

An aerial photograph of a coastal region, showing a wide expanse of blue water meeting a white sandy beach. The coastline is irregular, with several inlets and peninsulas. The water appears to be a deep blue, while the sand is a bright white. The overall scene is a natural, undisturbed coastal landscape.

# TAMIL NADU & PONDICHERRY

## COASTAL AREA ASSESSMENT

A POST TSUNAMI STUDY ON COASTAL CONSERVATION AND REGULATION

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CONSERVATION AND REGULATION



EQUATIONS  
INDIA

# TAMIL NADU & PONDICHERRY

## Coastal Area Assessment

A post tsunami study on coastal conservation and regulation.

EQUATIONS, INDIA

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EQUATIONS was founded in 1985 in response to an urge to understand the impacts of tourism development particularly in the context of liberalised regimes, economic reforms and the opening up of the economy. We envision tourism that is non-exploitative, gender just & sustainable where decision-making is democratised and access to and benefits of tourism are equitably distributed.

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# EXECUTIVE SUMMARY

## CONTEXT OF THE STUDY

This study was undertaken in the context of the tsunami of 26 December 2004, which was a grim reminder of the need to ensure the protection of coastal and island ecosystems and to revisit issues relating to legal and policy frameworks governing them. Both coastal and island ecosystems are ecologically fragile and extremely sensitive to the natural and anthropogenic activities affecting them. While it is not attempting to be a tsunami impact assessment study, it raises and attempts to answer a number of questions need to be addressed in the context of the tsunami and the series of events that followed. Primary among these are:

1. How can the integrity of coastal ecosystems be ensured and not compromised, given, on one the hand, the rehabilitation and reconstruction of affected communities, and on the other, the numerous development plans that have been chalked out by governments for different sectors?
2. Are the existing legal and policy frameworks and their processes adequate to regulate these activities?
3. What are the implications that natural disasters like the tsunami, pose for the implementation of legal and policy frameworks?

This study may be considered as a contribution to the ongoing debate and advocacy efforts with concerned individuals, groups and authorities to revisit the coastal area development debate and current legal and policy frameworks, specifically the Coastal Regulation Zone Notification, 1991 under the Environment (Protection) Act, 1986. EQUATIONS, having worked on impacts of tourism on communities and ecosystems, sees this study as an opportunity to revisit these issues in the particular context of tourism development, highlight concerns where we have been consistently attempting to influence tourism policy and its implementation.

## OBJECTIVES OF THE STUDY

The study was initiated with a set of short term and long-term objectives, which were:

### SHORT-TERM OBJECTIVES

1. Assess the extent of impact on human life, livelihoods, property and coastal and island ecosystems from an environmental perspective.

2. Assess the vulnerability of coastal and island ecosystems due to unplanned and unregulated development.
3. Collect preliminary information from the affected sites.
4. Examine violations of environmental laws and related matters thereof.

### LONG-TERM OBJECTIVES

1. Document procedural lapses in permitting such activities.
2. Facilitate strengthening of existing legal frameworks to address unplanned development.
3. Critique development plans and activities on coasts and islands.

However, during the course of the study, the team was compelled to revisit some of them. In the short-term objectives, legal violations of environmental laws, which in this case are the Coastal Regulation Zone Notification, 1991, could not be established due to the ambiguity in the Notification regarding clearance mechanisms for projects. What would appear to be an “in-principle” violation may actually be a cleared project. Detailed and case-by-case investigations have to be undertaken for this. Therefore, this aspect of the Notification has not been dealt with in this study. In the long-term objectives, documentation of procedural lapses in allowing such activities was also not undertaken due to the aforementioned reasons. The study has been able to deal with address all other objectives reasonably well.

## ACTIVITIES & REPORT

An assessment of the coastal areas in Tamil Nadu and Pondicherry which were affected by the tsunami of 26 December 2004 was carried out. EQUATIONS along with the support of a network of concerned organisations and individuals undertook this assessment by way of field visits, consultations with individuals and groups and compilation of secondary data. This exercise was initiated with the aim of assessing the extent of impacts on human lives, livelihoods, and ecosystems on the one hand, and to document and critique existing legal frameworks and development plans relating to coastal and marine systems.

This study was undertaken during the period March – December 2005. This assessment was undertaken by way of field visits, consultations with local individuals and groups, photo-documentation and compilation of secondary information and data. This investigation helped ascertain the extent of impacts on human lives, livelihoods, and ecosystems on the one hand, and to document and critique existing legal frameworks and development plans, especially tourism relating to coastal ecosystems in Tamil Nadu & Pondicherry.

The results attest to the fact that both coastal and marine ecosystems are important in terms of their ecological and livelihood sustaining functions. At the same time they are ecologically fragile and are extremely sensitive to the natural and anthropogenic activities affecting them. The first section of the report contextualises the impact of the tsunami by describing the role and function of coastal and marine ecosystems. A detailed description of the various components of marine and coastal ecosystems in Tamil Nadu and Pondicherry and the human activities impacting them are described in detail. This includes information on the distribution of coastal systems such as mangroves, wetlands and coral reefs, their ecological role and the anthropogenic activities and population densities reported from the districts. Detailed information on ecologically important areas such as the Gulf of Mannar, Pulicat Lake and Vedaranyam is provided. The impact of the tsunami in terms of loss to life and property are listed for districts as well as specific sites. Along the east coast of India, the Nagapattinam and Kanyakumari districts reported the maximum loss of life. The report also discusses the reconstruction activities that are being taken in the affected areas.

The second part of the study addresses how ongoing and planned reconstruction, rehabilitation and development activities need to be managed and presents an analysis of coastal management issues with respect to legislations and policies. The single overarching legislation for coastal areas, the Coastal Regulation Zone (CRZ) Notification, 1991 is examined in detail. Although proposed more than a decade ago, this notification is ambiguous and is yet to be fully implemented. The procedural lapses and loopholes regarding implementation of this legislation, problems with the jurisdictional scope and dilution of this notification by newer laws and numerous amendments is also discussed in this context.

A number of recommendations emerge from this study. These include: developing guidelines to strengthen the existing frameworks on coastal legislation, capacity building at the community and panchayat level on the CRZ rules and provisions, preservation of ecologically sensitive areas rich in biodiversity.

The strengthening of community based models of conservation and encouraging traditional means of beach conservation as opposed to sea walls and exotic plantations, renewed restrictions on constructions and conversion along the coast, carrying out sector wise studies on assessing economic costs and benefits to various sections of the society. Suggested means of rehabilitation and resettlement of people affected by the tsunami, specially the fisherfolk and those local people who depended on tourism and tourism related activities for their livelihood.



## RECOMMENDATIONS

1. Extend the Jurisdiction of CRZ to include the inter-tidal area in all zones
2. Urgent need to extend the CRZ seaward after detailed study to ascertain the area for impact from land based activities  
Action by: MoEF
3. Definition of local inhabitants and 'traditional rights and customary uses' to be defined and identified in the context of the CRZ notification.  
Action by: Civil Society and Government in consultation with local coastal communities
4. Demarcation of the HTL and the LTL needs to be done at the earliest  
Action by: NCZMA and SCZMA in consultation with local Panchayats.
5. Detailed project clearance guidelines need to be given in the CRZ notification complimented by EIA procedures for all project clearances  
Action by: the NCZMA and SCZMA
6. In order to understand the true status of implementation of the CRZ notification until now, detailed studies exploring the following questions will need to be undertaken:
  - a. How many of the development activities on the coast have been established legitimately following all due legal regulatory procedures?
  - b. How many of the legally established units comply with the conditions imposed on them?
  - c. How many units have been established without following all the environmental regulatory procedures?  
Action by: Peoples Movements and Networks, Civil Society Organizations in consultation with the SCZMA.
7. SCZMA suo moto needs to remove the ambiguity in its functioning by bringing into the public realm and disclosing practices they use to give clearances for projects
8. The linkages between other laws like Town and Country Planning; Building regulations and CRZ need to be synergised by MOEF
9. The CRZ should be synergised with the PRIA for implementation of CZMP. Representation of panchayats in the SCZMA needs to be ensured. A clause in this regard needs to be included the CRZ Notification to reflect the synergies with PRIA.  
Action by: MoEF
10. The Governments of Tamil Nadu, Pondicherry and the MoEF should provide for the independent, responsive and transparent functioning of the State CZMA.
11. The Governments of Tamil Nadu, Pondicherry need to reconstitute district level committees constituted by the CZMA through maximum public participation and involvement of local governing bodies, especially the panchayats of fishing villages.
12. A mechanism should be devised to make officials personally liable in case they fail to take action against violations.
13. Public access must be provided to all proceedings of the authorities, including minutes, copies of complaints, applications for approvals, approvals and action taken reports.
14. The CZMP needs to be rewritten keeping in mind the context of current developments, including changes that may have been brought about by the tsunami, with full participation of all aforementioned stakeholders.
15. The maps must be translated and disseminated widely. Access to the same should be mandatorily provided upto Panchayat level in Tamil for comments and approval, prior to it becoming an approved working document.
16. The state government should also take immediate steps to identify erosion prone, tsunami affected areas and areas, which are likely to be inundated due to climate, change as CRZ I areas in the CZMP.  
Action by: The state government needs to direct the SCZMA to prepare the new CZMP's for Tamil Nadu and Pondicherry.
17. There is a need for capacity building at the community and panchayat level on the CRZ rules and guidelines  
Action by: state government with TNCZMA
18. It is important that Vedaranyam and several other wetlands be declared as wetlands of international

importance under the RAMSAR convention.

Action by: MoEF

19. Encourage community based models of management

20. The ecologically important coastal areas need to be declared as ecologically sensitive areas under the Environment Protection Act, 1986.

Action by: MoEF

21. A review of the policy of bio-shields, especially coastal plantations should be undertaken and all plantation and afforestation activities should be on hold till this review is undertaken.

Action by: Department of Environment & Department of Forests, governments of Tamil Nadu; Pondicherry

22. Cumulative impact assessment studies need to be undertaken before grant of clearance to any more projects on the coast. This is to address the additional environmental damage that may result from any new proposed project in a certain area.

Action by: SCZMA to give directives to project proponents.

23. Sector-wise studies also need to be undertaken to assess the extent to which economic benefits and employment are created for local communities by activities such as tourism and these need to be weighed against the costs incurred by the communities by these activities in the form of loss of resources and socio-cultural impacts.

Action by: Government departments such as tourism

24. These studies should seek to determine the activities that are to be permitted along the coast and at what scale. These studies need to maintain the health and basic needs of local communities and ecosystems as central goals.

25. The state government should make available to the civil society all land records/ relevant documents of pre and post 1991 land use patterns and constructions. These will contribute significantly to the ongoing reconstruction phase.

26. Reconstruction of houses, settlements and other facilities that existed prior to the tsunami are to be allowed and no new constructions should be allowed. Reconstruction activities should not

alter the local beach ecology and geomorphology, especially in the case of use of raw materials such as sand stone, sand, etc. The type of reconstruction should be as per those permitted within the CRZ rules and guidelines. Technical guidelines reconstruction of shelters should be prepared as tool for organisations involved in reconstruction.

27. Since many NGOs new to the coast are developing fishing hamlets besides reconstruction of shelters, a guideline/key should be developed detailing all the activities and structures that are allowed in the different zones in the CRZ.

28. An addendum to GO 172 is much needed to protect the CRZ that becomes free of habitation. The GO must indicate that the lands that get freed up on the coast will be protected and used only in a manner which maintains the ecological balance of the coast and no developmental activities will be undertaken unless proved as being beneficial to the ecology of the coast. These areas should be marked in the CZMP and special committees at the district level which comprise of representatives of the fishing communities should determine the future use of these lands.

