**BEFORE THE NATIONAL GREEN TRIBUNAL (SZ), CHENNAI**

**O.A. 136 of 2024**

Saravanan …Applicant

Vs.

Commissioner of Fisheries and Fishermen Welfare and Ors.

…Respondents

**TYPED SET FILED BY THE APPLICANT**

| S.No. | Date | Particulars | Page No. |
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| 1. | May 2016 | Relevant extracts of "Comprehensive Shoreline Protection Management Plan For Entire Tamil Nadu Coast" - Report Submitted to Department of Environment Government of Tamil Nadu by Department of Ocean Engineering, IIT Madras | 01-13 |
| 2. | March 2022 | Relevant Extracts of "National Assessment of Shoreline along Indian Coast" by NCCR | 14-27 |
| 3. | May 2022 | Relevant Extracts of "Coastal Structures along Tamil Nadu and Puducherry beach" by NCCR | 28-33 |

Dated on this the 1st day of October, 2024

(1421/2011)

Counsel for the Applicant

# COMPREHENSIVE SHORELINE PROTECTION MANAGEMENT PLAN FOR ENTIRE TAMILNADU COAST



Report submitted to

**Department of Environment**

**Government of Tamil Nadu**

**By**

**Prof. V. Sundar**

**Prof. S.A. Sannasiraj**

Department of Ocean Engineering

Indian Institute of Technology, Madras

May 2016

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 69 | 8° 6'19.22"N | 77°24'32.02"E | 0.14 | 2.26 | 0.54 | 4.67 | 0 |
| 70 | 8° 7'55.02"N | 77°18'22.84"E | 0.07 | 3.58 | 0.3 | 6.12 | 0 |
| 71 | 8°15'14.47"N | 77° 9'7.82"E | 0.29 | 4.56 | 0.19 | 9.09 | 0 |
| 72 | 8°17'16.96"N | 77° 6'44.78"E | 0.14 | 3.94 | 0 | 0 | 0 |
| 73 | 8°17'14.41"N | 77° 6'21.71"E | 0.12 | 3.34 | 0.01 | 0.23 | 0 |
| | | | **17.19** | **281.56** | **42.64** | **514.11** | **29.25** |

**Table 2.2 Vulnerable reaches of Tamilnadu**

| S. No | Location (Village/Taluk/District) | Latitude/Longitude | | Length (m) |
|---|---|---|---|---|
| | | From | To | |
| 1 | Royapuram fishing Harbour to Ennore (near Kosasthalayar estuary/Chennai & Thiruvallur Districts. | 13° 13'50.28" N 80° 19'53.04" E | 13° 13'50.28" N 80° 19'53.04" E | 12500 |
| 2 | Foreshore Estate, Chennai District. | 13° 02'14.40" N 80° 16'49.32" E | 13° 00'58.92" N 80° 16'39.60" E | 3000 |
| 3 | Mahabalipuram, Kancheepuram District. | 12° 38'30.48" N 80° 12'16.92" E | 12° 36'57.06" N 80° 11'58.02" E | 2730 |
| 4 | Kalpakkam (Sadras) to Oyyaiikuppam villagc, Kancheepuram District. | 12° 37'1.2" N 80° 11'57.78" E | 12° 29'12" N 80° 09'29.4" E | 3000 |
| 5 | Chinnakuppam | 12° 26'54.8" N 80° 08'37.4" E | 12° 26'58.26" N 80° 08'50.31" E | 650 |
| 6 | Devanampattinam Village/Cuddalore District. | 11° 44'40.40" N 79° 47'16.60" E | - | 420 |
| 7 | Thazhanguda Village/Cuddalore District. | 11° 46'08.10" N 79° 47'37.40" E | - | 1570 |
| 8 | Suba Uppalavadi Village/Cuddalore District. | 11° 47'10.40" N 79° 47'40.40" E | - | 210 |
| 9 | Devanampattinam Village/Cuddalore District. | 11° 44'40.40" N 79° 47'16.60" E | - | 550 |
| 10 | Thazhanguda Village/Cuddalore District. | 11° 46'08.10" N 79° 47'37.40" E | - | 800 |
| 11 | Suba Uppalavadi Village/Cuddalore District. | 11° 47'10.40" N 79° 47'40.40" E | - | 450 |
| 12 | Devanampattinam Village/Cuddalore District. | 11° 44'40.40" N 79° 47'18.60" E | - | 800 |
| 13 | Thazhanguda | 11° 46'08.10" N | - | 800 |

***Kovalam (12$^0$ 58' N, 80$^0$ 16'E) to Cuddalore. (11$^0$ 43' N, 79$^0$47'E)***

Thetotal length of coastline along this stretch is about 115km and oriented at 14° to the north. Most of the waves approach the coast from south east direction. The beach slope in this stretch up to 4*m* depth is nearly 1:125 along Kovalam, 1:100 along Mahabalipuram coast. Three observation stations one each at Kovalam, Mahabalipuram and Cuddalore were considered, of which, Kovalam had 21 points covering a distance of 3150m, Mahabalipuram 26 points covering 5450m and Cuddalore 6 points covering a distance of 1718m. The coast of Kovalam is dominated by rock outcrops and jets into the ocean as a headland. Hence the discussion is based the behaviour of the beach width on south and north of this headland. The satellite imagery of this stretch of the coast is also discussed later in this part of the report. Erosion to an extent of about 20m on north side and accretion of about 30m on its south side are observed as can be seen in **Figs 3.4a** and**3.4b** respectively. This shows that natural obstructions also serve as littoral barriers leading to advancement of shoreline on its south anderosion on its north.

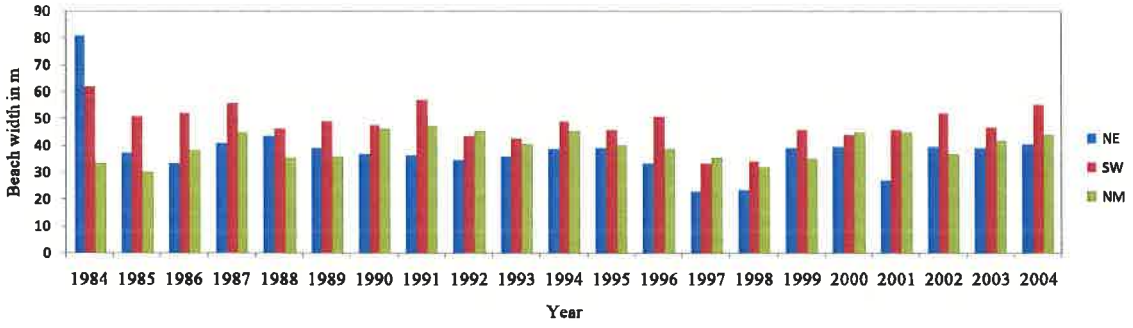



**Fig 3.4aBeach width changes along Kovalam (north) coast**

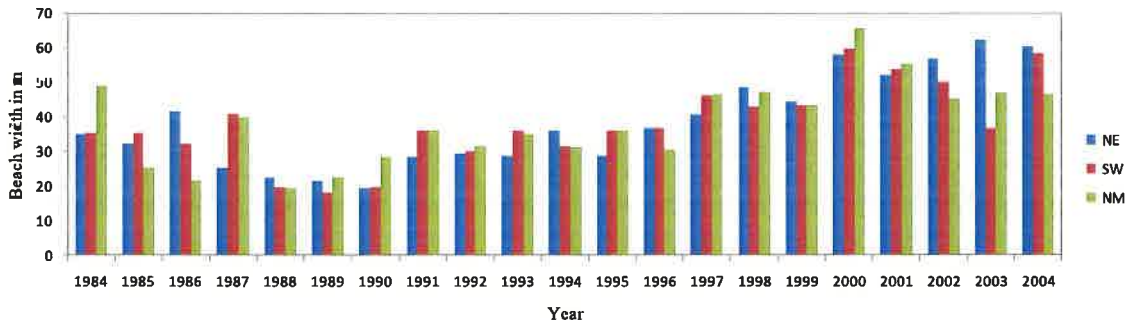



**Fig 3.4b Beach width changes along Kovalam (south) coast**

Along the coast of Mahabalipuram, a shore temple remains as a main tourist attraction. This temple was initially partly eroded and had been facing a severe threat from the onslaught of waves and resulting erosion. Hence, anti-sea erosion measures on a war footing was done in the mid 80's. The protection measure initially planned as two groins were joined which formed as a headland, the imagery of which is discussed. The measurements of the crest of berm elevation for about 20 years were undertaken. The season wise variations of the above parameter north and south of the mahabalipuram shore temple are shown in **Figs. 3.4c** and**3.4d** respectively. The results again demonstrate that the remedial measure jetting into the ocean has been serving as a littoral barrier leading to the advancement of the shoreline on its south and erosion on its north. The analysis of data indicates accretion of about 40m on southern side and erosion of about 20m on northern side.

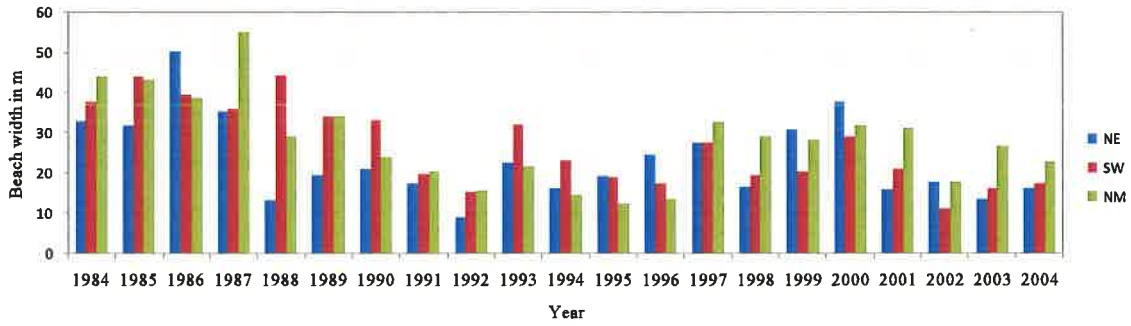



**Fig3.4c Beach width changes along Mahabalipuram (north) coast**

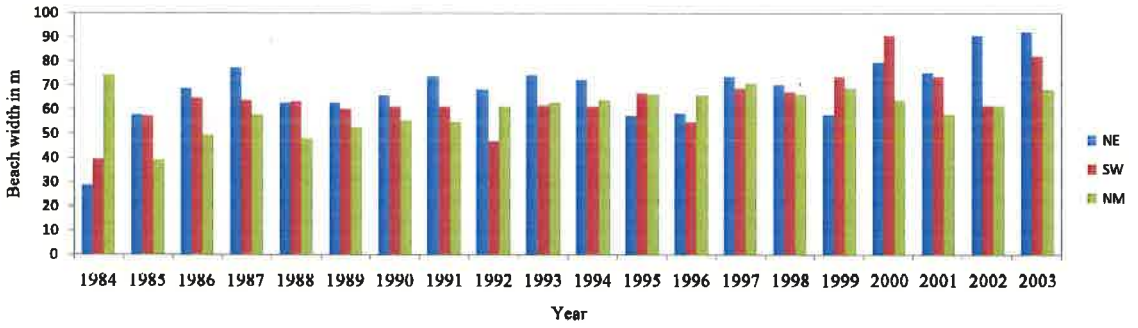



**Fig 3.4d Beach width changes along Mahabalipuram (south) coast**

Along the coast of Cuddalore two rivers join together in to Bay of Bengal. At the confluence region near the mouth of the rivers, a pair of training walls is constructed to facilitate smooth manoeuvring of vessels to the harbour located inside the river. The southern and northern training walls are 152m and 236m long respectively. The data available only at three points of observations covering a distance of about 180m on the south of the southern training wall were taken up for analysis, the results of which are projected in **Fig. 3.4d** . The results show the trapping of the sediments by the southern training wall and although observation points are not available on the north of the northern training wall, enough evidence is available to show thc crosion of the shoreline, for example through satellite imagery discussed later.

