CHAPTER 8

SUMMARY AND RECOMMENDATIONS

8.1 SUMMARY

8.1.1 Coastal Geomorphology

Visual interpretation of IRS LISS-III imagery helped in determining various coastal geomorphologic features like beach, spit, beach ridges, swales, mudflat, back swamp, dune complex, teri dune complex, natural levee, flood plain, deltaic plain, strand line etc. All the geomorphologic features, very particularly beach ridges, strandlines, swales and backwater system indicate various stages of sea level during the past years.

The estimation based on present study indicates that the coastal accretion is active along the Gulf of Mannar coast. The analysis of multi-date shoreline maps & satellite data indicates that 4.34 sq.km of coast was eroded and 23.49 sq.km coast of was accreted over a period of 30 years (1969-1998). The calculation shows the average rates of accretion and erosion as 0.783 sq.km/year and 0.144 sq.km/year respectively. The present study indicates that the coastline migration towards seaward side is very active in Gulf of Mannar. The calculation shows an average migration of shoreline towards sea is 4.7 m/year. The accretional nature or seaward migration of shoreline and occurrence of new spit formation along the shore indicate that the Gulf of Mannar coast is a prograding one or in other words sea level is falling.

The estimation based on present study indicates that the erosion and accretion of islands in the study area is active. The analysis indicates that

4.16 sq.km and 3.31 sq.km areas of islands in Gulf of Mannar were eroded and accreted over a period of 30 years (1969-1998) respectively. The average rates of erosion and accretion of islands are 0.010 sq.km and 0.006 sq.km/year at Tuticorin group of islands, 0.002 sq.km and 0.003 sq.km/year at Vembar group of islands, 0.037 sq.km and 0.043 sq.km/year at Keelakkarai group of islands and 0.068 sq.km and 0.057 sq.km/year at Mandapam group of islands. The present study also indicates that the Tuticorin group of islands migrates toward land ward side while the other groups of islands are migrating towards seaward side. The average rate of migration towards landward side by the Tuticorin group of islands is 13.21 m/year, whereas the average rates of migration towards seawards side by the Vembar, Keelakkarai and Mandapam groups of islands are 3.18, 32.9 and 47.88 m/year respectively.

Geographic Information system and ERDAS Imagine software are very much useful for bathymetry mapping of Gulf of Mannar. Various shelf morphological features like channels, continental rises, islands etc and their slopes, widths and extents are identified in the Gulf of Mannar.

The near shore seafloor variation study suggests that in the study area the sea floor is gradually rising due to sediment deposit and tectonic upliftment. The rate of average rising of sea floor is 0.021m/year, out of which sediment deposit accounts for 0.001m/year and influence of tectonics is 0.02m/year. In addition, occurrence of spit along the coast, formation of sand bar at Appa Island and between Manalli and Manalli Putti Islands and rising reef along the Mandapam and Keelakkarai groups of islands, are indicating the rising of sea floor or falling of sea level.

The various studies on coastal geomorphology, shoreline changes and seafloor changes suggest that the study area is under going progradation or sea level is falling.

8.1.2 Landuse/landcover

Visual interpretation of 1988 IRS LISS-II and 1998 IRS LISS-III imageries shows that various land use / land cover categories have been increased / reduced / converted into other categories over a period of ten years (1988-1998) as given below:

1. The Crop land has reduced from 539.86 sq.km to 417.66 sq.km and converted into:
   a) Fallow land (27.33 sq.km)
   b) Agriculture plantation (76.46 sq.km)
   c) Scrubland (76.26 sq.km)
   d) Saltpan and Aquaculture Ponds (1.86 and 0.59 sq.km)

2. The Fallow land has increased from 50.17 sq.km to 52.56 sq.km and converted into:
   a) Cropland (27.52 sq.km)
   b) Agriculture plantation (0.55 sq.km)
   c) Forest plantation (4.65 sq.km)
   d) Scrubland (12.42 sq.km).

3. The agriculture plantation land has increased from 185.560 sq.km to 192.57 sq.km converted into:
   a) Scrub land (33.24 sq.km)
   b) Crop land (23.57 sq.km)
   c) Salt pan (0.97 sq.km)
   d) Fallow land (6.564 sq.km)
   e) Forest plantation (18.72 sq.km)

4. The forest plantation has increased from 115.29 sq.km of to 145.02 sq.km and converted into:
   a) Agriculture plantation (6.19 sq.km)
   b) Scrub land (1.17 sq.km)
   c) Forest blank (4.54 sq.km)
   d) Crop land (2.46 sq.km)

5. The scrubland has increased from 243.48 sq.km to 294.02 sq.km and converted into:
   a) Settlement (7.10 sq.km),
   b) Salt pan (2.59 sq.km),
   c) Aquaculture pond (0.18 sq.km),
   d) Forest plantation (4.31 sq.km),
   e) Agriculture plantation (12.10 sq.km),
   f) Fallow and Crop land (7.60 and 34.90 sq.km).

