed several new records of non-acropora corals from Vengurla rock.

**Table 5. Sites at Vengurla Rock where diving was made during Oct.-Nov. 2015**

Sl. no.	Location	GPS Points
1	Vengurla Rocks Site 1	15°53'38.42"N 73°27'55.15"E
2	Vengurla Rocks Site 2	15°53'13.11"N 73°27'53.26"E
3	Vengurla Rocks Site 3	15°53'54.58"N 73°28'28.39"E

**Table 6. Checklist of coral associates at Vengurla rock**

Mollusca	Fishes	Seaweeds/ Algae
<i>Cellana radiate</i>	<i>Cephalopholis Formosa</i>	<i>Caulerpa scalpelliformis</i>
<i>Bursa tuberculata</i>	<i>Chaetodon collare</i>	<i>Padina sp.</i>
<i>Trochus radiates</i>	<i>Abudefduf bengalensis</i>	
<i>Cardium flavum</i>	<i>Acanturus xantopterus</i>	
	<i>Mugil cephalus</i>	
	<i>Lutjanjanus rivulatus</i>	
	<i>Scatophagus argus</i>	
	<i>Acanthopargus berda</i>	
	<i>Siganus vermiculatus</i>	
	<i>Pomacanthus annularis</i>	
	<i>Canphidermis maculate</i>	
	<i>Pempheris vanicoaensis</i>	

### **Coral inventorisation along Sindhudurg coast:**

The survey conducted till March 2015 revealed 11 species of corals in and around the Sindhudurg fort in Malvan along with three new records. However, the sub-tidal/underwater surveys conducted from April – November 2015 revealed few more species from Sindhudurg coast among which *Polycyathus verrilli* Duncan, 1889, *Goniopora minor*, *Pavona bipartita* Nemenzo, 1980 (new generic record to west coast) and *Leptastrea purpurea* (Dana, 1846) are unique records. The presence of *Dendrophyllia* from Vengurla rocks indicates presence of some more associated species of non-acropora corals from this site. The survey conducted so far along the Sindhudurg coast confirmed presence of atleast 20 species of corals of which seven (7) species have been recorded during April – November 2015 underwater surveys.

A list of corals recorded from the above sites are as below.

- |  |  |
|--|--|
| 1. <i>Turbinaria mesenterina</i>       | 11. <i>Siderastrea savignvana</i>                |
| 2. <i>Goniastrea pectinata</i>         | 12. <i>Coscinarea monile</i>                     |
| 3. <i>Goniopora sp.</i> (new record)*  | 13. <i>Cyphastera serialia</i>                   |
| 4. <i>Goniopora sp.</i> (new record)*  | 14. <i>Plesiastrea versipora</i>                 |
| 5. <i>Goniopora minor</i> (new record) | 15. <i>Pavona bipartita</i> (new generic record) |
| 6. <i>Porites lichen</i>               | 16. <i>Leptastrea purpurea</i>                   |
| 7. <i>Porites lutea</i>                | 17. <i>Pseudosiderastrea tayami</i>              |

- |  |  |
|--|--|
| 8. <i>Pavona minuta</i>                      | 18. <i>Dendrophyllia</i> sp. (new record)* |
| 9. <i>Tubastrea aurea</i>                    | 19. <i>Paracyathus stockesi</i>            |
| 10. <i>Polycyathus verrilli</i> (new record) | 20. <i>Cyphastera</i> sp.                  |

\* Description on the species shall be provided after proper identification of the species.

The coral coverage in all the observed sites differed from site to site. It was observed that corals viz. *Turbinaria mesenterina*, *Siderastrea savignvana* and *Goniastrea pectinata* are occurring dominantly across the sites with *Porites lichen*, *Porites lutea*, and *Goniopora minor* along with *Goniopora* sp. occurring in patches. The surveys conducted from mid-September to November 2015 revealed presence of *Tubastrea aurea* and *Dendrophyllia* sp. in Vengurla rock and could be new records to Sindhudurg coast. However, require further investigation. Further surveys from December 2015 onwards expected to add several new records of hard and soft corals from Sindhudurg coast.

Locationwise recording of different species of corals along the Sindhudurg coast is presented in Table 7.

### Checklist Of Corals recorded From Sindhudurg coast

PHYLUM : Cnidaria

CLASS: Anthozoa

ORDER: Scleractinia

SUBCLASS: Hexacorallia

FAMILY: Siderastreidae

1. *Coscinaraea monile* (Forskal, 1775)
2. *Siderastrea savignyana* (Milne Edwards and Haime, 1850)
3. *Pseudosiderastrea tayami* Yabe & Sugiyama, 1933

FAMILY: AGARICIIDAE

4. *Pavona minuta*
5. *Pavona bipartita*

FAMILY: DENDROPHYLLIDAE

6. *Tubastrea aurea* (Quoy and Gaimard, 1833)
7. *Dendrophyllia* sp.

8. *Turbinaria mesenterina* (Lamarck, 1816)

FAMILY: PORITIDAE

9. *Porites lutea* (Milne Edwards and Haime, 1851)

10. *Porites lichen* Dana, 1846

11. *Goniopora minor* Crossland

12. *Goniopora* sp.

13. *Goniopora* sp.

FAMILY: FAVIIDAE

14. *Goniastrea pectinata* (Ehernberg, 1834)

15. *Plesiastrea versipora* (Lamarck, 1816)

16. *Cyphastrea serailia* (Forsk, 1775)

17. *Cyphastrea* sp.

18. *Leptastrea purpurea* (Dana, 1846)

FAMILY: CARYOPHYLLIDAE

19. *Paracyathus stokesi* (Milne Edwards and Haime, 1848)

20. *Polycyathus verrilli* Duncan, 1889

**1. *Coscinaraea monile* (Forsk, 1775)**

1775. *Madrepora monile* Forskal, IV *Corallia, hauniae*, p.135

1907. *Coscinaraea monile* Marenzeller Riffkorallen. Expeditionen, S.M. Schiff *Pola* in das Rote Meer. Zool. Ergeb. XXV Tiefseekorallen, 13-27, pl. 1-2, Riffkorallen, 27-97, pl. 1-29. *Denkschr. Akad. Wiss.* XXVI. Wien 80.

Characters: Colonies encrusting or dome-shaped, calices 6-8 mm in diameter, about 2 mm deep, often 2 to 3 calicinal centres run together to form short valleys. Inter-corallite walls poorly developed. Septa are even and finely serrated giving colonies a smooth appearance. Axial fossa circular and with a papilliform columella.

Distribution: In India it is recorded from Gulf of Kachchh and Gulf of Mannar and Palk Bay. Widely distributed from Red Sea to Mergui Archipelago and Indian Ocean.



*Coscinaraea monile*, recorded from Malvan near the Fort

Remarks: It is a rare species. Mostly found on shallow reef environments. This species was recorded from Malvan near the eastern side of the Sindhudurg Fort.

## 2. *Siderastrea savignyana* Edwards and Haime, 1850

1850. *Siderastrea savignayana* Edwards and Haime, Recherches sur les vijayapolypiers. Mem. 4 Monographie des Astreides. Ann. Sci. Nat. zool. 3e. Ser., **13**, 63-110, pl. 3-4.

Characters: Colonies are encrusting or low mounds to one metre across. Corallites polygonal, 2- 4 mm diameter. Septa are neatly arranged. Fusing in neat fan-like groups. Walls have a fine ridge along the top.

Distribution: In India it is recorded only from Gulf of Kachchh. Worldwide, it is reported from Red Sea to Coral Sea.



*Siderastrea savignyana*, recorded distribution in and around Malvan

**Remarks:** Similar to *Pseudosiderastrea tayami* which has a similar growth form but septa have saw-like teeth. Mostly found on shallow reef environments or sandy lagoons. This species was recorded from Malvan during diving near the eastern side of the Sindhudurg Fort.

### 3. *Pseudosiderastrea tayami* Yabe and Sugiyama, 1935

1935. *Pseudosiderastrea tayami* Yabe and Sugiyama, *Proc. Jpn. Acad.*, 11(9): 378-8, 2 pls.

1956. *Anomastrea (Pseudosiderastrea) tayami* Wells, J.W. Scleractinia, in Moore, R.C. 'Treatise on Invertebrate Palaeontology.' *Coelenterata*. Univ. Kansas Press, F., F328-F440.

**Characters:** Colonies are encrusting to dome shaped, up to 160 mm in diameter. Corallites are small and cerioid, 3-6 mm in diameter. Septa have fine saw-like teeth. Septa are evenly spaced and inner margins of septa are fused. Columellae consist of one to four pinnules. Colonies are pale grey with distinctive white corallite walls in colour.

**Distribution:** It is present in all three major reef areas in India except Lakshadweep Islands. Globally, it is distributed from Madagascar to Coral Sea.



*Siderastrea savignyana* recorded to be associated with macroalgae in Malvan area

Remarks: Similar to *Siderastrea savignyana* but it has smaller corallites and forms larger colonies. Also similar to *Coscinaraea* but corallites are not polygonal. There is not much tissue on this species hence the skeletal characters are obvious in the field. Mostly found on shallow water, attached to bare rocks. This species was recorded from Malvan during diving near the eastern side of the Sindhudurg Fort.

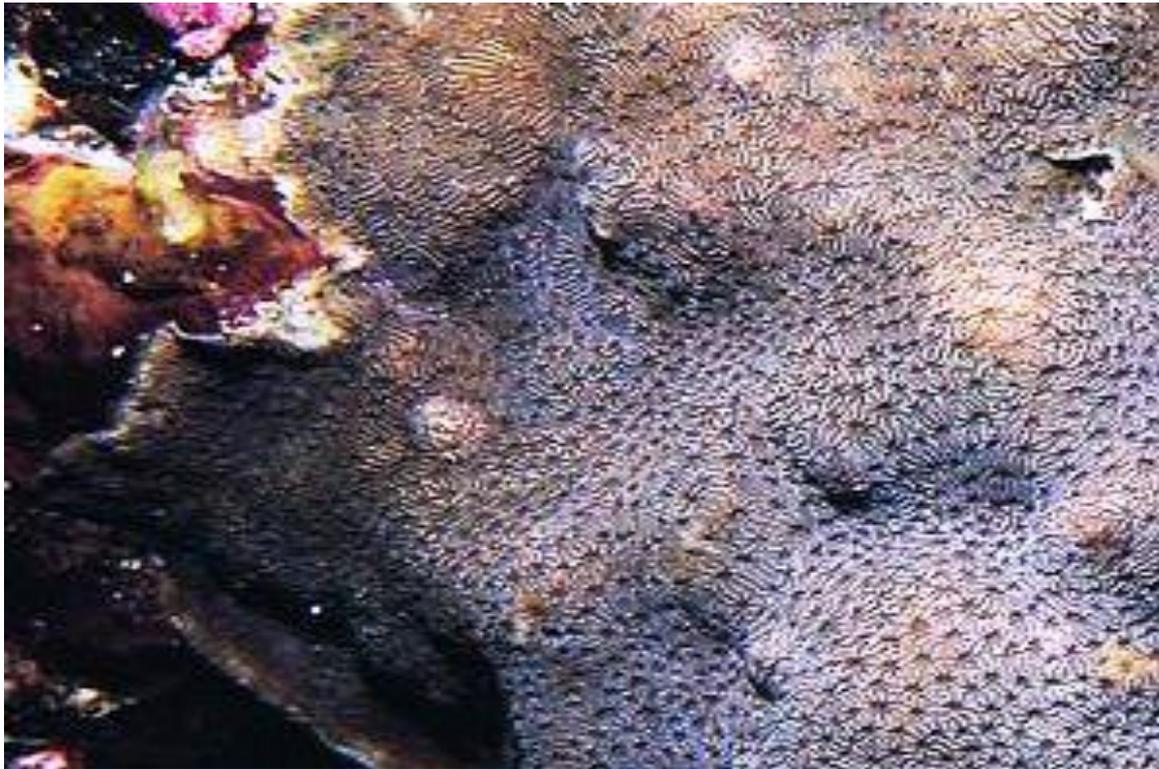
#### 4. *Pavona minuta* (Wells, 1954)

1954. *Pavona minuta* Wells, U.S. Geol. Survey. *Professional Papers* 260: 384-486.

1974. *Pavona xarifae* Scheer & Pillai, On a collection of Scleractinia from the Strait of Malacca. In: *Proceedings of the Second International Symposium on coral Reefs.* Great Barrier Reef Comm., Brisbane, 1, 445-64.

Characters: Colonies are submassive or encrusting with thin margins. Colony has a smooth surface due to the small, widely spaced corallites (2-3 mm diameter). Corallites walls are thick (because of wedge shaped septa). Colonies are dark green, brown or brownish-green.

Distribution: It is recorded in India only from Andaman and Nicobar Islands. Elsewhere, it is reported in the East Indian Ocean - Sri Lanka, South East Asia, Great Barrier Reef and the Pacific.



*Pavona minuta* was observed only once near Malvan Fort Diving Point 1

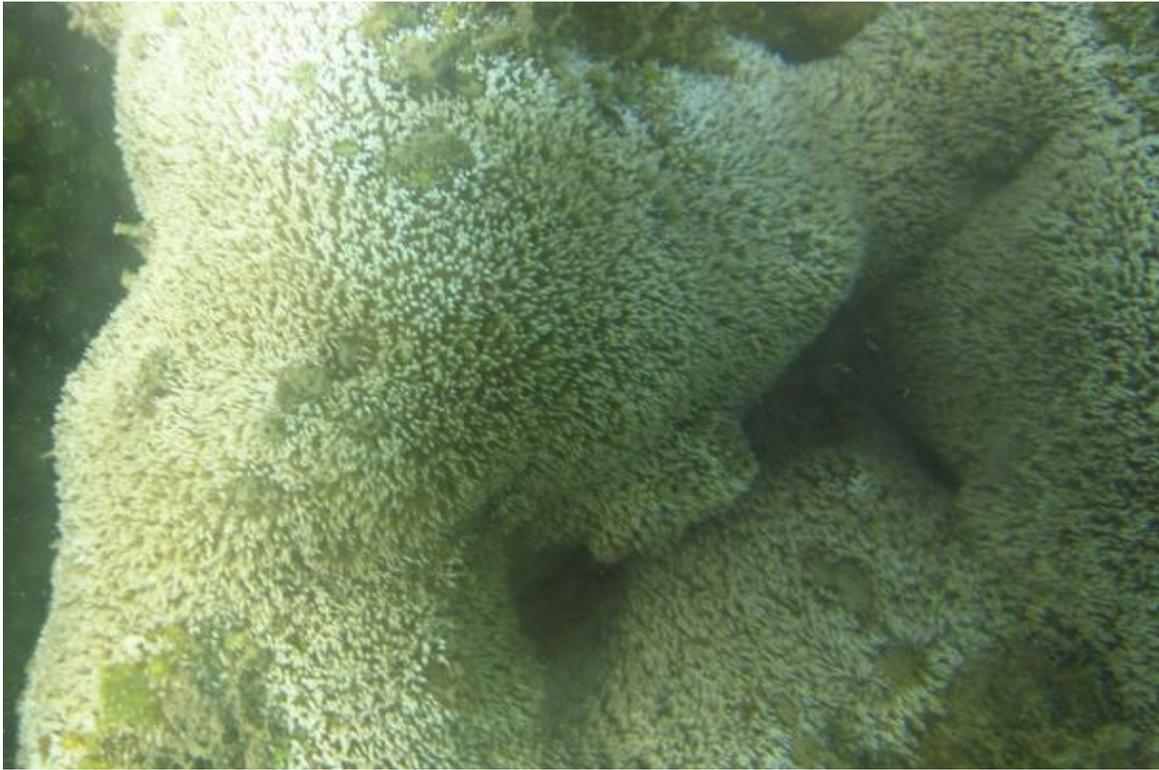
Remarks: *P. minuta* has more regular calices with fewer, more regular and exsert septa and well developed columellae than *P. clavus*. Mostly available in shallow reef areas. This species was recorded for the first time from Malvan during diving near Sindhudurg Fort.

#### **5. *Pavona bipartita* Nemanzo 1980**

**Characters:** Colonies are submassive and are more than a metre across. The corallites are shallow with poorly defined walls and are evenly distributed over the uneven surface of the colony with uneven ridges in between. The columella is small and septocostae extend over the ridges and are in two alternating orders. Colour is slightly brownish and the exsert septa are white in colour

**Distribution:** It is recorded in India only from Andaman and Nicobar Islands. Elsewhere, it is reported in the Western and Central Indo-Pacific region. .

Remarks: Mostly available in shallow reef areas.



*Pavona bipartita* dominant species of coral in Rock Garden area of Malvan

**6. *Tubastrea aurea* (Quoy and Gaimard, 1833)**



## 7. *Turbinaria mesenterina* (Lamarck, 1816)

1816. *Turbinaria mesenterina* Lamarck, Histoire naturelle des animaux sans vertebrates. Paris. 2, 1-568.
1967. *Turbinaria mesenterina* Scheer, Korallen von den Sarso-inseln im Roten Meer. Senckenb. Biol. 48 (5-6), 421-36.

Characters: Colonies are composed of unifacial laminae, which are highly contorted. Fronds more vertical than horizontal, amount of folding vary greatly and can form dense mass of folds and tubes, less convoluted (and corallites more tubular than conical) in deeper water or less light. Corallites are crowded, slightly exsert, 2.5-3.5 mm, tubular or conical, calices 1.3-2.0 mm, usually protuberant and strongly inclined ie vertical, older corallites deeply embedded to smooth.

Distribution: In India it is recorded in Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide, it is recorded from tropical Indo-Pacific, Red sea, East African coast, Marshall Islands, Fiji and the Great Barrier Reef.



