

4.1. Introduction

Coastal environment plays a vital role in nation's economy by virtue of the resources, productive habitats and rich biodiversity. India has a coastline of about 7,500 kms. The coastline of Tamil Nadu has a length of about 1076 kms constitutes about 15% of the total coastal length of India and stretches along the Bay of Bengal, Indian Ocean and Arabian Sea.

Table 4.1. Coastal length of Tamil Nadu

S. No.	Coastal information	Tamil Nadu		
		E. coast	W. coast	Total
1.	Coastal length (in Km)	1016	60	1076
2.	Continental shelf (in Sq.Km)			41412
	Upto 50 m depth	22411	844	23255
	51m-200m depth	11205	6952	18157
3.	Exclusive Economic zone (in million Sq.Km.) Extends to 200 nautical miles from shore	-	-	0.19
4.	Territorial waters (in Sq.Km.) (approx.)	-	-	19000

Source: Fisheries Statistics, 2004,
Department of Fisheries, Govt. of Tamil Nadu

4.2. Ecologically Important Coastal Areas

The Tamil Nadu coast is straight and narrow without much indentations except at Vedaranyam. Fringing and patch reefs are present near Rameswaram and Gulf of Mannar, Pitchavaram, Vedaranyam and Point Calimere have well developed mangrove systems (Table 4.2). In Tamil Nadu about 46 rivers drain into Bay of Bengal forming several estuaries adjoining coastal lagoons. The Cauvery River and its tributaries form a large delta supporting extensive agriculture. The other landforms of the Tamil Nadu coast are rock outcrops of Kanyakumari, mudflats, beaches, spits, coastal dunes and strand features. Deposition is observed at Point Calimere, Nagapattinam, South Madras, etc., while erosion is reported at Ovari Paravarnattam,

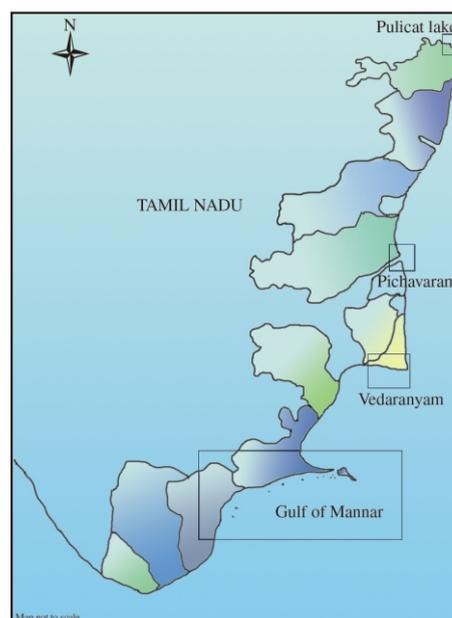


Fig. 4.1. Map showing the ecologically important areas of T.N

Mahabalipuram and North Madras near Ennore. Rich deposits of heavy minerals are available in Muttam-Manavalakuruchi coast. The southern tip is also known for the Tera sands³.

Table 4.2. Ecologically Important Coastal Areas identified in Tamil Nadu Coast

S.No.	District	Site	Ecological Importance
1.	Ramanathapuram	Gulf of Mannar (Islands between Rameswaram-Tuticorin)	Coral Reef
2.	Nagapattinam	Vedaranniyam, Muthupettai	Mangroves
3.	Cuddalore	Pichavaram	Mangroves
4.	Thiruvallur	Pulicat Lake	Lagoon

Source: Institute for Ocean Management, Anna University

4.3. Importance of Coastal Ecosystem

Coastal ecosystems have key inbuilt features or functions. The ecosystems involving in primary and secondary production, sustain the flora and fauna, store sediments and organic carbon, essential to the maintenance

of food chains. The coastal ecosystems provide foods (fish, oil, gas, minerals) and services (natural defence against storms and tidal waves, recreation and transportation). The coastal ecosystems provide habitat to genetically, ecologically and economically valuable biological organisms. Out of 71 phyla encompassing all forms of life, 43 phyla are in the oceans. The biological of our medicines contain active ingredients of natural origin. The compounds isolated from sponges have been used in the treatment of leukemia, and coral fragments are used in bone transplants and dental repairs. The bioactive compounds from the shark fin have the feature of anti-infectious and are active on the circulatory system¹⁴.

