

# COASTAL ECOSYSTEM AWARENESS CAMPAIGN

## TSUNAMI WHEN MINUTES COUNTS

**Severe degradation of coral reefs, mangroves as well as erosion of shoreline**

21 Dec 04 AWIFS

24 Jan 05

Coral reef  
Mangroves  
Beach  
Mudflat

**Comorta-Trinkat-Nancowry Islands, Nicobar**

**Degradation of coral reefs but mangroves less impacted**

16 Dec 04 AWIFS

2 Feb 05 AWIFS

Coral Reef  
Mangroves  
Mud on reef  
Detritus on reef  
Erosion mangroves

**Wandoor MNP, Andaman**

**Severe degradation of coral reefs**

16 Dec 04 AWIFS

Coral Reef  
Detritus on reef  
Sand on reef  
Beach

**Sentinel Island, Andaman**

**Mangroves and coral reefs unaffected by tsunami**

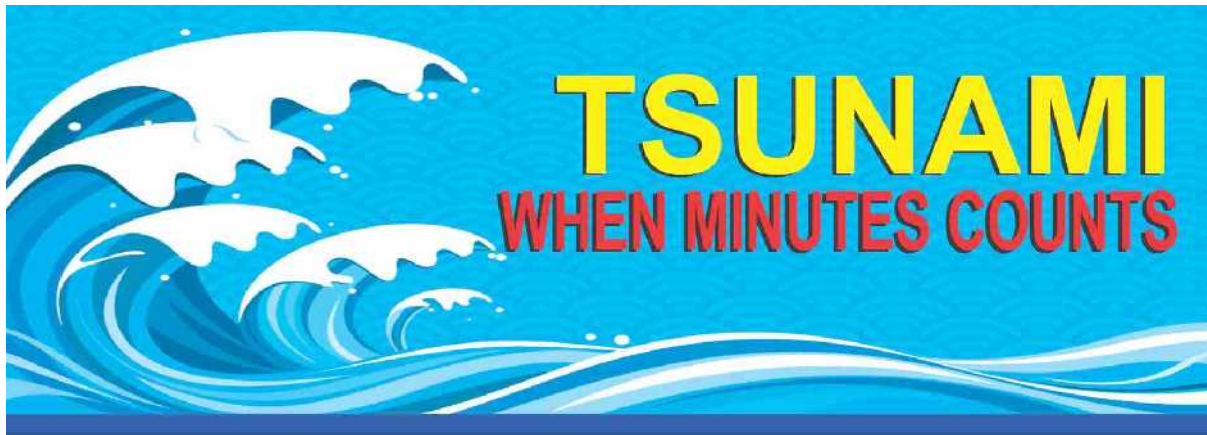
16 Dec 04 AWIFS

4 Jan 05 AWIFS

Coral reef  
Mangroves  
Beach  
Sand on reef

**Havelock I and RJ MNP**

The poster features four maps showing the impact of a tsunami on different coastal ecosystems. Each map includes a legend and dates for 'Before' and 'After' satellite imagery. The maps show significant damage to coral reefs and mangroves in some areas, while others remained unaffected.



FACTSHEET 02

INDIA@COP22



COASTAL HAZARD LINE MAPPING



Delineation of Coastal Hazard Line

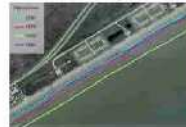
- The coast is vulnerable to a host of natural and man-made hazards
- In order to protect the people and their property mapping of Coastal Hazards which includes flooding and erosion is essential
- Coast attracts development and natural hazards put development at risk
- Delineation of "hazard line" along the entire coast of India is currently underway
- Uses Stereo aerial photography at along the coast covering a 7km stretch from the shore line to 1km inland
- Photography using Fixed-Wing Aircraft
- Airborne Differential GPS/SRTS & Inertial Devices
- Large Format Frame cameras
- Specialised Near-Range GPS in post-processed mode

Threat of coastal hazards on livelihood security and development is increasing. India coast is subject to severe weather events, such as cyclones, storm surges inflicting great loss of lives and property. Currently, the hazard line for the entire national coast is being mapped and delineated.



HAZARD LINE WILL INCORPORATE EFFECTS OF RECURRENT COASTAL HAZARDS, INCLUDING POTENTIAL INCREMENTAL EFFECTS INDUCED BY CLIMATE CHANGE

Shoreline Change Analysis



- Aerial Triangulation (AT) of 2 old vignettes of aerial Photography/High resolution satellite imagery of different vignettes
- Generation of Automatic DTM and ortho-imagery
- Different time series of coastlines extracted in 2D mode from the ortho-imageries
- Digital shoreline Analysis of different time series coastline data used to arithmetically project shoreline for next 100 years.