***Poompuhar ($11^0$ 13'N, $79^0$52'E) to Point calimere ($10^0$ 17'N, $79^0$ 53'E)***

Thetotal length of coastline along this stretch is about 115km and oriented at almost 180° to the north. The beach slope in this stretch up to 10*m* depth is nearly 1:150 along Poompuhar, 1:450 along Nagapattinam near Velankanni. Data from four observation stations one each at Poompuhar, Tranquebar, Nagapattinam and Velankanni were available. Of this Poompuhar has 6 points covering a distance of 1550m. River Cauvery joins Bay of Bengal as a small stream at the northern end of this stretch. The river mouth is mostly closed during fair season**Fig 3.5a** Beach width changes along Cuddalore coastand gets opened during flood season indicating the dominance of alongshore transport during fair season forming sand bar. The average of the crest of berm elevations from the six observed points all of which are on the south of the mouth of the river measured from 1982 to 2000 has been plotted in **Fig.3.5b**. Except for a few oscillations during early 90's, the trend is observed to be advancement of the shoreline.

## 3.5 SUMMARY

The shoreline analysis based on the Google earth imageries are compared with SAC and PWD data set and presented in **Table 3.1**.

**Table 3.1 Summarization of the status of the Tamilnadu coastline over the years**

| Places | Latitude | Longitude | PWD (1978-2004) | SAC (1989-2004) | IIT (2004-2015) |
|---|---|---|---|---|---|
| Ennore to Royapuram coast | 13°12'49.69"N to 13° 3'53.56"N | 80°19'31.09"E to 80°17'16.81"E | Erosion | Erosion | Accretion/stable |
| Marina | 13° 3'19.14"N | 80°17'3.70"E | Accretion/stable | Accretion/stable | Accretion/stable |
| Foreshore estate | 13° 1'27.10"N | 80°16'43.84"E | Accretion/stable | Accretion/stable | Accretion/stable |
| Kovalam | 12°47'25.18"N | 80°15'8.33"E | Erosion | Erosion | Erosion |
| Mahabalipuram | 12°37'8.99"N | 80°11'54.53"E | Erosion | Erosion | Erosion/stable |
| Cuddalore | 11°44'23.32"N | 79°47'13.64"E | Accretion/stable | Erosion | Erosion |
| Poompuhar | 11° 9'34.14"N | 79°51'21.96"E | Erosion | Erosion | Erosion |
| Tranque bar | 11° 1'43.26"N | 79°51'20.96"E | Erosion | Erosion/stable | Erosion/stable |
| Nagapattinam | 10°44'50.99"N | 79°51'3.64"E | Erosion/stable | Accretion/stable | Erosion |
| Velankanni | 10°40'29.30"N | 79°51'11.81"E | Erosion | Accretion/stable | Erosion |
| Point Calimere | 10°17'45.45"N | 79°52'37.35"E | Accretion/stable | Accretion/stable | Accretion/stable |
| Ammapattinam | 10° 0'49.21"N | 79°13'54.33"E | Accretion/stable | Accretion/stable | Accretion/stable |
| Rameswaram | 9°17' N | 79° 19' E | Erosion | Erosion/stable | Erosion |
| Keelakarai | 9°13'40.26"N | 78°47'10.14"E | Erosion/stable | Erosion/stable | Erosion/stable |
| Tiruchendur | 8°29'40.89"N | 78° 7'42.95"E | Erosion/stable | Accretion/stable | Erosion/stable |
| Manappad | 8°22'16.79"N | 78° 3'48.76"E | Accretion/stable | Accretion/stable | Accretion/stable |
| Manakkudi | 8° 5'23.58"N | 77°28'40.51"E | Accretion/stable | Accretion/stable | Erosion |
| Pallam | 8° 5'53.60"N | 77°25'58.59"E | Erosion/stable | Accretion/stable | Accretion/stable |
| Muttom | 8° 7'26.60"N | 77°18'50.65"E | Accretion/stable | Accretion/stable | Accretion/stable |
| Manavalakurichi | 8° 8'44.64"N | 77°18'3.11"E | Erosion/stable | Erosion/stable | Erosion |
| Colachel | 8°10'21.16"N | 77°15'16.54"E | Erosion/stable | Erosion/stable | Accretion/stable |
| Midalam | 8°12'10.76"N | 77°12'50.36"E | Erosion/stable | Erosion/stable | Erosion |
| Erayumanthurai | 8°14'37.48"N | 77° 9'47.83"E | Erosion/stable | Erosion/stable | Erosion |

**Fig.7.8**Comparison of Thane wave characteristics with Predicted wave characteristics of up-scaled winds of Thane to super cyclone of 1999 at off Chennai coast

**Points to be considered during field measurements**

During Thane cyclone, all the data buoys installed from Pudhucherri (11.87 N, 79.84 E) to Ennore (13.25N, 80.35E) had failed. The one installed in 20m water depth at the north Chennai groin field by ICMAM has survived and they made direct relay of the field data in their official website during the occurrence of Thane cyclone.

**This suggests that in order to capture extreme wave characteristics in particular during cyclones, it would be preferable to install wave rider buoys around 20m water depth on the east coast of India.**

## 7.3 CONCEPTUAL SOLUTIONS

The coast of Tamilnadu was visited and a general survey was carried out by Prof. V.Sundar, Department of Ocean engineering, I.I.T.Madras during Feb-March 2005 in order to assess the vulnerable areas being affected by the perennial problem of erosion along with the consideration of the effect of the tsunami 2004 and a detailed report have been submitted to Public works department, Govt of Tamil Nadu. The coastal region of the state is divided into three stretches namely, Chennai, Madurai and Trichy, accordingly the suitable conceptual protection measures for each of the regions are given as projected in **Table.7.4.**

**Table. 7.4** Summary of the protection measures for Tamil Nadu coast

| Name of the location | Name of the Region | Solution | Priority / Ranking |
|---|---|---|---|
| Kaatupallikuppam | Chennai | Plantations & Nourishment | ** |
| Ennore creek | Chennai | Groins | *** |
| Ennore – Ernavoorkuppam | Chennai | Groin field | *** |
| Masthankoilkupam | Chennai | Replenishment of Existing seawall | *** |
| North of Royapuram fishing harbor | Chennai | Replenishment of Existing seawall | ** |
| Cooum River | Chennai | Training walls | ** |
| Adyar river | Chennai | Dredging + plantations | * |
| Besant Nagar | Chennai | No intervention | |
| Kovalam | Chennai | Plantations | ** |
| Devaneri | Chennai | Seawall | *** |

| | | | |
|---|---|---|---|
| Mammalapuram | Chennai | Plantations | * |
| Meyyurkuppam | Chennai | Groin field + Seawall | *** |
| Oyyalikuppam | Chennai | Groin field | *** |
| Chinnakuppam | Chennai | Training walls | ** |
| Sodhanaikuppam | Chennai | Groin field | ** |
| Thanthiriyankuppam | Chennai | Groin field + plantations | ** |
| Mudaliarkuppam | Chennai | Plantations | * |
| Thazhanguda to Devanampattinam | Chennai | Training walls + Groin field + Seawall | *** |
| Singarathoppu | Chennai | Shifting of Dwelling units + Plantations | *** |
| Pudukuppam, Parangipettai | Chennai | Buffer blocks + plantations | ** |
| Neerodi to Erayumanthurai | Madurai | Groin field | * |
| Enayam to Muttam | Madurai | Groin field | ** |
| Vaniyakudi | Madurai | Groin | * |
| Colachel jetty | Madurai | Pair of Groins | *** |
| Kottilpadu | Madurai | Seawall + plantations | *** |
| Kadiyapattanam | Madurai | Training walls | * |
| Keezhamuttam | Madurai | Replenishment of Existing seawall | * |
| Pozhikarai to MezhaManakudithurai | Madurai | Groin field | *** |
| Keezhamanakudithurai | Madurai | Groin field + Training walls | *** |
| Ratchagar street | Madurai | Extension of existing groins | * |
| Vaavuthurai | Madurai | Seawall | * |
| Kootupuli | Madurai | No intervention | - |
| Perumanal | Madurai | No intervention | - |
| Idinthakarai | Madurai | Groin field | *** |
| Koothankuli | Madurai | Pair of groins | ** |
| Aalanthalai | Madurai | Groin field | *** |
| Punnakayal | Madurai | Training walls | ** |
| Threspuram | Madurai | Pair of groins | *** |
| Devipattanam to Nambuthalai | Madurai | Plantations + monitoring of coastline | * |
| Nagoor to Keechankuppam | Trichy | Training walls + T-shaped groin field | *** |
| Velankanni | Trichy | Dredging + Nourishment + plantaions+ Buffer blocks | *** |
| Vellapallam | Trichy | Training walls | * |
| Tharangampadi | Trichy | Replenishment of existing groins + groin | *** |

# CHAPTER 8

# ECOLOGICALLY SENSITIVE AREAS

## 8.1 GENERAL

A coastal eco-system usually consist of salt marshes, mangroves, wetlands, estuaries, reefs, and bays linked glued to physical, chemical, and biological interchanges above and below the water. A coastal eco-system is usually rich in nutrients, highly productive, and serves as a natural intersection between the human and natural world. Preserving a coastal ecosystem although, difficult is very essential, as it provides a broad range of benefits to humans. They even at certain locations serve as buffers against the ingress due to storms and also as water filters. They are breeding grounds for a variety of habitats for commercially important plants and animals. They are among the most popular tourist destinations at certain locations. The coastal eco-systems are quite sensitive to changes to environmental conditions, such as changes in temperature, salinity, nutrient availability, or sediment load many times leading to adverse impacts. The changes aforesaid could be due to nature or man-made.

**Effect of shoreline change on turtle nesting site**

Increase in sea level leading to coastal inundation and coastal erosion will result in a reduction in the area of nesting for the turtles and in particular the female turtles are believed to abandon nesting. This may be due to inaccessibility, lighting and disturbances during nesting, vegetation clearing and erosion of sand and hence the coast become unfavorable in cases where nesting had taken place, and also there are chances for the nests to be washed away during the high tide. This is quite serious in preserving the neutrality of the coast. In such locations hard measures could be avoided as far as possible and soft measures only if deemed necessary could preferably be of submerged type. The solutions however, will be site specific.

The usually adopted rubble mound sea walls if laid along the nesting beaches can serve as a hindrance and would prevent the sea turtles from continuing their life cycles. Rubble mound structures directly threaten sea turtles by reducing or degrading suitable nesting habitat. Beach nourishment may have negative impacts on the sea turtle nesting if the sand is too compacted for turtles to nest in or if the sand imported is drastically different from native beach sediments, thereby potentially affecting nest-site selection, digging behavior,

incubation temperature and the moisture content of nests. Due to the above facts it is extremely difficult to protect such stretches of the coast. This needs a careful in-depth studies with 'do nothing' being the first option.

**Effect of shoreline change on mangroves**

Sea level rise will lead to retreat of mangrove vegetation towards land. The mangrove margin migrates landward due to stresses caused by a rising sea-level such as erosion resulting in weakened root structures and falling of trees, increased salinity, and too high a duration, frequency, and depth of inundation [Gilman et al (2007)]. Mangroves are functionally linked to neighboring coastal ecosystems, including sea grass beds, coral reefs, and upland habitat, although the functional links are not fully understood and henceforth all other ecosystem will also be affected once the mangroves get affected and vice versa. If the mangrove retreat towards land is not in pace with sea level rise, the mangrove area will start to reduce more rapidly than expected due to the above mentioned stresses.

**Effect of shoreline change on Seagrass**

In general, seagrass beds are intolerant of any activity that changes the sediment regime when the change is greater than the natural variation. The rise in sea level may have numerous implications for circulation, tidal amplitude, current and salinity regimes, coastal erosion and water turbidity, each of which could have major negative impacts on local seagrass performance. Sediment disturbance, siltation, erosion and turbidity resulting from coastal engineering have also been implicated in the decline of seagrass beds worldwide (Carlos M. Duarte et al 2004). Consequent impact on seagrass due the changes undergone by mangroves due to their functional link in the coastal ecosystem. Seagrass and tidal freshwater plants will be redistributed from existing habitats, including expanding inland. Increased water depth will reduce the amount of light reaching underwater seagrasses, directly reducing productivity of the affected plants.