4.3.1. Bioshield

Mangrove forest establishes in coastal areas where river water mixes with seawater. These areas are called estuarine or brackish water environment of coastal zone. Mangrove forests located in the estuarine environment are intersected by a number of small creeks and channels and in many cases large open water bodies are also found associated with them. Mangrove forests and associated tidal creeks, channels and lagoons together constitute mangrove wetlands¹⁶.

Theses mangrove wetlands provide a variety of protective and productive services to the coastal communities:

1. Mangrove wetlands mitigate the adverse impact of storms, cyclones and Tsunami in coastal areas.
2. They reduce coastal erosion and on the other hand, gains land by accreting sea and adjacent coastal water bodies
3. They act as breeding, nursery and feeding grounds for

many commercially important prawns, fish, crabs and molluscs.

4. They enhance the fishery potential of adjacent coastal waters by providing them with large quantities of organic and inorganic nutrients.

Tsunami and Pichavaram mangroves

Pichavaram mangrove forest protected 6 hamlets against the fury of tsunami. Mangrove forest reduced the impact of the tsunami by two ways: a) velocity of the tsunami water greatly reduced after it entered into the mangroves due to friction created by thick mangrove forest and b) volume of water reaching a point is greatly reduced¹⁶.

4.4. Marine resources of Tamil Nadu

Tamil Nadu is endowed with one of the largest and richest fisheries in India. The State has 1.9 lakh sq. m of EEZ covering the three coastal zones already described, besides 21 coral islands in the Gulf of Mannar, with rich habitats of corals, coastal lagoons (Pulicat lake and Muthupet swamp) and estuaries. There are 5 major rivers, 51 reservoirs and innumerable tanks. These natural resources harbour a variety of finfish, shellfish and aquatic plants. The unique topography of Tamil Nadu with the Gulf of Mannar and Kaniyakumari in the south, and Pulicat Lake, which is the second largest lagoon in the country, in the north, has resulted in an abundance of endemic species and a large number of high value potential resources. They include spiny lobsters, crabs, flower shrimps, coral fish, sea bass, groupers, sea breams, mullets, gastropods (abalones, chanks) pearl oysters, etc. Nearly one-third of the seaweed resources of the Indian Ocean are found along the coast of Tamil Nadu, particularly the Gulf of Mannar (CASI, 2000).

Table 4.3. Resource potential in the three marine zones of Tamil Nadu

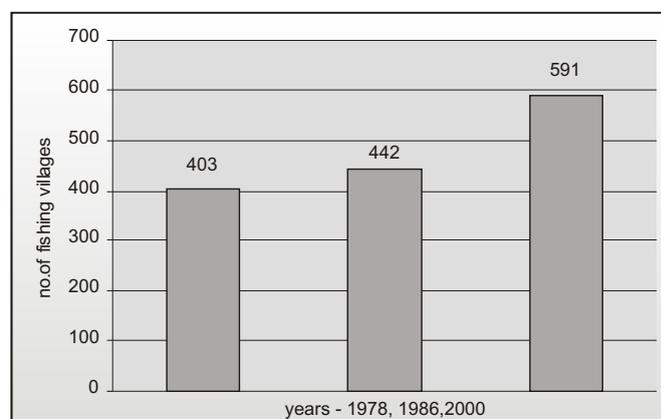
Fishery	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03	2003-04
Demersal fishery	200812	216298	220236	228827	234985	252957	237980	238738	251832	240780	241222
Pelagic fishery	116904	114432	121081	121963	121502	124526	135946	133664	122029	138434	139926

Source: Tamil Nadu Fisheries Statistics, 2004, Department of Fisheries

4.5. Fishing Communities

The thirteen coastal districts of the State have a total marine fishing population of about 6,98,268 people, who primarily fish in the continental shelf area. The total marine fisherfolk population forms about 1 per cent of the total state population. When compared to the 1986 survey of fishing communities in Tamil Nadu, there has been an increase in population by 46.55 per cent in the year 2000 (the highest population is recorded in Kanyakumari district (1,37,940) followed by Ramanathapuram (1,17,291) (DoF, 2000). According to the DoF Census of 1986, there were 403 fishing villages in the State in 1978, which increased to 442 by 1986. The 2000 survey indicates an increase in the number of villages to 591 (Figure 4.2). Bifurcation of the districts in 1990s could be one reason for the increase in the number of villages, as it often led to new settlements (DoF, 2000). There has also been an increase in the number of settlements in the districts of Ramanathapuram, Kancheepuram and Thiruvallur (DoF, 2000). The percentage of poor in the coastal areas, according to NIRD (1999) was 39.25

per cent (northern zone), 13 per cent (central zone), and 31 per cent (southern zone).