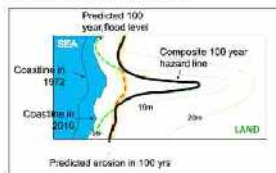
Inundation Modeling



Computation of Tide level with 100 year Return period at Primary ports

- Annual maximum tide level for each year is ascertained.
- This tide level is reduced to IMSL (Indian Mean Sea Level)
- Tide level corresponding to 100 year return period is computed using Weibull's distribution

Delineation of Hazard Line



- The higher the erosion and flood line, the higher the hazard line.
- This line is demarcated on the Digital Elevation Model (DEM) developed from aerial photography being carried out all along the coast up to 7 km from the coast.

Output from Hazard Line Mapping



- Contours with 0.5m (2.5 m for hills)
- Flood level with 100 years return period
- Predicted shoreline of 100 years
- Composite hazard line (the most landward of the 100-year flood line & erosion line)

State Public Utility and Positive Climate Action  
www.PUCL22.org

For more information:  
National Centre for Sustainable Coastal Management,  
Ministry of Environment, Forest and Climate Change,  
Anna University Campus, Chennai, India



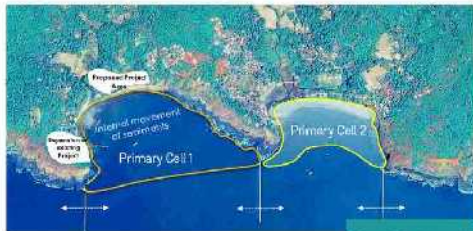
# TSUNAMI

## WHEN MINUTES COUNTS

INDIA SCOP 22  
FACTSHEET 03



### COASTAL SEDIMENT CELLS



The coastal zone is important for location of industry, transport facilities, culture, fisheries, tourism and urban development. It is constantly changing due to erosion, accretion, and flooding all of which threaten human use of the coast. It is essential to better understand the way in which this complex and multifunctional socio-economic mosaic may change in order to minimize its dangers and maximize its benefits. A spatial concept in developing such an understanding is the sediment cell.

A sediment cell serves two purposes:

- It is the basic functional unit of the coast within its boundaries coastal processes act as a coherent, integrated system. An understanding of the way in which this system functions allows us to identify the impacts of development on management and to take action to mitigate such impacts.
- It acts as a self-contained unit so that any development within the sediment cell will have a minimal impact on areas outside its boundaries.

SEDIMENT CELLS ARE LENGTHS OF DISCRETE, FUNCTIONALLY SEPARATE COASTLINE, WITHIN WHICH LONGSHORE DRIFT IS LARGELY SELF-CONTAINED

Coastal Sediment cells are identified as Primary Cells based on long term geomorphological features and Sub-Cells based on short term coastal processes.



### Findings

- West coast of India is delineated into 10 primary cells into 77 primary cells of varying coastal lengths.
- The 10 primary cells of West coast were further divided into 91 sub-cells and 17 primary cells of east coast were divided into 89 sub-cells.
- Most of the cell boundaries along the west coast were bounded by hard coastal headlands while major rivers formed most of the cell boundaries along the east coast.
- Cell boundaries along the east coast are located at the mouths of major rivers indicating the general process of sediment movement along the coast.



### Recommendations

- The sediment cell, once defined, provides the basis for a planning model, which in essence, describes how the coast works within the cell boundaries.
- This in turn makes it possible to develop practical measures for the coast that will deliver objectives of the community with minimum interruption of natural processes, in other words sustainable development.
- These practical measures can set out in the Shoreline Management Plan.
- It is advisable to implement any land erosion strategy in a broader perspective.
- With sediment cells as a base, ICZM Plan is prepared, setting out the collaborative, integrated objectives of all stakeholders, communities and managers and the means of its delivery.
- Within this ICZM Plan rests the Shoreline Management Plan as a vital but subsidiary unit, designed to deliver the objectives of ICZM in a sustainable manner.

Author: Dr. Rajesh Kumar, Director, Coastal Cell  
Co-author: Dr. S. S. S. S.

For more information:  
National Centre for Sustainable Coastal Management,  
Ministry of Environment, Forest and Climate Change,  
Anna University Campus, Chennai, India



# TSUNAMI WHEN MINUTES COUNTS

INDIA@COP22  
FACTSHEET 04



## CONSERVATION OF COASTAL ECOLOGICALLY SENSITIVE AREAS



The Coastal (Regulation) Zone, 2011 notified under the Environment (Protection) Act, 1986 has listed various coastal ecosystems, habitats, geo-morphological features, habitats and other areas such as archaeological and heritage sites, national parks, sanctuaries and reserve forests as Ecologically Sensitive Areas.