**Effect of shoreline change on mudflats and sand dunes**

This type of coast consists of unconsolidated material, mainly sand, some pebbles and shells; it can be classified as a soft coast. It has a gentle seaward slope — known as dissipative beaches that have broad fine sand and gradually steep slopes at the backshore/foredunes. Its profile depends on wave form and energy and wind direction; hence, profiles can be adjusted to provide the most efficient means of dissipating incoming wave energy. This type of coast experiences short-term fluctuation or cyclic erosion — accretion and long-term assessment is needed to identify erosion as a problem here. Often accretion and dune rebuilding take much

longer than erosional events and the beach has insufficient time to rebuild before the next erosive event occurs. Erosional features are a lowered beach face slope and the absence of a nearshore bar, berm and erosional scarps along the foredunes. Generally, erosion is a problem when the sand dunes completely lose their vegetation cover that traps wind-borne sediment during rebuilding, improves slope stability and consolidates the sand.

Ecologically sensitive area is the one, needs special protection because of its landscape, wildlife, special kind of eco-system or historical value. Coastal zone is a dynamic area with many cyclic processes owing to a variety of resources and habitats. Coastal plains and seas include the most taxonomically rich and productive ecosystems on the earth. Mangroves forests are over 20 times more productive than the average open ocean. Estuaries, salt marshes and coral reefs are 5 to 15 times higher. These enhanced rates of primary production result in an abundance of other life forms including species of commercial importance. Although occupying only 8% of the total surface, ecologically important areas account for 20-25% of global plant growth. (Ramesh et al 2008). The ecologically sensitive areas are included under CRZ-I, where no activity is allowed. The ecologically sensitive areas along the Tamilnadu coast are,

- Pulicat lake
- Pichavaram
- Vedaranyam, Muthupettai
- Palk Bay
- Gulf of Mannar

## 8.2 PULICAT LAKE

Pulicat lagoon, also called as lake of the Palar Basin, is the second largest lagoon on the east coast of India. The Pulicat lake is situated between 13°20' and 13°40'N lat. and 80°14' to 80°15'E **(as shown in Fig.8.1)** long with its narrow (1–1.5 km) opening into the Bay of Bengal through the south-eastern margin near the Pulicat town which is 70 km north of Chennai.

Pulicat Lake is one of the good productive ecosystems in India. Several researchers have been reported the biodiversity details from this area. Chacko*et al.* (1953) have given the first exhaustive account of the biodiversity of the Pulicat Lake and it has been classical benchmark for the biodiversity of the Pulicat Lake for a long time (Sanjeeva Raj, 1997, 2003, 2006).

# CHAPTER 10

# COASTAL SURVEY

## 10.1 GENERAL

Although the vulnerable locations, i.e., zones of perennial erosion, river mouth closures, need for preserving flora and fauna, ports and harbours, etc can be derived to a certain degree of accuracy, a coastal survey at least with minimum instruments to assess the ongoing stability of the shoreline, activities along the coast, the probable impact of future activities on the adjoining shoreline, its behaviour during extreme events will be very important for an effective SPMP. In this chapter, the details of such an exercise carried out during Jan and Feb 2016 are presented and discussed in part1, whereas, part 2 provides the results from the analysis of beach profiles taken over the past few years.

## 10.2 MEASUREMENT AND ANALYSIS OF BEACH PROFILES

The measurement and analysis of the beach profiles and sediment grain size at the vulnerable locations based on the coastal survey during mid-Jan 2016 to Feb 2016 are discussed in this **part.**

***Ernavur ( Nettukuppam 13°13'42.40"N80°19'50.12"E)***

The stretch of the coast of Nettukuppam is shown in **Fig.10.1a.** A clear view of the northern region of Nettukuppam that is continued as a seawall on the sea front is shown in **Fig.10.1b.** The conventional seawall to be given due to densely populated region. The conventional seawall with a crest elevation of +5.2m is recommended to avoid storm-surge overtopping when the surge occurrence coincides with high tide, the overtopping and erosion leading the damage to the seawall could be high. Erosion in Nettukuppam is shown in **Fig.10.1c.**

**Solution suggested:** *A groin field designed through detailed scientific studies with existing bathymetry and shoreline morphology would serve the purpose. The existing seawall needs a careful examination and at locations of distress, it has to be rehabilitated.*

***Kovalam(12°47'24.9"N 80°15'12.1"E)***

The stretch of the coast off Kovalam is shown in **Fig. 10.3a**.A bay like formation, from north of the above location has formed and this formation as per the local public appears to be eroding since 2007 at a rate of about 5m/year. This bay formation is likely due to the outcrops on its south acting as a natural littoral barrier. As regard to the coastal protection, it is suggested to tame the waves and thc scdimcnt transport by providing groins as tentatively shown in the above figure. The solution suggested can proveto serve as an efficient coastal protection as well as allow the local fishermen to use the bay on the legsideto the southern groin as a mini harbour. A perfect road is also available up to this beach, which may be quite suitable for the development of a fish landing centre and also prevent further coastal erosion. However, this needs further assessment as regard to thc Cost – Bcncfit analysis. A dctailcd numerical modelling is absolutely essential to conclude the protection measure.

Sediment samples have been collected along the beach, thc rcsults from thc sicvc analysis is shown in **Fig.10.3b**, whereas, the variation of the beach slope along this stretch of the coast is shown in **Fig. 10.3c.**

**Solution suggested:** *A field of short groins designed through detailed scientific studies with existing bathymetry and shoreline morphology would serve the purpose. It is recommended to provide a pair of training walls for training the mouth of Mutukadu backwater.*

**Fig.10.3a**Beach profile Left (North) of yellow temple

सत्यमेव जयते

Government of India

Ministry of Earth Sciences

**National Centre for Coastal Research**

# National Shoreline Assessment System (N-SAS)

https://www.nccr.gov.in/NSAS/#

## National Assessment of Shoreline Changes along Indian Coast

**Volume 1 - East Coast**

March 2022

# Executive Summary

Coastal erosion is considered as one of the significant threatening hazards faced by the global countries, especially to the coastal populations for their livelihood. With the increasing trend of coastal population and rapid developmental activities along the shore, there is a need for prominent and precise information about the rate and trend of coastal erosion in the past and the present states. Therefore, a comprehensive analysis of shoreline change, which varies from one coastal region to another, is necessary for the appropriate coastal protection and management measures needed in the near future.

The National Centre for Coastal Research (NCCR) has carried out a study on shoreline changes along the mainland of Indian coast under the project entitled "Coastal Processes and Shoreline Management Group (CPSM)". One of the significant purposes of this work is to develop a standard, dependable methods for mapping and analysing shoreline changes with frequent periodic updates on shoreline conditions, coastal erosion hotspots, etc., can be prepared for the Indian coast. Morphology of the coast varies from place to place, hence different proxies (wet/dry line in sandy shore, seaward facing vegetative line, seashore-facing direction of seawall, cliff-base or seaward facing edge of rocky coast) were used to estimate the shoreline change analysis along the Indian coast. A summary of Atlas on shoreline change entitled "National Assessment of Shoreline changes along Indian Coast - A status report for 26 years 1990-2016" was published on MoES foundation day on 27th July 2018. This report is an accompaniment to the summary of Atlas on shoreline change. This report interprets the results, provides information on shoreline changes for the 28 years (1990 to 2018), short-term (1990-2000, 2000-2006, 2006-2012 & 2012-2018. The Indian mainland coastal states were analysed separately in a state-wise manner and documented into different volumes to report the regional trends in shoreline change for different periods. About 6907.18 km long shoreline (in 1:25000 scale) distributed among nine coastal states and two union territories was analysed for the period 1990-2018 to estimate the shoreline change i.e., erosion, accretion and stable. Coastal erosion has become one of the most alarming threats in varying pockets along the Indian coast. Shoreline length used in the analysis is the shore face length (excluding the interior parts of river / creeks) obtained from Resources at-2, LISS-IV satellite data (by zooming in 1: 15000 scales). The shoreline analysis suggests that 33.6% of coast is eroding, 26.9% is accreting and 39.5% is in stable state.

The state wise analysis suggests that the more than 40% of erosion is noticed in 3 states/UT i.e. West Bengal (60.5%), Tamil Nadu (42.2%), Kerala (46%) and Pondicherry (56.2%) coast. While accretion is exceeding to 40% along Odisha (51%) and Andhra Pradesh (49.6%) coast. About 526 maps are prepared for entire Indian coast for identifying the vulnerable coastal areas in 1:25000 scale along with 66 district maps, 9 states / 2 UT maps. These maps shall be updated regularly as a part of N-SAS in coastal processes and shoreline management program. The project is aimed to generate the systematic information on coastal changes at various temporal scales, its nature, and extent, needed to evolve better management solutions.

# HOTSPOTS REGIONS IN EAST COAST

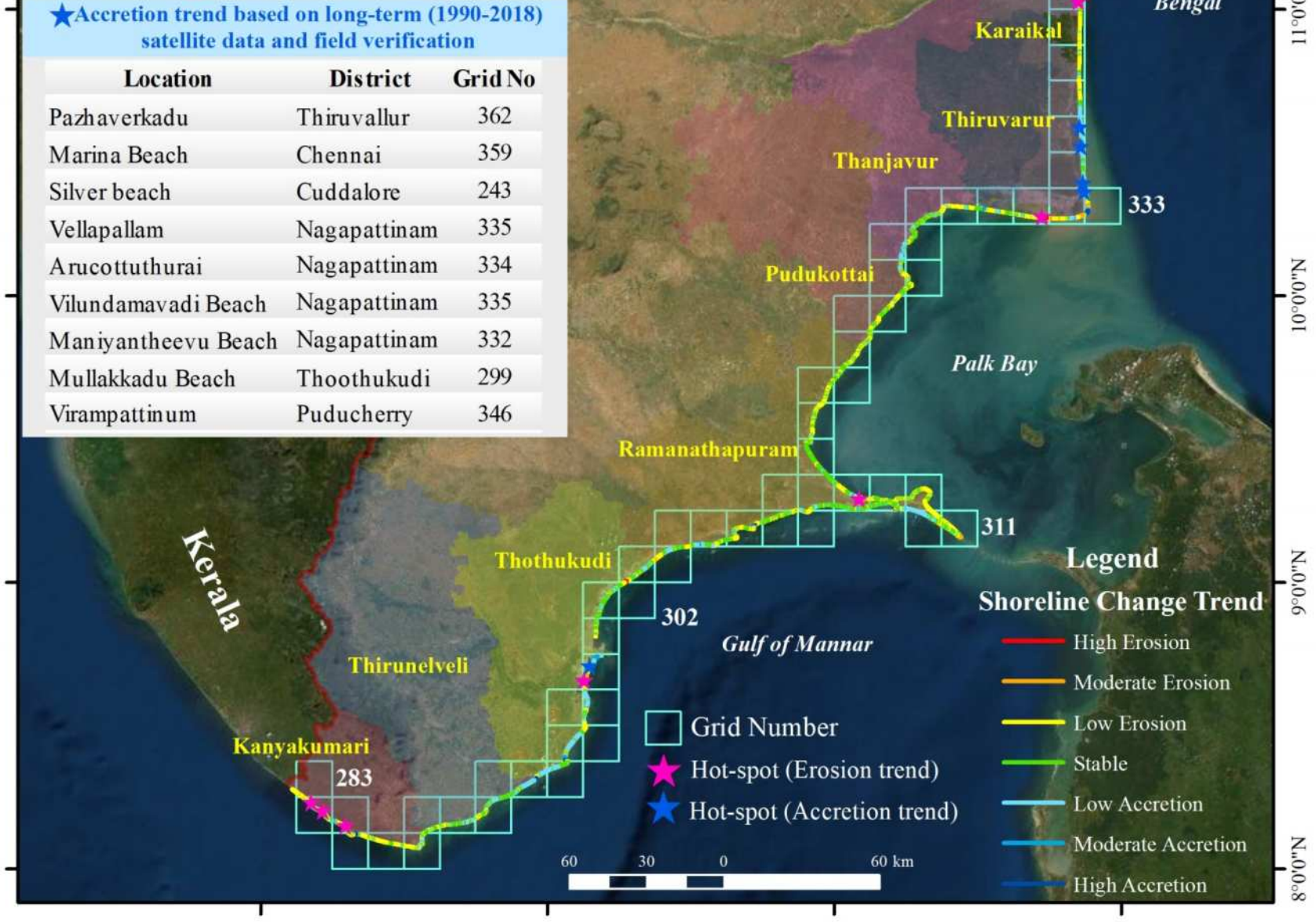
## Tamil Nadu

★ Erosion trend based on long-term (1990-2018) satellite data and field verification

| Locations | District | Grid No |
|---|---|---|
| Kattupalli Port North | Thiruvallur | 361 |
| Chinnakuppam | Thiruvallur | 360 |
| Pulicat north | Thiruvallur | 363 |
| Periyakuppam | Thiruvallur | 360 |
| Kasikovil kuppam | Thiruvallur | 360 |
| Periyakuppam | Kancheepuram | 353 |
| Chinnakuppam | Kancheepuram | 353 |
| Oyalikuppam | Kancheepuram | 353 |
| Chinna Mudaliyarchavadi | Villupuram | 346 |
| Periya Mudaliyarchavadi | Villupuram | 346 |
| Madavamedu Beach | Nagapattinam | 341 |
| Kodiampalayam beach | Nagapattinam | 342 |
| Chinnamedu | Nagapattinam | 339 |
| Tarangambadi | Nagapattinam | 339 |
| North of Poombhuhar port | Nagapattinam | 340 |
| Mannaram island, Kodiyakadu | Thiruvarur | 331 |
| Ariyamaan Beach, Uchipuli | Ramanathapuram | 314 |
| Agni Theertham Beach, Palayakkayal | Thoothukudi | 299 |
| Thengapattanam | Kanniyakumari | 284 |
| Midalam | Kanniyakumari | 284 |
| Pillayarkovil | Kanniyakumari | 285 |
| Bommaiyarpalaiyam | Puducherry | 346 |