Remarks: It is similar to *T. reniformis*, which can usually be recognized in underwater by its colour, it is more horizontal than vertical fronds and it has more immersed corallites, which give a smooth

appearance. It is dominant in shallow turbid environments. This is the most dominant species of corals all along the coast of Sindhudurg and particularly near Sindhudurg coast.

### 7. *Porites lutea* Milne Edwards and Haime, 1860

1860. *Porites lutea* Edwards and Haime, *Histoire naturelle des Coralliaires*. Paris. 1, 2 & 3, 1-326, 1-632, 1-560.

1976. *Porites lutea* Pillai and Scheer, Report on the stony corals from the Maldivian Archipelago. Results of the Xarifa Expedition 1957/58. *Zoologica (Stuttg.)*. 43 (126), 1-83, pl. 1-32.

Characters: Colonies are hemispherical or helmet-shaped and may be very large. The surface is usually smooth. Usually cream or yellow but may be bright coloured in shallow waters.

Distribution: In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed from Red Sea east to the Tuamotu Archipelago and the Great Barrier Reef.



Colonies of *Porites lutea* encountered in front of Sindhudurg Fort in Malvan

Remarks: *P. lobata* is similar but the five tall pali with radii are easily recognizable even in underwater. Mostly occur on back reef margins.

### 8. *Porites lichen* Dana, 1846

1846. *Porites lichen* Dana, *U.S. Exploring Expedition 1838-1842*, 7, p.1-740, pl.61.

Characters: Colonies form flat laminae or plates, or fused nodules and columns. Corallites are usually aligned in irregular rows separated by low ridges. Septal structures are variable and irregular. Colonies are bright yellowish-green, sometimes brown in colour.

Distribution: In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely distributed from the tropical Indo-Pacific, Red Sea to the Ellice and Marshall Islands, Fiji and Samoa and Great Barrier Reef.



Colonies of *Porites lichen* encountered in front of Sindhudurg Fort in Malvan

Remarks: Usually a dominant species of lagoons and reef slopes. There are small colonies of <50 sq.m. size of *Porites lichen* observed in front of the Sindhudurg Fort in Malvan.

### 9. *Goniopora minor* Crossland, 1952

1952. *Goniopora minor* Crossland, *Madreporaria, Hydro corallinae, Helliopora and Tubipora*.  
Sci. Rep. Great Barrier reef Exped. 1928-29. *Br. Mus. (Nat. Hist.)*, 6(3), 85-257, pl.  
1-56.

Characters: Colonies are hemispherical or encrusting. Calices are 2.5-4 mm in diameter, circular in outline, with thick walls. There are usually six thick pali, which are in contact forming a crown. All septal structures are heavily granulated. The live coral is brown or green, usually with distinguished coloured oral discs and pale tips to the tentacles.

Distribution: In India it is recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. It is widely distributed throughout Indo-Pacific and East Pacific regions.



Patches of *Goniopora minor* mixed with *Turbineria* observed in Rock Garden at Malvan

Remarks: This species is similar to *G. tenuidens*, which has blunt tentacles of uniform length. Mostly found in subtidal reef environments, especially lagoons.

#### 10. *Goniopora* sp.

Characters: Colonies are usually columnar or massive but may be encrusting. Corallites are usually thick but porous walls and calices are filled with compact septa and columella. Polyps are long and fleshy, extended day and night.



*Goniopora* sp. (species to be confirmed) observed at Rock Garden site in Malvan

#### 11. *Goniastrea pectinata* (Ehrenberg, 1834)

1833. *Astrea pectinata* Ehrenberg, *Beitrage zur physiologischen Kenntniss der Corellenthiere im Allegemeinen und besonders des Rothen Meeres. Abh. K. Akad. Wiss. Berl.* 1832, 250-380.
1974. *Goniastrea pectinata* Scheer & Pillai, *Report on the Scleractinia from the Nicobar Islands. Zoologica (Stuttg.)*.42, 3, heft 122, 1-75, pl. 1-33.

Characters: Colonies are submassive or encrusting. Corallites are cerioid to submeandroid usually with less than four centres. Walls are thick and paliform lobes are well developed. Living colonies are pale brown or pink, dark brown in deep or turbid water.

Distribution: In India it is reported from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Widely reported throughout the Indo-Pacific, Red Sea, Samoa, the Great Barrier Reef and the Coral Sea.



*Goniastrea pectinata* patches were observed along Malvan coast

Remarks: It is similar to *G. edwardsi* but has distinctly smaller corallites. Mostly found on the shallow water environments.

#### **12. *Plesiastrea versipora* (Lamarck, 1816)**

1816. *Astrea versipora* Lamarck, Histoire naturelle des Animaux sans vertèbres. Paris, 2, 1-568.
1974. *Plesiastrea versipora* Scheer and Pillai, Report on the Scleractinia from the Nicobar Islands. *Zoologica (Stuttg.)*.42, 3, heft 122, 1-75, pl. 1-33.

Characters: Colonies are flat and are frequently lobed. Corallites are monocentric and plocoid. Extratentacular budding produces daughter corallites. Corallites have calices approximately 2.5 mm in diameter. Paliform lobes form a neat circle around small columellae. Polyps are usually

extended only at night. Tentacles are short and are of two alternating sizes. Living colonies are yellow, cream, green or brown, usually pale-coloured.

Distribution: In India it is recorded from Gulf of Kachchh, Lakshadweep and Andaman and Nicobar Islands. It is widely distributed from St. Vincent's Gulf to South Australia.



Submassive form of *Plesiastrea versipora* seen in small patches

Remarks: *P. versipora* is close to *Montastrea* but has smaller corallites with well-developed paliform lobes. It is readily confused with other faviid species with corallites of similar size and shape, notably *Favia stelligera* and *Cyphastrea* species. Mostly occur in shaded places such as under overhangs.

### 13. *Cyphastrea serailia* (Forsk., 1775)

1775. *Madrepora serailia* Forskal, *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum Vermium que in itinere orientali observavit Petrus Forskal, XIV, Corallia Havniae*, 131-9
1975. *Cyphastrea serailia* (Forsk.) Chevalier, *Les scleractiniaires de la Melanesie francaise (Nouvelle Caledonie, Iles Chesterfield, Iles Loyaure, Nouvelles Hebrides). 2eme Partie. Exped. Francaise recifs corallines Nouvelle Caledonie, Edn. Fond. Singer-Polignac, Paris. 7, 5-407, pl.42.*

Characters: Colonies are usually massive or sub-massive, sometimes encrusting. Corallites are round and variable exsert. Calices of mature corallites are 1.5 to 2.8 mm in diameter. The corallites having 12 septa. The columella are usually inconspicuous and trabecular. The costae are equal or subequal and are poorly developed. Thecae vary greatly in height and thickness. The coenosteum is often largely composed of dissepimental blisters and is always covered with granulated exothecal spines. Living colonies are usually gray, brown or cream in colour.

Distribution: In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is reported throughout the Indo-Pacific from the Red Sea to the Marshall Islands and Philippines and the Great Barrier Reef.



*Cyphastrea serailia*, a rare species of coral also encountered during the survey

Remarks: *C. serailia* corallites have a very wide range of variation so that colonies from different habitats may appear to be different species. Nevertheless, it is readily distinguished from *C. chalcidicum* by the costae and from *C. microphthalma* by the number of septa.

#### 14. *Cyphastrea* sp.

Characters: Species are massive to columnar with a smooth or hillocky as in the case of *C. serailia* and massive or encrusting as in the case of *C. microphthalma*. Corallites are plocoid, with calices less than 3 mm in diameter. Costae are generally restricted to the corallite wall; the coenosteum is granulated. Polyps are extended only at night.



#### 15. *Leptastrea purpurea* (Dana, 1846)

1846. *Astraea purpurea* Dana, Zoophytes. U.S. Exploring Exped. 1838-1842, 7, 1-740, pl. 1-61.

1975. *Leptastrea purpurea* Chevalier, Les Scleractiniaires de la Melanesie francaise (Nouvelle caledinie, Iles Chesterfield, Iles Loyaure, Nouvelles Hebrides). 2eme Partie. Exped. Francaise recifs corallines Nouvelle Caledonie, Edn. Fond. Singer-Polignac, Paris 7, 5-407, pl.42.

Characters: Colonies are irregular. Encrusting or massive and range in size up to 1 mm in diameter. Colonies are sub-ceriod. Corallites are always discrete and polygonal and are characteristically

variable in size (2 - 11 mm in diameter). The septa are seldom thickened above the thecae. Costae are poorly developed, the coenosteum between adjacent corallites is usually a narrow, smooth strip overshadowed by the exsert septa. Living colonies are pale yellow or cream on their upper surface with dark calices.

Distribution: In India it is recorded from Gulf of Kachchh, Lakshadweep, Gulf of Mannar and Palk Bay and Andaman and Nicobar Islands. Worldwide it is reported throughout the Indo-Pacific, Red Sea, Hawaii and the Great Barrier Reef.



*Leptastrea purpurea* coral patches seen mostly associated with boulder rocks

Remarks: *L. transversa* is similar to *L. purpurea* but has uniformly sized corallites and septa have steeply plunging inner margins. Mostly found on a wide range of reef environments.

#### **16. *Polycyathus verrilli* Duncan, 1889**

Characters: Corallites 2-3 mm in diameter, 6-8 mm height (except one corallites 5 mm in diameter). Septa in 3 cycles with a few of the IV in larger corallites. All septa exsert, primaries the maximum, exsert parts vertical, edges entire, side granular. First two cycles of septa reach the columella often with a few of the third. Pali in front of the first 3 cycles of septa those of the primary and

tertiary septa subequal, those of the second cycle larger and with an incision, total pali up to 20. Columella with 10-12 vertical papillae standing below the level of the pali, concave.

Description: Colonial about 5 cm spread. Corallites close together, initial settlement composed of isolated solitary calices. Costae recognisable at the distal part of the corallites with a row of granules.



*Polycyathus verrilli* is a new addition to the list of corals from Sindhudurg coast

Remarks: This species is a new addition to the coral list of Sindhudurg coast. It is a rare species and earlier recorded from Gulf of Mannar and Andaman islands only.

### **17. *Dendrophyllia* sp.**

Description: *Dendrophyllia* is a genus of stony cup corals in the family Dendrophyllidae. Members of this genus are found at depths down to about 900 metres (3,000 ft). They are azooxanthellate corals as they do not contain symbiotic photosynthetic dinoflagellates. The Dendro Coral is considered one of the most popular corals within the large polyp stony coral category, which also includes Favites Corals and Goniopora Coral.



Solitary *Dendrophyllia* sp. observed at Vengurla rock

Characters: The Dendro coral has an uncanny resemblance to its popular cousin, the Sun Coral (*Tubastrea micrantha*), but it is very important to note that the Sun Coral and the Dendro Coral are totally different species. There are three key differences between the Dendrophyllia and Sun Coral. The first difference is that a Dendro's tentacle/ polyps are more often than not extended during the day where Sun Corals are not. Secondly, Sun Corals polyp size is less significant than that of the Dendro Coral's, as a matter of fact the polyps of the Dendro Coral straight out length is the longest of any coral species. And thirdly, the two different species of corals have diverse colony growth patterns.

Remarks: This coral could be found throughout both the Atlantic and Pacific Oceans, in tropical and mild waters, and with or without zooxanthellae. Some genera of the species are more comfortable inhabiting great depths of the seas than the lush reef rich aquatic wildlife habitat found in shallow waters, and have been known to colonize deep sea shipwrecks. Because the Dendro Coral do not rely on sunlight, but rather on the availability of nutrients, they can thrive in

dark waters. This coral is first time reported from Sindhudurg coast and could be new record from west coast of India. Identification at species level require further confirmation from multiple samples.

**18. *Paracyathus stokesii* Milne Edwards & Haime, 1848**

Characters: This is a temperate solitary coral and is a gonochoric and reproduces only sexually. Females produce a large number of small eggs in gametogenic synchrony and both sexes spawn. Corallites are solitary, short, stout, elliptical and solid, slightly deep, costae are granular, flat and equal. Septa are arranged closely and lined with granular ridges. Corallum is light brown in colour for deep water species and green in colour for the shallow water species. Tentacles extend only during night.



*Paracyathus stokesii* is presumably a new record to Sindhudug coast

Remarks: *Paracyathus indicus* Duncan, 1899, *P. profundus* Duncan, 1889 and *P. stokesii* Milne Edwards & Haime, 1848 are recorded from Indian coasts (Pillai 1972). The present record of *Paracyathus stokesii* in Malvan is pressured to be a new distributional record to India and the central Indian Ocean.

**Table 7. List of coral species recorded along Sindudhurg coast**

Sl.No.	Scientific name of coral	Reporting sites along Sindhudurg
1.	<i>Turbinaria mesenterina</i>	Malvan Fort, Rock Garden, Tarkarli, Vengurla, Devbaug
2.	<i>Goniastrea pectinata</i>	Malvan Fort, Rock Garden, Tarkarli, Devbaug
3.	<i>Goniopora</i> sp. (new record)	Rock Garden, Devbaug
4.	<i>Goniopora</i> sp. (new record)	Rock Garden, Tarkarli
5.	<i>Goniopora minor</i> (new record)	Malvan Fort, Rock Garden, Tarkarli
6.	<i>Porites lichen</i>	Malvan Fort, Rock Garden, Devbaug
7.	<i>Porites lutea</i>	Malvan Fort, Rock Garden, Devbaug
8.	<i>Pavona minuta</i>	Malvan Fort, Rock Garden
9.	<i>Tubastrea aurea</i>	Malvan Fort, Rock Garden
10.	<i>Polycyathus verrilli</i> (new record)	Malvan Fort, Rock Garden, Devbaug, Vengurla
11.	<i>Siderastrea savignvana</i>	Malvan Fort, Rock Garden, Devbaug
12.	<i>Coscinarea monile</i>	Malvan Fort, Rock Garden
13.	<i>Cyphastrea serialia</i>	Malvan Fort, Rock Garden, Devbaug
14.	<i>Pleasiastrea versipora</i>	Malvan Fort, Rock Garden, Vengurla
15.	<i>Pavona bipartita</i> (new generic record)	Malvan Fort, Rock Garden, Vengurla
16.	<i>Leptastrea purpurea</i>	Malvan Fort, Rock Garden, Devbaug
17.	<i>Pseudosiderastrea tayami</i>	Malvan Fort, Rock Garden, Vengurla
18.	<i>Dendrophyllia</i> sp. (new record)	Vengurla
19.	<i>Paracyathus stockesi</i>	Vengurla
20.	<i>Cyphastrea</i> sp.	Malvan Fort, Rock Garden, Vengurla

**Inventorisation of coral associates:**

The list of corals recorded from Sindhudurg coast is presented in Table 7 as above and also in Table 8. Other than that, the sub-tidal/underwater surveys conducted at Malvan, Vijaydurg, Devgad, Deobaug and Vengurla coastal waters revealed several species of coral associated fishes viz. Seven banded seargent, Bengal seargent, Parrot fish, damsel fishes, Blackspot snapper, Yellowfin snapper, Malabar reef cod, Bluelined hind, vermiculated rabbit-fish, Grouper fish, Butterfly fish, Surgeon fish, Scat, Parrot fish, Goat fish, Flag fish, Indian Trigger fish and Lion fish etc.

At Vengurla rock, there was good diversity of coral associated fishes observed. Among the other associated organisms sponges, Gorgonians, Seafans, bivalves, Chiton, Opisthobranch belonging to order *Sacoglossa*, *Elysia ornata* (Swainson, 1840), Brittle stars, Polychaete, Hermit

crabs were prominent. Blue Button Jellyfish *Porpita porpita* was common in the underwater environment.

The survey conducted reveals at least 11 species of corals in and around the Sindhudurg fort in Malvan along with three new records. However, indicating of the possibility of several new records along the coast. Atleast three species of corals that have been recorded during the survey and could be new record to Malvan and to India.

The coral coverage in all the observed sites differed from site to site. It was observed that corals viz. *Turbinaria mesenterina*, *Siderastrea savignvana* and *Goniastrea pectinata* occurring dominantly across the sites with *Porites lichen*, *Porites lutea*, and *Goniopora* sp. occurring in patches.

**Table 8. List of coral species recorded along Sindhudurg coast**

Sl.	Scientific name of coral	Reported by
1	<i>Coscinaraea monile</i>	ZSI,SDMRI
2	<i>Cyphastrea microphthalma</i>	SDMRI
3	<i>Cyphastrea serialia</i>	ZSI, SDMRI
4	<i>Echinopora</i> sp.	SDMRI
5	<i>Favita</i> sp.	SDMRI
6	<i>Favita abdita</i>	SDMRI
7	<i>Favita flexuosa</i>	SDMRI
8	<i>Favita halicora</i>	SDMRI
9	<i>Goniastrea pectinata</i>	ZSI, SDMRI
10	<i>Goniastrea retiformis</i>	SDMRI
11	<i>Goniastrea minor</i>	ZSI, SDMRI
12	<i>Goniopora</i> sp.	ZSI
13	<i>Goniopora</i> sp.	ZSI
14	<i>Leptastrea</i> sp.	SDMRI
15	<i>Montastrea</i> sp.	SDMRI
16	<i>Pachyseris</i> sp.	SDMRI
17	<i>Pavona varians</i>	SDMRI
18	<i>Pavona bipartite</i>	ZSI
19	<i>Platygyra</i> sp.	SDMRI
20	<i>Plesiasrea</i> sp.	SDMRI
21	<i>Plesiastrea versipora</i>	ZSI
22	<i>Porites</i> sp.	SDMRI
23	<i>Porites lichen</i>	ZSI

24	<i>Porites lutea</i>	ZSI
25	<i>Pseudosiderastrea tayamii</i>	ZSI
26	<i>Tubastrea sp.</i>	SDMRI
27	<i>Tubastera lutea</i>	ZSI
28	<i>Turbinaria mesenterina</i>	ZSI, SDMRI
29	<i>Turbinaria peltata</i>	SDMRI
30	<i>Sinderastrea savignvana</i>	ZSI

While conducting the intertidal survey along the coast of Tambaldeg, a spotted seahorse *Hippocampus kuda* was sighted near the Mithbhav Jetty (16°16'47.04"N; 073°24'50.24"E). The specimen was collected, preserved with formalin, packed in a polythene bag and brought to the laboratory and confirmed from the morphological characters to be *Hippocampus kuda* (Bleeker, 1852) and was a female (♀). Although this species has been reported from the west coast of India, presumably this is first time reported from Sindhudurg coastline of Maharashtra.