29. The GO which allows district officials to acquire wetlands for the purpose of reconstruction and housing needs of tsunami affected families needs to specify a date after which such acquisition should not be allowed and the earlier GO which requires district officials to seek the state governments prior approval before such acquisitions should be restored.

30. It is strongly recommended that tourism development should not displace the local communities, not change their traditional livelihood practices and not deny access to coastal areas and resources, which are their traditional and customary rights.

31. The Tourism Department should respect the need to protect ecologically sensitive areas and leave them alone from tourism development.

32. The ecological and social footprint of tourism in existing coastal tourism destinations needs to be measured. Social and environmental impact assessments have to be conducted for any tourism project or plan irrespective of its size.

## LIST OF ABBREVIATIONS

1.	CPCB	Central Pollution Control Board
2.	CRZ	Coastal Regulation Zone
3.	CZMA	Coastal Zone Management Authority
4.	CZMP	Coastal Zone Management Plan
5.	EIA	Environment Impact Assessment
6.	EP Rules	Environment (Protection) Rules
7.	EPA	Environment (Protection) Act (1986)
8.	Gol	Government of India
9.	HC	High Court
10.	HTL	High Tide Line
11.	ICZMP	Integrated Coastal Zone Management Plan
12.	LNG	Liquefied Natural Gas
13.	LTL	Low Tide Line
14.	m	metres
15.	MoEF	Ministry Of Environment And Forests
16.	MoPNG	Ministry of Petroleum & Natural Gas
17.	MoST	Ministry of Surface Transport
18.	MoT	Ministry of Tourism
19.	NDZ	No Development Zone
20.	NOC	No Objection Certificate
21.	SC	Supreme Court
22.	SCC	Supreme Court Cases
23.	SCZMA	State Coastal Zone Management Authority
24.	SCZMP	State Coastal Zone Management Plan
25.	SEZ	Special Economic Zone
26.	SPCB	State Pollution Control Board
27.	TN	Tamil Nadu
28.	TNCZMA	Tamil Nadu Coastal Zone Management Authority
29.	Uol	Union of India
30.	WP	Writ Petition

## INTRODUCTION

### 1.1. THE MILIEU

Coastal areas are subjected to natural dynamics induced by processes such as low and high tides, land and sea breezes, the formation of sand dunes along beaches, the formation of sand bars and spits, frequent storms and cyclones and the occasional yet devastating tsunami. These ecosystems have the capacity to respond to a change and recover from such situations in the normal course, but this response is often affected and slowed down as a result of anthropogenic activities. A spanner is thrown in the system when human activities assume proportions beyond what coastal ecosystems can bear—in the form unplanned, unregulated and unfettered expansion and developmental activities and what are considered remedial activities or management measures, e.g. sea walls and coastal plantations of exotic species.

As is the case in many parts of the world, the coastal areas in India are also densely populated. Apart from rural and urban settlements, coastal areas are the site of many kinds of industrial and infrastructure developments. Chemical and petrochemical industries, thermal power plants, aquaculture and tourism are the main industrial activities that happen along the coastline. Not to mention all major and minor ports, harbours and jetties that dot the Indian coastline and islands of Andaman and Nicobar Islands and Lakshadweep. Defence and nuclear installations also favour coastal areas.

Coastal ecosystems such as estuaries, mangroves, wetlands, coral reefs and deep seas receive less attention in the form of policy and legal frameworks as compared to terrestrial ecosystems like forests and mountains. This is also evident from various laws and policies that govern forests nationally. Although some these would be applicable to specific sub-systems of coastal areas (e.g. mangrove forests come under the Wild Life (Protection) Act, 1972 and the Forest (Conservation) Act, 1980, a substantial portion of the coastal areas are to be governed by a single notification under the Environment (Protection) Act, 1986 — the Coastal Regulation Zone (CRZ) Notification, 1991.

### 1.2. THE TSUNAMI AND ITS AFTERMATH

Initial assessments carried out by the government as well as non government and inter-governmental agencies emerged with similar findings—rehabilitate natural ecosystems; natural protective measures are preferred to artificial physical barriers; manmade barriers such as seawalls fragment habitats and would aggravate the impacts of tsunami by creating turbulence. Most of these environmental assessments are also critical and advocate better coastal management and land use strategies to reduce vulnerability and stress on coastal ecosystems.

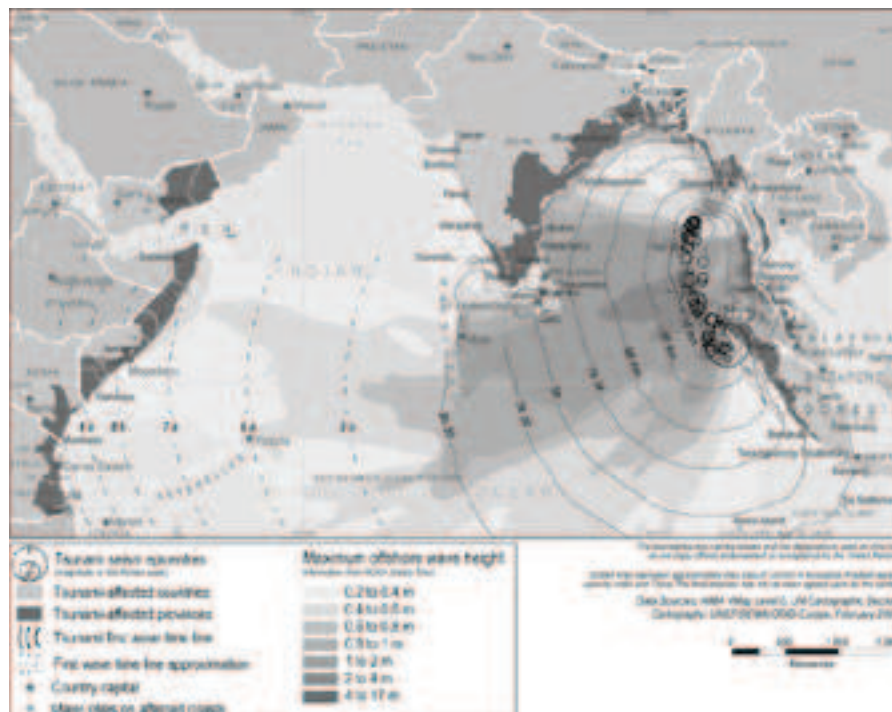
It may not be possible to directly correlate the extent of tsunami linked damage to life and property to the volume of development on the coastal areas due to various factors in play, e.g. time of tsunami as this would determine daily human activity on the beaches, the proximity of habitats to coastline, etc. It may also not be possible to assess how vulnerable coastal ecosystems have become to natural disasters due to the amount of effort, technical expertise and time required to undertake such assessment studies. However, at the same time, it is possible to deduce how haphazard and unrestricted developments have rendered coastal ecosystems vulnerable to undesired change. This is more pronounced in the case of coastal states such as Tamil Nadu and Pondicherry, which suffered maximum damage as compared to the other states on the coast

The Coastal Regulation Zone (CRZ) Notification, 1991 was conceived to be a guideline that would influence all types of developmental activities on the coast, yet it has not been fully implemented since its introduction a decade and a half back. There are numerous violations and dilutions of its philosophy, provisions and clauses. The Notification itself remains ambiguous as to its implementation (for e.g. the process of obtaining clearances for projects), although it lays down clearly what are permissible and non-permissible activities. Affected areas like Tamil Nadu and the Andaman and Nicobar Islands do not yet have approved Coastal Zone Management Plans; almost a decade has passed since the Supreme Court deadline was given for submission and approval of these Plans. Developmental projects and activities

seem to be taking place on an ad hoc basis under the Notification. However, the Notification remains as “what a straw is to a drowning person”. Over and above this, legislations at national or state level bring about policies and plans that contradict the principles of CRZ. In the context of tourism, it is important to study the wide range of lobbies that push for “certain kinds of developmental activities”

that will have impacts on communities, livelihoods, ecology and development of sustainable tourism. The need of the hour is to go back to the original philosophy of the CRZ Notification, take on board the contemporary challenges and rework its norms, provisions and regulatory measures. This study is an attempt in this direction.

FIGURE 1 : PATH OF TSUNAMI ON TIME SCALE & MAGNITUDE OF IMPACT



Source: [http://www.grid.unep.ch/product/map/images/indianocean\\_propwave.gif](http://www.grid.unep.ch/product/map/images/indianocean_propwave.gif)

### 1.3. METHODS

The study in Tamil Nadu was carried out in three phases—a rapid assessment undertaken in January 2005, a field visit in March 2005 and another field visit combined with consultations in November and December 2005.

EQUATIONS and the Tamil Nadu Environment Council<sup>1</sup> (TNEC) initially conducted a rapid assessment immediately after the tsunami in January 2005. This was done in collaboration with various NGOs, individuals and networks. The rapid assessment survey was instrumental in documenting at first level issues that would eventually help in understanding issues of coastal access, conservation and management in later field visits that were undertaken as part of the study.

Following the rapid assessment and in order to gather more detailed information on impacts of the tsunami on coastal communities and ecosystems, primary data collection was carried out. This process involved

field level investigations with active support of state level partners. The team travelled from Tiruvallur to Kanyakumari (excluding three districts—Thiruvallur, Thanjavur and Pudukkottai) including Pondicherry and Karaikal. The team surveyed the coastal areas and attempted to collect information on the following:

1. Extent of fragmentation and degradation through development prior to disaster.
2. Current status of developments, including those planned, post disaster.

Field level information was collected on ecosystem types as well as development activities and their impacts. The team only made its observations during two visits to the affected areas. During the first visit the team gathered preliminary information and the same was followed up in the second visit where more detailed information was gathered based on discussions with the coastal communities. As planned the first round of visits were to Thiruvallur,

<sup>1</sup> Tamil Nadu Environment Council (TNEC) is a state level network of NGOs which are working on environmental issues. The main functions of the TNEC is advocating on the environmental concerns in the state, it has also brought out the State of the Environment reports for the last decade.

Chennai, Kanchipuram, Villupuram, Pondicherry Cuddalore, Nagapattinam, Ramanathapuram, Thoothukudi Tirunveli and Kanyakumari. The second visit included an additional of the three districts of Tanjavur, Thiruvarur and Pudukkottai.

A systematic photo-documentation process was also undertaken. The field data that was collected included:

- a. Documentation of various types of coastal ecosystems
- b. Assessing development impacts of:
  1. Industry – categories and types, locations, checklist impacts
  2. Mining – sand, rare earths
  3. Aquaculture farms
  4. Tourism – hotels, resorts, parks, water theme parks, amusement parks
  5. Infrastructure – East Coast Road (ECR), roads, other facilities and amenities
  6. Artificial beach protection, and other infrastructure built to withstand erosion and storm surges
  7. Social infrastructure

The above data was collected through observations, interviews, group discussions and consultative meetings with coastal communities, their representatives and civil society groups during November and December 2005.

## 1.4. LIMITATIONS

The main limitation confronted by the study in Tamil Nadu and Pondicherry was the non availability of studies on specific impacts of the tsunami e.g. on coral reefs and mangroves.

Our inquiry was limited to a macro level assessment of the ecosystems. Moreover, studies like those would require investments in terms of time, money and expertise much beyond the scope and mandate of the study.