★Accretion trend based on long-term (1990-2018) satellite data and field verification

| Location | District | Grid No |
|---|---|---|
| Pazhaverkadu | Thiruvallur | 362 |
| Marina Beach | Chennai | 359 |
| Silver beach | Cuddalore | 243 |
| Vellapallam | Nagapattinam | 335 |
| Arucottuthurai | Nagapattinam | 334 |
| Vilundamavadi Beach | Nagapattinam | 335 |
| Maniyantheevu Beach | Nagapattinam | 332 |
| Mullakkadu Beach | Thoothukudi | 299 |
| Virampattinum | Puducherry | 346 |



1990 - 2018

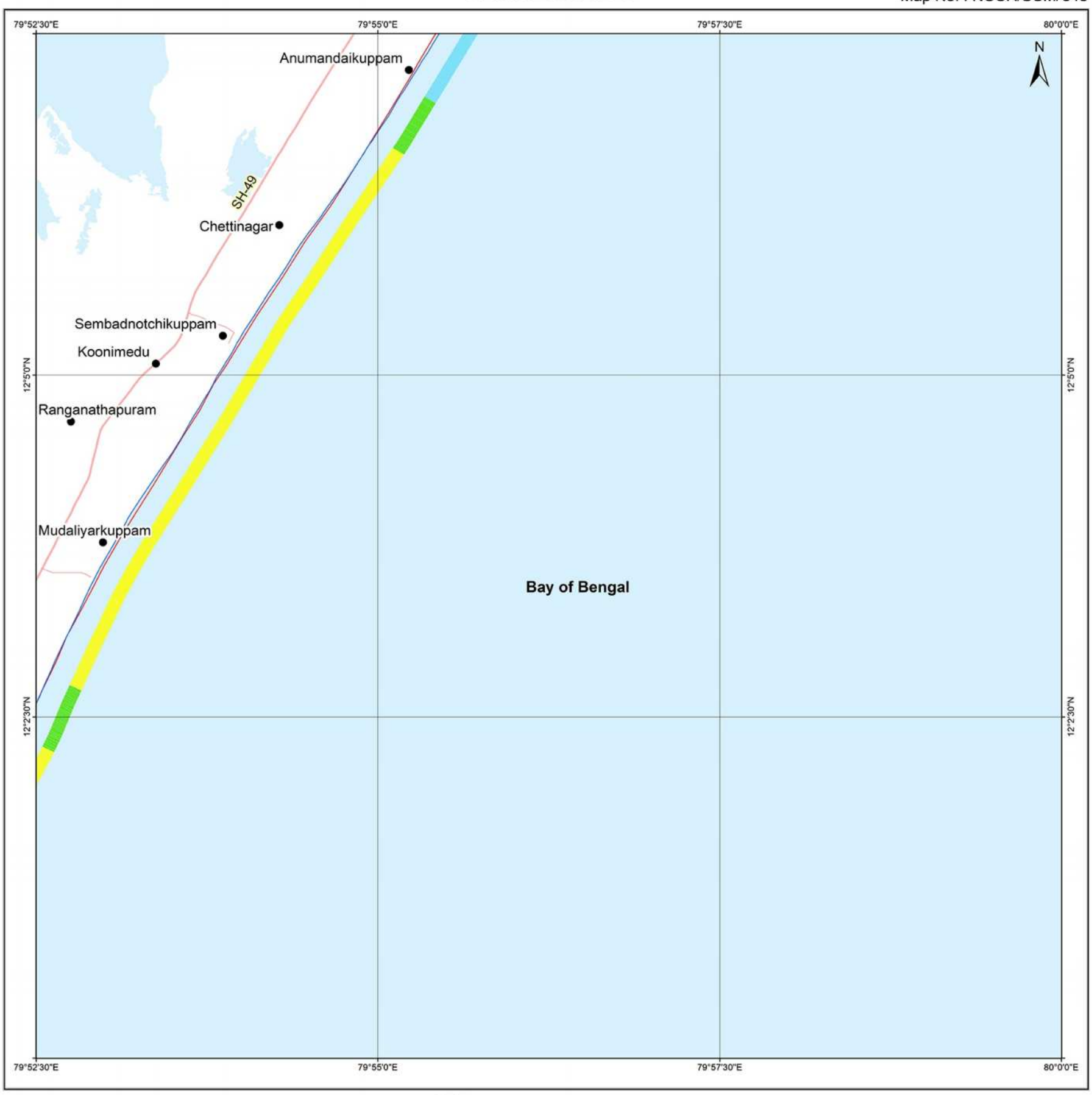
**KANCHEEPURAM**

# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**57 P / 16 / SE**

Map No. : NCCR/SCM/348




*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

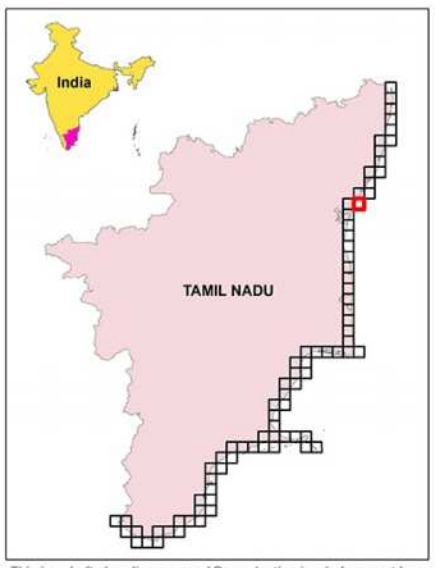
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 04/04/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 06/12/2014 |
| LISS-IV | 05/24/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 10/29/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 10/28/2000 |
| TM | 07/25/1990 |

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- Breakwater
- Seawall/Ripraps
- Rocky Coast
- Administrative Boundary
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1990 - 2018

**VILLUPURAM &KANCHEEPURAM**

# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**57 P / 16 / NE**

Map No. : NCCR/SCM/349


*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

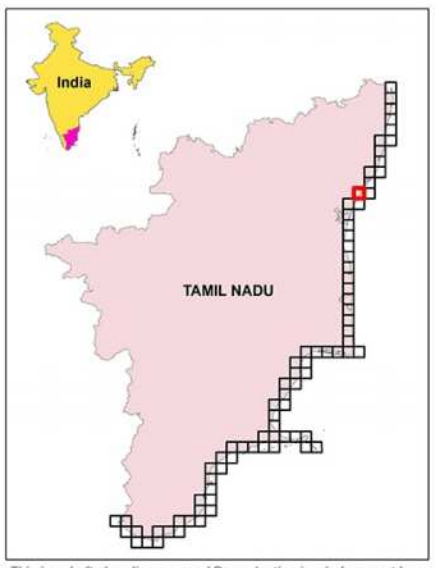
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 04/04/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 06/12/2014 |
| LISS-IV | 05/24/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 10/29/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 10/28/2000 |
| TM | 07/25/1990 |

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1990 - 2018

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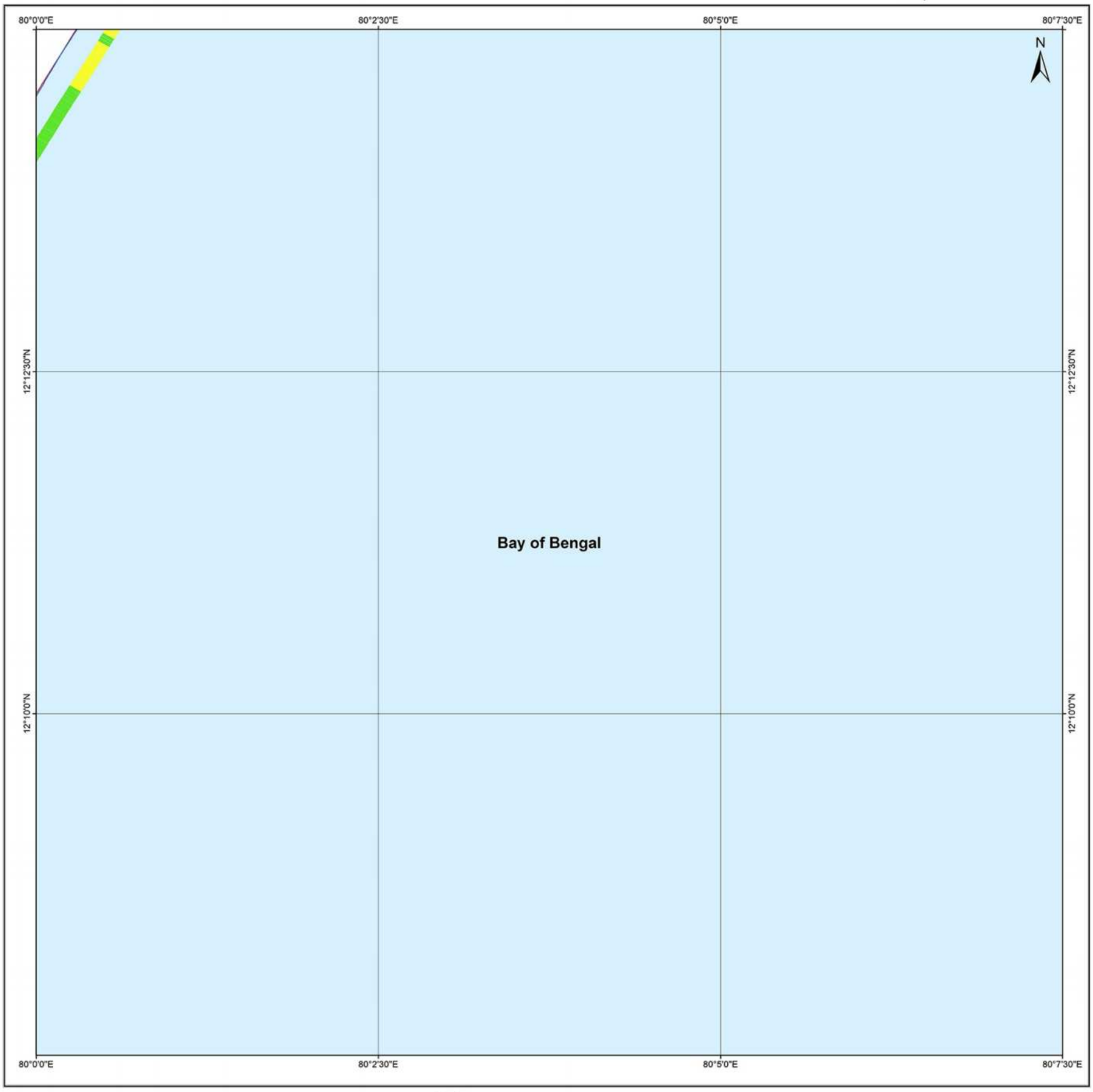
# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 4 / NW**