#### **Faunal inventorisation – Corals and associated Fauna of Sindhudurg coast:**

Corals were found attached to rocky substratum in intertidal and sub-tidal regions. However, in the inter-tidal regions, the density was sparse restricted to 1-2 small colonies. Among the species recorded so far, *Porites lichen*, *Porites lutea*, *Goniastrea sp.* were found to be common in Malvan. Along with this macrofauna of five major groups were recorded both from intertidal region, collection through walk along the coastal stretch and also collections from different fish landing centres along the Sindhudurg coast.

The sub-tidal/underwater surveys conducted at Malvan, Vijaydurg, Devgad, Deobaug and Vengurla coastal waters revealed several species of coral associated fishes viz. Seven banded seargent, Bengal seargent, Parrot fish, damsel fishes, Blackspot snapper, Yellowfin snapper, Malabar reef cod, Bluelined hind, vermiculated rabbit-fish, Grouper fish, Butterfly fish, Surgeon fish, Scat, Parrot fish, Goat fish, Flag fish, Indian Trigger fish and Lion fish etc. A list of coral associated flora/fauna recorded along the Sindhudurg coast is given in Table 2.

Random diving was made at several locations in Vijayadurg. However, no coral assemblage was recorded, but Zooxanthaelate patches were dominant on rocky substratum. This indicates that the coral assemblages if any at Vijayadurg could be very patchy and recent. Large patch of

Sargassum was observed at all diving points. Similarly, at Devgad, no coral patches were encountered during random diving made. However, along fishes known to occur in coral areas seen, large school of dolphins (>15) also observed swimming close to the shore.

**Corals and associated fauna recorded during the period under report\***

**Table 9. Detail of faunal species recorded along the Sindhudurg coast**

Sl.No.	Groups	No. of species
1	Corals	13
2	Mollusca	16
3	Echinodermata	2
4	Crustaceans	12
5	Polychaetes	3
6	Fishes	38

**Table 10. Corals: 6 species\***

Sl.No.	Name of Species	Achara	Chivala	Devgarh	Vengurla	Navagarh	Malvan	Nevati	Vijayadurg
1	<i>Porites lichen</i>					+	+		
2	<i>Porites lutea</i>	+					+	+	+
3	<i>Goniastrea</i> sp	+	+	+	+	+	+	+	+
4	<i>Turbinaria</i> sp.					+	+	+	+
5	<i>Goniopora</i> sp.		+	+	+		+	+	+
6	<i>Leptastrea</i> sp.	+			+		+	+	+

\*confirmation of other species are being done.

**Table 11. Mollusca : 16 species**

Sl.No.	Name of Species	Achara	Chivala	Devgarh	Vengurla	Navagarh	Malvan	Nevati	Vijayadurg
1	<i>Lima lima</i>	+	+	+	+		+		+
2	<i>Meretrix meretrix</i>	+	+	+		+	+		+
3	<i>Solen truncates</i>			+	+	+	+	+	+
4	<i>Martesia striata</i>		+		+	+	+	+	+
5	<i>Donax incarnates</i>	+	+				+	+	+

6	<i>Donax scrotum</i>	+	+	+	+	+	+		
7	<i>Pinctada chemnitzii</i>	+	+	+	+	+	+		
8	<i>Modiolus striatulus</i>		+	+		+	+	+	
9	<i>Brachyodontes Karachiensis</i>		+	+	+	+	+	+	+
10	<i>Murex adustus</i>	+	+	+	+	+	+		
11	<i>Drupa konkanensis</i>	+		+	+	+	+	+	+
12	<i>Thais carinifera</i>	+	+	+			+	+	+
13	<i>Coecella transversalis</i>	+	+	+	+		+	+	+
14	<i>Donax incarnates</i>		+	+	+	+	+	+	
15	<i>Donax scrotum</i>	+	+	+	+	+	+	+	+
16	<i>Mytilus viridis</i>	+	+	+	+	+	+		+

**Table 13. Echinodermata: 2 species**

Sl.No.	Name of Species	Achara	Chivala	Devgarh	Vengurla	Navagarh	Malvan	Nevati	Vijayadurg
1	<i>Holothuria scabra</i>	+	+	+	+	+	+	+	+
2	<i>Astropecten indica</i>	+	+	+	+	+	+	+	+

**Table 14. Crustacean: 12 species**

Sl.No.	Name of Species	Achara	Chivala	Devgarh	Vengurla	Navagarh	Malvan	Nevati	Vijayadurg
1	<i>Penaeus indicus</i>	+	+	+	+	+	+	+	+
2	<i>Penaeus monodon</i>	+	+	+	+	+	+	+	+
3	<i>Penaeus semisulcatus</i>	+	+	+	+	+	+	+	+
4	<i>Metapenaeus affinis</i>		+	+	+	+	+	+	
5	<i>Scylla serrata</i>		+	+			+	+	
6	<i>Portunus pelagicus</i>	+		+	+	+	+	+	+
7	<i>Charybdis cruciata</i>		+	+	+		+	+	+
8	<i>Petrolisthes bacci</i>			+	+		+		+
9	<i>Uca sp.</i>	+	+	+	+		+		+
10	<i>Ocypoda cardimana</i>	+	+	+	+	+	+	+	+

11	<i>Dotilla myctiroides</i>			+	+	+	+	+	
12	<i>Dardanus megistos</i>	+	+	+		+	+	+	+

**Table 15. Polychaetes: 3 species**

Sl.No.	Name of Species	Achara	Chivala	Devgarh	Vengurla	Navagarh	Malvan	Nevati	Vijayadurg
1	<i>Sabellaria sp.</i>					+	+		+
2	<i>Sabellaria simplex</i>			+		+	+		+
3	<i>Sabellaria chandrae</i>						+		+

**Table 16. Fishes: 24 species**

Sl.No.	Name of Species	Achara	Chivala	Devgarh	Vengurla	Navagarh	Malvan	Nevati	Vijayadurg
1	<i>Platycephalus indicus</i>	+	+	+	+	+	+	+	+
2	<i>Mugil Cephalus</i>	+	+	+	+	+	+	+	+
3	<i>Aetomylaeus maculates</i>	+	+	+	+	+	+	+	+
4	<i>Scoliodon laticaudus</i>	+	+	+	+	+	+	+	+
5	<i>Carangoides sp.</i>	+	+	+	+	+	+	+	+
6	<i>Lutjanus johni</i>	+	+	+	+	+	+	+	+
7	<i>Trichiurus lepturus</i>	+	+	+	+	+	+	+	+
8	<i>Gazza minuta</i>	+	+	+	+	+	+	+	+
9	<i>Etroplus suratensis</i>	+	+	+	+	+	+	+	+
10	<i>Scoliodon laticaudus</i>	+	+	+	+	+	+	+	+
11	<i>Anoxypristis cuspidate</i>	+	+	+	+	+	+	+	+
12	<i>Coilia dussumieri</i>	+	+	+	+	+	+	+	+
13	<i>Siganus vermiculatus</i>	+	+	+	+	+	+	+	+
14	<i>Lactarius lactarius</i>	+	+	+	+	+	+	+	+
15	<i>Osteogeneiosus militaris</i>	+	+	+	+	+	+	+	+
16	<i>Sardinella fimbriata</i>	+	+	+	+	+	+	+	+
17	<i>Hilsa ilisha</i>	+	+	+	+	+	+	+	+

18	<i>Stolephorus indicus</i>	+	+	+	+	+	+	+	+
19	<i>S. commersonnii</i>	+	+	+	+	+	+	+	+
20	<i>Thryssa mystax</i>	+	+	+	+	+	+	+	+
21	<i>Chirocentrus dorab</i>	+	+	+	+	+	+	+	+
22	<i>Epinephelus dicanthus</i>	+	+	+	+	+	+	+	+
23	<i>Mugil Cephalus</i>	+	+	+	+	+	+	+	+
24	<i>Aetomylaeus maculates</i>	+	+	+	+	+	+	+	+

The following are the sites in Malvan in Sindhudurg district, one near Rock Garden and other adjacent to Sindhudurg Fort where corals and associated fauna and flora are observed to be occurring in patches and are in abundance. The details of fauna and flora recorded during the surveys are given Table 9 to Table 23.

Table 17. Permanent Monitoring Plot information for Sindhudurg coast

Site Name	Latitude	Longitude
Sindhudurg Fort Area-Malvan <b>FA Site A (Station-01)</b>	16.042226 N	73.461168 E
Sindhudurg Fort Area-Malvan <b>FA Site B (Station-02)</b>	16.043134 N	73.461661 E
Sindhudurg Fort Area-Malvan <b>FA Site C (Station-3)</b>	16.045490 N	73.462412 E
Rock Garden Area -Malvan <b>RG Site A (Station-4)</b>	16.063317 N	73.457253 E

Name of Location	Code Name
Fort Area	FA Site A & FA Site B

Table 18. Diversity for fauna collected from above sites

Fauna collected (species wise/ local name)						Flora collected (species wise/ local name)
Fishes	Crustacean	Mollusca	Echinoderms	Corals	Cnidarians	Seaweed/ Seagrass/ Algae (sp.wise)
<i>Abudefduf vaigiensis</i>	<i>Calappa lophos</i>	<i>Littoraria sp.</i>	<i>Holothuria sp.</i>	<i>Goniastrea pectinata</i>	<i>Anthopleura asiatica</i>	<i>Avrainvillea erecta</i>

Chaetodon sp.		Trochus radiatus	Holothuria scabra	Porites lichen		Bryopsis plumosa
Neoglyphidodon melas				Porites lutea		Dictyota bartayresiana
Parrot fish				Siderastrea savignvana		Padina gymnospora
Eel				Turbinaria mesenterina		

<u>Name of Location</u>	<u>Code Name</u>
Fort Area	FA Site C

Table 19. Diversity for fauna collected from above sites

<u>Fauna collected (species wise/ local name)</u>						<u>Flora collected (species wise/ local name)</u>
<u>Fishes</u>	<u>Crustacean</u>	<u>Mollusca</u>	<u>Echinoderms</u>	<u>Corals</u>	<u>Cnidarians</u>	<u>Seaweed/ Seagrass / Algae (sp.wise)</u>
Abudefduf vaigiensis	Calappa lophos	Littoraria sp.	Holothuria scabra	Goniastrea pectinata		Avrainvillea erecta
Neoglyphidodon melas	Sand crab	Umbonium vestiarium		Porites lichen		Bryopsis plumosa
				Porites lutea		Dictyota bartayresiana
				Siderastrea savignvana		Padina gymnospora

Table 19. Diversity for fauna collected from above sites	<u>Code Name</u>
<u>Name of Location</u>	
Rock Garden Area	RG Site A

Table 20. Diversity for fauna collected from above sites

<u>Fauna collected (species wise/ local name)</u>						<u>Flora collected (species wise / local name)</u>
<u>Fishes</u>	<u>Crustacean</u>	<u>Mollusca</u>	<u>Echinoderms</u>	<u>Corals</u>	<u>Cnidarians</u>	<u>Seaweed/ Seagrass/ Algae (sp.wise)</u>
Abudefduf vaigiensis	Calappa lophos	Littoraria sp.	Astropecten indica	Porites lichen	Anthopleura asiatica	Avrainvillea erecta
Butterfly fish		Trochus radiatus	Holothuria sp.	Siderastrea savignvana		Bryopsis plumosa
Melichthys indicus		Umbonium vestiarium		Turbinaria mesenterina		Dictyota bartayresiana

<i>Neoglyphidodon melas</i>		<i>Trochus marmoratus</i>		<i>Goniopora</i> sp.		<i>Gelidiopsis intricata</i>
				<i>Goniastrea pectinata</i>		<i>Padina gymnospora</i>
				<i>Coscinarea monile</i>		<i>Sargassum tenerrimum</i>
				<i>Cyphastera serialia</i>		

Site Name	Latitude	Longitude
Sindhurg Fort Area-Malvan <b>FA Site A (Station-01)</b>	16.042226 N	73.461168 E
Sindhurg Fort Area-Malvan <b>FA Site B (Station-02)</b>	16.043134 N	73.461661 E
Sindhurg Fort Area-Malvan <b>FA Site C (Station-3)</b>	16.045490 N	73.462412 E
Rock Garden Area -Malvan <b>RG Site A (Station-4)</b>	16.063317 N	73.457253 E

Name of Location	Code Name
Fort Area	FA Site A & FA Site B

Due to wave actions, poor visibility, turbidity and tourist disturbances, information could not be ascertained from few locations. Nevertheless, coral colonies varies from 500 cm to 10 m in size were observed at Chivala, Malvan Fort and Rock Garden areas. Also, some locations where diving was made did not have corals but presence of large colonies of sea cucumbers, sea urchins and invade with seaweeds. Among coral associated fish viz. Goby, Indo-pacific sergeant, and Bengal sergeant were common. Besides, presence of sea anemone, eel and clams were also documented in surveyed sites.

Table 21. Diversity for fauna collected from above sites

Fishes	Fauna collected (species wise/ local name)					Flora (species wise/ Seaweed/ Seagrass/ Algae (sp.wise)
	Crustacean	Mollusca	Echinoderms	Corals	Cnidarians	
<i>Abudefduf vaigiensis</i>	<i>Calappa lophos</i>	<i>Littoraria</i> sp.	<i>Holothuria</i> sp.	<i>Goniastrea pectinata</i>	<i>Anthopleura asiatica</i>	<i>Avrainvillea erecta</i>
<i>Chaetodon</i> sp.		<i>Trochus radiatus</i>	<i>Holothuria scabra</i>	<i>Porites lichen</i>		<i>Bryopsis plumosa</i>
<i>Neoglyphidodon melas</i>				<i>Porites lutea</i>		<i>Dictyota bartayresiana</i>

Parrot fish				<i>Siderastrea savignvana</i>		<i>Padina gymnospora</i>
Eel				<i>Turbinaria mesenterina</i>		

Name of Location	Code Name
Fort Area	FA Site C

Table 22. Diversity for fauna collected from above sites

Fauna collected (species wise/ local name)						Flora collected (species wise/ local name)
Fishes	Crustacean	Mollusca	Echinoderms	Corals	Cnidarians	Seaweed/ Seagrass / Algae (sp.wise)
<i>Abudefduf vaigiensis</i>	<i>Calappa lophos</i>	<i>Littoraria sp.</i>	<i>Holothuria scabra</i>	<i>Goniastrea pectinata</i>		<i>Avrainvillea erecta</i>
<i>Neoglyphidodon melas</i>	Sand crab	<i>Umbonium vestiarium</i>		<i>Porites lichen</i>		<i>Bryopsis plumosa</i>
				<i>Porites lutea</i>		<i>Dictyota bartayresiana</i>
				<i>Siderastrea savignvana</i>		<i>Padina gymnospora</i>

Name of Location	Code Name
Rock Garden Area	RG Site A

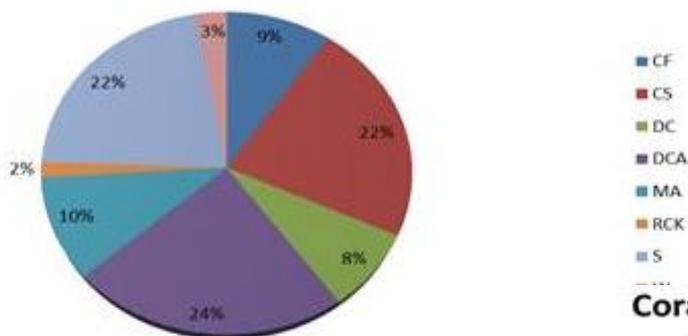
Table 23. Diversity for fauna collected from above sites

Fauna collected (species wise/ local name)						Flora collected (species wise / local name)
Fishes	Crustacean	Mollusca	Echinoderms	Corals	Cnidarians	Seaweed/ Seagrass/ Algae (sp.wise)
<i>Abudefduf vaigiensis</i>	<i>Calappa lophos</i>	<i>Littoraria sp.</i>	<i>Astropecten indica</i>	<i>Porites lichen</i>	<i>Anthopleura asiatica</i>	<i>Avrainvillea erecta</i>
Butterfly fish		<i>Trochus radiatus</i>	<i>Holothuria sp.</i>	<i>Siderastrea savignvana</i>		<i>Bryopsis plumosa</i>
<i>Melichthys indicus</i>		<i>Umbonium vestiarium</i>		<i>Turbinaria mesenterina</i>		<i>Dictyota bartayresiana</i>
<i>Neoglyphidodon melas</i>		<i>Trochus marmoratus</i>		<i>Goniopora sp.</i>		<i>Gelidiopsis intricata</i>
				<i>Goniastrea pectinata</i>		<i>Padina gymnospora</i>
				<i>Coscinarea monile</i>		<i>Sargassum tenerrimum</i>
				<i>Cyphastera serialia</i>		

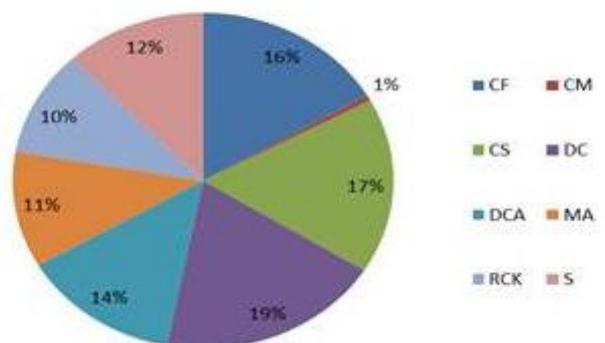
All the seven sites surveyed in Malvan were having corals and associated fauna. However, the diversity is different in all the sites. While the sites - 1 & -2 (Station-01 and Station-02) were found to be dominated with corals viz. *Turbinaria mesenterina*, *Siderastrea savignvana* and *Goniastrea pectinata*, the site-3 (Station-03) was found to be dominated with *Porites lichen* and *Porites lutea*. Similarly, the site- 4 (Station-04) (Rock Garden) was dominated with *Turbinaria* and *Goniopora* sp. Interestingly, the site-5 (station-05) [back side of the Fort known in the name of *Rani ka Bagh*] was found to be infested with Sea Urchins *Chaetodiadema* sp. with few small colonies of encrusting corals. The site-06 (Station-06) adjacent to the Fort (Queens Garden) was relatively deeper and with rocky substratum (appx. 4-6 m depth). The coral coverage was found to be poor and more algal growth was observed on the substratum. The site-7 (Station-07), which is a submerged rocky outcrop was also surveyed and a good population of sea cucumber (*Holothuria* sp.) were found on the bottom along with coral associated fishes.