## 1.5. THE STUDY AREA

FIGURE 2: TAMIL NADU AND PONDICHERRY



The Tamil Nadu coast is straight and narrow without much indentation except at Vedaranyam. Fringing and patch reefs are present near Rameswaram and the Gulf of Mannar. Pichavaram, Vedaranyam and Point Calimere have well-developed mangrove systems. 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 the 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, Mahabalipuram and North Madras near Ennore.

## PONDICHERRY

Topographically, the Pondicherry region is flat country having an average elevation of about 15 meters above sea level, intersected by the deltaic channels of the rivers Gingee and Ponnaiyar and other streams forming the two main drainage basins, interspersed with lakes and tanks. To the northwest of Pondicherry town, a girdle of low hills (or an elevated ground of about 30m high) is noticed. This high ground suddenly emerges from the low alluvial plain country known as Gorimedu. This forms the most prominent feature of the landscape. The Gingee River crosses the region diagonally from the northwest to the southeast. Ponnaiyar forms the southern border. The alluvial delta of Ponnaiyar is almost on dead level ground, only a few meters above the sea. The coastal border has a length of 22 km and a breadth ranging from four to six hundred meters. Superficially, the coast is flat and sandy. The coastal zone of Pondicherry comprises newer and older dunes including saline areas of clayey texture. The other zone is made up of the two plateaux – Pondicherry plateau and the Thiruvakkarai plateau.

Karaikal, which forms a part of the fertile Cauveri delta the region, is completely covered by the distributaries of the Cauveri. Covered completely by a thick mantle of alluvium of variable thickness, the lie of the land is flat having a gentle slope towards the Bay of Bengal in the east. It is limited on the north by the Nandalar and on the southeast by the Vettar. The group of rocks known as the Cuddalore formations is met with in the area contiguous to the Karaikal region in Nagappattinam District<sup>2</sup>.

<sup>2</sup> <http://karaikal.nic.in/Administration/General/General.htm>

## DEVELOPMENT ACTIVITIES AND IMPACTS

The state of Tamil Nadu is gifted with a beautiful and resource rich coastline. The lives of 7.60 lakhs marine fishermen and several thousands who are employed in allied activities depend on the health of the coast. So the effective management of the coast is by no means only a social and environmental issue but has economic relevance too. The significance of coastal ecosystem constituents in protecting coastal habitats and communities is clearly explained by the manner in which the impacts of the tsunami were felt in different parts of coastal Tamil Nadu and Pondicherry. Factors such as the alteration of the coastal landscape by siting of development projects and the degree of human intervention on the coast, which resulted in the loss of mangroves, sand dunes, etc. the type of construction on the coast, and increasing urbanisation along the coast have influenced the extent of tsunami casualties.

A district-wise overview of some of the development projects that exist along the coast and the impacts they have had and continue to have on the coastal ecosystem is presented below. A summary of development activities is also provided in Table 1.

### 2.1. THIRUVALLUR

Pulicat lake, the Ennore creek, backwaters, Buckingham canal and salt marshes are linked with one another to form a part of a coastal ecosystem that is fragile and sensitive. The impact on any one of these water bodies will have an adverse effect on the entire ecosystem. The Pulicat lake was identified as a site of international importance by the International Union for the Conservation of Nature (IUCN). The area used to have rich mangroves but due to industrialisation these have been degraded. Pollution from pesticides, sewage, agricultural chemicals and industrial effluents are the major threats. The Arani and Kalangi rivers draining into the lake bring in fertilisers and pesticides with runoff from the agricultural fields in the drainage basin. Domestic sewage also enters the lake. The lake is thus being increasingly subjected to many kinds of anthropogenic disturbances. The Tamil Nadu Pollution Control Board Laboratories, Alkali Industries, Ashok Leyland and other automobile industries are located along the coast in Thiruvallur district. Part of the lake is in Andhra Pradesh.

The left side of Ennore Express way has several industries including the Madras Thermal Power station (MTPS), boulders and groynes were laid along a continuous stretch till the power plant area. This has resulted in sea erosion of the adjacent villages, especially at the villages located north of the power plant. Groynes<sup>3</sup> and sea walls constructed near Ennore and the boulder wall of 3.3m height and 2.3m width opposite the Coromandel Cement Factory at Ennore also aggravated the impact of the tsunami over the coastal communities living nearby (Plate #1).

The power plant is a major cause of pollution of the lake as it discharges fly ash and hot water into the lake directly. The hot coolant water released by the MTPS is damaging the Pulicat ecosystem (Coastal Action Network, 2004<sup>4</sup>). But the locals say that the government has not given any attention to this issue.

The Ennore port has further aggravated the erosion problem by inducing it further north. The local people have said that it is a major cause for sea erosion in this area and the sea had come in about 500m and had completely wiped out two streets in Sattan kuppam. In Korrai Kuppam the community well was lost. Hence a sea wall is being built in north of Chennai to check these coastal problems (Plate #2). The strip of land between the Bay of Bengal and Pulicat Lake faces severe sea erosion. An elderly shopkeeper in Korai Kuppam said that the sea used to be a mile away from his shop, but now it is very close.

The beach here used to have a lot of vegetation and sand dunes. Some villagers said that casuarinas were found all along the beach. But in recent years, private landowners have removed them. People shared that in the last 20 years, coconut trees, casuarina forests and huge sand dunes had decreased as they were wiped out by sea erosion. The original mangrove forests have been steadily cleared to establish salt pans (Plate #3). Added to this is the problem of chemically treated residual water that is let out of the adjacent shrimp farms and remains in small pond-like configurations in the middle of the degraded mangroves.

<sup>3</sup> groyne - a protective structure of stone or concrete; extends from shore into the water to prevent a beach from washing away, <http://www.thefreedictionary.com/Groynes>

<sup>4</sup> Coastal Action Network, 2004. "Protection of Coastal Ecology and Coastal Communities – Issues and Concerns", Nagapattinam.



## 2.2. CHENNAI

The Chennai coastal stretch used to be characterised by fine sandy beaches, and fishing settlements interrupted by backwaters, casuarinas and coconut groves. Even though the coastal stretch of Chennai is short, this is the most densely populated part of the coast. The beach of the southern stretch in Chennai is broad and here human intervention is very high due to high population densities in the coastal communities. These parts have already witnessed a high degree of urbanisation, for instance even the settlements of the fishermen are multi-storeyed. In Sulerikadu a high-rise building with a hatchery is located along the East Coast Road (Plate #4). Another is the Devanery housing complex beyond Elanthopu that is located less than 50m from the HTL (Plate #5). The land between Chennai and Kancheepuram is premium real estate and this trend will only grow as several IT companies and an international airport are poised to come up along the coast.

In Manali, effluent discharge pipes extend right up to the sea and dump industrial effluents (See Box 1 for more details), while the location of the industries themselves may not be a violation of CRZ norms. Industries along Uppannar river in Cuddalore are dumping their effluents into the river. This and several other observations about the pollution caused by the industrial units in Manali have been made by the Local Area Environment Committee (LAEC)<sup>5</sup>. Existing chemical industries have been contributing immensely to the pollution loads in the coastal areas of Chennai. Major industries like Hindustan Teleprinters, Indian Drugs and Pharmaceuticals, Madras Surgical Instruments, Britannia and numerous industries engaged in electroplating, battery and electrical goods manufacturing, chemical, textile industries, pigment colouring, paint manufacturing industries, automobile spare parts manufacturing units, private hospitals and government institutions,

slaughter houses, crematorium and graveyards are located along the Adyar and Coovum (Chennai) estuaries and foreshore coastal belts. In and around Tondiarpet, the Chennai port and polluting seafood export industries are also located.

Landscaping is yet another major activity carried out by the government for putting up recreation facilities. The Marina beach has witnessed considerable landscaping. The northern stretch towards Ennore has very little beach and in most of these areas, groynes were laid much before the tsunami and the same continues even now.

The Chennai stretch towards Mamallapuram has casuarina groves, coconut groves, and aquifers near Neelangarai and Kapaleswar Nagar. But these are likely to disappear soon as these areas are fast developing into farmhouses of film personalities and politicians. Farmhouses located between Periyannemeli and Pattipulam along the ECR on the seaward side have their compound wall extending right up to the sea front. Many guesthouses and resorts like Buena Vista have come up within 60m from the HTL. Some of the casuarina groves have been destroyed by the tsunami.

Several shrimp farms and jellyfish processing units are also located along this coast. Many of them are barely 100m away from the sea. Along the ECR too, a number of prawn farms and hatcheries have come up and many of these are within the 500m of the CRZ. Some are even located along rivers and creeks. There are more than 50 shrimp hatcheries functioning between Chennai and Mamallapuram. These hatcheries are highly destructive, as they increase the salinity of the ground water and make the surrounding land barren, unfit for any cultivation.

### BOX 1 THE MANALI INDUSTRIAL AREA

Manali, situated 25 km north of Chennai along the coast and lies en route to the Ennore port, is a notified critical industrial complex. The 800-hectare industrial area is home to several large and medium-scale industries and undefined number of small-scale industries. 14 of the major industries belong to the 'Red' category. The "parent" company Chennai Petroleum Corporation Ltd. (CPCL) supplies products and by-products to the downstream companies situated in the area. Manali industrial area, 25 km away from Chennai city is a notified critical industrial complex because of the existence of a petroleum refinery, down stream petrochemicals, fertiliser and chemical industries. It is spread over an area of 800 hectares. There are 14 major industries located in the complex. With CPCL as the Parent Company, most of these industries obtain raw material from CPCL. The areas of concern for the local people have been the accumulated waste discharged in unauthorised areas, ground water deterioration, handling/disposal of wastes through agents and poor ambient air quality due to flares and fugitive emissions.

<sup>5</sup> Relying upon paragraph 55 of the apex court order dated 14.10.2003 which requires the involvement of alert and informed members of the community in the task of environment protection, the SCMC constituted Local Area Environment Committee (LAEC) for Delhi, Maharashtra, Kerala, Bhopal, and Hyderabad. For Tamil Nadu, the SCMC constituted LAECs for SIPCOT Industrial Estate, Cuddalore and surrounding area, Manali Industrial Area, Chennai and surrounding and for M/s. Hindustan Lever Ltd., Kodaikanal to assist the SCMC with the enormous task of ensuring that the orders of the Supreme Court dated 14.10.2003 are implemented in letter and spirit in the state.

### 2.3. KANCHEEPURAM

The Kancheepuram coast has witnessed a ongoing landscape change during 2003 – 2005 due to unregulated development of tourist facilities and structures. Facilities like that of the Jambodai and MGM resorts have occupied prime space along the coast from the sea front. The facility, especially the building, discotheque and a lawn covering the beach has been built at the cost of coconut plantations that were destroyed for this purpose. The most serious impact has been the loss of access for the local fisher folk to the beachfront and the sea all through this stretch. There is also noise pollution mainly due to the pumps and during periods of high tourist activity. The MGM Restaurant occupies a space within 75 metres of the coast in Kovalam. Sangrila- Dolphin City is an entertainment space that used dolphins and seals to attract people and is located within 50 m of the HTL; but it has been closed down. Incidentally, the compound wall of Dolphin city was damaged by the waves during the tsunami. In Mamallapuram, Fisherman's Cove is located within the CRZ. Inside Mamallapuram, near the Shore Temple, inundation due to natural factors has been high and there are walls made up of boulders. In the name of tourism, a lot of artificial landscaping on the beach by use of granite slabs and Mexican grass has been undertaken (Plate # 6), a private handicraft shop is being established within 200m of HTL. A religious institution, Sri Narayana Gurukulam and Dhyana Nilayam (a multi-denominational Christian institution) have been constructed within 50m of the HTL.