Map No. : NCCR/SCM/350




*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

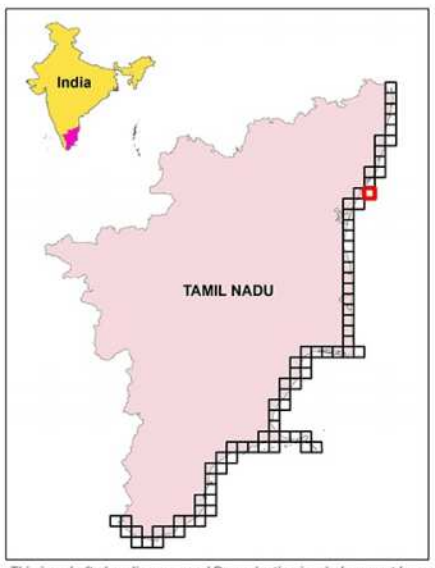
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 04/04/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 06/12/2014 |
| LISS-IV | 05/24/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 10/29/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 10/28/2000 |
| TM | 07/25/1990 |

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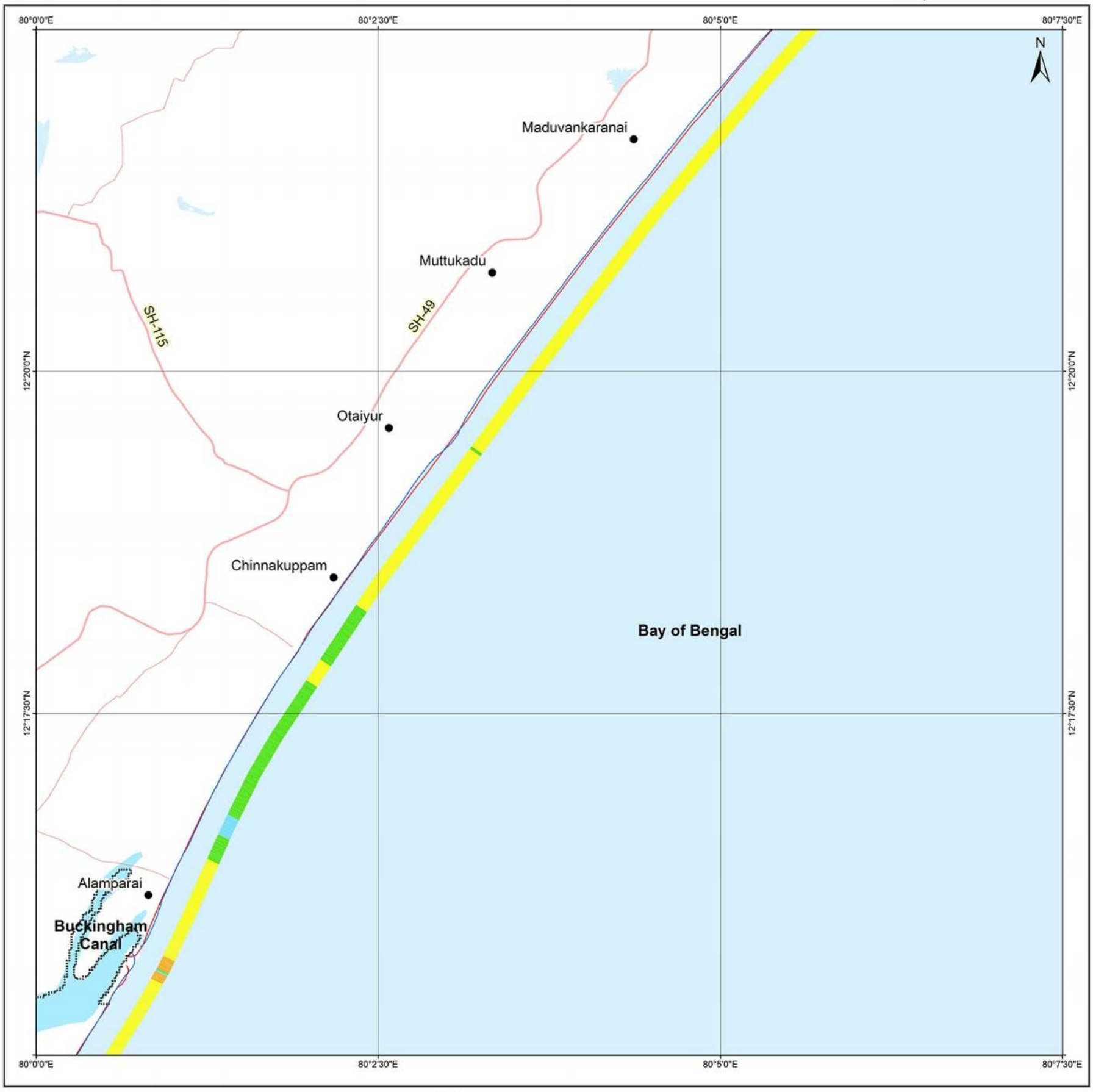
# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 3 / SW**

Map No. : NCCR/SCM/351




*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

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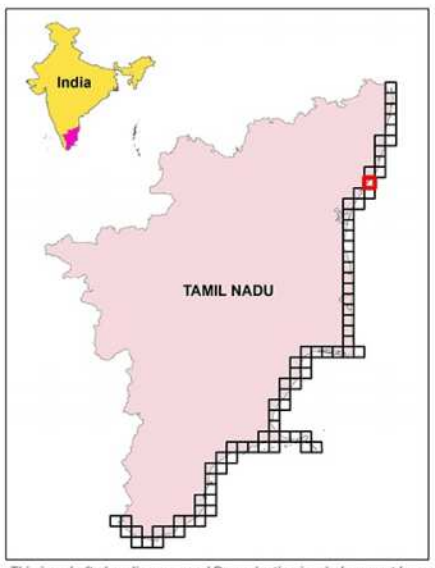
| ETM+ | 10/28/2000 |
| TM | 07/25/1990 |

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# SHORELINE CHANGE MAP
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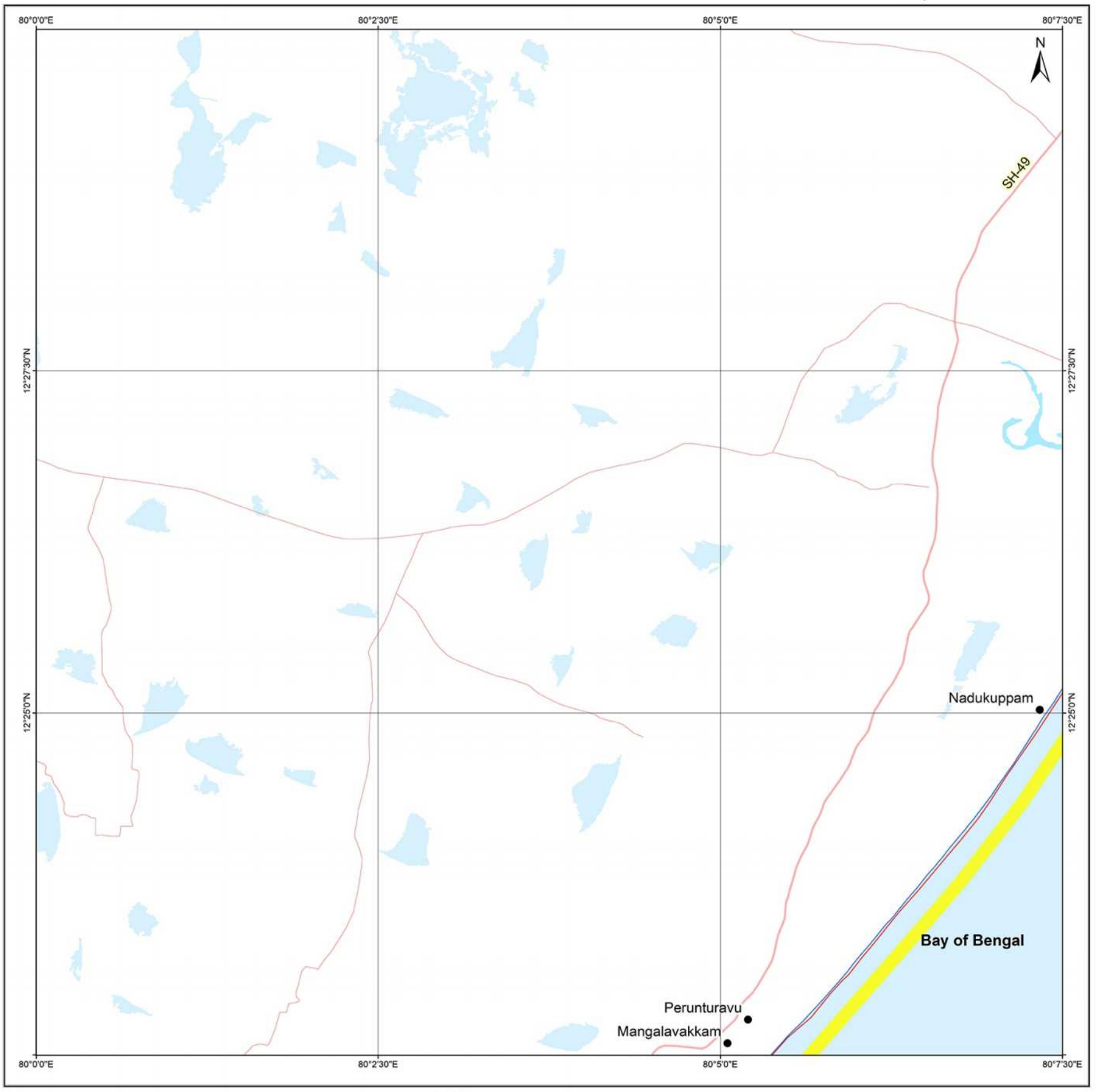
Restricted Use

**66 D / 3 / NW**

Map No. : NCCR/SCM/352




*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018

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**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

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Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

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| LISS-III | 05/14/2008 & 10/29/2008 |
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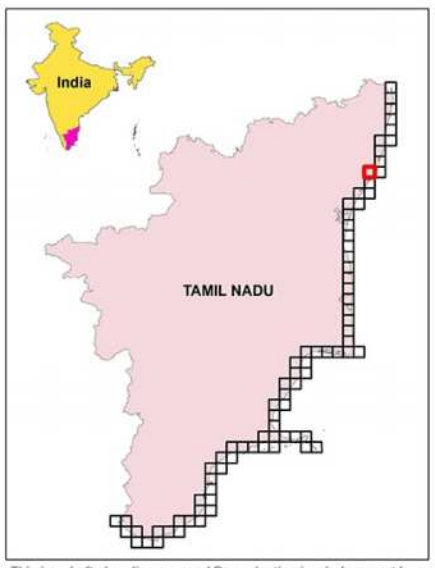
| ETM+ | 10/28/2000 |
| TM | 07/25/1990 |

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Map No. : NCCR/SCM/353


*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018

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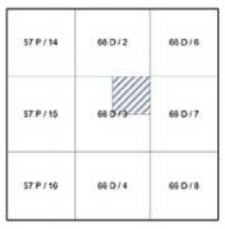


**Scale**

1000 m 500 0 1 2 km

1:25,000

UTM Coordinates Zone 44

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Spheroid : The World Geodetic System 1984 (WGS84)

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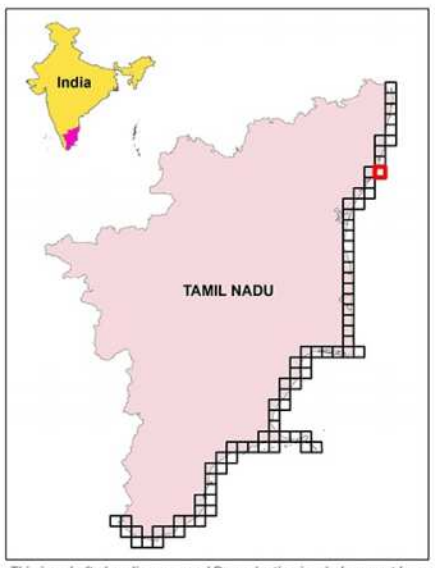
| LISS-IV | 03/18/2012 |
| LISS-III | 05/14/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 10/28/2000 & 08/28/2000 |
| TM | 07/25/1990 |