**Corals and associated fauna based on LITs and Quadrates**

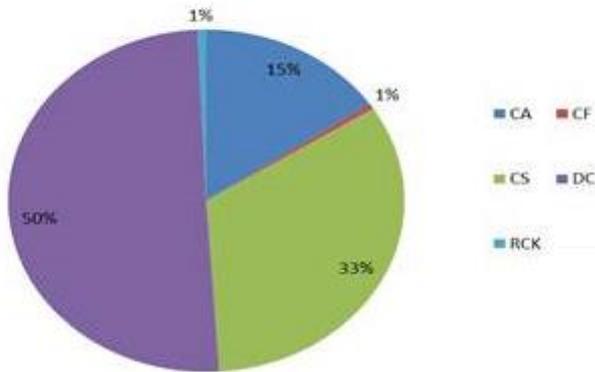
**Coral Distribution of Rock Garden Area: Stn 4 / LIT 1**



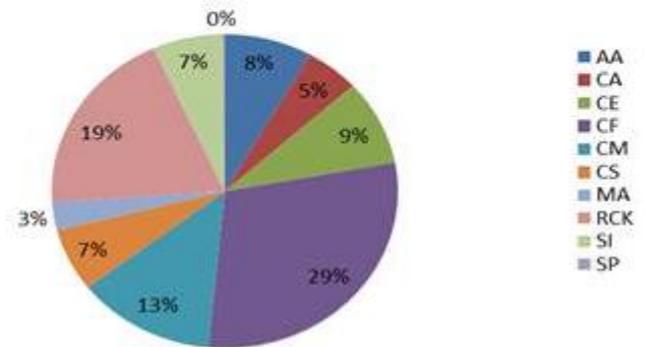
**Coral Distribution on the Left Side of Sindhudurga Fort: Stn 2/LIT 2**



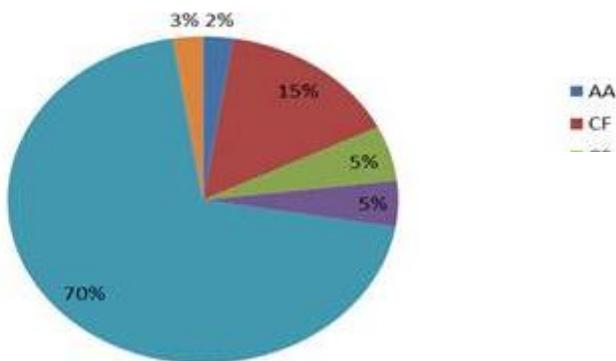
**Coral Distribution of Right side of Sindhudurg Fort: Stn 3 / LIT 2**



**Coral Distribution on the Left Side Of Sindhudurg Fort: Stn 1/ LIT 1**



**Coral Distribution on the Left Side of Sindhudurga Fort : Stn 1 / LIT 2**

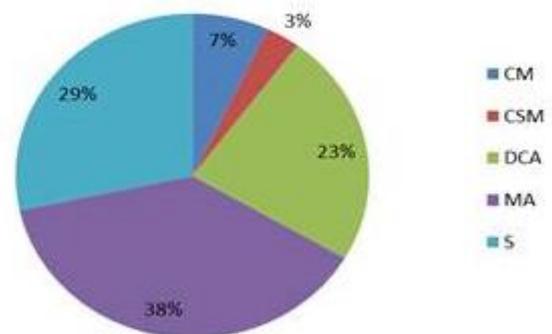


**Abbreviation:**

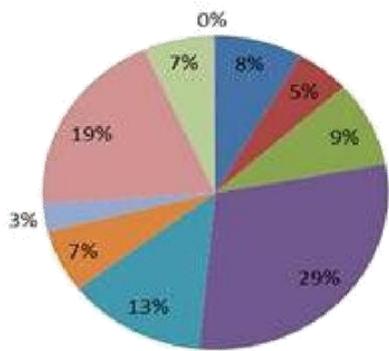
- AA : Algal Assemblage;
- CA : Coraline Algae;
- CE : Coral encrusting;
- CF : Coral Foliage;
- CM : Coral Massive;

- CS : Coral Sub-massive;
- MA : Macro Algae;
- RCK : Rock
- SI : Silt
- SP : Sponge

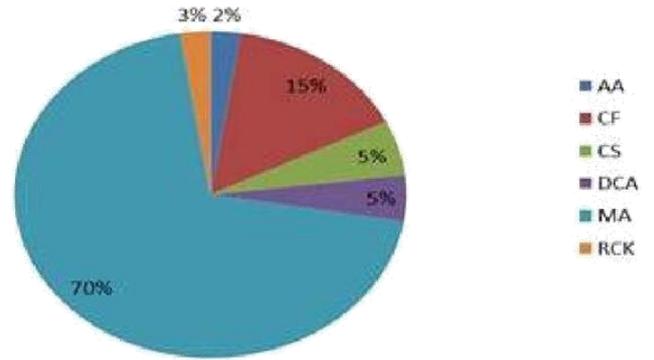
**Coral Distribution on the Left Side of Sindhudurga Fort: Stn 2/ LIT 1**



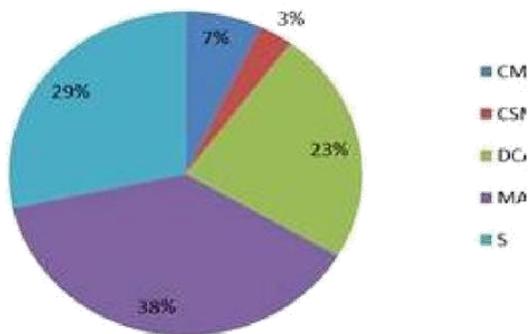
**Coral Distribution on the Left Side of Sindhudurg Fort: Stn 1/ LIT 1**



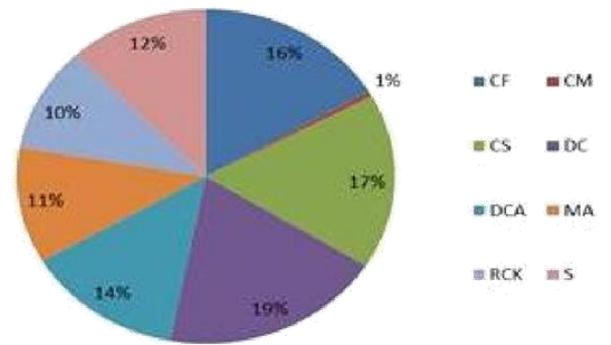
**Coral Distribution on the Left Side of Sindhudurga Fort : Stn 1 / LIT 2**



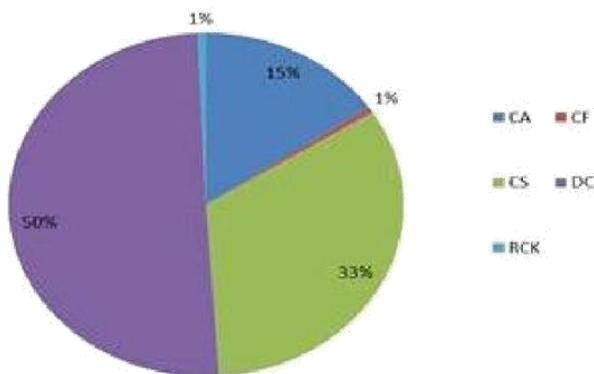
**Coral Distribution on the Left Side of Sindhudurga Fort: Stn 2/ LIT 1**



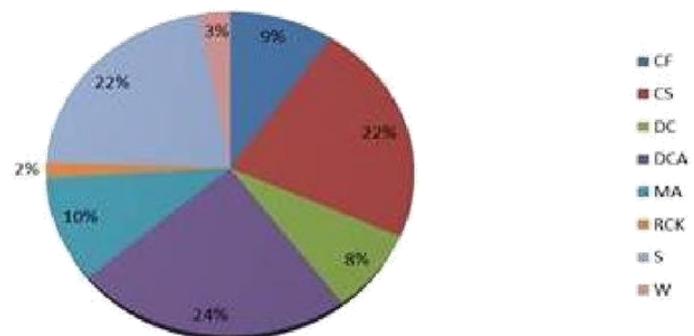
**Coral Distribution on the Left Side of Sindhudurga Fort: Stn 2/LIT 2**



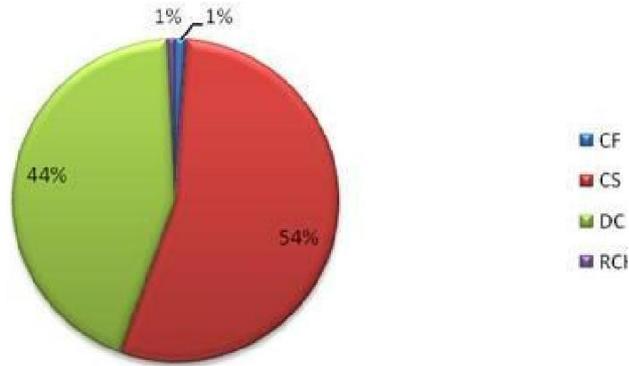
**Coral Distribution of Right side of Sindhudurg Fort: Stn 3 / LIT 2**



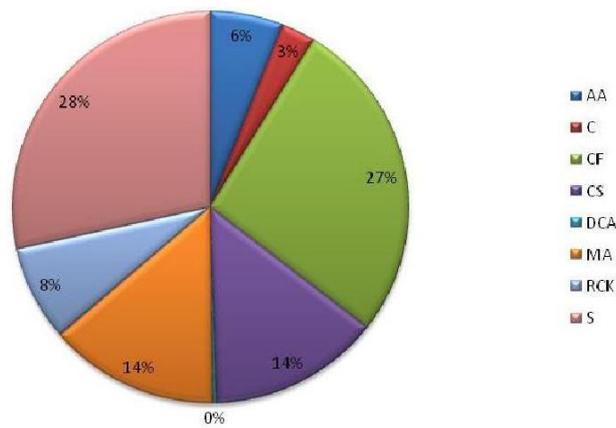
**Coral Distribution of Rock Garden Area: Stn 4 / LIT 1**



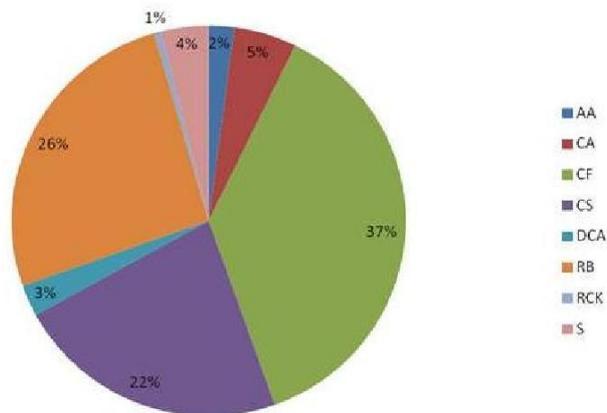
### Coral Distribution of Right side of Sindhudurg Fort: Stn3/LIT1



### Coral Distribution of Rock Garden: Stn4/LIT1



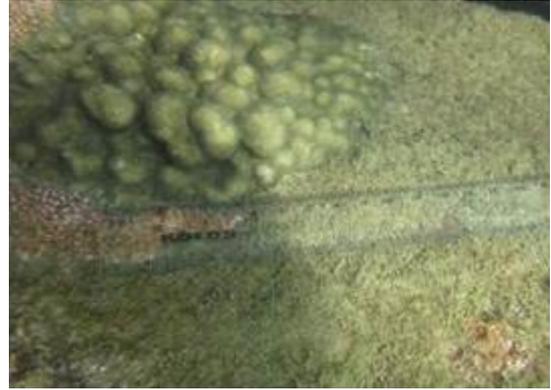
### Coral Distribution of Rock Garden: Stn4/LIT2



Corals and associated fauna observed at Malvan



*Turbinaria mesenterina*



*Porites lichen*



*Porites lutea*



*Siderastrea savignayana*



Seaweeds



Seaanemone



Coral associated fish (*Abudefduf bengalensis*)



Fish schooling in coral patches



*Turbinaria mesenterina*



*Porites lichen*



*Porites lutea*



*Siderastrea savignayana*



Seaweeds



Seaanemone



Associated fish



Associated fish school

All the sites in Malvan are having corals and associated fauna. However, the diversity is different in all the sites. While the sites - 1 & -2 (Station-01 and Station-02) were found to be dominated with corals viz. *Turbinaria mesenterina*, *Siderastrea savignvana* and *Goniastrea pectinata*, the site-3 (Station-03) was found to be dominated with *Porites lichen* and *Porites lutea*. The LIT data collected from all the four sites in April-March 2015 are corroborate with that of October-November 2015 data as there was no difference in the coral coverage in the sites surveyed and data from the permanent LIT laid.

**LIT and Quadrate Data: April-May 2015 and October-November 2015**

**Line Intercept Transect data on coral abundance along Sindhudurg**

**(Results of April – May 2015 and October-November 2015 LIT survey)**

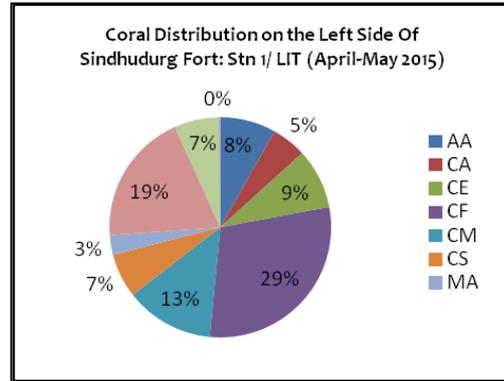
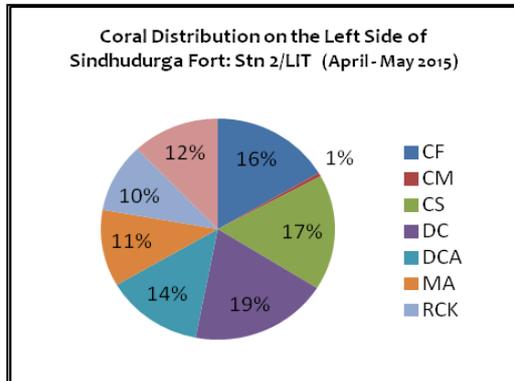
**(LIT data of April – May 2015)**

Table 18. Physico-chemical parameters collected from monitoring sites

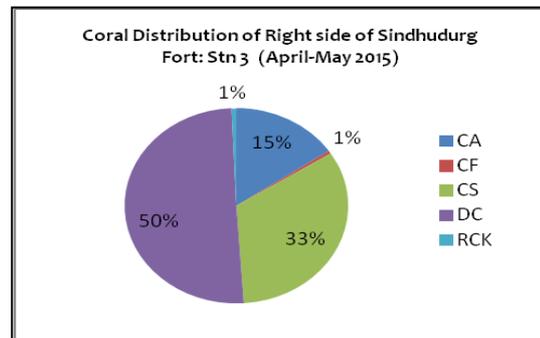
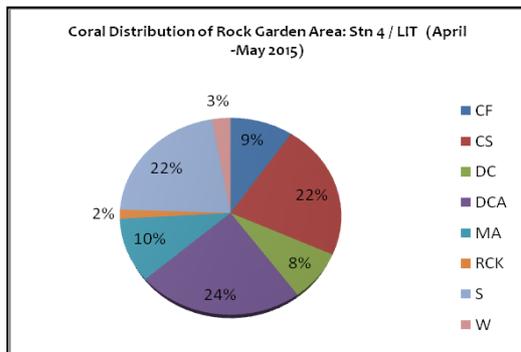
		Coastline : Malvan		
Location :	Fort Area ( Sta.1)	Lat: 16.04641 N	Long: 73.45841 E	pH : 8
Tide :	Low Tide	Transect No: Stn 1 / LIT	Visibility : 1.5 Meter	Salinity : 42
Depth :	2 Meter	Reef Zone : Flat		Temp : 32.7° C