Source: Department of Fisheries, Chennai 6

Fig 4.2. Fishing Villages in Tamil Nadu

4.6. Urban and Rural settlements

The coastline is bounded on the north by Pulicat Lake and south by Kanyakumari and stretches over 13 districts. The coastline has mixture of land uses. It has urban areas, ports, industries and several rural settlements involved in agricultural and fisheries. Apart from the Chennai Corporation, the coastal area consists of urban area such as 4 Municipalities and 20 special

Table 4.4. District wise coastal length of Tamil Nadu

S.No.	Name of the District	Coramandal (Chennai-point calimere)	Palk Bay	Gulf of Mannar	West coast (Kanyakumari - Neerodi)	Total
1	Chennai	19.0	0	0	0	19.0
2	Thiruvallur	27.9	0	0	0	27.9
3	Kanchipuram	87.2	0	0	0	87.2
4	Villupuram	40.7	0	0	0	40.7
5	Cuddalore	57.5	0	0	0	57.5
6	Nagapattinam	124.9	63.0	0	0	187.9
7	Thiruvarur	0	47.2	0	0	47.2
8	Thanjavur	0	45.1	0	0	45.1
9	Pudukkottai	0	42.8	0	0	42.8
10	Ramanathapuram	0	95.8	141.0	0	236.8
11	Tuticorin	0	0	163.5	0	163.5
12	Tirunelveli	0	0	48.9	0	48.9
13	Kanyakumari	0	0	11.5	60.0	71.5
		357.2	293.9	364.9	60.0	1076.0

Source: Fisheries Statistics, 2004, Department of Fisheries, Govt. Tamil Nadu

Panchayats/Townships. The coast also has 43 rural settlements within the coastal area including 30 village panchayats and 13 villages (Table 4.4). Coastal fisheries is a major activity and there are number of fishing harbours. Agriculture and plantations of casuarinas and *Prosopis* are quite common along the coast. There are two major ports along the coast viz., Chennai and Thoothukudi, two medium ports at Cuddalore and Nagapattinam and six minor ports at Pamban, Kilakarai, Rameswaram, Colachel, Kanyakumari and Valinokkam. While Ports and industries add economic dimension to the coast, the Gulf of Mannar Biosphere Reserve, Point Calimere Wildlife Sanctuary, Mangrove Forests at Pitchavaram and Muthupet and coral reefs at Tuticorin add aesthetic and environmental dimension to the coast⁷.

4.7. Environmental Concerns

4.7.1. Industrial Pollution

The major activities that are responsible for coastal pollution in Tamil Nadu are discharge and disposal of

untreated domestic and industrial wastes, discharges of coolant waters, harbour activities such as dredging, cargo handling, dumping of ship wastes, spilling of cargo's chemicals and metal ores, fishing activities etc³. There are 14 major industries located in the Ennore-Manali areas. The industries at Manali and Ennore are mostly chemical based, manufacturing petro-chemicals, fertilizers, pharmaceuticals, paints etc. There are two power plants at Ennore, namely, Ennore Thermal Power Plant with a production capacity of 200 MW and North Chennai Thermal Power Plant with a production capacity of 600 MW. The fly ash is continuously deposited in the sea. The industries at Ennore-Manali are using a wide variety of raw materials and discharge waste products into the air, water or land as gaseous emissions, liquid effluents and sludge, respectively. In the coastal area of Tamil Nadu 488.02 MLD of waste water is generated and only 226 of MLD is treated³. The effluent discharge area of the major industries around Ennore-Manali is listed in Table 4.5.

Table 4.5. List of Major industries around Manali and Ennore areas and their effluent discharge area.