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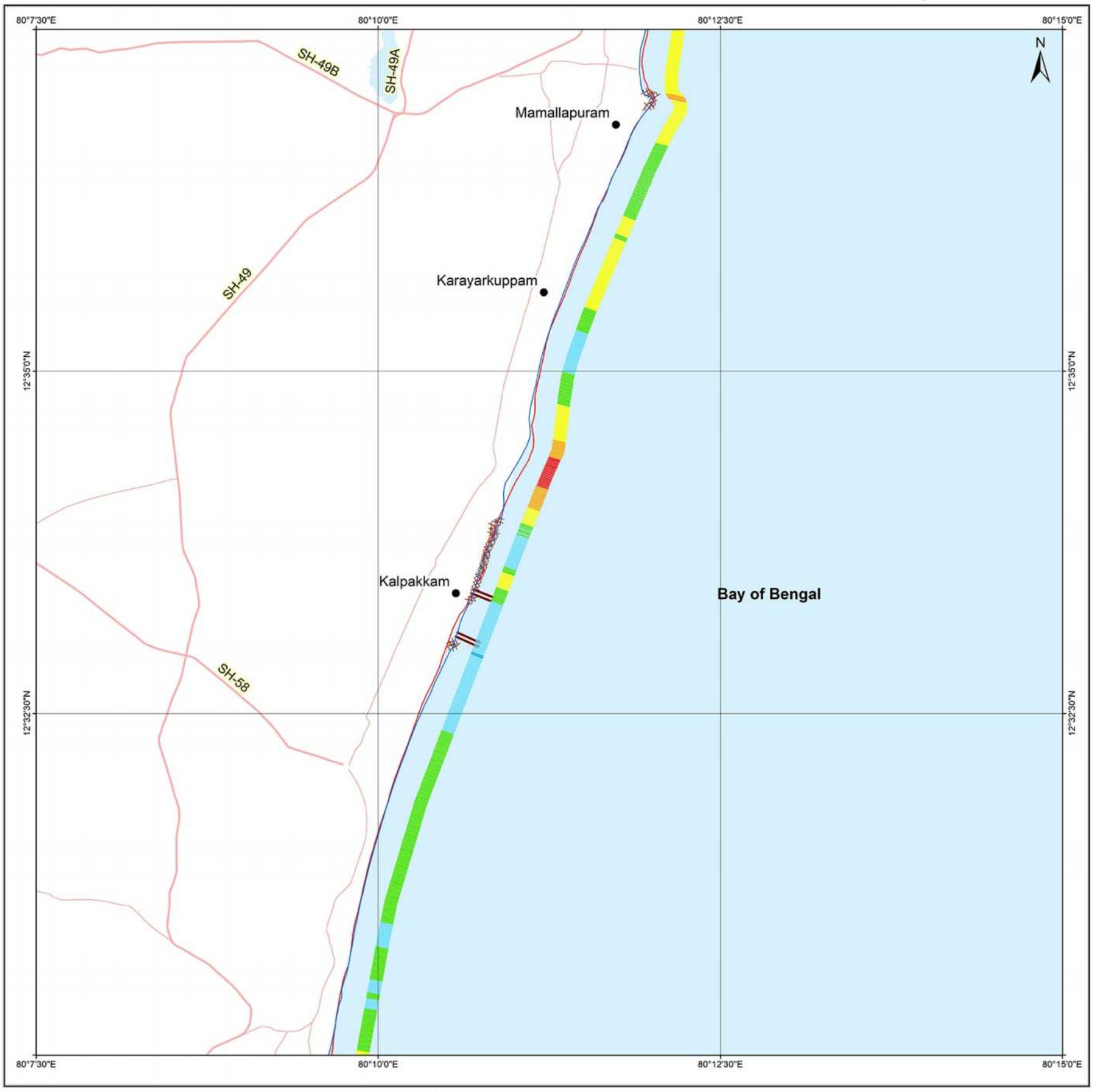
# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 2 / SE**

Map No. : NCCR/SCM/354




*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 04/04/2018 & 08/26/2018

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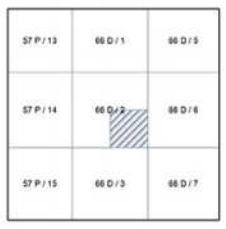
**Incidence on 1:50,000 Sheets**




**Scale**

1000 m 500 0 1 2 km

1:25,000

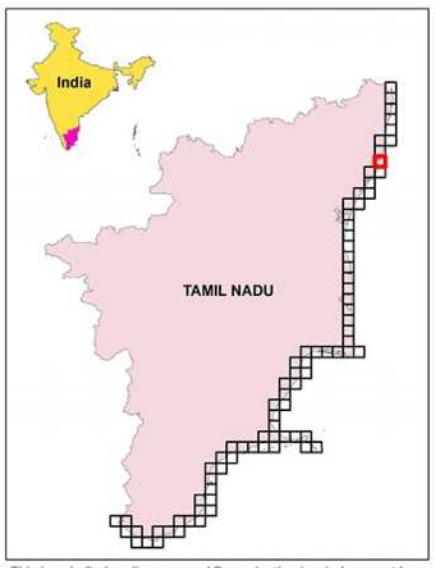
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 04/04/2018 & 08/26/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 04/25/2014 |
| LISS-IV | 04/06/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 05/14/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 08/28/2000 |
| TM | 07/25/1990 |

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1990 - 2018

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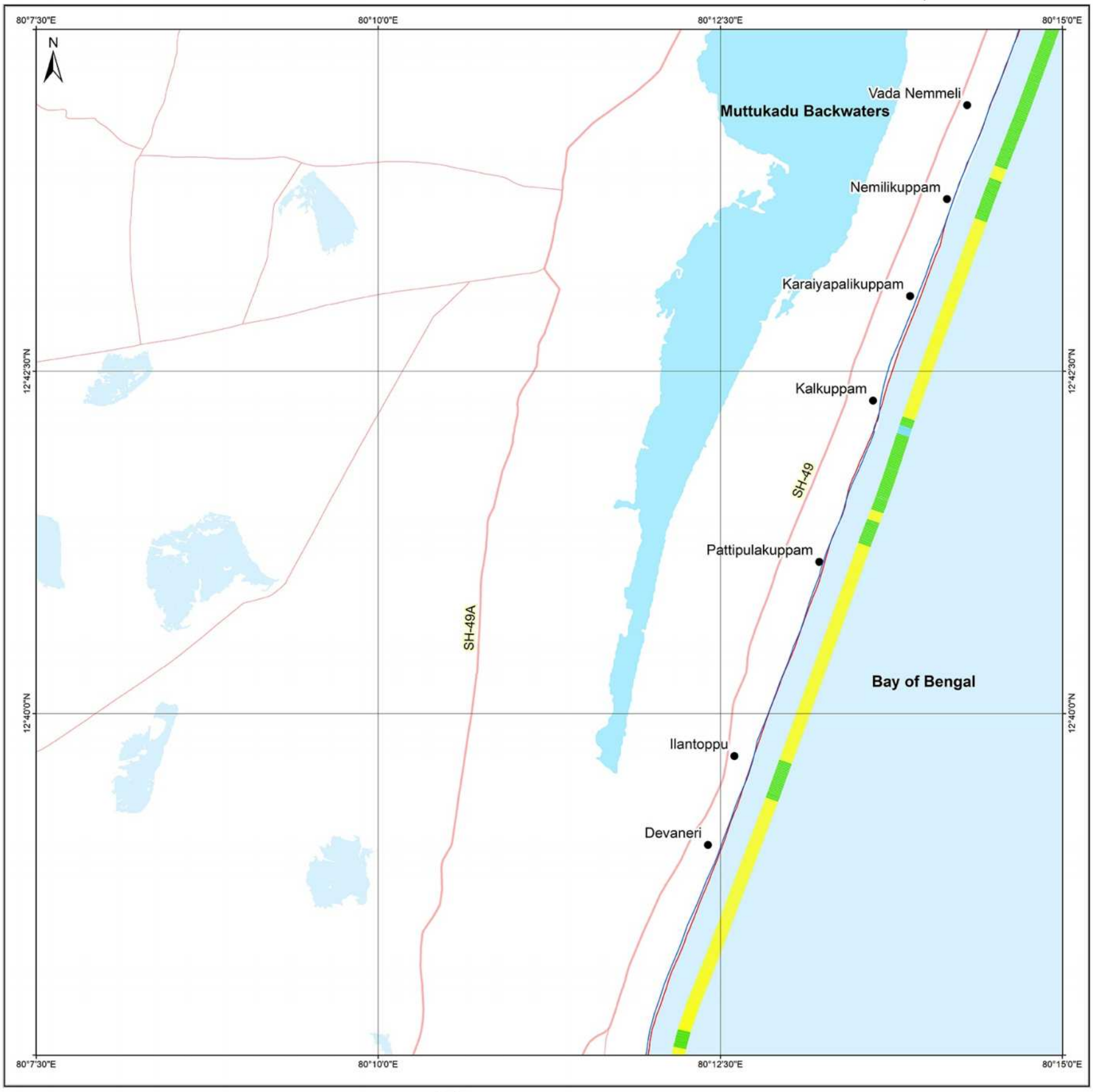
# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 2 / NE**

Map No. : NCCR/SCM/355




*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 08/26/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 08/26/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 04/25/2014 |
| LISS-IV | 04/06/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 05/14/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
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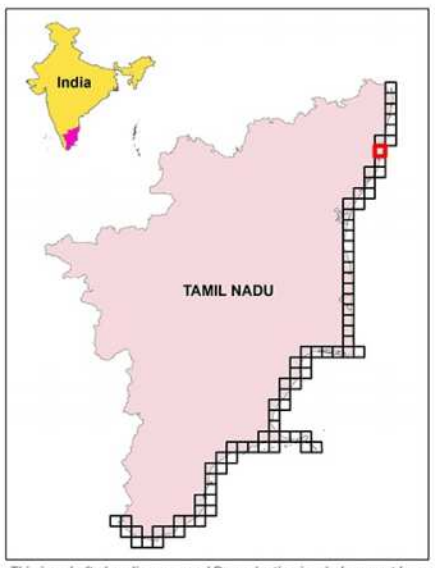
| TM | 07/25/1990 |

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1990 - 2018

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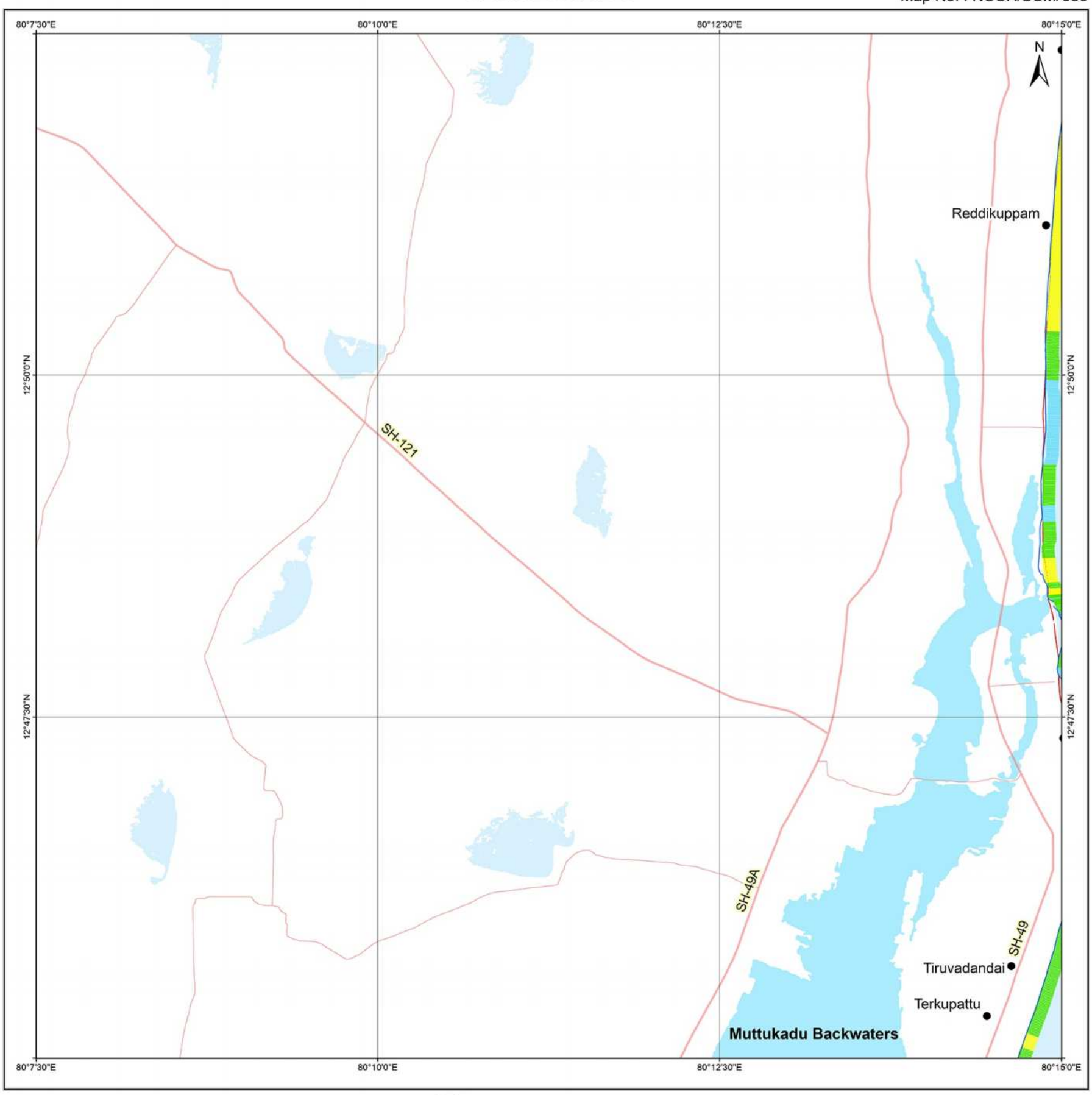
# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 1 / SE**