		Coastline : Malvan		
Location :	Fort Area ( Sta.2)	Lat: 16.04193 N	Long: 73.46186 E	pH : 8
Tide :	Low Tide	Transect No: Stn 2 / LIT	Visibility : 1.5 Meter	Salinity : 42
Depth :	2 Meter	Reef Zone: Flat		Temp : 32.2° C

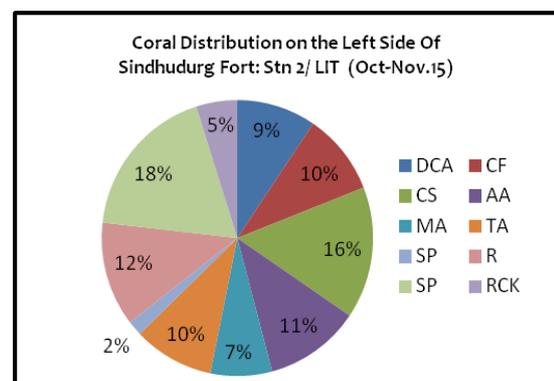
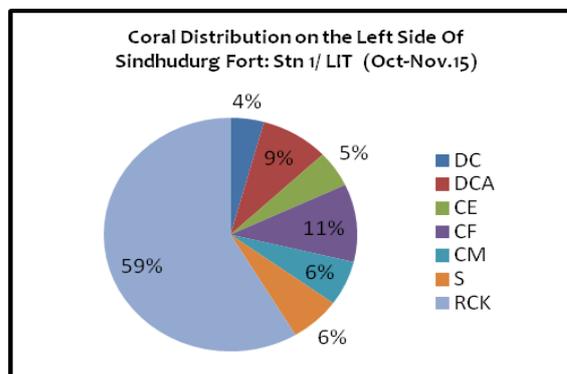
		Coastline : Malvan		
Location :	Fort Area (Sta.3)	Lat: 16.03913 N	Long: 73.45930 E	pH : 8.4
Tide :	Low Tide	Transect No: Stn 3 / LIT	Visibility : 1 Meter	Salinity : 42
Depth :	1.5 Meter	Reef Zone : Flat		Temp : 32.7° C



		Coastline : Malvan		
Location :	Fort Area (Sta.2)	Lat: 16.04193 N	Long: 73.46186 E	pH : 7.9
Tide :	Low Tide	Transect No: Stn 2 / LIT	Visibility : 1 Meter	Salinity : 43
Depth :	2 Meter	Reef Zone: Flat		Temp : 29.7° C



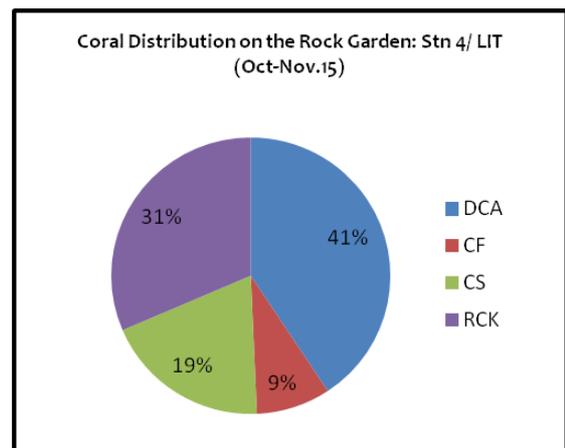
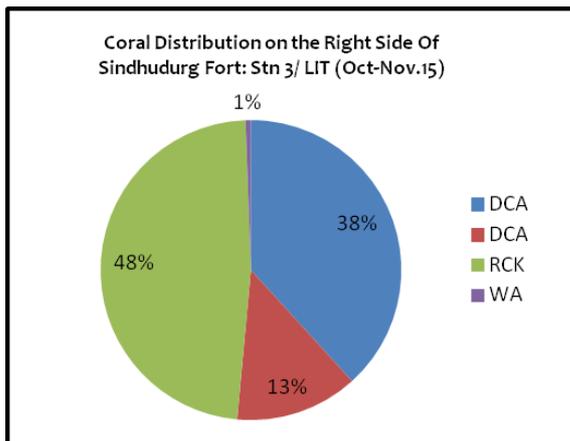
(LIT data of October – November 2015)



		Coastline : Malvan		
Location :	Fort Area ( Sta.1)	Lat: 16.04641 N	Long: 73.45841 E	pH : 8.3
Tide :	Low Tide	Transect No: Stn 1 / LIT	Visibility : 1 Meter	Salinity : 43
Depth :	1.5 Meter	Reef Zone : Flat		Temp : 33.7° C

		Coastline : Malvan		
Location :	Fort Area ( Sta.3)	Lat: 16.03913 N	Long: 73.45930 E	pH : 8.4
Tide :	Low Tide	Transect No: Stn 3 / LIT	Visibility : 1.5 Meter	Salinity : 45
Depth :	1.5 Meter	Reef Zone : Flat		Temp : 29.7° C

		Coastline : Malvan		
Location :	Rock Garden (St.4)	Lat: 16.03509 N	Long: 73.27261 E	pH : 8.3
Tide :	Mid Tide	Transect No: Stn 4 / LIT	Visibility : 1 Meter	Salinity : 43
Depth :	2 Meter	Reef Zone : Flat		Temp : 29.9° C

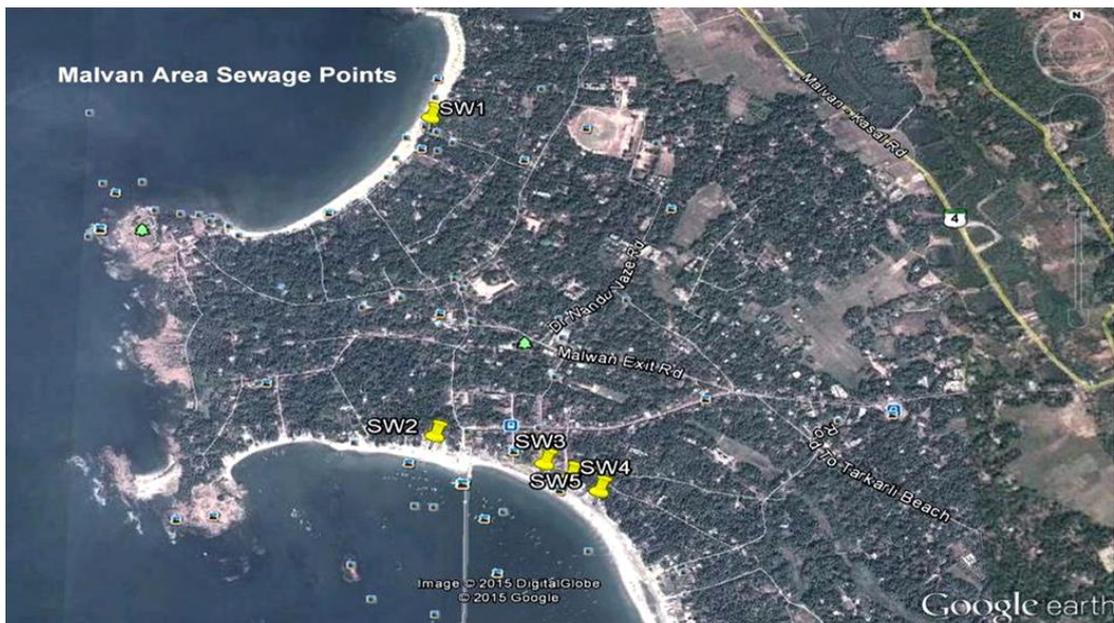


Sites at Vijayadurg where random diving was made during October-November 2015



Underwater survey sites in Vengurla rock

Map of distribution of Sewage Points in Malvan area





**Sites surveyed and identified as source of sewages to coastal waters of Sindhudurg**

### **Effect of anthropogenic activities on coral reef ecosystems along the Sindhudurg coast**

At all the locations where corals were encountered during the surveys conducted, the wave action was strong and hence at the low tide the water in the rock pools was fairly turbid. On an average suspended particulate load in the water was very high compared to other coral reef areas like Gulf of Mannar. In the inter-tidal zone, salinity decreased to <15 ppt due to river discharge which brings an enormous amount of sediment into these waters through land run off. This could be the reason for occurrence of hermatypic corals in the sub-tidal zone because of their ecological adaptations to change in salinity and turbidity. On the other hand, the drainage from land based effluents mainly that of the municipal sewages from coastal townships viz. Vengurla, Tarkarli, Malvan, Devgad and Vijayadurg directly discharging into the Arabian Sea and at places very close to the coral occurrence sites, thereby not only increase turbidity (visibility of substratum/corals

through water < 1 m) but also eutrophication level. The micro and macro algal assemblages are encountered mostly in places where there is land based drainage close to the coral areas/rocky substratum. Algal growth is known to be detrimental to coral growth and therefore, some of the locations surveyed only had algal colonies and devoid of any corals in spite of suitable/conductive environment for corals. During the field surveys, the land drainage points were noted all along the Sindhudurg coast, the geo-coordinates of which are given below.

The other anthropogenic activities prevailing all along the Sindhudurg coast is the marine fishing practices. There are more than 30 fishing villages and ~ 6000 registered mechanized fishing boats operating along the coast. The below table shows the number of fish landing centres and fishing boats operating along the Sindhudurg coast (Table 24 & Table 25). The list of commercially important fishes recorded from the fishing vessels along the Sindhudurg coast is presented in Table 26. Although the fishing is known to be carried out in the deeper water away from the coral areas, the fish traces/bycatch are more often dumped in the nearshore coastal waters of Vengurla, Malvan, Devgad and Vijayadurg. In addition to this, the coast based fish processing plants also supporting to add effluents into the coastal waters of Sindhudurg. This is another reason for growth of scavenger, eutrophication and thereby increase in the turbidity of coastal waters and that may be influencing the growth of corals in the region. However, to support this, more indepth study is required.

Sl. No.	Sewage point	Landmark	GPS location	
			Latitude	Longitude
1	SW1	Near Devgad Beach	16°22'33.28"N	73°22'25.16"E
2	SW2	Near Devgad Beach	16°22'35.62"N	73°22'28.35"E
3	SW3	In Fishing Village	16°22'37.31"N	73°22'29.18"E
4	SW4	Near Fishing Harbour	16°22'41.15"N	73°22'28.27"E
5	SW5	Near Fishing Harbour	16°22'47.15"N	73°22'41.12"E
6	SW6	Near Anandwadi	16°22'57.12"N	73°22'45.00"E
7	SW7	In Anandwadi	16°23'00.23"N	73°22'45.34"E

Sl. No.	Sewage Point	Landmark	GPS Location	
			Latitude	Longitude
1	SW1	Chivala beach	16° 3'55.60"N	73°27'48.76"E
2	SW2	Malvan beach near the jetty	16° 3'19.72"N	73°27'48.17"E
3	SW3	Malvan beach near Fish market	16° 3'16.45"N	73°27'57.77"E
4	SW4	Malvan beach near Fish market	16° 3'14.96"N	73°27'59.89"E
5	SW5	Malvan beach near the Fish landing center	16° 3'13.44"N	73°28'2.30"E

**Table 24. Fish Landing centers along the Sindhudurg Coast (Taluka Wise)**

Devgad	Malvan	Vengurla
Vijaydurg	Makrebag	Kochara/ Nivati
Anandwadi	Dandi	Khavana
Phanshe/ Padwane	Medha	Kelus
Wadatar/ Mali	Aachara	Khanoli/ Vayangani
Mithmumbari	Tondavali	Navabag/ Dabhoswada
Kunkeshwar/ Katwan	Talashil	Muth/ Ubhadanda
Mithbhav	Sarjekot/ Miryabandh	Mochemad
Mauryavadi	Dhuriwada	Aaravali/ Tak
	Vayari	Shiroda
	Tarkarli/ Kalethar	Aronda
	Deobag	Redi
	Morbar/ Bhogwe	Manshivada
		Pirvadi/ Hussainbag
		Shipetu

**Table 25. Number of Fishing Vessels (Trawlers, Non-mechanized, Mechanized Boats, Boats using Gill net, Pursein and Mini-pursein) along Sindhudurg coast**

Sl. No.	Number of vessel	Taluka			Total
		Devgad	Malvan	Vengurla	
1	Mechanical Boats	489	758	151	1398
2	Non-mechanical	156	595	619	1370
3	Big Trawlers	180	313	35	528
4	Gill-net Technique	499	1438	1068	3005
5	Licensed Pursein	9	12	0	21
6	Licensed Mini-pursein	0		2	11





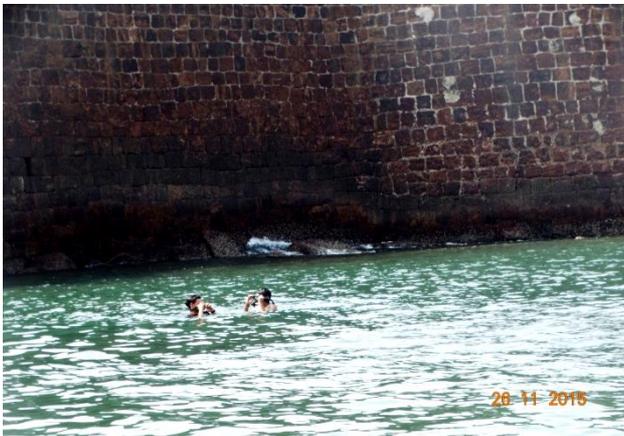
Land based sewage draining into the coastal waters of Sindhudurg coast



Underwater snorkeling and scuba diving site at Vengurla Rock



Underwater snorkeling and scuba diving site at Vijayadurg



Underwater snorkeling and scuba diving site at Devgad fort



Quadrat and LIT at permanent monitoring plot in Malvan near the fort



A submassive form of *Siderastrea savignvana* at Malvan



A patch of *Goniopora minor* observed near Vengurla rock



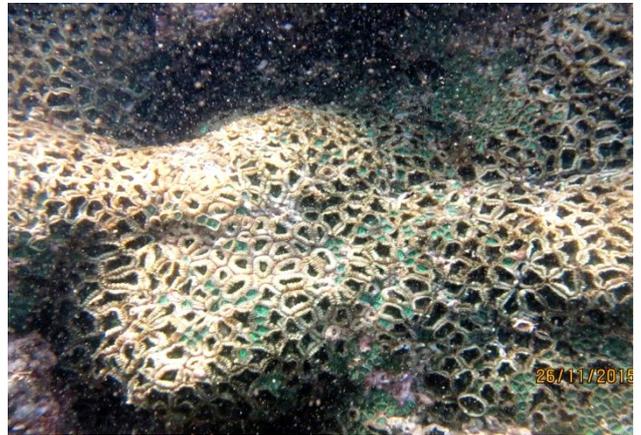
Gorgonians observed at Vengurla rock



Sea urchin, a commonly seen echinoderm along Sindhudurg coast



Sea anemone, bivalve mollusca, ascidians (coral associates)



Zooxanthellate, attached to intertidal and subtidal rocks, often confused with coral patches



Large school of fishes seen in Vijayadurg



Opisthobranch, a common indicator in coral reef ecosystem, encountered at Vengurla

Corals and associated fauna observed at Malvan



*Turbinaria mesenterina*



*Porites lichen*



*Porites lutea*



*Siderastrea savignayana*



Seaweeds



Seaanemone



Coral associated fish (*Abudefduf bengalensis*)



Fish schooling in coral patches

**Table 26. Checklist of Coral Associated commercially important fish species of the Sindhudurg District with special reference to Malvan (Based on field observations)**

Sl. No.	Common Name	Marathi Name	Scientific Name
1.	Barred Flagtail	-	<i>Kuhlia mugil</i>
2.	Bengal Sergeant Major	-	<i>Abudefduf bengalensis</i>
3.	Black Damsel	-	<i>Neoglyphidodon melas</i>
4.	Black-banded Cat Shark	Suniyara	<i>Chiloscyllium punctatum</i>
5.	Blackspot Sergeant	-	<i>Abudefduf sordidus</i>
6.	Blackspot Snapper	Kumbharin	<i>Lutjanus ehrenbergii</i>
7.	Black-tip Reef Shark	Pilo	<i>Carcharhinus melanopterus</i>
8.	Blubberlip Snapper	Charcha	<i>Lutjanus rivulatus</i>
9.	Bluebarred Parrotfish	-	<i>Scarus ghobban</i>
10.	Blue-lined Hind	Chamata	<i>Cephalopholis formosa</i>
11.	Brown Demoiselle	-	<i>Neopomacentrus filamentosus</i>
12.	Crescent-Grunter	-	<i>Terapon jarbua</i>
13.	Darkstriped Squirrelfish	-	<i>Sargocentron praslin</i>
14.	Dotted Butterflyfish	-	<i>Chaetodon semeion</i>
15.	Eel	Ahir/ Vam	<i>Anguilla sp.</i>
16.	Freshwater Damsel fish	-	<i>Neopomacentrus taeniurus</i>
17.	Gold silk Sea Breams	-	<i>Acanthopargus berda</i>
18.	Goldspotted Spinefoot	-	<i>Siganus punctatus</i>
19.	Indian Goatfish	-	<i>Parupeneus indicus</i>
20.	Japanese Threadfin Bream	Rano	<i>Nemipterus japonicus</i>
21.	John's Snapper	Kumbharin	<i>Lutjanus johnii</i>
22.	Malabar Red Snapper	-	<i>Lutjanus malabaricus</i>
23.	Mangrove Red Snapper	Tamboshi	<i>Lutjanus argentimaculatus</i>
24.	Mullet Fish	Gunjali	<i>Mugil cephalus</i>
25.	Oblong Silver Biddy	Shetuk	<i>Gerres oblongus</i>
26.	Red-tailed Butterflyfish	-	<i>Chaetodon collare</i>
27.	Reef cod/ Rock Cod	Gobro	<i>Epinephelus chlorostigma</i>
28.	Sapphire Damsel	-	<i>Pomacentrus pavo</i>
29.	Sergeant Major	-	<i>Abudefduf vaigiensis</i>
30.	Silver Moony	-	<i>Monodactylus argenteus</i>
31.	Spotted Drepane	Chand Masa	<i>Drepane punctata</i>
32.	Spotted Scat	-	<i>Scatophagus argus</i>
33.	Vermiculated Spinefoot	Bandoshi	<i>Siganus vermiculatus</i>
34.	Yellowfin Surgeon	-	<i>Acanthurus xanthopterus</i>

## Objectives IV

### 5. Establish a monitoring protocol for coral reef ecosystems with the involvement of local stakeholders across the Sindhudurg coast.