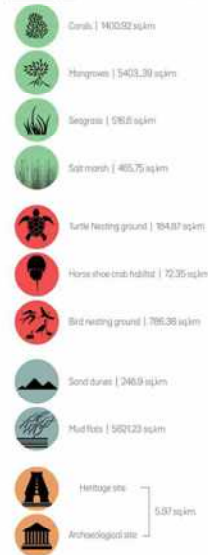
- The extent of coastal ecosystems viz., mangroves, coral reefs, seagrass and salt marshes in India including its island territories has been mapped to be ~7800 sq.km
- Habitats such as turtle nesting sites and horse shoe crab habitats occupy about 260 sq.km
- Geomorphological features such as sand dunes and mudflats account for 5888 sq.km
- Marine Protected Areas and the coastal Reserved Forest account for about 12800 sq.km.
- The coastal and marine protected areas (106 Nos.) in India account for about 5% of the territorial waters.

BY 2020, 10% OF THE COASTAL AND MARINE AREAS TO BE BROUGHT UNDER AREA-BASED CONSERVATION MEASURES - Aichi target 2020

Ecologically Sensitive Areas (ESAs) are biologically diverse ecosystems which provide significant ecosystem services and the geomorphological features which play a role in maintaining integrity of the coast.



### Findings: Extent of ESAs in CRZ I Areas



- An ESA knowledge system has been developed.
- A framework has been developed for identification and demarcation of Highly Sensitive Zones within the coastal ecosystems using scientific criteria. The sensitivity thresholds, would aid in preparation of location-specific Conservation Management Plans.
- A Digital Architecture for hosting the spatial, ecological and health data of coastal ecologically sensitive areas has been developed to serve as a National Knowledge System on coastal ESAs.




### Recommendations

- Appropriate institutional mechanism has to be put in place for mapping the coastal ecosystems periodically and for assessing their ecological health
- Capacity building and strengthening institutional structure for the management of highly sensitive ecosystems are needed.
- The spatial, ecological and the socio-economic data on the coastal ecosystems need to be integrated for developing a decision support system to aid in evidence-based location-specific conservation planning by the coastal States and union territories.

Sustainable Lifestyle = Positive Climate Action  
www.indiaatcop22.org

For more information:  
National Centre for Sustainable Coastal Management,  
Ministry of Environment, Forest and Climate Change,  
Anna University Campus, Chennai, India





# TSUNAMI

## WHEN MINUTES COUNTS

INDIA3COP22  
FACTSHEET 12



### MAPPING OF FISHING SPACE



#### Purpose/Characteristics

- Implementation of decentralisation and participatory management of coastal fishing villages.
- Analysis of various capitals of fishing communities for strengthening and enhancing the capacity of fishermen.
- Integration of national, district, regional and local level plans with the local level in the village level.
- Empower the fishing community through administrative and development leadership.
- Identification of financial resources for infrastructure and welfare development through various schemes implemented by Government of India.
- Enumeration of poor/high fishermen villages.
- To support coastal States / UTs to map and prioritise common priorities and infrastructures in coastal fishing communities as guided in CRZ 2011 Notification.

Capacity development is key to protect financial health of coastal fishermen communities through better planning, participation and empowerment.



MAPPING OF FISHING SPACE IS A COLLECTIVE CHOICE FOR LIVELIHOOD DEVELOPMENT AND COMMON PROPERTY MANAGEMENT IN FISHING VILLAGES



#### Findings

- Prepared a guideline and resource manual for local level decentralised planning for fishing villages to address long term/collective needs in view of expansion of fishing communities and other infrastructures and to provide facilities for coastal fishing communities.
- Developed institutional mechanisms for participatory resource management.
- Development of database of fishing villages to analyse the fishermen capitals to enhance their capacity in participatory resource management.
- Develop long term and short term plans and maps for coastal fishermen villages to support local bodies.
- Development of coping systems and action plans to improve human capital of coastal fishing community.



#### Recommendations

- Decentralised planning exercises tested in fishing village of Tarni Modu. This will be tested again in Gujarat to replicate the fishing village planning exercises in all coastal states and union fishing villages.

Sustainable Lifestyle – Positive Climate Action  
www.india3cop22.org

For more information:  
National Centre for Sustainable Coastal Management,  
Ministry of Environment, Forest and Climate Change,  
Anna University Campus, Chennai, India.