Map No. : NCCR/SCM/356




*Shoreline Change Trend for Period* 1990 - 2018

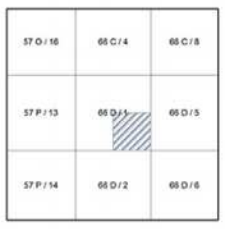
- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 08/26/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**




**Scale**

1000 m 500 0 1 2 km

1:25,000

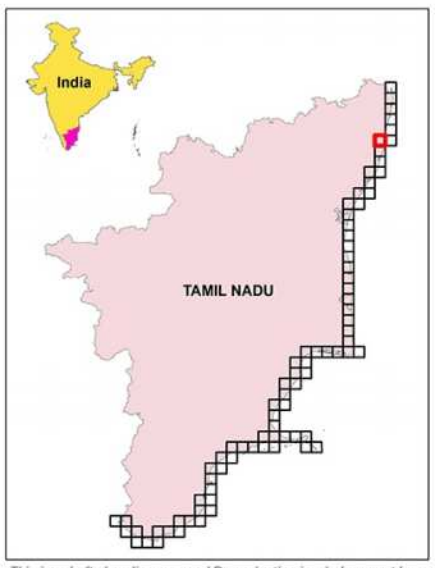
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 08/26/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 04/25/2014 |
| LISS-IV | 04/06/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 05/14/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 08/28/2000 |
| TM | 07/25/1990 |




- Settlements
- Port
- Harbour
- Groynes
- Jetty
- Breakwater
- Seawall/Riprap
- Rocky Coast
- Administrative Boundary
- National Highways
- State Highways
- Other Roads
- Railways
- Lakes
- Rivers

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ESSO

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Pallikaranai, Chennai - 600100

1990 - 2018

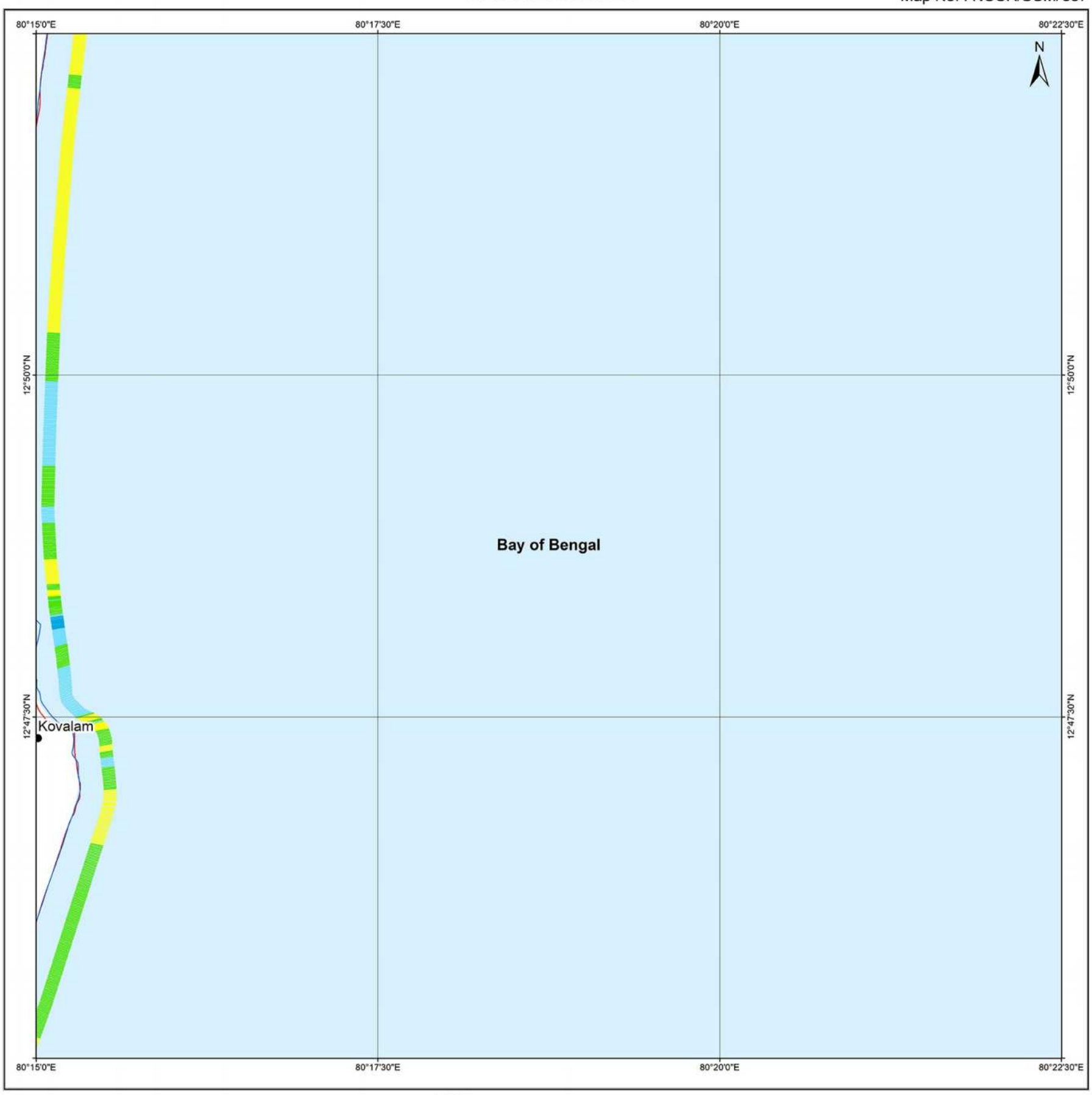
**KANCHEEPURAM**

# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 5 / SW**

Map No. : NCCR/SCM/357



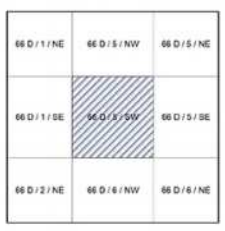

*Shoreline Change Trend for Period* 1990 - 2018

- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 08/26/2018

**Index to sheets**




**Incidence on 1:50,000 Sheets**


**Scale**

1000 m 500 0 1 2 km

1:25,000

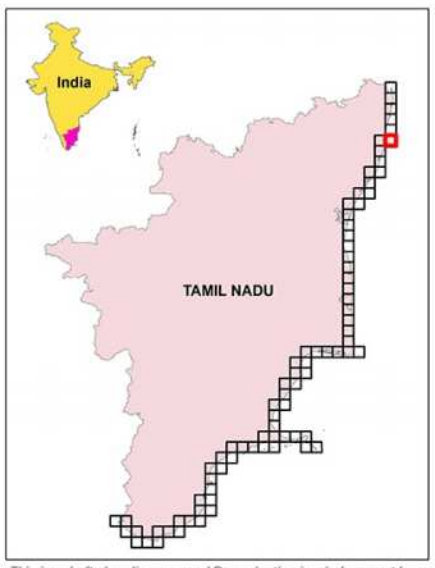
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 08/26/2018 |
| LISS-IV | 02/06/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 04/25/2014 |
| LISS-IV | 04/06/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 05/14/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 08/28/2000 |
| TM | 07/25/1990 |




- Settlements
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- State Highways
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1990 - 2018

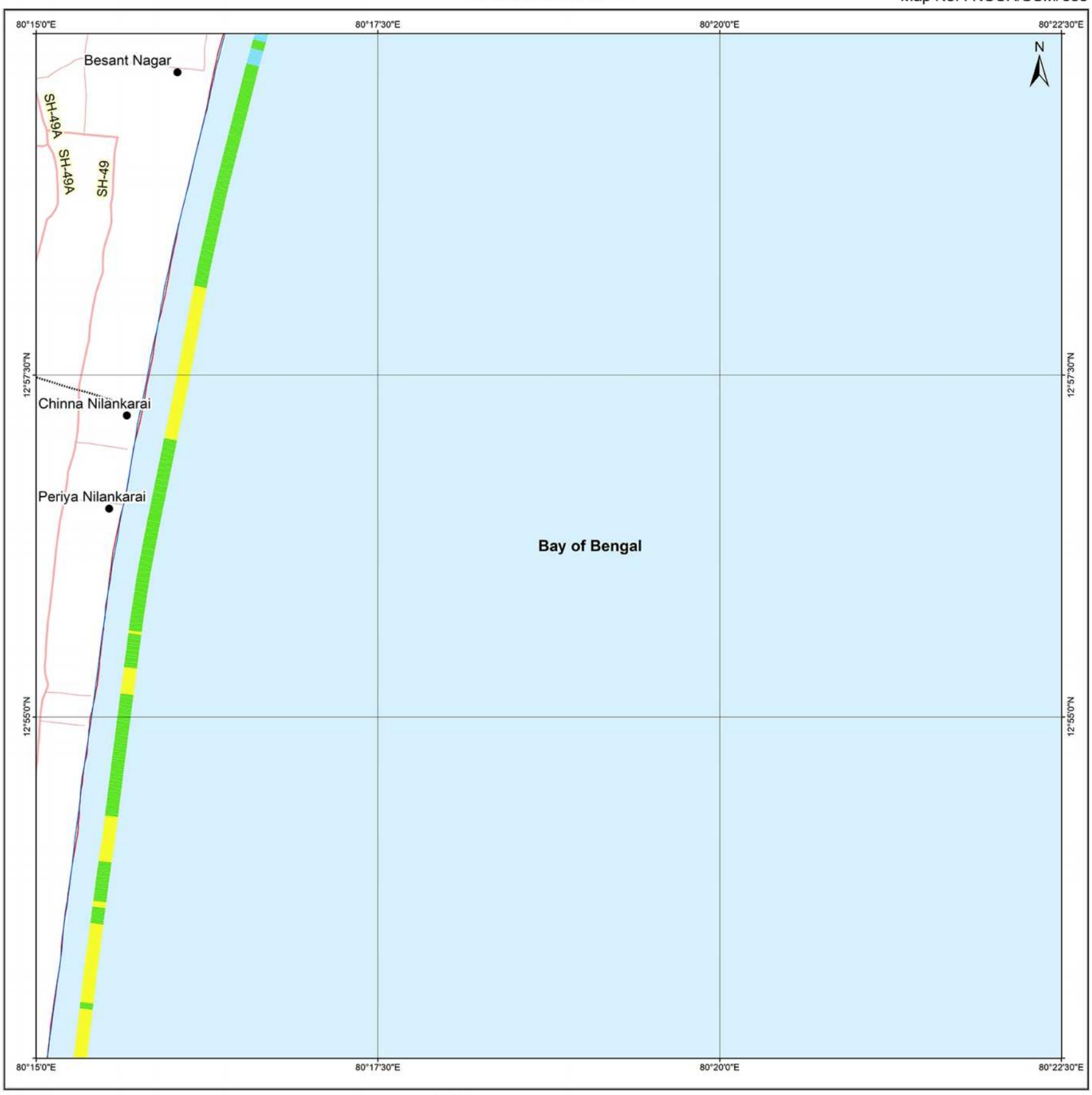
**KANCHEEPURAM**

# SHORELINE CHANGE MAP
## TAMIL NADU

Restricted Use

**66 D / 5 / NW**

Map No. : NCCR/SCM/358




*Shoreline Change Trend for Period* 1990 - 2018

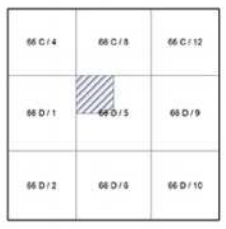
- High Erosion
- Moderate Erosion
- Low Erosion
- Stable Coast
- Low Accretion
- Moderate Accretion
- High Accretion