#### a. Consultation Meeting with Tourist Boat Owners on Coral Protection and Anchorage Points in Tourism Areas

A preliminary discussion was held by the Director, ZSI with the field research personnel of ZSI based at Malvan and the two project management staff of GOI-UNDP-GEF-Sindhudurg Project on information on the possible occurrence of corals in the periphery of Sindhudurg Fort in Malvan. Based on the information gathered through intertidal and subtidal surveys by the research personnel of ZSI and GOI-UNDP-GF-Sindhudurg Project staff, preliminary underwater surveys was done at Tourist Sites around the Sindhudurg Fort in Malvan by scanning through the water by a beach landing craft (BLC) boat.

A meeting of the tourist boat owners/tour operators was held, organized jointly by the ZSI and GOI-UNDP-GEF-Sindhudurg Project in the office of the GOI-UNDP-GEF-Sinduudurg Project at Malvan on 26<sup>th</sup> February 2015 in which more than 20 tourist boat owners/operators participated. Various issues pertaining to conservation and restoration of corals in Malvan were discussed. The list of participants attended the meeting is given in Appendix-II.

It was viewed by the boat owners/tourist operators that near about last seven years, coral watch tourism has been continuing and the numbers of tourists to Malvan are increasing every year and thereby increase in the number of boats. During peak season, on a single location (Tourist Points adjacent to Malvan fort), at one point of time, more than 15 boats are anchoring and that force the boat owners/tourist operators to anchor their boat right on the coral beds, although they tend to avoid anchoring on any coral directly. In all the sites tourism is found as the the dominant social and economic activity. However, the lack of demarcated anchorage points or mooring for the boats poses threat to corals and associated fauna as un-guided dropping of anchors causes severe coral damages. Also, in few areas, it was observed that *Turbinaria* colonies have been tilted upside down likely due to anchorage.

This raise a concern for immediate arrangement of floating buoy or mooring points where boats could be tied and tourism and corals can continue in a healthy atmosphere. The expert of ZSI assured to the participants that ZSI will recommend locations which are suitable for anchoring and with no harm to corals in and around the tourism sites to the GOI-UNDP-GEF-Sindhudurg Project for implementation of the same and provide alternate anchoring sites in the form of floating buoy or mooring points.

It was viewed by the boat owners/tourist operators during the interaction meeting held in February 2015 at Malvan in the GOI-UNDP-GEF-Sindhudurg Project Office coral watch tourism has been tremendously increasing and the numbers of tourists to Malvan are increasing every year and thereby increase in the number of boats. During peak season, on a single location (Tourist Points adjacent to Malvan fort), at one point of time, more than 15 boats are anchoring and that force the boat owners/tourist operators to anchor their boat right on the coral beds, although they tend to avoid anchoring on any coral directly. In all the sites tourism is found as the the dominant social and economic activity. However, the lack of demarcated anchorage points or mooring for the boats poses threat to corals and associated fauna as un-guided dropping of anchors causes severe coral damages. Also, in few areas, it was observed that *Turbinaria* colonies have been tilted upside down likely due to anchorage.

**Genesis for a capacity building workshop at Malvan:** For improvement of the conservation prospects of the unique flora and fauna along the Sindhudurg coast especially that of the Malvan Marine Sanctuary, long term solutions need to be anchored in several key areas: establishing a robust database on the biodiversity profile of the region as a foundation for informed decision making and regular monitoring of the health of the coastal and marine ecosystem especially the corals and associated flora and fauna of Sindhudurg coast. In order to undertake the future monitoring activities by stakeholders of Sindhudurg coast, capacity building of local stakeholders was also envisaged under this project. For any conservation effort involving local community, capacity building at local level is a must blended with a strong awareness component. Keeping this in mind, a one day Capacity building Workshop for stakeholders was organised at Malvan, Maharashtra on 3<sup>rd</sup> October 2015 in which various stakeholders depending directly or indirectly on

Malvan marine sanctuary and Sindhudurg coast given hands on training on different aspects of conservation of corals and associated coastal resources of Malvan and Sindhudurg coast.

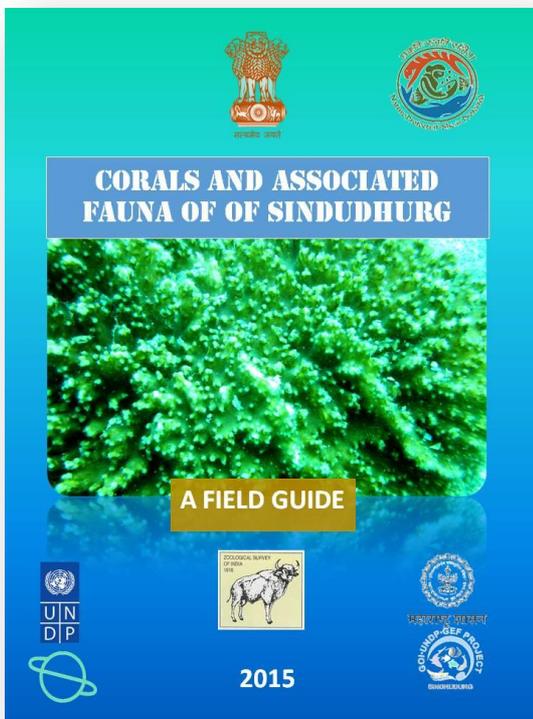
The workshop was conducted for enhancing the capacity of stakeholder/frontline staff involved along the coast for understanding the conservation value of corals and associated fauna of Sindhudurg coast including monitoring protocol for management. The one day workshop was held on 3<sup>rd</sup> October 2015 at Malvan, Sindhudurga, and was inaugurated by Dr. Kailash Chandra, Director, Zoological Survey of India. The Inaugural Session was also co-chaired by Dr. Subir Ghosh, Consultant of GOI-UNDP-GEF-Sindhudurg Project, the Deputy Conservator of Forests of Sawantwadi Forest Division-Shri Ramesh, and the Programme Manager of GOI-UNDP-GEF-Project at the MoEFCC, New Delhi-Shri C. Sashi Kumar. More than 40 participants including frontline staff of Forest Department, Government of Maharashtra, Fisheries Department, Port Department, Tourist Boat Operators, Fishermen and NGOs/CBOs attended the workshop. A poster on “Do’s and Don’t for Protection of Coral Reef of Sindhudurg” was released by the Director, ZSI. Also, Underwater Sheets on Corals, Fishes and Associated Flora and Fauna for guidance of tourists by Tourist Operators was released and distributed to participants. A manual entitled “TRAINING MANUAL ON MONITORING AND REPORTING OF CORAL REEF ECOSYSTEM” was released during the inaugural function and distributed to the participants. Field T-shirts were also distributed to the participants. The workshop was conducted in three sessions. On the advise of Dr. Subir Ghosh, Consultant of GOI-UNDP-GEF-Sindhudurg Project at the CCF, Mangrove Cell, Mumbai and on the request of participants from Tourist Boat Owners Association and Fishermen community of Malvan, another consultation workshop was organised on 27<sup>th</sup> October 2015 at the GOI-UNDP-GEF-Sindhudurg Project in Malvan. The participants who attended the workshop also interacted with the experts and research personnel of GOI-UNDP-GEF-Sindhudurg Project and ZSI team about their problems, which are highlighted as below:

- Permanent anchorage points
- Permanent underwater structures which the tourist can hold while taking photography and videos without touching the corals.
- Large size of the Poster near the reservation/booking windows and on the boats walls.
- Practical demonstration of coral reef biophysical monitoring methods taking the tourist boat owners to the sea along with ZSI/Forest Department team.
- Proper SCUBA diving certificate for tourist boat operators.

- Awareness should start in
- the school level at Malvan and surrounding areas.

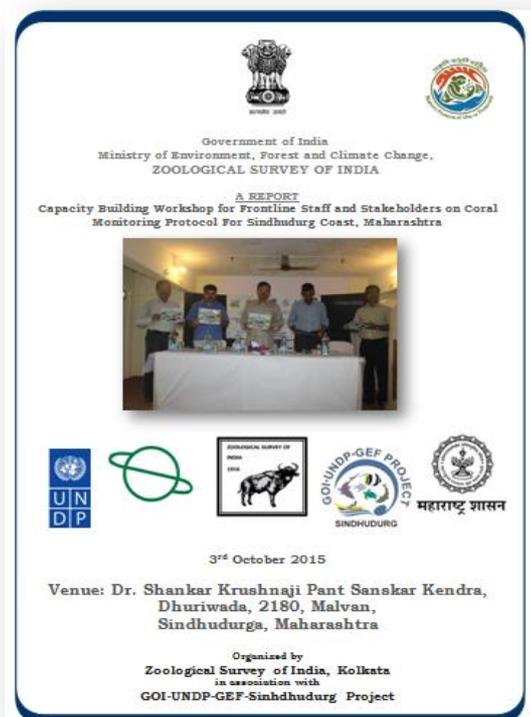
The proceedings of the workshop is enclosed as Annexure-II.

As an outcome of the project document, a “**Training manual on monitoring and reporting of coral reef ecosystem**”, Awareness Poster on “**Do’s and Don’t for Coral Reef Ecosystem of Sindhudurg**” and three Underwater Identification Sheets (**Corals, Fishes and Associated Fauna of Sindhudurg**) have been prepared. A field guide on “**Corals and Associated Fauna of Sindhudurg**” is being prepared; the manuscript of the same is being reviewed by experts for suggestions and comments for improvement in the text.



**Monograph on Corals and Associated Fauna of Sindhudurg**

**Report of Capacity Building Training Workshop for Frontline Staff and Stakeholders of Sindhudurg on Coral Reef Ecosystem**



## RECOMMENDATIONS

- The study conducted suggests that corals of Sindhudurg are not subjected to bleaching yet, as against the case of major reef regions in India, which includes Gulf of Kachchh, Gulf of Mannar and Lakshadweep. However, recording of reef health is necessary to identify pressures and to prescribe conservation measures. The live corals and associated faunal assemblages in and around Sindhudurg fort is luxuriant but need monitoring. In this respect, ZSI has identified four stations for long term monitoring of coral health by demarcating monitoring plots and deploying permanent transects. These stations should be continuously monitored by the enforcement agencies viz. forest and wildlife department of Government of Maharashtra involving the local communities including the tourist boat owners of Sindhudurg fort.
- At the same time, tourism is hectic in areas with corals, particularly in sites which are close to the Fort. Tourism boats do not have a common/identified boat anchoring points thereby increasing the risks of anchor damages on corals. Therefore, there should be provision for mooring points for boats in areas of tourism interest. The issues can be taken up at the Sindhudurg fort authority and Maritime Board.
- Fishing is rampant in Malvan and thereby there is concern on the amount of ghost nets and if these are not brought under control, it is very likely to hamper corals in the long run. Therefore, more awareness among fishermen is necessary to keep the coral area clean and devoid of any plastics and ghost nets.
- In all the sites surveyed, it was observed that sewage is a concern as Malvan township including processing plants/industries are directly releasing the municipal and industrial sewages into the sea without treatments that is causing high eutrophication of water and allowing algal growth on the corals as well as increasing the turbidity of the water. Therefore, sewage treatment is necessary before releasing into the sea.

- Public awareness with special reference to the tourists visiting Malvan for Sindhudurg Fort and recreational diving/snorkelling on coral protections (Dos/Don't) is necessary through display of posters/handouts. Towards this, ZSI is preparing such posters/handouts to be distributed to the tourist boat owners/operators and also for displaying in public places for awareness on coral conservation.
- Coral watch tourism has been continuing along Sindhudurg and the numbers of tourists to Malvan are increasing every year and thereby increase in the number of boats. During peak season, on a single location (Tourist Points adjacent to Malvan fort), at one point of time, more than 15 boats are anchoring and that force the boat owners/tourist operators to anchor their boat right on the coral beds, although they tend to avoid anchoring on any coral directly. In all the sites tourism is found as the dominant social and economic activity. However, the lack of demarcated anchorage points or mooring for the boats poses threat to corals and associated fauna as un-guided dropping of anchors causes severe coral damages. Also, in few areas, it was observed that *Turbinaria* colonies have been tilted upside down likely due to anchorage.
- This raise a concern for immediate arrangement of floating buoy or mooring points where boats could be tied and tourism and corals can continue in a healthy atmosphere.

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## References

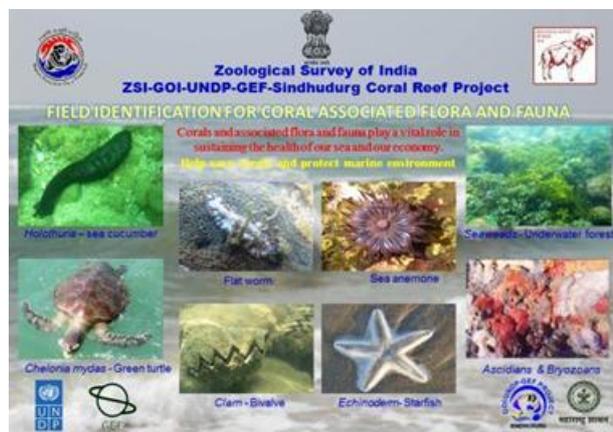
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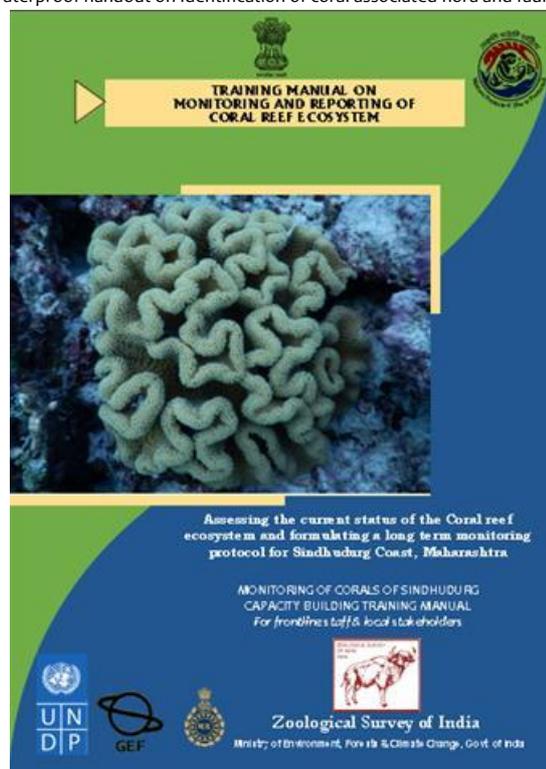
Waterproof handout on Identification of corals of Sindhudurg



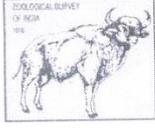
Waterproof handout on Identification of coral associated fishes of Sindhudurg



Waterproof handout on Identification of coral associated flora and fauna of Sindhudurg



Training Manual on Corals for Frontline Staff and Stakeholders



*Dr. Basudev*



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भारतीय प्राणी सर्वेक्षण/Zoological Survey of India  
पश्चिमी प्रादेशिक केंद्र/Western Regional Centre,  
विद्यानगर, सेक्टर नं. 29 /Vidya Nagar, Sector No. 29,  
पी. सी. एन. टी. पोस्ट/P.C.N.T. Post,  
रावेत रोड, आकुर्डी/Rawet Road, Akurdi,  
पुणे-411 044/Pune- 411 044,

To,

**Dr. Basudev Tripathy,**  
Scientist-D & Project Investigator,  
ZSI-GOI-UNDP-GEF-Sindhudurg Coral Reef Project  
Mollusca Section  
ZOOLOGICAL SURVEY OF INDIA  
M-Block, New Alipore  
KOLKATA-700 053

**Subject: Receipt of marine specimens of Sindhudurg Coral Reef Project-reg.**

Sir,

With reference to your e-mail dated 10<sup>th</sup> April 2016, the marine specimens (538 examples) of "ZSI-GOI-UNDP-GEF-Sindhudurg Coral Reef Project" have been deposited in the National Zoological Collection (NZC) of Zoological Survey of India (ZSI), Western Regional Centre (WRC), Pune as per the following details.

