

## COASTAL SENSITIVITY MAPPING OF GULF OF KACHCHH AND GULF OF CAMBAY, INDIA

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**ABSTRACT:** In this study, two major Gulf regions (Gulf of Kachchh, Gulf of Cambay) along the west coast of India have been selected for their coastal sensitivity. These two gulf regions have the highest number of ports in the country which handle 20 % of India's cargo. There are many environmental problems associated with increased port development and maritime activity including tanker spills and accidents as well as sediment deposition on corals due to dredging activities. Gulf of Kachchh is very high sensitive and covers a wide range of ecosystems i.e. sandy beaches, mud and sand flats, rocky foreshore and, sea grass beds, salt marshes, mangroves, seabirds & fish. The area covered by mangroves at Kachchh area was estimated as 968.20 sq km whereas the tidal area was 1187 sq km. Intertidal biomass is very high at Vadinar and Sikka compared to Bedi and Okha. According to satellite data, the total reef area in the Gulf is 139.72 sq km. it has decreased from 217 sq km in 1975 to 139.7 sq km in 2011 which amounts to a net loss of 43%. Gulf of Cambay is also sensitive area to the oil spill. The total mangroves are found in 2 km buffer area along the gulf coast is 187.86 sq km. The Mudflats of Gulf have extended to the total area of about 1086.71 sq km include tidal flats and mudflats. There is a need of comprehensive contingency plan to protect the resources.

**Keywords:** Gulf of Kachchh, Gulf of Cambay, India, Environmental Sensitivity mapping, Oil spills.

### INTRODUCTION

Coastlines are under threat during oil spills because of its direct contact with oil when reaching the shoreline. Oil fate and impacts vary significantly depending on shoreline type and biological resources. There are also frequently human-use, economic, and aesthetic issues in coastal areas that must be considered as well. Environmental sensitivity index (ESI) maps are essential components of oil spill contingency planning that indicate substrates demanding specific clean-up actions and response options considering ecological, recreational and commercial concerns (NOAA, 2002). Since 1989, GIS techniques have been able to transform traditional paper maps into electronic ones. ESI maps that serve as quick references for oil-spill response teams and managers of coastal zones are also useful for identifying sensitive resources before a spill occurs (Jenson, 1998). In this way, protection priorities could be identified and established and cleanup strategies could be designed in advance. To deal with the oil spill problem in the coastal area, ESI maps are prepared as a guideline to contingency planning. These maps are prepared in advance of arrival of oil spill (Mani Murali, 2009). These maps are color coded in which color variation shows the respective vulnerability of coast. Ranking is normally given on the scale of 1 to 10, in that 10 are

given for the highly vulnerable coasts and 1 for less vulnerable.

### STUDY AREA

In the present study, we selected two major Gulfs which are along the west coast of India. They are Gulf of Kachchh (Fig 1a) and Gulf of Cambay (Fig 1b). These two gulfs region has the highest number of ports in the country i.e 41 and these ports handle 20 % of India's cargo. It is estimated that by the year 2015, cargo volumes at these ports will grow to about 400 mn ton i.e 39 % of the total nation's cargo. There are many environmental problems associated with increased port development and maritime activity including tanker spills and accidents as well as sediment deposition on corals due to dredging activities



**Fig 1a**

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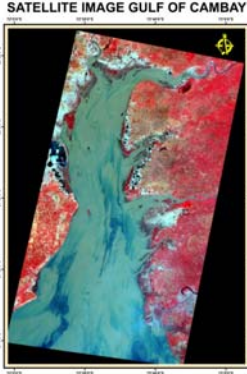


Fig 1b

Mudflats of Gulf have extended to the total area of about 1086.71 sq km.

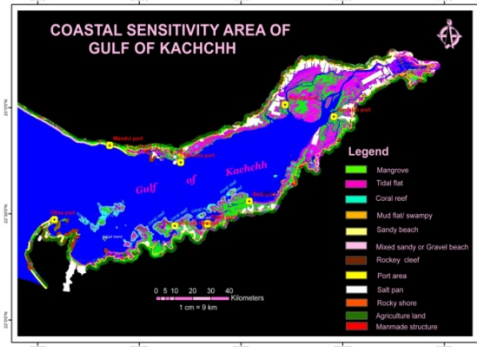


Fig 2a

## DATA AND METHODOLOGY

Remote Sensing has potential of taking synoptic view with high spatial resolution as it provides fast way of data collection and cheap with respect to field data collection. In the present study, satellite data of medium resolution alongwith topographic map was successfully applied in ESI mapping. Satellite images of IRS P6 sensor with 23.5 m resolution was used in this study. In the present study, the False Color Composite (FCC) was classified digitally by using unsupervised classification in ERDAS imagine software 9.1. Using different band combinations and proper filtering, many land use/ land cover classes were identified. The objective of digital image classification was to achieve pixel level classification.