6. The sandy area has reduced from 39.28 sq.km to 36.80 sq.km and converted into:
   a) Agriculture plantation (3.72 sq.km)
   b) Forest plantation (5.03 sq.km).

7. The tanks have increased from 70.84 to 74.85 sq.km and changed into:
   a) Cropland (4.15 sq.km),
   b) Scrubland (2.95 sq.km),
   c) Agriculture plantation (1.27 sq.km)
   d) Saltpan (0.03 sq.km).

8. The island vegetation has reduced from 3.81 sq.km to 2.28 sq.km
9. The natural forest has reduced from 3.86 sq.km of to 0.062 sq.km.

The validation of this result by ground truth confirmed that growth of population and human activities have caused these land use/land cover changes.

The multi-date remote sensing data analysis indicates that 0.860 sq.km of mangroves, 0.375 sq.km of marsh vegetation and 1.84 sq.km of mud flat have increased over a period of ten years (1988-1998). These increasing land cover categories indicate that the study area is under going progradation or sea level is falling.

8.1.3 Socio economic study

Socio economic studies indicate various occupations of coastal communities in the Gulf of Mannar region includes fisheries, seaweed collection, shell collection, coral mining and agriculture.

8.1.4 Coral reef study

Visual classification of 1988 LISS-II and 1998 LISS-III data shows that 25 sq.km of coral reef area in Gulf of Mannar was lost over a period of ten years (1988-1998). The validation of this result by ground truth confirms that there are eight main anthropogenic causes and four natural causes for the degradation of coral reefs.

Anthropogenic causes

1. Over fishing and destructive fishing practice
2. Seaweed collection
3. Commercial shell collection
4. Coral mining
5. Poor land use practices

6. Coastal and urban development
7. Harbour and dredging
8. Industrial development and pollution

Natural causes

1. Sea level fall
2. Northeast monsoon
3. Wave, tide, ocean current
4. Suspended sediment

Visual interpretation of IRS LISS-II and IRS LISS-III image aids in determining various coral reef features like reef area, reef vegetation and degraded reef area and their areal extent.

The total coral reef area in Gulf of Mannar is estimated to be only 61.01sq.km. In this, 67.2% dead coral, 19.6% live coral and 13.1% coral mining.

Digital classification of IRS LISS-III using Principal Component Analysis with 3rd band (NIR band: 0.77-0.86μm) could be used for coral reef zonations and species identification. It would not be useful for areal estimation because of shallow sandy bottom and exposed dead corals have the same signature.

Digital classification of IRS LISS-III data with Principal Component Analysis technique provides more accuracy in classification of coral reef areas when compare to Maximum likelihood and K-Means classification techniques.

8.2 RECOMMENDATIONS

1. It is necessary to create awareness among the coastal communities in the study area, in order to protect and conserve the coral reefs through effective involvement of educational institutions and NGOs.

2. Stringent measures need to be under taken with immediate effect to ban coral mining and to take into task those involved in or those who encourage the exploitation of corals for any purpose. Patrolling the coast to check coral mining should be carried out.

3. Law should be enacted to regulate and stop trawl boat operation in the zone earmarked for non-mechanized boat. The Department of Forest and the Department of Fisheries should take steps to stop anchoring of vessels on coral reefs, pair trawling and dynamite fishing.

4. Indiscriminate picking of budding seaweeds needs to be banned.

5. Commercial shell collection should be controlled and closely monitored.

6. Marine Resources Management Centres should be established to improve the skills of fishermen communities in areas other than coral mining, which in turn will lead to efficient management of coral reefs.

7. Initiatives to train the coastal fishermen in mechanized boat operation, shell collection, seaweed collection and conservation of coral reefs need to be taken up so that they could find alternate sources of livelihood.

8. Deforestation along the coast and islands of Gulf of Mannar should be banned. The Forest Department should take up afforestation along the coast and islands of Gulf of Mannar to protect soil erosion.

9. Discharging of untreated sewage and urban wastes into the coastal waters should be totally banned.

10. Dumping of any kind of material that would affect the coral reef ecosystem should be banned.