Pattipulam is a stretch that was originally covered with Casuarina groves. This area has now been converted into private resorts and cottages. Silver Sea Beach, a unit of Mayajal has constructed cottages starting from the ECR right upto the sea front. A resort named ABC Baywatch has been set up with many private villas constructed within 100-200 m from the HTL in Periyaneli, a fishing hamlet with more than 300 families. The first three rows of houses facing the seafront were damaged by the tsunami.

In Kanathur, the sea front marginally elevated. In this area, four hatcheries are in operation within the 60 m of the HTL. The tsunami has caused some damages to the hatcheries. Some of the hatcheries that are located in the CRZ are K.R. Hatchery, Surendra Hatchery, Royal Hatchery and Aana Nova Hatchery. The Maruti Aqua Hatchery is in operation within 50 m of HTL in Sadurangapattinam. Matha Hatchery was seen to be operating within 100 m of the HTL. DJ Hatchery,

located at about 75 m from the HTL is in operation in Kovalam (Plate #7). Local people say that the hatchery has a motor pump that was installed on the beach for pumping in water as well as discharging the processed water. Raj Hatcheries was found located along the side of the creek. The hamlet of Meyyurkuppam has been affected due to the pollution from two hatcheries, Vivek Hatchery and Aqua Hatchery, which have been functioning within 50m of the HTL.

In Vembalur area in this district, private plantations dominate the entire coastal landscape. There is a danger of these being converted into real estate plots and used for economic activity in the future.

### 2.4. VILLUPURAM

There are casuarina plantations in this stretch; eucalyptus plantations here are maintained by the local forest office in the Agaram area.

Mining and quarrying activities were observed at Kottai Kadu in Villupuram district. In Perundurayur and Odiyur, many shrimp hatcheries were seen to be operating. From Naravakkam to Eggiyarkuppam, aquaculture activities are being carried out, the prominent operating unit being Calypso Aquatech Shrimp Hatchery. Ventura Hatchery is in operation in Keezhkuppam and Oceanic shrimp hatchery is in operation in Alapakkam. Shrimp farming activities such as those by BMR Shrimp Hatchery, are being carried out in Anumanthai (Plate #8).

### 2.5. PONDICHERRY AND KARAİKAL

The coastal stretch in Pondicherry is flat and at an elevation of about 15 meters. Red sandy beaches, sand dunes and casuarina groves are found along the coast of Pondicherry especially in places such as Kooraimedu kuppam, Anumanthai and Othiyoor. The northern part of Pondicherry has better coastal vegetation than the southern part. But in Karaikal area, especially in Vadakku Amman Koil Pathu, dense casuarina groves were uprooted for urbanising the coast and these areas were converted into real estate plots. This has led to the inundation of water into the land for more than a kilometre and has seriously affected the quality of agricultural land. Several educational institutions here occupy the coastal areas.

A lot of constructions have been undertaken in these parts by levelling the sand dunes. Local people say

that this has been done because they are left with no other option when the populations increase in their area. The tsunami affected the places where the sand dunes were levelled and construction work was carried out. In places where the sand dunes and the thaazhai (Pandanus) are present the damage is comparatively less. In the two villages near Vadakuammankoilpathu in Karaikal, where huge sand dunes, casuarinas, palm trees and grasses are present, the water did not enter the land and therefore there were no casualties due to the tsunami here.

There is a great deal of tourism related development activity and government constructions that have taken place along the Pondicherry coast (Plate #9). Several of these need to be inspected for violation of siting norms – Ranganathapuram Gardens, Manjakuppam, Hollywood Farm Beach Resort and Hotel Pondicherry Ashok and Periya Kalapet.

Many concrete buildings have been constructed at a distance less than 70 m from the HTL. James Court Resort is located less than 60m from the HTL. The Pondicherry University Guest House, Pillaichavadi is also located very close to the sea.

Some hatcheries such as Sona Hatchery, Best Marine Harvest and Rank Marine Hatchery in Koonimedu area are operational along the coast.

## 2.6. CUDDALORE

Cuddalore faces the severe problem of pollution from pesticides, sewage, agricultural chemicals and industrial effluents. The State Industries promotion Corporation of Tamil Nadu (SIPCOT) Industrial complex covering an area of 516 acres is located in Cuddalore. The units located within this complex pollute the ground and surface water. The pollution has impacted the availability of fishes. In Sothikuppam, it has been noted that these industries have also polluted drinking water (Plate #10).

The Local Areas Environment Committee (LAEC) in Cuddalore has identified air and water pollution due to effluent discharge and dumping of hazardous waste and health hazards due to these and issues about the illegalities by units operating without necessary permissions as critical issues to address.

On Feb 25, 2005 the LAEC sent a letter to the National Coastal Zone Management Authority (NCZMA) regarding the location of a unit within the CRZ in SIPCOT. Members of the TNPCB did a verification

of the unit's distance from River Uppanar, and a final report is awaited. Some units have also been found expanding capacity and production without the necessary clearances from state and central government authorities.

Cuddalore has become a hotspot for shrimp farming and hatcheries. In many cases, these units are not locally owned; therefore the local population does not derive much income from them. Some of the local communities have been against these farms and hatcheries and they have also successfully resisted the establishment of some of the units. But in some villages south of Puddupattinam, local farmers and fishermen have leased land to shrimp farms and in some cases run their own such units.

In Periyakuppam, shrimp farms are located on the western side of the estuary. These farms that have come up on good agricultural land have replaced coconut groves and mango plantations. Agricultural farmers complain of saline intrusion but their mouths are sealed by the generous contributions of money by these farmers to the local festivals and other community functions. There are nearly 30-40 shrimp ponds here.

There are three Kuppams near Cuddalore—Chinakuppam, Periya Kuppam and Aazhikuppam. These villages are contiguous with the Palar River estuary and have a good source of fresh water. In Aazhikuppam people shared that due to the pumping of water from the estuary to the shrimp ponds, the water level of the estuary has dropped drastically and has affected traditional fishing in this area. There is no opportunity to do traditional shrimp farming because of the opposition from the intensive shrimp farmers. There is a half finished abandoned permanent structure that is supposed to be shrimp hatchery supposed to be owned by a Pune businessman, but stopped due to the denial of a loan by the bank. Apparently this was because the hatchery was to be located only 50 m from the seacoast. There are jellyfish holding tanks, which are operated by the locals to supplement their livelihood.

Several areas on this coastal stretch that are very fertile with fresh water ponds and good vegetation have been sold as real estate plots for future construction. Happy Bay is a farmhouse that has already come up at Thinnapattinam. Other commercial farmhouses are Sea Breeze, Vishvasamudhra, etc. Some of

these constructions have been erected within 50m of the HTL. Some casurina plantations still occur at the seafront forming a barricade. But with all the proposed development, it is unlikely that they will remain.

## 2.7. NAGAPATTINAM

Nagapattinam is one of the cyclone prone areas in Tamil Nadu. Nagapattinam, Keelvelur, Vedaranyam, Taranagambadi (Tranquebar) and Seerkazhi, are the five taluks and each has its own coastal eco systems. Seerkazhi taluk has wetlands; Vedaranyam taluk is rich in mangroves, tropical forests and wetlands. Keelvelur taluk has rich coastal vegetation and sand dunes.

Nagapattinam has witnessed a number of losses due to a series of cyclone storms in the past. During the Rapid Assessment survey carried out prior to this Coastal Area Assessment by EQUATIONS and TNEC, the village elders in Keechankuppam recalled that there were huge sand dunes which acted as a natural barrier to the coast and the coastal community, but these were fully washed away in a cyclonic storm in the 1960s. Many of the villages around Nagapattinam have levelled the sand dunes for the construction of houses. Due to such unplanned and unregulated constructions natural barriers are no longer present.

In Keelvelur taluk, the coastal vegetation is good. South Poigainallur, a village south of Velankanni sets a positive example, as the local communities are involved in protecting the coastal vegetation for several years. This has yielded in conservation of coastal plantations and it also saved the people from the impacts of the tsunami (See Box 2 & plate #11). In areas south of Serudoor, sand binders were present earlier but these have been affected due to human intervention. Three huge sand dunes which existed adjacent to the river got washed away because the artificial diversion of river Upparu away from the Velankani beach. Groynes were laid near the estuaries. The objective of these interventions was to broaden the beach at Velankani to accommodate the huge number of tourists who visited the church. This disrupted the smooth functioning of the coastal ecosystem.

Even after the tsunami, for the purpose of reconstruction, sand mining is being done from the beach. (Plate #12), Sand is also being mined from Kallar river near Nagapattinam to rebuild roads.

The number of deaths in Vedaranyam is comparatively less because the population is less; a primary reason for this could also be because this is an area, which has a rich coastal ecosystem.

In Point Calimere, where the forests and sand dunes had been left intact, they acted as a natural barrier against the tsunami. However, in some of the areas fishermen from other districts, who come for the monsoon catch, had levelled the sand dunes and put up tents. Such modifications on the ecosystem did result in the loss of 20 to 30 lives after the tsunami.

In Tarangambadi and Seerkazhi, the major destructive factor was the presence of saltpans and aquaculture farms. Shrimp industries accelerated the impact of the tsunami in the villages, which lies in the delta region. Aquaculture and saltpans pose a major threat to the fragile ecosystem of Nagapattinam as they have replaced the wetlands of this region.

In Tarangampadi, there is a governor's bungalow opposite to the Dutch fort that has been converted to a hotel by the Neemrana Group named "bungalow on the beach" - (Plate #13). This structure is old and is very close to the beach. Extension activities, like construction of a dormitory (Plate #14) have also been undertaken here.

In Upparu, near Keechankuppam, in Nagapattinam district, a sea wall was constructed to prevent sea erosion. Earlier it was the sand dunes, which protected from sea erosion and facilitated the natural ecosystem and the estuaries to play their role effectively. The construction of sea walls however fragmented the coastal ecosystem and aggravated the force of the sea. Even this artificial barrier was dislocated by the tsunami and the same time it accelerated the effect of tsunami over area.

## BOX 2 SAND DUNES OF SOUTH POIGAINALLUR (PRAXIS, 2005)

South Poigainallur is very well known for its sand dunes along the seashore. The dunes which range in height from 30-40 feet start at a distance of 15 metres from the sea. The dunes start at the northern side of South Poigainallur near Kallar, which is ½ km from South Poigainallur and ends near Vailankanni (near Pookara street) and extends to a length of 6.5 km.

According to the local residents, these sand dunes were formed about 500 years ago, when sand was dug to construct a port at Nagapattinam. The sand that was dug out was kept along the shore. The sand accumulated and formed into dunes in due course. Even now, sand piles up on the dunes through the day adding to the height.

From the sand dunes to the Public Works Department (PWD) Canal are lowlands, which are ½ km in length, on the eastern side of South Poigainallur. From the PWD Canal to the Paravai road, there are high lands. The village has a radius of about 30 kilometres. In the lowlands, paddy, groundnut and vegetables are cultivated. On the high lands, palm, mango, Jambalona and Bhir trees are cultivated. The total extent of land in the village is about 660 ha. From the Paravai Main Road there are 17 streets inside the village to the extent of 13.20 km.

**Formation and maintenance of sand dunes:** When the Gounders settled on the seashore of South Poigainallur during the 13th century, they practiced agriculture as their livelihood. Agriculture has hence been the traditional occupation of people in the area. They cultivated local species of paddy such as Koduvalai, Kadampalai, Garudan Samba and vegetables such as brinjal, ladies fingers, cluster beans and greens with the help of groundwater that is available in village ponds that are at a depth of 8 to 10 feet.