Serial No.	Name of specimen (Broadly classified)	Locality	Date of collection	Time of collection	Field Coll. No.	Ex.
I / 4412	Porifera: Sponge	Fort area, Site-2, Malvan (16.04193°N & 73.46186°E), 3m depth	19.02.2016	10:30 A.M.	Lot No. 30	1
I / 4413	Cnidaria: Anthozoa: Alcyonacea: Sea Fan	Vengurla Rocks (15.84489°N & 73.46741°E), 14m depth	29.11.2015	12:35 P.M.	Lot No. 6	1
I / 4414	Cnidaria: Anthozoa: Alcyonacea: Sea Fan	Vengurla Rocks, Site-2 (15.898494°N & 73.474553°E), 10m depth	11.01.2016	12:45 P.M.	Lot No. 38	1
I / 4415	Cnidaria: Anthozoa: Alcyonacea: Soft Coral	Vengurla Rocks, Site 1 (15.894006°N & 73.465319°E), 10m depth	29.11.2015	10:45 A.M.	Lot No. 41	1
I / 4416	Cnidaria: Anthozoa: Alcyonacea: Gorgoniidae: Gorgonian	Vengurla Rocks, Site 2 (15.886975°N & 73.464794°E), 12m depth	29.11.2015	11:34 A.M.	Lot No. 34	1
I / 4417	Cnidaria: Anthozoa: Alcyonacea: Gorgoniidae: Gorgonian	Deobag Diving Point (15.98669°N & 73.48984°E), 6m depth	15.10.2015	12:13 P.M.	--	1
I / 4418	Cnidaria: Anthozoa: Scleractinia: Coscinaraeidae: <i>Coscinaraea monile</i> (Forsskal, 1775)	Fort area, Site-1, Malvan (16.04581°N & 73.46341°E), 3m depth	18.09.2015	10:44 A.M.	--	1

I / 4419	Cnidaria: Anthozoa: Scleractinia: Dendrophylliidae: <i>Turbinaria mesenterina</i> (Lamarck, 1816)	Rock Garden, Malvan (16.06104°N & 73.45567°E), 3m depth	08.08.2015	01:32 P.M.	--	1
I / 4420	Cnidaria: Anthozoa: Scleractinia: Poritidae: <i>Porites lichen</i> Dana, 1846	Fort area, Site-2, Malvan (16.04193°N & 73.46186°E), 3m depth	02.11.2015	11:56 A.M.	--	1
I / 4421	Cnidaria: Anthozoa: Scleractinia: Poritidae: <i>Porites lutea</i> Milne Edwards & Haime, 1851	Fort area, Site-2, Malvan (16.04193°N & 73.46186°E), 3m depth	02.11.2015	11:56 A.M.	--	1
I / 4422	Cnidaria: Anthozoa: Scleractinia: Poritidae: <i>Porites lutea</i> Milne Edwards & Haime, 1851	Fort area, Site-2, Malvan (16.04193°N & 73.46186°E), 3m depth	02.11.2015	11:56 A.M.	--	1
I / 4423	Cnidaria: Anthozoa: Scleractinia: Poritidae: <i>Porites lutea</i> Milne Edwards & Haime, 1851	Fort area, Site-1, Malvan (16.04581°N & 73.46341°E), 4m depth	02.11.2015	09:23 A.M.	--	1
I / 4424	Cnidaria: Anthozoa: Scleractinia: Poritidae: <i>Porites lutea</i> Milne Edwards & Haime, 1851	Fort area, Site-1, Malvan (16.04581°N & 73.46341°E), 4m depth	02.11.2015	09:23 A.M.	--	1
I / 4425	Arthropoda: Malacostraca: Decapoda: Prawn	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	08.01.2016	06:30 P.M.	Lot No. 5	1
I / 4426	Cnidaria: Hydrozoa: Anthoathecata: Porpitidae: <i>Porpita porpita</i> (Linnaeus, 1758)	Rock Garden, Malvan (16.062444°N & 73.454983°E), 0m depth	08.09.2015	06:10 P.M.	Lot No. 32	4
I / 4427	Mollusca: Gastropoda: Gastropod	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
I / 4428	Cnidaria: Scyphozoa: Jellyfish	Kunkeshwer beach (16.33266°N & 73.39241°E), 3m depth	13.10.2014	10:00 A.M.	Lot No. 17	1
I / 4429	Annelida: Polychaeta: Polychaete tube	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 25	1
I / 4430	Arthropoda: Malacostraca: Decapoda: Prawn	Fish landing center, Malvan (16.05038°N & 73.46838°E), 0m depth	24.04.2015	06:36 P.M.	Lot No. 12	1
I / 4431	Arthropoda: Malacostraca: Decapoda: Prawn	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 25	1
I / 4432	Arthropoda: Malacostraca: Decapoda: Penaeidae: <i>Penaeus merguensis</i> de Man, 1888	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
I / 4433	Arthropoda: Malacostraca: Decapoda: Hermit Crab	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	3
I / 4434	Arthropoda: Malacostraca: Decapoda: Hermit Crab	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 25	1
I / 4435	Arthropoda: Malacostraca: Decapoda: Hermit Crab	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
I / 4436	Arthropoda: Malacostraca: Decapoda: Crab	Tambaldeg Beach (16.29826°N & 73.40451°E), 0m depth	12.10.2014	11:30 A.M.	Lot No. 4	1
I / 4437	Arthropoda: Malacostraca: Decapoda: Crab	Fish landing center, Malvan (16.05038°N &	24.04.2015	06:36 P.M.	Lot No. 12	1

		73.46838°E), 0m depth				
I / 4438	Arthropoda: Malacostraca: Decapoda: Crab	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	15.05.2014	04:30 P.M.	Lot No. 13	4
I / 4439	Arthropoda: Malacostraca: Decapoda: Crab	Kunkeshwer beach (16.33266°N & 73.39241°E), 0m depth	13.10.2014	10:00 A.M.	Lot No. 17	2
I / 4440	Arthropoda: Malacostraca: Decapoda: Crab	Devgad jetty (16.37932°N & 73.37709°E), 0m depth	13.03.2014	10:30 A.M.	Lot No. 18	4
I / 4441	Arthropoda: Malacostraca: Decapoda: Crab	Deobag beach (15.96838°N & 73.50268°E), 0m depth	18.03.2014	10:00 A.M.	Lot No. 20	3
I / 4442	Arthropoda: Malacostraca: Decapoda: Crab	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	3
I / 4443	Arthropoda: Malacostraca: Decapoda: Crab	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 25	1
I / 4444	Arthropoda: Malacostraca: Decapoda: Matutidae: <i>Matuta planipes</i> Fabricius, 1798	Deobag beach (15.96838°N & 73.50268°E), 0m depth	18.03.2014	10:00 A.M.	Lot No. 20	1
I / 4445	Arthropoda: Malacostraca: Decapoda: Calappidae: <i>Calappa lophos</i> (Herbst, 1782)	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	08.03.2014	06:45 P.M.	Lot No. 15	1
I / 4446	Arthropoda: Malacostraca: Decapoda: Calappidae: <i>Calappa lophos</i> (Herbst, 1782)	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	1
I / 4447	Arthropoda: Malacostraca: Decapoda: Leucosiidae: <i>Arcania</i> sp.	Chivala beach, Malvan (16.06252°N & 73.4587°E), 0m depth	14.04.2015	10:00 A.M.	Lot No. 22	1
I / 4448	Arthropoda: Malacostraca: Decapoda: Matutidae: <i>Matuta planipes</i> Fabricius, 1798	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	1
I / 4449	Arthropoda: Malacostraca: Decapoda: Portunidae: <i>Charybdis (Charybdis) feriata</i> (Linnaeus, 1758)	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	08.03.2014	06:45 P.M.	Lot No. 15	1
I / 4450	Arthropoda: Malacostraca: Decapoda: Portunidae: <i>Charybdis (Charybdis) feriata</i> (Linnaeus, 1758)	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 28	1
I / 4451	Arthropoda: Malacostraca: Decapoda: Portunidae: <i>Portunus (Portunus) sanguinolentus</i> (Herbst, 1783)	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	08.01.2016	11:20 A.M.	Lot No. 9	1
I / 4452	Arthropoda: Malacostraca: Stomatopoda: Squillidae: <i>Squilla</i> sp.	Devgad jetty (16.37932°N & 73.37709°E), 0m depth	13.03.2014	10:30 A.M.	Lot No. 18	1
I / 4453	Arthropoda: Malacostraca: Stomatopoda: Squillidae: <i>Squilla</i> sp.	Deobag beach (15.96838°N & 73.50268°E), 0m depth	18.03.2014	10:00 A.M.	Lot No. 20	1
I / 4454	Arthropoda: Malacostraca: Stomatopoda: Squillidae: <i>Squilla</i> sp.	Navabag beach (15.85493°N & 73.62284°E), 0m depth	09.03.2014	09:45 A.M.	Lot No. 23	2

I / 4455	Arthropoda: Malacostraca: Stomatopoda: Squillidae: <i>Squilla</i> sp.	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 25	1
I / 4456	Arthropoda: Malacostraca: Stomatopoda: Squillidae: <i>Squilla</i> sp.	Rajkot, malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
I / 4457	Mollusca: Bivalvia: Bivalve	Deobag beach (15.96838°N & 73.50268°E), 0m depth	18.03.2014	10:00 A.M.	Lot No. 20	8
I / 4458	Mollusca: Cephalopoda: Myopsida: Loliginidae: <i>Loligo</i> sp.	Fish landing center, Malvan (16.05038°N & 73.46838°E), 0m depth	24.04.2015	06:36 P.M.	Lot No. 12	1
I / 4459	Mollusca: Cephalopoda: Octopoda: Octopodidae: Octopus	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
I / 4460	Mollusca: Cephalopoda: Sepiida: Sepiidae: <i>Sepia</i> sp.	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 25	1
I / 4461	Mollusca: Gastropoda: Gastropod	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	15.05.2014	04:30 P.M.	Lot No. 13	17
I / 4462	Mollusca: Gastropoda: Gastropod	Deobag beach (15.96838°N & 73.50268°E), 0m depth	18.03.2014	10:00 A.M.	Lot No. 20	2
I / 4463	Mollusca: Gastropoda: Gastropod	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	2
I / 4464	Mollusca: Gastropoda: Trochidae: <i>Trochus radiatus</i> Gmelin, 1791	Deobag Diving Point (15.98669°N & 73.48984°E), 5m depth	15.10.2015	12:13 P.M.	Lot No. 31	8
I / 4465	Mollusca: Molluscs	Tambaldeg Beach (16.29826°N & 73.40451°E), 0m depth	06.10.2014	10:00 A.M.	Lot No. 4	15
I / 4466	Mollusca: Gastropoda: Anaspidea: Aplysiidae: <i>Stylocheilus longicauda</i> (Quoy & Gaimard, 1825)	Fort area, Site-2, Malvan (16.0428489°N & 73.4633851°E), 3m depth	21.12.2015	10:34 A.M.	Lot No. 40	1
I / 4467	Mollusca: Gastropoda: Caenogastropoda: Turritellidae: <i>Turritella duplicata</i> (Linnaeus, 1758)	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
I / 4468	Mollusca: Gastropoda: Littorinimorpha: Rostellariidae: <i>Tibia curta</i> (G. B. Sowerby II, 1842)	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
I / 4469	Mollusca: Gastropoda: Sacoglossa: Plakobranchidae: <i>Elysia ornata</i> (Swainson, 1840)	Rock Garden, Malvan (16.0629259°N & 73.4578452°E), 1m depth	19.04.2015	03:47 P.M.	Lot No. 40	1
I / 4470	Echinodermata: Asteroidea: Starfish	Deobag beach (15.96838°N & 73.50268°E), 0m depth	18.03.2014	10:00 A.M.	Lot No. 20	2
I / 4471	Echinodermata: Asteroidea: Paxillocida: Astropectinidae: <i>Astropecten polyacanthus</i> Müller & Troschel, 1842	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	08.03.2014	06:45 P.M.	Lot No. 15	1
I / 4472	Echinodermata: Asteroidea: Paxillocida: Astropectinidae:	Achara beach (16.19919°N &	10.03.2014	08:00 A.M.	Lot No. 25	1

	<i>Astropecten polyacanthus</i> Müller & Troschel, 1842	73.43491°E), 0m depth				
I / 4473	Echinodermata: Asteroidea: Paxilloida: Astropectinidae: <i>Astropecten</i> sp.	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	2
I / 4474	Echinodermata: Echinoidea: Sea Urchin	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	1
I / 4475	Echinodermata: Echinoidea: Dry shell of Sea Urchin	Fort area, Site-1, Malvan (16.04581°N & 73.46341°E), 3m depth	18.09.2015	10:44 A.M.	--	1
I / 4476	Mollusca: Gastropoda: Gastropod	Malvan beach, near Fort (16.04581°N & 73.4634°E)	08.03.2014	9:00 A.M.	--	7
I / 4477	Mollusca: Molluscs	Chivala beach (16.06245°N & 73.45842°E), 0m depth	25.08.2014	4:47 P.M.	--	10
I / 4478	Mollusca: Molluscs	Kolamb beach, Malvan	23.07.2014	5:30 P.M.	--	45
I / 4479	Mollusca: Molluscs	Devbag beach (16.96838°N & 73.50268°E)	18.03.2014	10:00 A.M.	--	9
I / 4480	Mollusca: Molluscs	Khavana beach	22.10.2014	3:00 P.M.	--	10
I / 4481	Mollusca: Gastropoda: Gastropod	Achara beach (16.20150°N & 73.73571°E), 0m depth	10.03.2014	08:00 A.M.	--	10
I / 4482	Mollusca: Molluscs	Nivati beach (15.93677°N & 73.53900°E)	10.10.2014	3:00 P.M.	--	20
I / 4483	Mollusca: Molluscs	Malvan beach, near Fish Landing Centre	23.05.2014	11:30 A.M.	--	40
I / 4484	Mollusca: Molluscs	Dandi beach (16.04415°N & 73.47538°E)	02.10.2014	5:00 P.M.	--	30
I / 4485	Mollusca: Molluscs	Kolamb beach, Malvan	11.09.2014	6:35 P.M.	--	40
I / 4486	Mollusca: Molluscs	Tarkalli beach (16.05615°N & 73.46872°E)	15.09.2014	9:20 A.M.	--	42
I / 4487	Mollusca: Molluscs	Kunkeshwer beach (16.33266°N & 73.39241°E), 0m depth	06.10.2014	12:30 P.M.	--	43
I / 4488	Mollusca: Molluscs	Chivala beach (16.06245°N & 73.45842°E), 0m depth	13.08.2014	6:20 P.M.	--	10
I / 4489	Mollusca: Gastropoda: Gastropod	Niwati Jetty (15.93903°N & 73.53561°E)	09.03.2014	12:27 P.M.	--	4
I / 4490	Mollusca: Gastropoda: Gastropod	Nivati beach, near Fort (15.93910°N & 73.51682°E)	10.10.2014	3:00 P.M.	--	2
V / 3301	Chordata: Elasmobranchii: Myliobatiformes: Dasyatidae: Whiptail stingray	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	08.01.2016	11:20 A.M.	Lot No. 9	1

V / 3302	Chordata: Elasmobranchii: Myliobatiformes: Dasyatidae: Whiptail stingray	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	08.03.2014	06:45 P.M.	Lot No. 15	1
V / 3303	Chordata: Elasmobranchii: Myliobatiformes: Dasyatidae: Whiptail stingray	Rajkot, Malvan (16.05029°N & 73.46844°E), 0m depth	09.01.2016	10:45 A.M.	Lot No. 44	1
V / 3304	Chordata: Elasmobranchii: Orectolobiformes: Hemiscylliidae: <i>Chiloscyllium punctatum</i> Müller & Henle, 1838	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3305	Chordata: Actinopterygii: Fish	Tambaldeg Beach (16.29826°N & 73.40451°E), 0m depth	12.10.2015	11:30 A.M.	Lot No. 4	1
V / 3306	Chordata: Actinopterygii: Fish	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	08.01.2016	06:30 P.M.	Lot No. 5	9
V / 3307	Chordata: Actinopterygii: Fish	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 11	11
V / 3308	Chordata: Actinopterygii: Fish	Fish landing center, Malvan (16.05038°N & 73.46838°E), 0m depth	24.04.2015	06:36 P.M.	Lot No. 12	11
V / 3309	Chordata: Actinopterygii: Fish	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	15.05.2014	04:30 P.M.	Lot No. 13	1
V / 3310	Chordata: Actinopterygii: Fish	Fish landing center, Malvan (16.05036°N & 73.46854°E), 0m depth	25.05.2014	05:30 P.M.	Lot No. 16	1
V / 3311	Chordata: Actinopterygii: Fish	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	08.03.2014	06:45 P.M.	Lot No. 19	11
V / 3312	Chordata: Actinopterygii: Fish	Chivala beach, Malvan (16.06245°N & 73.45842°E), 0m depth	12.03.2014	11:15 A.M.	Lot No. 21	2
V / 3313	Chordata: Actinopterygii: Fish	Navabag beach (15.85493°N & 73.62284°E), 0m depth	09.03.2014	09:45 A.M.	Lot No. 23	3
V / 3314	Chordata: Actinopterygii: Fish	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 24	16
V / 3315	Chordata: Actinopterygii: Perciformes: Gobiidae: <i>Trypauchen vagina</i> (Bloch & Schneider, 1801)	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3316	Chordata: Actinopterygii: Anguilliformes: Eel	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3317	Chordata: Actinopterygii: Clupeiformes: Clupeidae: <i>Anodontostoma chacunda</i> (Hamilton, 1822)	Fish landing center, Malvan (16.05036°N & 73.46854°E), 0m depth	25.05.2014	05:30 P.M.	Lot No. 16	1
V / 3318	Chordata: Actinopterygii: Perciformes: Chaetodontidae: <i>Heniochus acuminatus</i> (Linnaeus, 1758)	Malvan fish market (16.05135°N & 73.46931°E), 0m depth	19.02.2016	07:47 A.M.	Lot No. 43	1
V / 3319	Chordata: Actinopterygii: Perciformes: Sciaenidae: <i>Johnius</i>	Fish landing center, Malvan (16.05029°N &	12.11.2015	06:30 P.M.	Lot No. 3	1