S.No.	Name of the Industry	Product	Effluent discharge area
1.	Tamil Nadu Petroproducts Ltd.,	Linear Alkyl Benzene, Paraffin, Heavy Alkaline	Ammulovoyal canal
2.	Kothari Sugars and Chemicals Ltd.,	Sugar	Sea
3.	Madras Refineries Ltd.,	Petroleum Products and Petrochemicals	Ammulovoyal Canal
4.	Indian Additives Ltd.,	Paint	Ammulovoyal Canal
5.	Madras Fertilizers Ltd.,	Fertilizers	Ammulovoyal Canal
6.	Sriram Fibres Ltd.,	Yam	Own land
7.	SPIC heavy chemicals Ltd,	Caustic soda and chlorine	Sea`
8.	North Chennai Thermal Power Station	Power	Buckingham canal
9.	Ennore Thermal Power Station	Power	Sea
10.	Ennore Thermal Power Station-Ash Slurry	Power	Sea
11.	SPIC Organic	Chemicals	Sea
12.	MPL	Petro products	Sea

Source: *Integrated Coastal and Marine Area Management (ICMAM) Plan for Chennai, 2003.*

Several chemical industries are located in the SIPCOT industrial complex at Cuddalore. Refineries, bromide extraction plant and chemical industries are located along the coast in Thanjavur district. Manufacture of magnesium chloride solution plant is located in Ramanathapuram district. Manufacture of aluminum flouride, urea, ammonium chloride, caustic soda manufacturing factories is located in Thoothukudi district. Except some of the major industries, the effluents coming out of the industries are disposed off in the coastal area.

In Cuddalore the major problem confronted in the town is due to the development of Cuddalore chemical complex by the SIPCOT near the coast. There are 12 major industries very close to the seacoast. The treated effluent from the industrial unit is discharged on land. Another industrial complex along the coast is found near Nagapattinam. This group consists of a TNEB, Thermal Power station at Nannilam, WIMCO Bromide extraction plant at Vedaranyam, Mettur chemical Plant manufacturing Liquid Bromide, the Indian Steel Rolling Mill at Thirunindravur of Tiruvarur district. The Thermal Power Unit discharges 500 lit/day of effluent and the Indian Steel Rolling Mill discharges 12,500 litres of effluent/day¹³.

Thoothukudi is one of the major ports and an active center for harbour, fishing, salt pans and related industrial development. Thoothukudi Municipality generated sewage of 14 mld. This sewage is discharged into the sea without any treatment¹³.

4.7.2. Ports and fishing harbour

The shoreline along the coast of Tamil Nadu is subjected to oscillation due to natural and man made activities. The development of ports, harbour has led to erosion of coast, closure of tidal inlets causing degradation by water quality and access to inland waterway. The shoreline along the coast is enclosed by wave induced littoral

drift leading to accretion and erosion. The development of Satellite port causes acceleration of accretion and rehabilitation measure by, dredging for allowing tidal exchange and disposal of dredged material affect sediment transport. The disposal of industrial waste coupled with domestic waste into inland estuaries and waterways has led to deterioration of creek water quality. The sediment depletion due to port structures causes erosion, loss of coastal properties, compulsory rehabilitation of native fishermen¹.

4.7.3. Seawater intrusion

In the urban and agricultural areas bordering the seas, the coastal aquifers prove to be an important source of groundwater resource. It is seen that seawater is the most common pollutant of freshwater in coastal aquifers. Coastal aquifers that have their end boundaries in contact with sea or other saltwater bodies often get intruded by saltwater, as a result of overexploitation, and due to the various other activities of human beings. The major problems in the groundwater sector of coastal areas are over development leading to the ever-increasing fresh water demands, declining water table leading to reduction in sustainability of tubewells and salinity ingress in coastal aquifers³. Large scale extraction of groundwater is done for irrigation purposes as well as for drinking. The groundwater in the coastal Tamirabarani basin extracted for the requirement of industrial complex including the port trust and city requirements. This has led to lowering of the water table in many areas. In Chennai city, over tapping of ground water for drinking water has led to seawater intrusion near Minjur and further extraction has been banned¹³.