In order to protect crops from the waves and check soil erosion, the people erected fences using palm leaves along the seashore and planted palm trees along the fence. The farmers have patta lands 100 meters from the seashore. The high tides brought sand to the shore carried on the waves, which was then cast along the fencing lines along the seashore.

The palm trees on the fencing lines prevented soil erosion and sand casting onto the agriculture fields. Moreover, during the season of the North winds (Winter season - November to December), a lot of sand accumulates on the seashore. This is how the famous sand dunes of South Poigainallur were formed along the fencing lines of agricultural lands on the seashore.

Since sand is carried easily by the wind, the accumulation has been easy and the height of the dunes has grown over time. 500 years ago, the height of the sand dunes was only 5-10 feet, whilst now it is 30-40 feet.

**Protection of sand dunes by the people:** The height of the dunes has been increasing year after year. The farmers have planted palm trees, created casuarinas plantations, bamboo and Alexandria lauri (Punnai) on the sand dunes to check soil erosion. In the year 2001, some outsiders started digging sand from the sand dunes for construction purposes. The landowners resisted the outsiders and prevented the digging of sand from the sand dunes by presenting a united front.

**People's perception of the sand dunes:** The sand dunes have been formed on the fencing lines of agriculture fields over a number of years due to the accumulation of sand carried by the winds. Since sand dunes have been formed on patta lands owned by the farmers, the farmers have not allowed outsiders to dig sand in their land and this has facilitated the process of formation of sand dunes over the years.

The people believe that the sand dunes have protected them from natural disasters such as cyclones and high tides. The dunes have in fact been largely responsible for minimising the number of deaths in the village. After the tsunami, the Panchayat passed a resolution to protect the sand dunes and banned outsiders digging sand from the sand dunes.

## 2.8. THIRUVARUR

Thiruvavarur district faced the threat to coastal ecosystem even before the tsunami in the form of massive growth of shrimp industries, in spite of lot of struggles by the local communities and panchayat. The shrimp farms around Sengangadu and Muthupet have affected the mangroves to a great extent. The chemicals used in the shrimp industries have spoiled the agricultural land (Plate #15) and this affects fresh water available.

### BOX 3

The local community and the Thillai Valagam Panchayat President has highlighted the massive development of shrimp industries, 100 acres of prawn farms which also comes under CRZ I; they have also highlighted that if the mangrove forests are not there, there is no possibility of fish being available in the area. Muthupet is known for its mangroves, lagoons and this becoming one of the major tourism attractions of the district.

Further the local community has expressed their displeasure over the denial of access to them over the area by the Tourism and Forest Department. They say that they are not allowed to camp over night to pursue their traditional methods of fishing in the lagoon. The reason they cite is that the tourism department does not want them to be around when the tourists are getting an aerial view of the mangroves from the towers. In addition to this each fisher folk union has to pay the Forest department an annual lease amount of 40,000 per year for fishing rights in that area. The local communities have now filed a case and are awaiting the judgement.

## 2.9. TANJAVUR

The main activity that is impacting the coastal areas of Tanjavur district is numerous aquaculture farms and saltpans that come up along the coast (Plate #16). There are no other developmental activities; one tourism project “Manohara” seems to have not taken off.

## 2.10. PUDUKOTTAI

Similar to that of Tanjavur, Pudukottai has also witnessed large-scale development of aquaculture farms (Plate #17). There are traces of mangroves in many parts of the district but these have been severely affected by chemical wastes from the aquaculture farms.

## 2.11. RAMANATHAPURAM

Ramanathapuram district has rich coastal bio diversity and unique coral reefs found in the Gulf of Mannar region on one part of its coast. On the other side is the Palk Bay and its 21 islands that provide some cover to the Ramanathapuram coast.

There are not many development activities along the coast of this district. Since the Gulf of Mannar Biosphere is a Protected Area (PA) under the Forest Department, most anthropogenic activities here are prohibited; the coral reefs are in a relatively good condition. Several fishing and other coastal communities are denied access to this area after it was declared a protected area.

Currently, the proposed Sethusamudram **Shipping Canal Project (SSCP)** is the major threat to the coastal ecosystem (See Box 3). Civil society groups and local communities who are part of a movement against this project state that the project if realised will affect over seventy thousand families (Coastal Action Network Report). It was also learnt from the coastal communities here that a lot of changes inside the sea have taken place after the tsunami and in many low-lying areas sand-spits have been formed.

## BOX 4 THE SETHUSAMUDRAM SHIPPING CANAL PROJECT

Sethusamudram Shipping Canal Project (SSCP) plans to develop an offshore shipping channel which is 167 km long passing through the Gulf of Mannar, the Palk Strait and the Palk Bay. It involves dredging in an area 89 km long, 300 m wide and to a depth of 12 m.

It has been claimed that the Canal would cut short the distance (not time) for ships navigating between the west and east coasts of India, by avoiding the circumnavigation of Sri Lanka. In the proposed route, ships would navigate through the Gulf of Mannar and the Palk Bay and enter the Bay of Bengal directly, thereby reducing by about 500 km, the distance covered by ships travelling between India's east and west coasts.

The problem with the project is that during the construction/dredging along the canal itself several species especially seabed fauna (including protected species like corals, sea fans, sea cucumbers, etc.) will be lost. This is admitted by the Tuticorin Port Trust in their studies and EIA (Environmental Impact Assessment). Furthermore, the project is designed based on an incomplete EIA with many aspects not studied at all (such as sediment transport and hydrodynamic studies). The studies that were done were all rapid assessment studies based on 3 months primary data making the EIA suspect. For a project of this nature the EIA study should have been a comprehensive EIA (i.e. based on long term primary data).

The result is an environmentally flawed project, which will affect the local ecology of the Gulf of Mannar and Palk Bay. The sediment from the dredging will affect the coral reef ecosystem and the overall productivity of the region thus affecting the fisheries and livelihoods of over seventy thousand families. The Canal and the dredge/dumping of dredge will amplify the possible impacts and vulnerability due to natural phenomenon such as tsunami and cyclones.

### 2.12. THOOTHUKUDI

The Thoothukudi district coast witnesses massive development activities along the coast. Chemical industries, salt industries, power plants and sand mining play a vital role in impacting the coastal ecosystem (Plate #18). The wastages from the power plant are dumped into the sea as a fly ash and this results in the less catch of fishes. The construction of sea wall by the Thoothukudi port increases turbidity, and even though it is claimed that it prevents sea erosion in Thoothukudi it is observed to have increased sea erosion in Kanyakumari very highly<sup>6</sup>. The wastages from the Darangathara Chemical Works have hugely affected the traces of mangroves in Punnakayal area. In addition to this there is a trend of emerging destinations, for example, places near the Tuticorin port trust, Roche park, Raj park (near camp) are all developing as a recreational spots for people in Thoothukudi. The local fishermen are denied access to dry fishes near places like Raj Park. Sethusamudram Shipping Canal project emerges as a major threat to the livelihood of the fishermen, Sandmining in Periyathazhai and the near by stretches poses a major threat to the ecosystem. Prawn farms and saltpans are the other major violators of the coastal ecosystem.

### 2.13. TIRUNELVELI AND KANYAKUMARI

The southern districts of Tirunelveli and Kanyakumari do not have much coastal vegetation. These coasts have an abundance of rare stones and rare earths like garnet and titanium and other radioactive sand minerals the end product of which is thorium. In Tirunelveli, mining for sand and rare earths takes place in Kuttapulli, Perumanal, Kuthankuzhi and Uvari.

In Mela Manakudi (Kanyakumari district) the mining for sandstone and sand has made the beach vulnerable to erosion (Plate #19). Sand mining is a common phenomenon in these districts. The tsunami entered areas such as Periavilai, Chinnavilai and Manavalakurichi where rare earth sand mining was done earlier and after sand mining separation, the unwanted sands were dumped. Melamanakudi in Kanyakumari districts set an example of violating the coastal zone norms and it is one of the worst affected places by the tsunami in the district. Sand mining is taking place as close as 50m of high tide line. Local communities are of the opinion that sand mining aggravated the impacts of the tsunami.

The study team observed that the road constructed in Melamanakudi is very close the sea (probably less than 50m from the HTL). The bridge between

<sup>6</sup> Extract from the study done by Dr. Victor Rajamanickam, a professor of coastal geomorphology and mineralogy and HOD of Dept of Disaster Management - SASTRA – Deemed University Tanjavur

Keelamanakudi and Melamanakudi had an impact on the coastal ecosystem. During the tsunami, the mouth of the Manakudy estuary, which is bereft of any mangroves, bore the impact of the tsunami due to which the connecting bridge was broken and carried far into the river. A little further away mangrove stretches along the estuary prevented much damage. The collapse of the bridge as a result of the tsunami caused several deaths in Melamanakudi.

Similar to that of Cuddalore district Kanyakumari district the district administration is intensifying development of beach tourism. The renovation of tsunami damaged infrastructure and construction of new infrastructure for beach tourism was expedited as compared to the rehabilitation of tsunami affected people. In Sothavilai and Kanyakumari the beach has been levelled and play materials erected. In the post tsunami the state government and tourism departments have given a major thrust to the development of tourism in Kanyakumari. The state

government has allotted Rs 9.56 crore to promote tourism activities in the district<sup>7</sup>; similarly the district administration has spent Rs 4 crore to provide infrastructure facilities for the tsunami-hit tourism spots in Kanyakumari districts (Plate #20).

Numerous amusement parks are the other major activities on the beaches of Kanyakumari: Baywatch amusement park on the Kovalam road in Kanyakumari has setup its operation for receiving 4000 visitors per day. Apart from this, elevated structures have been constructed by levelling sand dunes in order to have an elevated area to watch the sunrise and sun set, which is a prime tourist attraction and a popular activity for tourists.

Kanyakumari and Sothavilai are both beach tourism areas. Here the Tourism Department of Tamil Nadu has levelled the sand dunes and has converted it into a play area with slides, bars and other structures. This has resulted in a change in the coastal landscape.