	<i>dussumieri</i> (Cuvier, 1830)	73.46844°E), 0m depth				
V / 3320	Chordata: Actinopterygii: Perciformes: Serranidae: Spinycheek Grouper	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3321	Chordata: Actinopterygii: Perciformes: Scatophagidae: <i>Scatophagus argus</i> (Linnaeus, 1766)	Fish landing center, Malvan (16.05036°N & 73.46854°E), 0m depth	25.05.2014	05:30 P.M.	Lot No. 16	1
V / 3322	Chordata: Actinopterygii: Perciformes: Terapontidae: <i>Terapon jarbua</i> (Forsskal, 1775)	Fish landing center, Malvan (16.05135°N & 73.46931°E), 0m depth	19.02.2016	07:30 A.M.	Lot No. 8	1
V / 3323	Chordata: Actinopterygii: Perciformes: Trichiuridae: <i>Lepturacanthus savala</i> (Cuvier, 1829)	Fish landing center, Malvan (16.05036°N & 73.46854°E), 0m depth	25.05.2014	05:30 P.M.	Lot No. 16	1
V / 3324	Chordata: Actinopterygii: Scorpaeniformes: Lionfish	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3325	Chordata: Actinopterygii: Siluriformes: Plotosidae: <i>Plotosus sp.</i>	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3326	Chordata: Actinopterygii: Syngnathiformes: Syngnathidae: <i>Hippocampus kuda</i> Bleeker, 1852	Mithbhav jetty (16.284972°N & 73.422°E), 0m depth	03.04.2015	04:43 P.M.	Lot No. 26	1
V / 3327	Chordata: Actinopterygii: Perciformes: Carangidae: <i>Atule mate</i> (Cuvier, 1833)	Fish landing center, Malvan (16.05029°N & 73.46844°E), 0m depth	12.11.2015	06:30 P.M.	Lot No. 3	1
V / 3328	Chordata: Actinopterygii : Fish	Vengurla Rocks, Site-2 (15.898494°N & 73.474553°E), 10m depth	11.01.2016	12:45 P.M.	Lot No. 38	2
V / 3329	Chordata: Reptilia: Squamata: Elapidae: <i>Enhydrina schistosa</i> (Daudin, 1803)	Achara beach (16.19919°N & 73.43491°E), 0m depth	10.03.2014	08:00 A.M.	Lot No. 1	1
V / 3330	Chordata: Reptilia: Squamata: Elapidae: <i>Enhydrina schistosa</i> (Daudin, 1803)	Chivala beach, Malvan (16.04601°N & 73.27398°E), 0m depth	26.05.2015	07:45 A.M.	Lot No. 36	1

Your's faithfully,

*S.K. Pati*  
26/04/2016

(Dr. S.K. Pati)

Senior Zoological Assistant

Enclosure: Nil.

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F. No. 6-3/Tech./2016-17/495

Date: 26.04.2016

Forwarded to Dr. Basudev Tripathy, Scientist-D and P.I., Sindhudurg Coral Reef Project, Mollusca section, ZSI, Kolkata for necessary information.

*V.D. Hegde*  
26.04.2016

(Dr. V.D. HEGDE)

Scientist-D & Officer-in-Charge

## APPENDIX-II

Meeting with the recreational tourist boat owners/tourist operators at Malvan on issues related to coral conservation and management of Sindhudurg at GOI-UNDP-GEF-Sindhudurg Project Office, Malvan on 26<sup>th</sup> February 2015

Table 30. Participants from Boat Owners/Tourist Operators

Sl. No.	Name of boat owner/tourist operator	Contact details	Representation
1.	Mahendra G. Singh, Malvan	7744833305	Boat owner
2.	Yogesh Maybar, Malvan	9421054508	Tourist operator
3.	Narayan B. Atkar, Malvan	9420366633	Boat owner
4.	Jagannath Khawdi, Malvan	9765373780	Tourist operator
5.	Suraj S. Bhosle, Malvan	8983000628	Boat owner
6.	Valachand S. Parab, Malvan	9403801801	Tourist operator
7.	Gurunath Rane, Malvan	9403938318	Boat owner
8.	Vinayak Parab, Malvan	9404754007	Tourist operator
9.	Baban Koyad, Malvan	9960036393	Boat owner
10.	Rohan Ramachandra Acharekar, Malvan	9049947804	Boat owner
11.	Valachand Subhash Parab, Malvan	9561396079	Boat owner
12.	Swakeer Ambedkar, Malvan	9403352505	Tourist operator

Table 31. Participants from Zoological Survey of India

Sl. No.	Name	Contact details	Representation
1.	Dr. Rajkumar Rajan, Scientist-D, Marine Biology Regional Centre, Zoological Survey of India, Chennai & Principal Co-Investigator of the Project	9445395077	ZSI
2.	Dr. Ch. Satyanarayana, Scientist-C, , Zoological Survey of India, Kolkata & Principal Co-Investigator of the Project	9433325559	ZSI
3.	Dr. Basudev Tripathy, Scientist-D, , Zoological Survey of India, Kolkata & Principal Co-Investigator of the Project	9477942292	ZSI
4.	Mr. Abhishekh Nandkishore Satam, Junior Research Fellow, ZSI-GOI-UNDP-GEF-Sindhudurg Coral Reef Project	07208779110	ZSI
5.	Mr. Sanmitra Roy, Junior Research Fellow, ZSI-GOI-UNDP-GEF-Sindhudurg Coral Reef Project	07030457376	ZSI
6.	Mr. Nitesh Kumar, Technical Assistant, ZSI-GOI-UNDP-GEF-Sindhudurg Coral Reef Project	07066738020	ZSI

Table 32. Participants from GOI-UNDP-GEF-Sindhudurg Project

1	Mr. Suhel Jhamadhar, Socio-Economic and Livelihood Specialist, GOI-UNDP-GEF-Sindhudurg Project
12	Mr. Merwyn Fernandes, Conservation Biologist, GOI-UNDP-GEF-Sindhudurg Project, Malvan
3.	Mr. Rohit Sawant, Project management Unit, Devgad , GOI-UNDP-GEF-Sindhudurg Project, Malvan
4	Ms. Durga Thigale, Project management unit, Vengurla GOI-UNDP-GEF-Sindhudurg Project, Malvan
5.	Mr Rupesh Ghadigaonkar, Office Assistant, GOI-UNDP-GEF Sindhudurg Project, Malvan



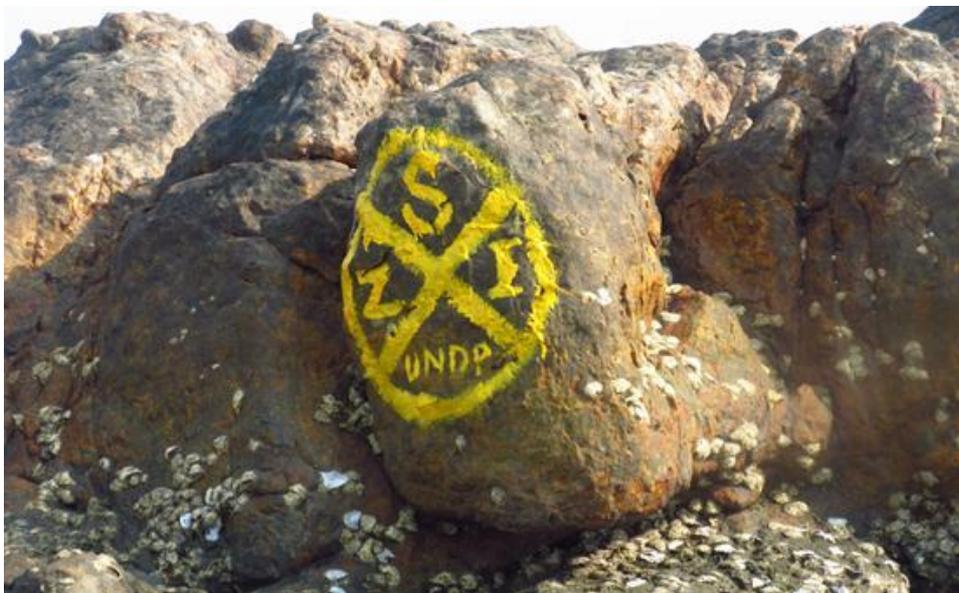
Tourists for underwater coral watch at sites adjacent to Malvan Fort



View of permanent monitoring plot from Sindhudurg fort



Fixing nails underwater for LIT. These marked sites will be visited regularly for monitoring of corals



Physical demarcation of permanent monitoring plots on rocks/bolders



Interaction with boat owners/tourist operators during the consultative meeting at Malvan



Interaction with boat owners/tourist operators during the consultative meeting at Malvan



A submassive form of coral (*Pavona bipartita*) at Malvan



Corals of species viz. *Porites lichen* and *Porites lutea* have large spread in front of Fort



*Turbinaria mesenterina* – the most common and abundant corals at Malvan



Sea cucumber - *Holothuria* sp. abundant in site-06 could attract tourists as an alternate site



LIT – Line intersect Transect laid at the permanent monitoring plots to assess coral coverage



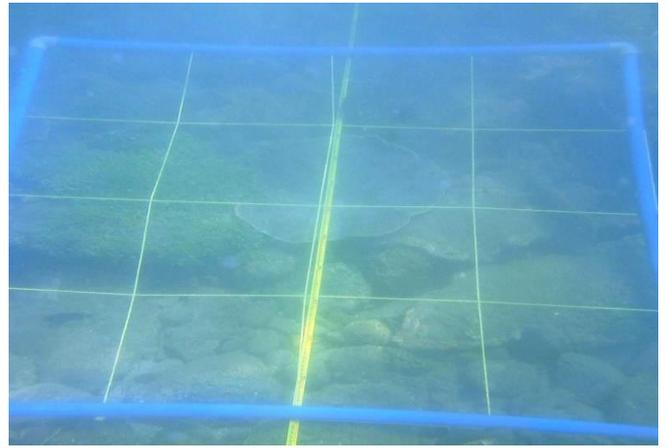
*Pavona bipartita* – a new addition to the coral list of Malvan



Algal growth in coral patches near Malvan Fort



*Cephalopholis formosa* commonly seen Grouper fish in coral pathes around Malvan fort



Permanent LITs have been marked with buoys



Coral associates: Brittle star



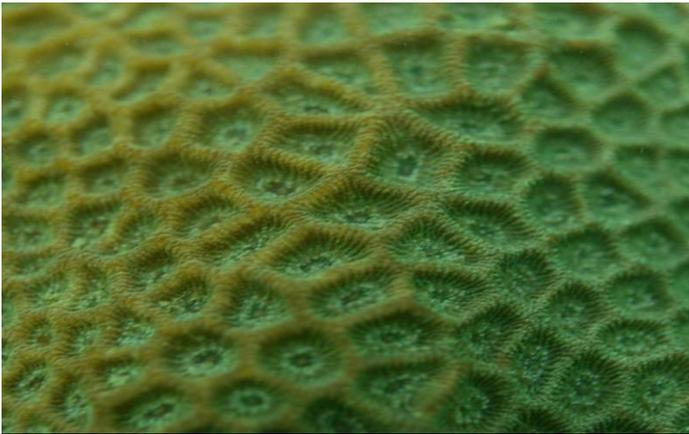
Coral associates: Sponge



*Coscinarea monile*



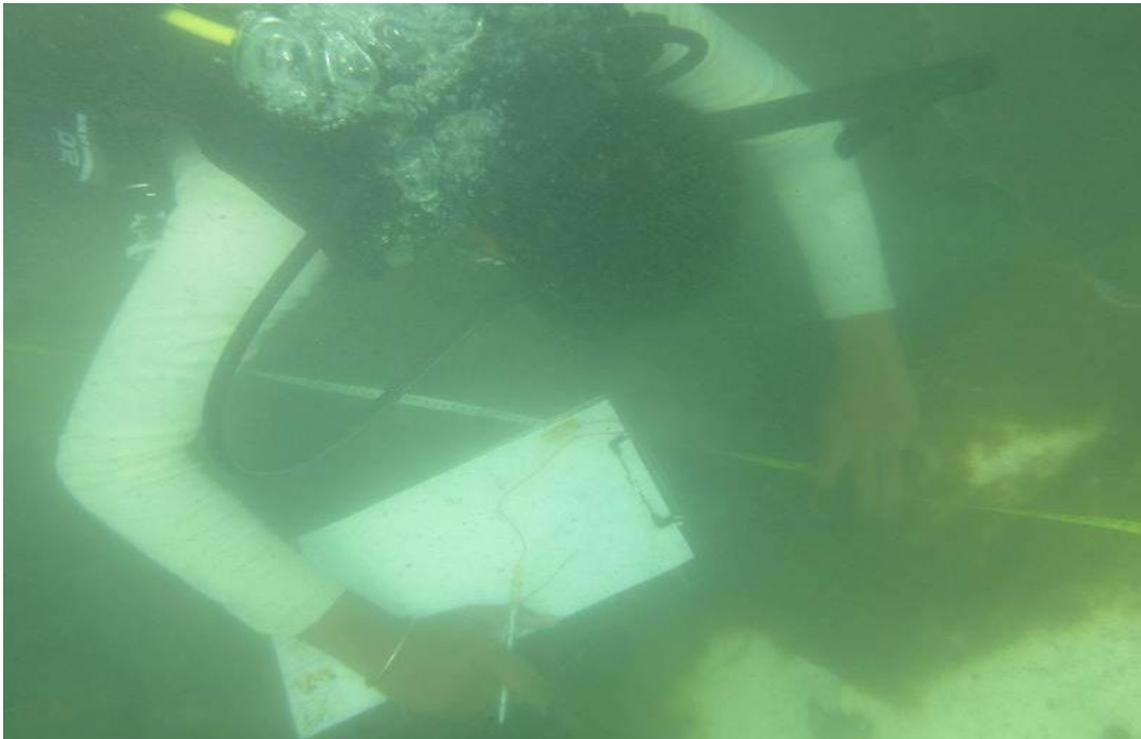
Hard Coral *Porites lichen*



Hard Coral *Goniastrea pectinata*



*Metapograpssus messor* Mangrove Crab



Data collection by LIT method by researcher



A patch of corals (colony of *Goniopora stutchburyi*, *Goniostrea pectinata* and *Porites lichen*)





सत्यमेव जयते

## निसर्गासाठी थोडसं...

### प्रवाळांच्या परिसरात खालील गोष्टी लक्षात ठेवा...

- प्रवाळांच्या भागात होडी नांगरू नका. प्रवाळ आणि होडी यात सुरक्षित अंतर ठेवा. तेल प्रदुषणामुळे प्रकाश आणि प्राणवायू प्रवाळांपर्यंत पोहचत नाही.
- प्रवाळांना हात लावू नका. ते खूप नाजूक आहेत आणि त्यांची वाढखूप हळू होते. (वर्षाला १.५ सेमी) फक्त छायाचित्र काढा.
- सागरी प्रवाळांवर पाय ठेऊ नका. असे केल्यास ते तूटून जातील आणि त्यांचा पृष्ठभागाला नुकसान होण्याची शक्यता आहे.
- समुद्रतळाची उलथापालट करू नये. असे केल्यास प्रवाळांची हानी होते.
- मासे व इतर जीवांना अन्न भरवू नये. असे केल्याने त्या अन्नाची सवय होते व त्यामुळे समुद्रीजीव त्या अन्नस्रोतावर विसंबून रहातो. त्यामुळे प्रवाळांना धोका निर्माण होतो.
- मृत अथवा जिवंत समुद्री जीवजंतुना त्या आवासस्थाना पासून इतर ठिकाणी हलवू नये. याच संकलन करू नये आणि प्रवाळ ही आपणास मिळालेली नैसर्गिक देणगी आहे. ती भेटवस्तू रूपात देऊ नका.
- समुद्रजीवांचे संकलन केल तर समुद्री पर्यावरणात असमतोल निर्माण होईल.
- मृत अथवा जिवंत जीवजंतूना इतर ठिकाणी हलवू नका कारण ते सामान्यतः विभाजी होऊन समुद्रात विलिन होतात या जीवांना समुद्रात सोडून द्या कारण ते पोषणात समुद्रात अवलंबून असतात.
- प्लास्टिक कचऱ्यामुळे सागरी प्रावळ व अन्य समुद्री जीवांची न भरून येणारी हानी म्हणून केरकचरा कचरा पेटीत टाका.
- प्रवाळ प्राहण्यांचा आनंद घ्या आणि त्यांनाही छानपणे जगू द्या.

## DO YOUR BIT FOR NATURE

### 'Do's and 'Don't's in coral areas OF MALVAN











- If you go **boating** near a coral reef, don't anchor on the reef, keep your boat in a safe distance from reef. Oil pollution will cut off the light and oxygen to coral polyps.
- If you **dive**, don't touch the corals. Corals are very delicate animals and grow very slowly (on an average about 1.5 cm in a year). Take only pictures.
- Keep your fins, gears, and hands away from corals, as this contact will **damage the delicate coral animals** and hurt you as well.
- **Don't stir the sediment** in the bottom with your fins. Sediment can settle on coral and choke it to death.
- **Don't feed fish or any other animal**. This activity and left overs will result in algal growth, which is very detrimental to corals.
- **Discourage people from removing marine life** dead or alive from marine ecosystem. Corals are already a gift. Don't give them as presents. Leave them where they are. Removing any animal will **upset the balance of the ecosystem**.
- Normal death of the animals leads to natural breakdown and recycling in to the sea. **Removal and killing them unnaturally deprives dependent animals** without nutrients and elements that they need for growth.
- Plastic, glass, trash etc. can cause irreparable damage to corals and other marine species, so **dispose off waste items in dustbins or designated sites**.
- **Enjoy and let Corals live in joy. Live and let live.**