4.7.4. Threats to coral reefs

Coral reefs are the most diversified and complex marine ecosystems, and the reefs of Gulf of Mannar are one of the greatest natural treasures. The islands in the Gulf of

Mannar are classified into 4 major groups, they are Mandapam, Keezhakkarai, Vembar and Tuticorin Group¹². The degradation of coral reefs in the Gulf of Mannar has been well noticed. The coral reefs of Palk Bay and Gulf of Mannar have been quarried earlier for industrial purposes¹¹. After declaration of the area as a Gulf of Mannar Marine National Park, action to control illegal removal of corals has been undertaken.

Tsunami impact has been observed in the coastal region in Gulf of Mannar. In general, there is no significant impact on corals, associated habitat and resources due to tsunami. Soil erosion was noticed in two islands (Thalaiyari Island in Keezhakkarai Group and Krusadai Island in Mandapam Group). Due to strong waves few table corals (*Acropora cytherea*) were tilted and branching corals (*Acropora intermedia*, *Acropora nobilis*) were broken. The damage was estimated to be about 1-2% of the total live table and branching corals. Fine sand deposited (4-6 cm) in almost all cup corals (*Turbinaria* sp.) in mainland patchy reef after tsunami. Generally, 25-30% of cup corals in this area are filled with fine sand (layers of 1-2 cm)¹².

4.7.5. Threats to seagrass bed

Seagrass *Enhalus acaroides* is now a threatened species. *Dugong dugon* which is dependent on sea grass for

food, is also under threat. Several cases have been recorded for deterioration of seagrass beds like eutrophication, siltation, trawling, coastal engineering constructions and removal for commercial purposes⁹. Extensive areas of sea grass beds with species such as *Cymodocea* sp. *Thalassia* sp. and *Enhalus* sp. are being disturbed by stake net fishing and intensive trawling operation around the islands¹⁰.

4.7.6. Brackish water and Aquaculture farms

Tamil Nadu has a total of 56,000 ha. of potential shrimp farming area, making the coast of Tamil Nadu an attractive destination for investment in shrimp culture. Amongst the coastal districts of Tamil Nadu, Chennai, Kancheepuram, Thiruvallur, Cuddalore, Nagapattinam and Kanniyakumari district have witnessed an increase in aquaculture activities.

4.7.7. Impact of Tsunami

The Indian Ocean undersea earthquake of magnitude 9.3 in the Richter scale that occurred on 26 December 2004 has devastated the coastal areas of all the 13 coastal districts of Tamil Nadu, including Nagapattinam, Kanyakumari, Cuddalore, Chennai and Kanchipuram³.

Table 4.6. Tsunami damage in India

Tsunami damage in India					
Factor	Andhra Pradesh	Kerala	Tamil Nadu	Pondicherry	Total
Population affected	211,000	2,470,000	691,000	43,000	3,415,000
Area affected (Ha)	790	-	2,487	790	4,067
Length of coast affected (Km)	985	250	1,000	25	2,260
Extent of penetration (Km)	0.5 - 2.0	1 - 2	1 - 1.5	0.30 - 3.0	
Reported height of tsunami (m)	5	3-5	7-10	10	
Villages affected	301	187	362	26	876
Dwelling units	1,557	11,832	91,037	6,403	110,829
Cattle lost	195	-	5,476	3,445	9,116

Source: TN official website

The state of Tamil Nadu has been the worst affected on the mainland, with a death toll of 7,995. Nagapattinam district has had 6,065 casualties, with entire villages having been destroyed. Kanyakumari district has had 799 deaths, Cuddalore district 610, the state capital Chennai 206 and Kancheepuram district 130. The death tolls in other districts were Pudukkottai (15), Ramanathapuram (20), Tirunelveli (4), Thoothukudi (3), Tiruvallur (29), Thanjavur (37), Tiruvarur (29) and Viluppuram (48)⁸.

Those killed in Kanyakumari include pilgrims taking a holy dip in the sea. Of about 700 people trapped at the Vivekananda Rock Memorial off Kanyakumari, 650 were rescued. In Chennai, people playing on the Marina beach and those who taking a Sunday morning stroll were washed away, in addition to the fisherfolk who lived along the shore and those out at sea. The death toll at Velankanni in Nagapattinam district is currently 1,500. Most of these people were visiting the Basilica of the Virgin Mary for Christmas, while others were residents of the town.