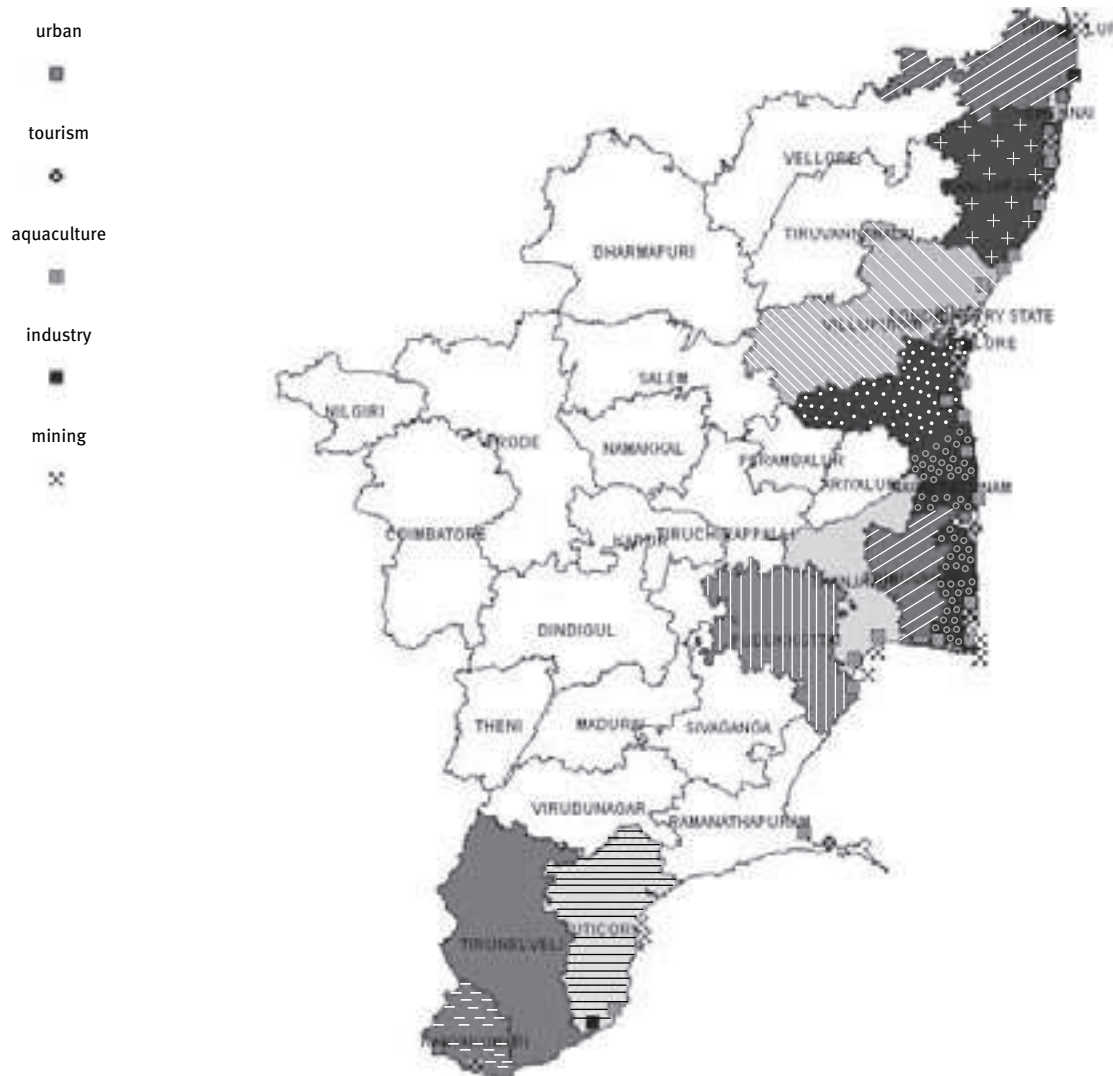
TABLE 1  
SUMMARY OF DEVELOPMENTAL ACTIVITIES IN TAMIL NADU AND PONDICHERRY

NO	DISTRICT	PLACE	PREVALENT ACTIVITIES
1.	Tiruvallur	Pulicat	Industrialisation, salt pans, atomic power station
2.	Chennai	Rayapuram	Groins, sea walls
3.	Kancheepuram	Chennai suburban areas to Kancheepuram	Tourism (resorts), aquaculture, urbanisation
4.	Villupuram	Marakkanam	Salt pans, aquaculture
5.	Pondicherry	Pondicherry	Tourism
6.	Cuddalore	Cuddalore	Industrialisation, tourism, aquaculture
7.	Karaikal	North Ammanpathu	Urbanization
8.	Nagapattinam	Nagapattinam, Velankanni	Destruction of sand dunes, aquaculture, tourism
9.	Tiruvarur, Thanjavur	Point Calimere, Muthupet	Degradation of mangroves, deforestation, salt pans, aquaculture
10.	Pudukottai	Pudukottai	Aquaculture farms
11.	Ramnathapuram	Rameshwaram	Tourism, aquaculture, salt pans
12.	Thoothukudi	Thoothukudi	Industrialisation, salt pans, degradation of mangroves
13.	Tirunelveli	Kootapuli	Sand mining
14.	Kanyakumari	Muttom, Kanyakumari	Sand mining, leveling of sand dunes, tourism

<sup>7</sup> <http://www.hindu.com/2006/01/03/stories/2006010309490300.htm>



FIGURE 3: SUMMARY OF TSUNAMI IMPACTS & DEVELOPMENTAL ACTIVITIES IN TAMIL NADU & PONDICHERRY



NAME OF DISTRICT	POPULATION AFFECTED
Thiruvallur	15,600
Chennai	73,000
Kancheepuram	100,000
Villupuram	78,240
Pondicherry	43,432
Cuddalore	99,704
Nagapattinam	196,184
Thiruvarur	0
Tanjavur	29278
Pudukkottai	66,350
Ramanathapuram	0
Thootukudi	110,610
Tirunelveli	27,948
Kanyakumari	187,650

## COASTAL TOURISM IN TAMIL NADU & PONDICHERRY

Tamil Nadu has promoted its cultural heritage and natural beauty, including its beaches. The major coastal tourism destinations are Chennai, Mamallapuram, Velankanni, Rameshwaram and Kanyakumari. These areas have witnessed large-scale development of tourism infrastructure. A spill over effect is visible in other coastal areas of Tamil Nadu where new areas are being earmarked for coastal tourism. At the same time the aforementioned destinations are being expanded with more infrastructures. The new areas that are being included as coastal tourism areas are Pulicat Lake, Cuddalore, Pichavaram, Tarangambadi, Point Calimere, Muthupet, Thootukudi and adjoining areas in Kanyakumari like Sothivalai<sup>8</sup>.

The tourism policy note of 2005-2006 of the Department of Tourism, Government of Tamil Nadu states that in recent years, tourism has become a priority sector in the State. This, it says, is reflected in higher budget allocations, growing partnership efforts between the public and private sectors, increased tourist arrivals, vibrant and vigorous promotion efforts, etc. The emphasis is laid on making tourism a mass movement and a prime mover for promoting entrepreneurship, poverty reduction and economic development.

Pondicherry is a popular tourist destination with both domestic and foreign tourists. Having previously been a French colony, the history and culture of Pondicherry are its prime attractions. Consequently the Union Territory has geared itself in capitalising on its uniqueness.

### 3.1. STATUS OF TOURISM ALONG THE COAST OF TAMIL NADU AND PONDICHERRY

#### 3.1.1. PULICAT LAKE

It is known for its fine beaches, bird sanctuary and backwaters. It is popular with domestic tourists who visit this area during the day. A few foreign tourists also come to this area. Therefore the kind of tourism development seen here is mostly shops, restaurants and transportation facilities, with very few lodging facilities. As with many tourism areas that receive high number of day visitors, the main problems seen here are construction of tourism related facilities in close proximity of the coast and proliferation of non-biodegradable wastes like plastics.

#### 3.1.2. CHENNAI

The coastal stretch of Chennai is short; this is the most densely populated part of the coast. The beach of the southern stretch in Chennai is broad and here human activity is very high. The Marina beach is used by people of the city of Chennai, domestic and foreign tourists. The beach has been slowly expanded in all directions and addition of new developments to enhance the infrastructure is a perpetual activity with the government departments. Except for the sand and the sea, the beach has lost all its natural features. Some of the infrastructure that is put up on the beach are lamp posts, roads, benches, platforms, statues of prominent political personalities, hoardings etc. As we move south, there are large areas of the beach that have been acquired by corporate agencies like VGP, and Buena Vista (Neelangarai) who have constructed an amusement park over a large area very close to the coast.

There are many hotels and resorts along the coast, the prominent ones being Taj Groups Fisherman's Cove. The Leela Group has acquired seven acres of prime land near the beach front in MRC Nagar for the purpose of starting a 20 storey five star deluxe hotel.

In 2003 the Government had proposed a beautification project which had envisaged the moving out of local people, the contract was to be given to a Malaysian company but due to a popular protest and the Central

<sup>8</sup> Tamil Nadu Tourism Policy Note -2005-2006

government's notification to the state government dated April 23rd 2003 quoting the coastal regulation the project was dropped<sup>9</sup>.

### 3.1.3. KANCHEEPURAM

The Kancheepuram coast has witnessed rapid landscape changes due to unregulated development of tourist facilities, resorts and other structures. Mamallapuram is a well-known tourist destination. Mamallapuram has historical importance and its monuments, which are centuries old, are declared as one of the 13 World Heritage Centres by the UNESCO in 1985. The Mamallapuram dance festival is held annually and was conducted even just after the Tsunami in order to promote tourism. This Festival, which had started on 23-12-2004 and stopped from 26-12-2004 was resumed from 7th January 2005 and continued up to 30th January 2005.

To begin with, the department of tourism has constructed numerous wayside amenities along the East Coast Road, on the seaward side of the road very close to the coast (Plate #21). These include parks and picnic spots. There are many resorts that have come up close to the coastal areas in this district. Numerous hotels and restaurants have also come up on either side of the ECR. Many of these constructions would sometimes be within 200 m when the ECR runs very close to the coastline. The exact number of resorts, hotels and other tourist facilities was not counted during this study due to it being of a rapid assessment type. Some of the areas that have large tracts of coast under tourism are Jambodai where MGM resorts are located.

### 3.1.4. PONDICHERRY

The main beach in Pondicherry is accessed from Auroville. Although the amount of tourism infrastructure is less here, there are numerous thatched structures that have been erected very close to the coast (Plate #22). The local people are denied access to the beach between 11 am and 4 pm, during which time the beach is occupied by foreign tourists.

### 3.1.5. CUDDALORE

Pitchavaram mangroves and Silver beach are the major tourism spots along the coast in this area. The District administration has additionally promoted tourism in Samiarpettai and has developed the beach with infrastructure - lights and roads.

### 3.1.6. NAGAPATTINAM

In Tarangampadi, there is a governor's bungalow opposite to the Dutch fort that has been converted to a hotel by the Neemrana Group named Bungalow on the Beach (Plate #13). This structure is old and is very close to the coast. Extension activities of the hotel, like construction of a dormitory (Plate # 14), have also been undertaken here.

Velankanni is an important pilgrim tourist destination in the district. The number of tourists to Velankanni has been increasing steadily. The coastal stretch is very narrow and cannot accommodate the tourist inflow. The local authorities therefore decided to broaden this stretch by diverting the Upparu River from the Velankanni beach. Groynes were also laid near the estuaries.

Nagapattinam also gets a sizable number of pilgrims to the mausoleum in Nagore. The combined activities of Nagore and Velankanni have prompted the establishment of many tourism related infrastructure in the coastal areas.

Point Calimere is a wildlife sanctuary and it attracts many domestic tourists. The infrastructure is minimum at present but the tourism department is planning to 'develop' this into an 'ecotourism' destination.

### 3.1.7. THIRUVARUR

Mangroves and lagoons in Muthupet have been one of the major tourism attractions. However, the impact of tourism development in the area is affecting the local communities. (Please see Box # 3 in the section on developmental impacts)

### 3.1.8. RAMANATHPURAM

The tourism development in this district is comparatively low. Ariyaman beach is the emerging beach tourism destination along the coast of this district.

### 3.1.9. THOOTHUKUDI

There are many indications of beach resorts poised to come up in the coastal areas of Thoothukudi. Also many recreational areas are being developed in and around the port area in Thoothukudi town, for example places near the Thoothukudi Port Trust - Roche park, Raj park (near camp).