*Shoreline date*

- 07/25/1990
- 08/26/2018

**Index to sheets**


**Incidence on 1:50,000 Sheets**




**Scale**

1000 m 500 0 1 2 km

1:25,000

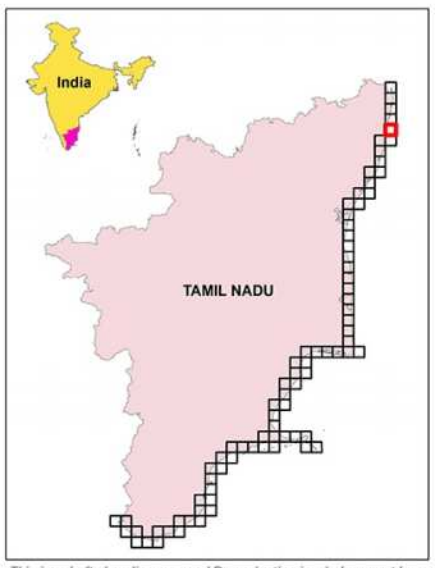
UTM Coordinates Zone 44

Datum : The World Geodetic System 1984 (WGS84)

Spheroid : The World Geodetic System 1984 (WGS84)

**Data Sources: Satellite Data**

| Sensors | Date of acquisition |
|---|---|
| LISS-IV | 08/26/2018 |
| LISS-IV | 02/06/2017 & 01/03/2017 |
| LISS-IV | 04/14/2016 |
| LISS-IV | 07/01/2015 |
| LISS-IV | 04/25/2014 |
| LISS-IV | 04/06/2013 |
| LISS-IV | 03/18/2012 |
| LISS-III | 05/14/2008 |
| PAN (Cartosat-1) | 07/01/2006 |
| ETM+ | 08/28/2000 |
| TM | 07/25/1990 |




- Settlements
- Port
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सत्यमेव जयते

Government of India

Ministry of Earth Sciences

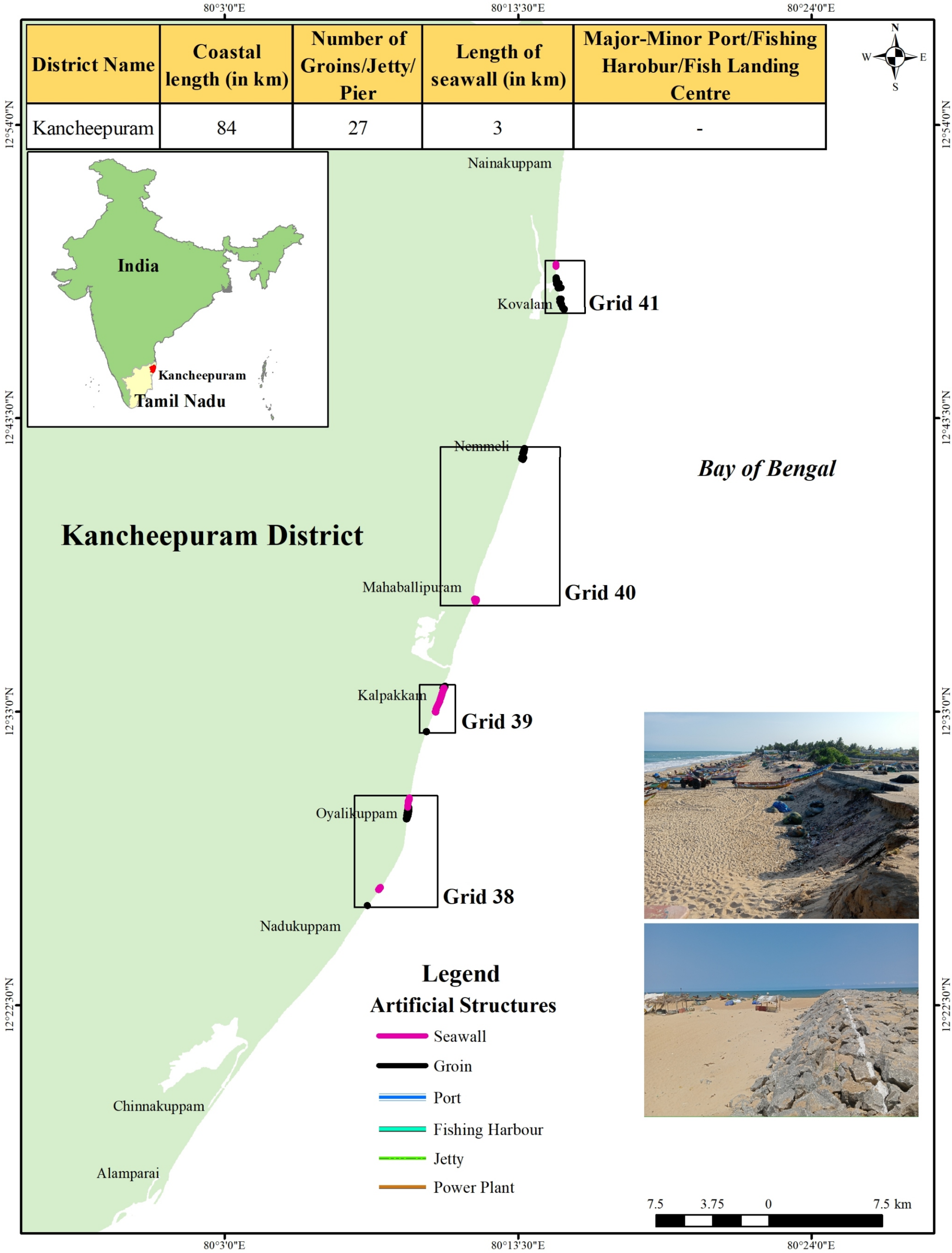
**National Centre for Coastal Research**

# Coastal Structures along Tamil Nadu and Puducherry Coast

May 2022

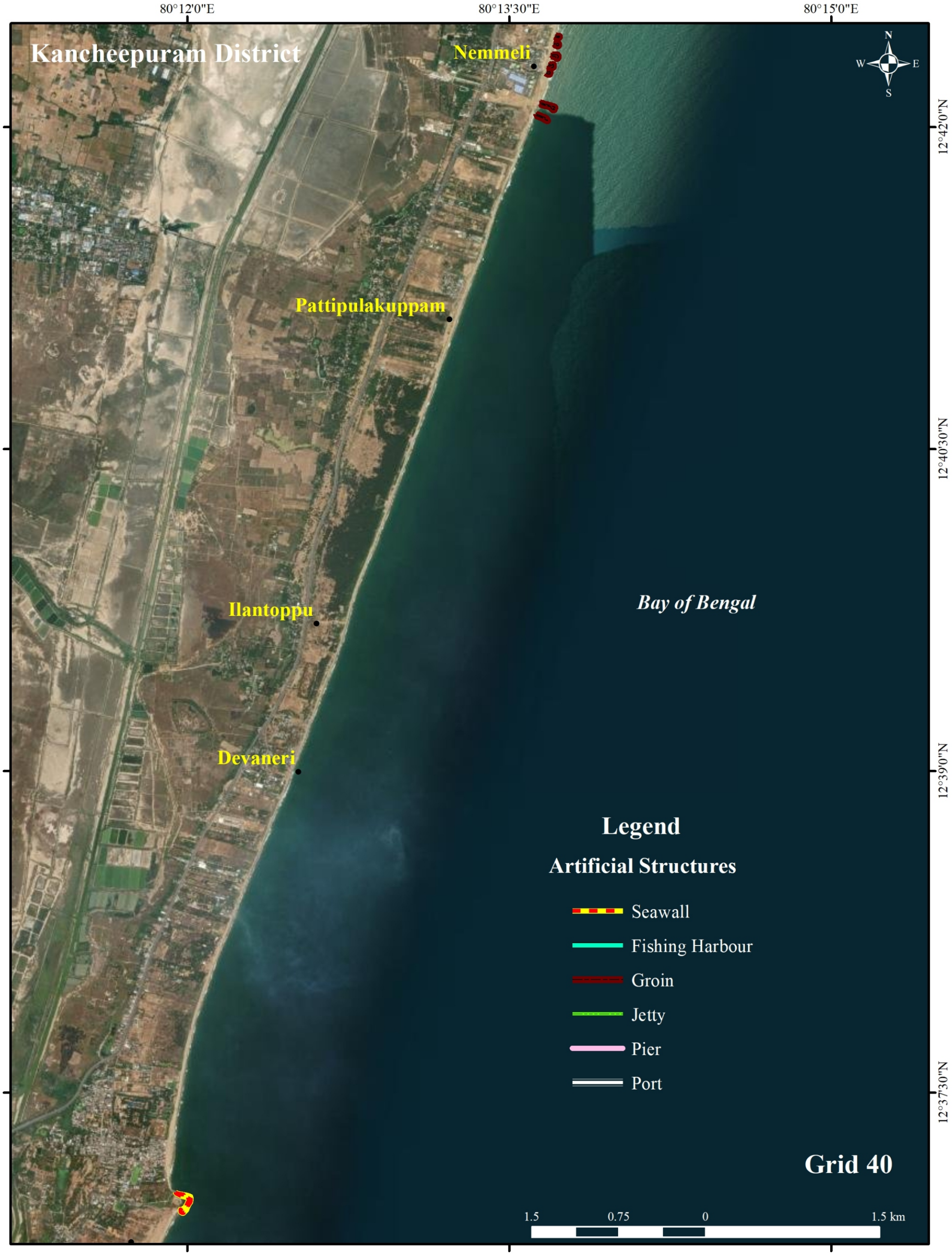
# 4.12 Kancheepuram District

| District Name | Coastal length (in km) | Number of Groins/Jetty/ Pier | Length of seawall (in km) | Major-Minor Port/Fishing Harobur/Fish Landing Centre |
|---|---|---|---|---|
| Kancheepuram | 84 | 27 | 3 | - |




80°8'0"E
80°9'0"E
80°10'0"E
12°29'0"N
12°28'0"N
12°27'0"N
12°26'0"N
N
W
E
S
Kancheepuram District
Uyyalikuppam
Palar River
Bay of Bengal
Kadalur Periya kuppam
Artificial Reef
Vengadu
Legend
Artificial Structures
Seawall
Fishing Harbour
Groin
Jetty
Pier
Port
Grid 38
1
0.5
0
1 km


80°10'0"E
80°10'30"E
80°11'0"E
12°33'30"N
12°33'0"N
12°32'30"N
Kancheepuram District
N
W
E
S
Kalpakkam
Madras Atomic
Power Station
Bay of Bengal
Legend
Artificial Structures
Seawall
Fishing Harbour
Groin
Jetty
Pier
Port
Grid 39
0.45
0.225
0
0.45 km


80°12'0"E
80°13'30"E
80°15'0"E
12°42'0"N
12°40'30"N
12°39'0"N
12°37'30"N
Kancheepuram District
Nemmeli
Pattipulakuppam
Ilantoppu
Devaneri
Bay of Bengal
N
W
E
S
Legend
Artificial Structures
Seawall
Fishing Harbour
Groin
Jetty
Pier
Port
Grid 40
1.5
0.75
0
1.5 km


80°14'30"E
80°15'0"E
80°15'30"E
12°49'0"N
12°48'30"N
12°48'0"N
12°47'30"N
Kancheepuram District
N
W
E
S
Muttukadu
Bay of Bengal
Kovalam
Legend
Artificial Structures
Seawall
Fishing Harbour
Groin
Jetty
Pier
Port
Grid 41
0.4
0.2
0
0.4 km