The fishery and aquaculture sectors in Tamil Nadu and Andhra Pradesh, and in the islands of Andaman and Nicobar have suffered major damages. Many fishing villages in these areas have lost human life, fishing boats, hatchery facilities, shelters and other belongings¹⁵.

The post-tsunami assessments revealed considerable ecological changes particularly in the severely affected areas. The data showed change in the inter tidal and sub tidal faunal assemblages. The density and diversity of phyto and zoo plankton had reduced while the benthic macro fauna was almost absent in all sampling locations in the inter tidal zone. There were vast changes in seafloor topography and shoreline, mostly transgression (50-250m) and regression (5-20m) in some areas. The deposition of heavy minerals was observed along the coastal track up to 3-20m away from the shore and was unusually abundant in the northern part of the state EC and pH values were high

in the affected agriculture lands and the micropaleontology study indicated the presence of foraminifera (*Elphidium* sp. and *Quinqueloculina* sp.) in the agriculture lands, which is a clear indication of seawater intrusion. However, there was no impact on ground water, but few areas showed higher concentrations of EC and salinity and they were transient. Some mangrove plants were uprooted in Pichavaram and Muthupet and the only major impact was sedimentation, which blocked free movement of water. In the case of other coastal plantation (casuarina, coconut and palm), the leaves become dry, otherwise, they withstood the tsunami impact except uprooted of few coconut trees in some places.¹⁷

4.8. Policy initiatives for conserving marine environment

4.8.1. Coastal Regulation Zone Notification, 1991 (CRZ)

In 1991, the Coastal Regulation Zone Notification (CRZ) under Environmental Protection Act 1986 was issued by the Ministry of Environment and Forests to protect the 500 meter zone from the high tide line and along rivers and creeks upto the area of tidal action. The Coastal Regulation Zone in Tamil Nadu is categorized under three categories as below:

Category I (CRZ I): Areas that are ecologically sensitive and important such as National Parks, Sanctuaries, Reserved Forests, Mangroves, Estuaries, Corals, areas close to breeding grounds of fish and other marine life, areas of outstanding natural beauty.

Category II (CRZ II): The areas that have already been developed up to or close to the shoreline. For this purpose, developed area is referred to as the area within the municipal limits which is already substantially built up and which has been provided with drainage and approach road and other infrastructure facilities, such as water supply and sewerage mains.

Category III (CRZ III): Areas that are relatively undisturbed and those which do not belong to Categories I and II. This will include coastal zone in the rural areas (developed and undeveloped) and areas within municipal limits where substantial development has not taken place.

4.8.2. Other Laws and Regulations

Apart from the Coastal Regulation Zone notification, 1991 there are many legislations / acts and rules related to coastal activities. The following are the important ones:

Indian Fisheries Act, 1897; Indian Ports Act, 1902; Merchant Shipping Act, 1974, Wildlife (Protection) Act 1972; Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981; Indian Coast Guards Act, 1974; and Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981; Environment (Protection) Act 1986; The Petroleum Act, 1934; National Environment Tribunal Act, 1995; Hazardous Wastes (Management and Handling) Rules, 1989. In addition to this, India has signed and ratified several international conventions relating to oceans and related activities. Some of these are related to marine environment and applicable to coastal area also. The important ones are: MARPOL 1973/1978; London Dumping Convention, 1972; Convention on Civil Liability for Oil Pollution Damages (CLC 1969) and its Protocol, 1976; Fund, 1971 and its Protocol, 1979; CITES, Convention on Biodiversity, 1992.

4.8.3. Dr. M.S. Swaminathan Committee

An expert Committee under Dr. M.S. Swaminathan was constituted by the Ministry on 19th July, 2004, for comprehensively reviewing the Coastal Regulation Zone Notification, 1991, in the light of findings and

recommendations of previous committees, future pronouncements, representations of various stakeholders and suggest suitable amendments, if necessary, to make the coastal regulatory framework consistent with well established scientific principles of coastal zone management. The committee has submitted its report to the Ministry on 14th February, 2005. The setback lines in the zones categorized as CMZ II and III will be based on vulnerability of the coast to natural and manmade hazards. For the purpose of mapping the vulnerability of the coast seven parameters are taken into account like elevation, geology, geomorphology, sea level trends, horizontal shoreline displacement (erosion/accretion), tidal ranges and wave heights⁶.