## RESULTS AND DISCUSSION

As per this study, Gulf of Kachchh (GOK) is very high sensitive to the oil spills. Different species of mangrove is found in Gulf of Kachchh. The area covered by mangroves at Kachchh is estimated around 968.20 sq. km in 2011. The intertidal habitat of GOK (Fig 2a) covers a wide range of ecosystems such as sandy beaches, mud, sandy regions, rocky foreshore, sea grass beds, salt marshes and mangroves. The continuous wave action and associated littoral sediment transport make intertidal stretch a unique environment for biogenic activities of organisms in this region. GOK sustains a rich and highly bio-diversified intertidal flora and fauna. The total tidal area in the Gulf of Kachchh is 1187 sq km. The total area of 2km buffer from the coast in Gulf of Cambay (GOC) is 3123.17sq km (Fig 2b). The coast around this gulf is identified by estuaries and consists of extensive mudflats. The total mangroves are found in 2 km buffer area along the gulf coast is 187.86 sq km. The

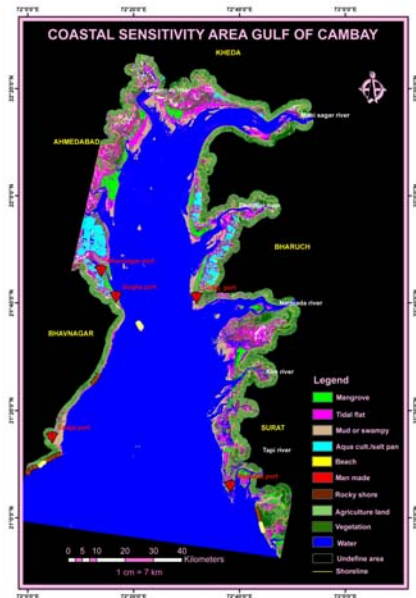


Fig 2b

## CONCLUSION

This study is first of its kind in this region to have an integrated approach using remote sensing and GIS which gives a close look at the sensitivity of the west coast gulf regions to oil spills. This research focuses on improving information about coastal environment mapping from remote sensing and GIS technology to generate maps of environmental sensitivity index for oil spill in Gulf of Kachchh and Gulf of Cambay by using different techniques of digital image processing. This study demonstrates the use of GIS approach to identify the area and resources that are likely to be affected due to an oil spill in the study area. Qualitative assessment of risk to resources in the study area was also carried out. It was found that the Gulf of Kachchh is very high sensitive and covers a wide range

of ecosystems i.e. sandy beaches, mud and sand flats, rocky foreshore and, sea grass beds, salt marshes, mangroves, seabirds & fish. The area covered by mangroves at Kachchh area was estimated as 968.20 sq km whereas the tidal area was 1187 sq km. Intertidal biomass is very high at Vadinar and Sikka compared to Bedi and Okha. According to satellite data, the total reef area in the Gulf is 139.72 sq km. it has decreased from 217 sq km in 1975 to 139.7 sq km in 2011 which amounts to a net loss of 43%. Gulf of Cambay is also sensitive area to the oil spill. The total mangroves are found in 2 km buffer area along the gulf coast is 187.86 sq km. The Mudflats of Gulf have extended to the total area of about 1086.71 sq km include tidal flats and mudflats. There is a need of comprehensive contingency plan to protect the resources. The results are useful for both industry and government agencies, which require specific information on the impact of a spill incident to comply with the stringent regulations.

#### **ACKNOWLEDGEMENTS**

Authors acknowledge the Director, NIO for providing the facilities to carry out this work.

#### **REFERENCES**

- Jensen, J. R., Halls, J. N., & Michel, J. (1998). A Systems Approach to Environmental Sensitivity index (ESI) Mapping for Oil Spill Contingency Planning and Response. *Photogrammetric Engineering & Remote Sensing*, 64(10), 1003-1014.
- Mani Murali, R., Rohan kumar. Mapping of environmental sensitivity index (ESI) for the oil spills at Goa coast, India, *Proceedings of Geomatrix 09, CSRE IIT Bombay*, (2009).
- NOAA Technical Memorandum NOS, OR&R 11, 2002, *Environmental Sensitivity Index Guideline version-3*.