<sup>9</sup> <http://www.hinduonnet.com/2003/04/24/stories/2003042405410400.htm>

### 3.1.10. KANYAKUMARI

Kanyakumari is one of the most famous pilgrim centres in India. The meeting of three oceans is a unique feature of the destination. Vivekananda rock, Thiruvalluvar statue, Bagavathy Amman temple, a clear view of sunset and sunrise are the main attractions of Kanyakumari. The rampant development of the tourism industry has left no space along the beach; the immediate stretches of land adjoining the sea towards the southern side have been completely occupied by the hotel industry. The development of tourism has resulted in inappropriate infrastructure creation, which has huge environmental repercussions. One such example is the jetty, which services Vivekananda rock. The jetty protrudes into the sea parallel to the coastal line, this makes the currents to bend and flow in another direction. Amusement parks and water theme parks are the recent additions to attract domestic tourists. Baywatch is one such theme park, which has planned its operation to cover about 4000 visitors a day. Sand dunes were levelled to have an elevated structure over it for a clear view of sunrise and sunset.

The adjoining areas to the main tourist centre that are being developed currently in Kanyakumari district are given below.

#### **Sankuthurai**

Sankuthurai is yet another emerging beach tourism destination, which attracts domestic tourists mostly from Kanyakumari and neighbouring districts. In order to develop infrastructure the government has laid road within 60m from the coast. Sand dunes were removed for erecting structures related to tourism.

#### **Sothavilai**

Sothavilai is another well-known beach tourism destination in the district, the beach has rich dune vegetation and for the promotion of tourism in many areas sand dunes were levelled and structures were erected on the sand dunes.

Both these places will become like many other beach tourism destinations, with burgeoning boarding, lodging and recreational structures, if immediate checks are not put to regulate tourism development. Another vast stretch of coastal area will be a casualty to shortsighted and callous tourism development.

### 3.2. TOURISM PLANS OF TAMIL NADU POST TSUNAMI

The Tourism Department of Tamil Nadu seems relatively unconcerned about the loss of lives and property of Indian citizens due to the tsunami. It was more concerned about the safety of foreign tourists. Its media announcements post tsunami announced in the media that all foreign tourists are safe and that no foreign tourists had died. It was 'business as usual' for the Department. It set out on series of what it termed as 'confidence building measures, close on the heels of the tsunami, which included resuming the Mamallapuram dance festival on 7th January 2005, inaugurating the India Tourist and Industrial Fair in Chennai on 13th January 2005 and encouraging tour operators to not cancel scheduled itineraries.

On 26th January 2005 a luxury liner with 52 British tourists on board arrived in the Chennai port. Around 900 foreign tourists visited Tamil Nadu in a separate luxury liner, which docked at the Chennai and Tuticorin ports in February 2005. Their itinerary included a visit to Chennai city, Mamallapuram, Kancheepuram, Madurai and Tirunelveli. On 28th March 2005 another ship arrived in Chennai Port with about 650 American Passengers.

The tsunami provided the Tourism Department with a splendid opportunity to bring back various schemes and proposals that were hitherto in the pipelines. The strategy was to use the tack of promoting tourism development on the coast as a paradigm for economic upliftment, to compensate for the damage. For the Department, the tsunami had "... unearthed new treasures... and ... brought answers to all questions..." (Tamil Nadu Tourism, 2005). The policy note of 2005-2006 demands the implementation of various tourism development schemes, which are given in table 2 and detailed below.

In order to not loose out on the tourism potential the government has acted quickly in the reconstruction of infrastructure for tourism purposes. At a time of calamity it is but right to focus on the people affected and first address their needs in terms of rehabilitation, reconstruction and re generation of their livelihood options including those that are related to tourism and are dependant on tourism.

The amount allocated to re-construction of coastal tourism related infrastructure is Rs. 57 crores (as per the statement by the tourism minister Mr A. Miller during the National Tourism and Culture festival at

Kanyakumari – 2nd Jan 2006). This amount, although much smaller than the amount allocated for disaster relief, has been disbursed and utilized for the said purpose of rebuilding tourism infrastructure along the coast.

**TABLE 2**  
**POST TSUNAMI TOURISM DEVELOPMENT PLANS OF DEPARTMENT OF TOURISM - TAMIL NADU FOR THE PERIOD COMMENCING 2005-06**

SL .	SCHEME	AREAS	COST (RS IN LAKHS)
1.	Integrated Development of Mamallapuram – 2 <sup>nd</sup> phase	Mamallapuram	432
2.	Integrated development of Tourism Circuits - Development of Vivekananda Travel Circuit	Ramanathapuram Kanyakumari	168.24 662.48
3.	Beach tourism	Muttom & Thekkurichi Kayalpattinam Poompuhar Pulicat Lake Thirumullaivasal	150 30 30 30 7.45
4.	Development of the Ecotourism Circuit	Pichavaram Point Calimere Muthupet	294.40
5.	Coastal Area Development Programme	Nagapattinam beach Velakanni beach Silver beach Manora	Not known

### 3.2.1. GOVERNMENT OF INDIA ASSISTED SCHEMES

#### i) Integrated Development of Mamallapuram

The total cost of this project is approximately Rs. 19.00 crores. Ministry of Tourism, Government of India has accorded sanction for a sum of Rs. 5.00 crores towards the 1st phase of work.

#### A. Shore Temple area: Project cost Rs. 2.00 crores

The following works were taken up under this scheme

- a) Construction of 15 commercial shops
- b) Construction of compound wall
- c) Digging of well
- d) Ticket counter
- e) Parking lot
- f) Pathway
- g) Landscaping
- h) Planting of saplings
- i) Electrical works etc.

The above works have been completed.

#### B. Five Rathas area: Project cost Rs. 3.00 Crores

The following works were taken up under this project.

- a) Construction of compound wall
- b) Landscaping
- c) Construction of 101 shops (the shops on the road to Five Rathas will be shifted to these shops)
- d) Restaurant
- e) Toilet
- f) Bus-shelter
- g) Ticket counter
- h) Kiosk
- i) Signages
- j) Pathway etc.

The above works are nearing completion.

#### ii) Integrated Development of Mamallapuram 2nd Phase

Under the 2nd Phase, a proposal at a cost of Rs. 519.99 lakhs was sent to Ministry of Tourism, Government of India for according sanction. Ministry of Tourism, Government of India during February 2005 has conveyed sanction for Rs. 432.00 lakhs and released a sum of Rs. 345.00 lakhs as first instalment to commence the work. The details of works to be taken up under this scheme are as follows:

- 1) Development of area opposite to Arjuna's

- Penance area
- 2) Development of area opposite to Archaeological Survey of India Office
- 3) Construction of Higher Secondary School, Primary school and Balwadi
- 4) Development of approach road to Five Rathas, Shore temple
- 5) Construction of Bus Stand
- 6) Widening of pathway
- 7) Development of Tiger Caves, Sri Sthalasayanaperumal temple premises and tank
- 8) Development of tourist bus stop

### 3.2.2. INTEGRATED DEVELOPMENT OF TOURISM CIRCUITS - DEVELOPMENT OF VIVEKANANDA TRAVEL CIRCUIT (RAMANATHAPURAM AND KANYAKUMARI)

A tourist circuit is defined as a route on which at least three major tourist destinations are located and none of these are in the same town, village or city. At the same time they should be in such proximity that a tourist would like to cover them in a sequence. It should have well defined entry and exit points. A tourist who enters at the entry point would get motivated to visit all the places identified on the circuit. The objective of having a tourist circuit is to increase the total number of visits to all the destinations in the circuit and to provide to the tourists the attraction of all the destinations located in the circuit as a package. For one tourist circuit area or circuit, the government of India would sanction maximum amount of Rs. 8.00 crores.

During the year 2003-2004, the Ministry of Tourism, Government of India sanctioned the following works under the Adi Sankara circuit and the Vivekananda circuit. Currently these projects are underway.

#### Ramanathapuram

The development of places associated with the visit of Swami Vivekananda, a detailed proposal for a sum of Rs. 367.84 lakhs was sent to Ministry of Tourism, Government of India.

Accordingly, Ministry of Tourism, Government of India has conveyed sanction for a sum of Rs. 168.24 lakhs and released a sum of Rs. 54.47 lakhs as first installment to commence the work in 2005- 2006.

#### Kanyakumari

Under the scheme of development of Vivekananda Travel Circuit, the Ministry of Tourism, Government of India in 2005- 2006, has sanctioned a number of

schemes for a sum of Rs. 662.48 lakhs. The details are given below: -

#### a) Flood lighting of Vivekananda Rock Memorial at Kanyakumari.

Vivekananda rock memorial is one of the major tourist attractions in Kanyakumari. It has therefore been decided to provide flood lighting for good view during the night hours. Government of India has sanctioned a sum of Rs. 32.13 lakhs and released the amount in full to CPWD to implement the scheme.

#### b) Mounting of Sound and Light show at Kanyakumari.

The Government of India has sanctioned a sum of Rs. 225.00 lakhs and released Rs. 202.00 lakhs as first installment to India Tourism Development Corporation to commence the work. It has been decided to mount the sound and light show at the boat jetty area.

#### c) For the benefit of tourists. Government of India has sanctioned a sum of Rs. 255.35 lakhs and released Rs. 76.60 lakhs as first instalment to India Tourism Development Corporation to execute the works of construction of:

- 1) Five cottages at Vivekananda Kendra
- 2) Strengthening of boat jetty at Vivekananda rock memorial
- 3) Development of sun viewpoint and soft drinks shop at boat jetty.

### 3.2.3. BEACH TOURISM

The Government of India has sanctioned a sum of Rs. 150.00 lakhs and released Rs. 45.00 lakhs as the first instalment to India Tourism Development Corporation to commence the work at Muttom and Thekkurichi beachfronts in Kanyakumari District. Infrastructure like accommodation, kiosks, toilets, restaurant, landscaping at Muttom beach and aquarium, rain shelter, dress changing rooms, jetty, and landscaping at Thekkurichi beach have been taken up in 2005- 2006.

During 2004-2005, the following beaches were taken up for development with Government of Tamil Nadu Financial Assistance.

- a) Kayalpattinam beach (Thoothukudi District) Rs. 30.00 lakhs
- b) Improvements to Poompuhar Tourist Complex (over

looking the sea in Nagapattinam District) Rs. 30.00 lakhs

c) Provision of infrastructure facilities at Pulicat Lake (Tiruvallur District) Rs. 30.00 lakhs

d) Thirumullaivasal Beach (Nagapattinam District) Rs. 7.45 lakhs

### 3.2.4. DEVELOPMENT OF THE ECOTOURISM CIRCUIT

#### **Point Calimere Wildlife Sanctuary, Muthupet Mangroves and Pichavaram**

The development of ecotourism has been referred to in the vision document 2002, the policy note of the Tourism Department for the year 2003-2004 and 10th Five year Plan (2002-2007) document. It was therefore proposed to establish an Ecotourism Circuit covering Point Calimere in Nagapattinam District, Muthupet in Thiruvarur District, and Pichavaram in Cuddalore District. This has a proposal for a sum of Rs. 368.00 lakhs. The proposal was sent to Ministry of Tourism (Government of India) for according sanction under the scheme of Integrated Development of Tourism Circuit. Government of India has conveyed sanction during 2004-2005 and released a sum of Rs. 294.40 lakhs as first instalment to commence the work.