Coastal zone Management has also been recommended by this committee which is as follows:

- ❑ Coastal zone is defined as an area from the territorial waters limit (12 nautical miles) including its seabed upto the landward boundary of the local self government abutting the sea coast.
- ❑ Coastal zone also includes inland water bodies influenced by tidal action including its bed and the adjacent land area upto the landward boundary of the local government abutting such water bodies.
- ❑ In case of ecologically sensitive areas, the entire notified area/biological boundary of the area will be included³.

It has been recommended to have four management zones which will have integrated management plans for their management.

4.9. Policy response

4.9.1. Coastal Zone Management Authority

The Government of India, MoEF has constituted an authority namely, the Tamil Nadu Coastal Zone Management Authority, to enforce the Coastal Regulation

Zone notification. The Chairman of the Authority is the Secretary to Government, MoEF and the Director, Department of Environment is the Member Secretary.

4.9.2. Green Squad

The Government of India has emphasized that violations along the coast should be checked by the State Government through increased surveillance. Hence the Department of Environment has setup a green squad for monitoring CRZ violations.

4.9.3. Aquaculture Authority

Considering the environmental damages of aquaculture practices, the Supreme Court of India banned aquaculture within CRZ and entrusted the job of issuing clearance to the farms for the existing/proposed farms outside the CRZ to the Aquaculture Authority constituted as per the directions of the Supreme Court of India with headquarters at Chennai. To assist the Authority in regularizing shrimp farming, State level committee and District level committees have been constituted in the State.

Important functions of the Aquaculture Authority

- ❑ To ensure that no shrimp culture pond can be constructed (or) set up within Coastal Regulation Zone and up to 1 000 m of Pulicat Lake
- ❑ To ensure and give approval to the farmers who are operating traditional and improved traditional systems of aquaculture for adopting improved technology for increased production
- ❑ To ensure that the agricultural lands, salt pan lands, mangroves, wet lands, forest lands, land for village common purposes and the land meant for public purposes shall not be used (or) converted for construction of shrimp culture ponds.

- ❑ To implement the “Precautionary Principle” and the “Polluter Pays Principle” in coastal shrimp aquaculture activities
- ❑ To regulate and give the necessary approvals/authorisation for shrimp activities outside Coastal Regulation Zone areas and 1000 m from the Pulicat lake.

Source : Aquaculture Authority website

4.10. Projects on coastal environment

4.10.1. World Bank Project

The following activities are envisaged under the World Bank assisted Emergency Tsunami Rehabilitation Project by the Department of Environment.

4.10.1.1. Demarcation of HTL

The objective of this exercise is to prepare HTL demarcation digitized Coastal village maps in the scale of 1:5000 for easy identification of CRZ areas with reference to the Coastal Zone Notification, 1991.

4.10.1.2. Fixing Stone Pillars along HTL

Stone pillars will be fixed in the HTL points along the coast and tidal influenced water bodies for easy identification and regulation of CRZ notification

4.10.1.3. Preparation of Integrated Coastal management Plan, Resource Assessment and Coastal Vulnerability maps

The objective of this exercise is to formulate an integrated Coastal Zone Management plan incorporating Coastal Vulnerability mapping, resource assessments and ocean bathymetry in Tsunami affected areas. Special area Management Plans will also be developed for conservation and judicious utilization of coastal resources on a sustainable basis for amelioration of socio-economic condition of the local people without causing adverse impact on the environment. The initiative will also include training needs

assessment and development of suitable training packages for policy makers, Panchayat Presidents and local communities on the above topic.

4.10.1.4. Assessment of Polluted Water Bodies and their remediation

An assessment of polluted coastal water bodies in Tsunami affected areas, identify those water bodies that have potential for remediation, prepare management plans for selected water bodies and execute the remediation plans which should include all options for rehabilitation including bio-remediation.

4.10.1.5. Training and awareness programmes

Training programmes for stakeholders including resource users, planners and policymakers on the coastal regulation zone, importance and advantages of ICZMP and vulnerability mapping, shoreline protection and environmental awareness will be carried out.

4.10.2. Integrated coastal and Marine Area Management

(ICMAM) is a concept that facilitates sustainable management of the activities prevalent along the coastal and marine areas and ensures rational utilization of the resource available in the coastal land and adjoining sea. The Department of Ocean Development (DOD) was designated as the nodal agency to implement the coastal and marine area management component. The major objective of the project is to develop expertise on use of scientific tools and techniques that are need for integrated of coastal and marine areas.

The DOD established an integrated and Coastal and Marine Area Management (ICMAM) Project Directorate at Chennai in January 1998 to implement the four capacity building projects. They include Geographical Information System (GIS) based information system for selected critical

habitats, Determination of Waste Allocation Capacity for selected coastal areas; Development of environmental Impact Assessment (EIA) Guidelines for selected coastal activities and Preparation of Model ICMAM Plan for selected Coastal areas¹.

4.10.3. ENVIS on Coastal Zone Management

To deal with information on "Coastal Zone Management" the Ministry for Environment and Forests established ENVIS centre at Institute for Ocean Management, (COZMA), Anna University. The Objectives of COZMA are to develop well equipped information center on Coastal Zone management. To apply the modern technologies of acquisition processing, storage and retrieval of Coastal Zone Management topics to support and promote research and development towards sustainable Integrated Coastal Zone Management planning and to promote national and international co-operation and liaison in exchange of knowledge base on coastal and island management⁹.

4.11 References

1. Anon, 2003. Integrated Coastal and Marine Area Management (ICMAM) Plan for Chennai, Department of Ocean Development, ICMAM 288pp.
2. Anon, 2004. Fisheries Statistics, 2004, Department of Fisheries, Govt. of Tamil Nadu
3. Anon, 2005. To review the coastal regulation zone notification 1991. Ministry of Environment and Forests. 116pp.
4. Venkataraman, K. 2003. Natural Aquatic Ecosystems of India, Thematic Biodiversity and Strategy and Action Plan, The National Biodiversity Strategy Action plan, India. 275pp.
5. Kumaraguru A. K, K. Jayakumar, J. Jerald Wilson and C. M. Ramakritinan, 2005. Impact of the tsunami of 26

- December 2004 on the coral reef environment of Gulf of Mannar and Palk Bay in the southeast coast of India, *Current Science*, Vol. 89, No. 10.
6. Annual Report, 2004-05. Ministry of Environment and Forests.
 7. Balaji, S. 2005. Bio shield for coastal protection: Mangroves, shelterbelts and coral reefs, *In: National workshop on Tsunami effects and mitigation measures*, Department of Ocean engineering, 153-159 p.
 8. TN Government Website.
 9. Institute for Ocean Management, Anna University, (web: <http://www.annauniv.edu/iom>).
 10. Venkataraman, K., Ch. Satyanarayana, J.R.B. Alfred and J. Wolstenholme, 2003. Handbook on Hard corals of India, Zoological Survey of India. 266pp.
 11. Kannan, L., T. Thangaraj and R. Sridhar, 2006. Reflection of Boxing Day Tsunami on coral reef ecosystem of India. *In: Geomatics in Tsunami*, New India publishing agency, pp. 167-177.
 12. Patterson, J.K. 2005. Rapid assessment of status of corals in the Gulf of Mannar after Tsunami. Assessment Report, SDMRI, Tuticorin.
 13. Balaji, S. 2000. Environmental issues in coastal zone management of Tamil Nadu, (*In*) Management of problems in coastal area ocean engineering center. 105--113 p.
 14. Ramachandran, S., D. Asir Ramesh and V.S. Gowri, 2000. Coastal ecosystems: Their problems and management, (*In*) Management of problems in coastal area ocean engineering center. 170-185 p.
 15. Anon, 2005. Food supply and food security situation in countries affected by the Asia tsunami, FAO website (<http://www.fao.org/giews/english/shortnews/asiatsunami050114.htm>).
 16. MS Swaminathan Research Foundation website (www.mssrf.org).
 17. Anon, 2005. Rapid environmental impact assessment after Tsunami in the inter tidal and sub tidal and coastal areas including water bodies and lakes along Tamil Nadu Coast, 30pp.