The component of the “ecotourism” projects are:

a) Eco Tourism at Point Calimere Wild Life Sanctuary at a cost of Rs.212.00 lakhs

- 1) Providing interpretation center
- 2) Provision of tented accommodation
- 3) Erection of publicity boards
- 4) Dubbing of wild life films in local language
- 5) Improvement of the tourist track inside the sanctuary
- 6) Creation of nature trail
- 7) Renovation of Poonarai Illam rest house
- 8) Providing compound wall to forest lodge
- 9) Children’s park
- 10) Parking lot
- 11) Creation of infrastructure facility in Thambusamy illam rest house
- 12) Providing approach road to the sanctuary

b) Development of eco-tourism at Muthupet mangroves in Thiruvarur District at a cost of Rs. 51.50 lakhs

- 1) Creation of a visitor’s centre
- 2) Providing power boats
- 3) Construction of visitor’s rest shed

- 4) Raising observation towers
- 5) Creation of bio-diversity spots
- 6) Providing wooden board walks
- 7) Publicity and awareness

c) Development of eco-tourism in and around Pichavaram (covering Portnova, MGR Thittu and Chinna Vaikkal) at a cost of Rs. 104.50 lakhs

- 1) Construction of jetty
- 2) Construction of cottages
- 3) Construction of restaurant
- 4) Construction of waiting shed
- 5) Construction of pre fabricated toilets, urinal blocks, sales counter, water tank, benches
- 6) Providing interpretation centre
- 7) Purchase of boats.

Apart from the above, during the year 2005-06, the tourism department it is being proposed to develop the following places under the Coastal Area Development Programme:

- 1) Nagapattinam Beach Nagapattinam District
- 2) Velankanni Beach Nagapattinam District
- 3) Silver Beach Cuddalore District
- 4) Manora Tanjavur District

### 3.2.5. ANALYSIS & RECOMMENDATIONS

The state government’s earlier efforts on promoting tourism in Nilgiris and Kodaikanal has resulted in large scale construction of hotels, restaurants, shops, resorts and other tourism-related infrastructure. This has taken its toll on the fragile ecology of the Western Ghats. As fallout of this, in the recent years the government’s focus has shifted to develop tourism in untapped places. The coastal areas have thus received a greater attention.

The earlier policy documents of 1996-1997 and 2001-2002 of the Tourism Department acknowledged adverse impacts of tourism and therefore the need for carrying capacity studies, importance of the Coastal Regulation Zone (CRZ) Notification and conservation and preservation of coastal ecology. But in later policy notes, including the one that has been prepared for 2005-06 after the tsunami, the environmental and social concerns are completely missing. There is not even a mention of the CRZ or the need to conserve coastal ecosystems. Instead it proposes ecologically sensitive areas as new tourism destinations. It has allowed projects like the Leela Group of Hotels to come up at the beach front, which is being done by filling up backwaters near

the Adyar estuary. The proposed Sethu Samuthram Canal Project and proposal for the extension of ECR is expected to boost development along the coasts and hence further expansion of tourism projects.

In many tourist places, beach resorts are jostling local fishermen out of the seafront. The coastal ecosystems are being impacted through destructive activities like flattening of sand dunes for the construction of cottages, swimming pools and other infrastructure. The fishing communities require the sea front for salting and drying of fish, landing boats and fishnets.

The local fishing communities depend on the natural lagoons and mangroves for their livelihoods. The restricted access to the areas because of promotion of tourism is adversely affecting the community. For example in Muthupet there are two watchtowers that have been put up by the Tourism Department. The local fishermen are now denied access to the lagoon by the tourism department citing reasons of disturbance to the tourists. The fishing patterns of the locals have also been affected by the tourism related infrastructure. The fisher folk are now not allowed to stay in the area or camp overnight in the area while they are fishing; this is a forced deviation from their age-old practices in the area. The local communities have expressed their apprehension on the new developments and are not happy with the restrictions that are imposed on them by the forest department and the tourism department. The rights that they traditionally enjoyed in the area as a fishing community have been violated.

**It is strongly recommended that tourism development should not displace the local communities, not change their traditional livelihood practices and not deny access to coastal areas and resources, which are their traditional and customary rights.**

The current tourism developments in the coastal areas of Tamil Nadu are unmindful of ecological considerations and far removed from all sustainability criteria. The “ecotourism” plans in Pichavaram, Point Calimere and Muthupet do not reflect any notions of ecotourism values. These plans might have as well been formulated in the absence of the nomenclature of ecotourism. This shows a complete lack of understanding of the aspects of ecotourism on the part of Tourism Department. Moreover, the Tourism Department is committing the same mistake, which is done universally – opening up ecologically sensitive

areas for tourism and branding it as ecotourism.

**The Tourism Department should respect the need to protect ecologically sensitive areas and leave them alone from tourism development.**

The various schemes and proposals that are being implemented will have irreparable impacts on the coastal areas and communities. It is not known whether these schemes and proposals have been developed on the basis of social and environmental impact assessments. Not only will the new areas be subjected to bear the brunt of unplanned and unregulated tourism development, but the expansion plans in existing coastal tourism destinations will exacerbate current negative impacts visible here. This is an alarming trend because the already fragile coast line will be weakened by these alterations. A standing testimony to this is what happened in Serudoor (Velankanni) and Sothavilai (Kanyakumari) where a similar alteration of the topography (sand dunes) of the coast aggravated the impact of the tsunami.

**The ecological and social footprint of tourism in existing coastal tourism destinations needs to be measured. Social and environmental impact assessments have to be conducted for any tourism project or plan irrespective of its size.**



## OVERVIEW OF THE IMPACT OF THE TSUNAMI ON THE TAMIL NADU COAST

The Tamil Nadu state has a coastal stretch of 1076 km encompassed in 13 coastal districts. In the state, 8010 human lives were lost to the tsunami. More than a lakh people have been affected in both Kancheepuram and Tuticorin districts and in Kanyakumari and Nagapattinam each, almost 2 lakh people have been affected. The death toll in Nagapattinam was the maximum and was seven times that of Kanyakumari.

The Union Territory of Pondicherry comprises of two regions: Pondicherry and Karaikal. Cuddalore district of Tamil Nadu lies between Pondicherry and Karaikal. The total death toll in Pondicherry and Karaikal is 579. Karaikal, which is adjacent to Nagapattinam coast, had a death toll of 472, whereas the death toll in Pondicherry was 107.

The statistics of loss of lives and affected populations is from the official website of TN Government<sup>10</sup> and Pondicherry Government<sup>11</sup>.

Factors that have determined damage and loss of life are:

1. Topography of coastal and marine areas
2. Coast area
3. Anthropogenic activities on the coast
4. Population density of the affected areas
5. Nature of habitat – dwelling units, location
6. Proximity and distance of dwelling units
7. Un-preparedness of the people (this is generic)
8. Administrative regulations

District wise summaries of the population and area affected by the tsunami in Tamil Nadu and Pondicherry is given in Tables 3 and 4 respectively.

TABLE 3  
DISTRICT WISE SUMMARY OF THE POPULATION AND AREA AFFECTED BY  
THE TSUNAMI IN TAMIL NADU

NAME OF DISTRICT	TOTAL POPULATION	POPULATION DENSITY	POPULATION AFFECTED	POPULATION AFFECTED (%)	DEGREE OF CASUALTY (RATIO OF POPULATION IMPACTED: LIVES LOST)	TOTAL LENGTH OF COAST
Chennai	42,16,268	24231	73,000	1.73	206	19
Cuddalore	22,80,530	626	99,704	4.37	614	57.5
Kancheepuram	28,69,920	647	100,000	3.48	130	87.2
Kanyakumari	16,69,763	992	187,650	11.23	799	71.5
Nagapattinam	14,87,055	548	196,184	13.19	6065	187.9
Pudukkottai	14,52,269	312	66,350	4.56	15	42.8
Ramanathapuram	11,83,321	287	0	0	20	236.8
Tanjavur	22,05,375	649	29278	1.32	37	45.1
Thiruvallur	27,38,866	800	15,600	0.56	29	27.9
Thiruvarur	11,65,213	538	0	0	36	47.2
Tirunelveli	28,01,194	411	27,948	0.99	4	48.9
Tuticorin	15,65,743	339	110,610	7.06	3	163.5
Villupuram	29,43,917	406	78,240	2.65	47	40.7
Total					8005	1076 km

<sup>10</sup> <http://www.tn.gov.in/tsunami/damages.htm>

<sup>11</sup> <http://www.pondicherry.nic.in/tsunami/dmg1002.htm>

**TABLE 4**  
**DISTRICT WISE SUMMARY OF THE POPULATION AND AREA AFFECTED BY THE TSUNAMI**  
**IN PONDICHERRY**

NAME OF DISTRICT	TOTAL POPULATION	POPULATION DENSITY	POPULATION AFFECTED	POPULATION AFFECTED (%)	DEGREE OF CASUALTY (RATIO OF POPULATION IMPACTED: LIVES LOST)	TOTAL LENGTH OF COAST
Pondicherry	7,35,004 <sup>12</sup>	2534 <sup>13</sup>	26,000	3.53	107	
Karaikal	1,70,640	1064	17,432	10.21	492	
Total	905,644	2029 <sup>14</sup>	43,432		599	25

### **BOX 5** **CORAL REEFS TO THE RESCUE**

The following is an account told to us by local women. In Chinna Eruvadi, women go to sea for collecting shrimp. On 26th December 2004, five women went to sea early in the morning for this purpose. While collecting they found that the water level had gone down from 8 ft to 12 ft and within a few seconds it raised to 15 ft. The water dragged all the five women towards the sea. Three of the women survived tied a rope to the reefs and held on till they were rescued later. Lakshmi, one of the five women lost two of her sisters to the killer waves. She added that if there were no coral reefs she wouldn't be alive.

#### **4.1. THIRUVALLUR**

In this district 15 villages located between Pulicat Lake and the sea were affected. In some villages, the distance between sea and backwater is about 500m. All through the coastal stretch groynes were laid to prevent sea erosion. Villagers from the area, which is situated between the backwater lake and sea, have claimed that these groynes have been laid to prevent the areas from sea erosion, however this only exacerbated the erosion in the adjacent villages. There is few areas left now for people to settle down in this locality. Thiruvallur district, which earlier had mangrove forests, has lost them to industrialisation. The death toll in the affected villages was 29. Thiruvottiyur 1 and 2, Sathankadu, Pulicat and Thirupalaivanam, are mostly situated in areas prone to sea erosion.

#### **4.2. CHENNAI**

The coastal stretch of Chennai is comparatively lower than the others in elevation, the fishing community settlements in these areas are multi-storied and the population of the coastal communities is dense within the city limits. Fishing villages like Srinivasapuram, Nochikuppam and Kasimedu are the most affected.

The death toll in Chennai district is 206 with an affected population of 73000 people in 24 villages.

An important factor that may have determined the extent of impact is the presence of broad beaches with dense population within Chennai city limit and narrow beaches in northern Chennai. All through the stretch from Chennai to Ennore, groynes were laid as many of the villages were situated in close proximity to the sea. Just behind the villages runs the Ennore Express Road. The maximum distance between the sea and the road is 300 m. In Srinivasapuram the population is high and most of the houses are multi-storeyed (more of an urban settlement) unlike other fishing settlements in the coast. The fishing communities are accommodated in slum clearance board areas. The high number of deaths has been mainly due to high density of population near the coast.

Several of these structures are suffering from poor maintenance and have crumbled. The state govt wants the families dwelling in these buildings to buy these dwelling spaces or else move out. Neither of these

<sup>12</sup> <http://www.pon.nic.in/ecostat/popuatglance.htm>

<sup>13</sup> <http://www.pon.nic.in/ecostat/popuatglance.htm>

<sup>14</sup> <http://www.censusindia.net/data/chapter5.pdf>

are economical options for the fishing community. The areas where these buildings are located are also premium real estate within the city and will be readily taken up by builders. For instance a short distance north of Adyar, the Leela Palace Hotel is being developed.

The families living in these slums are not identified as fishing hamlets and their requirement to be located close to the coast is not addressed as a matter of right. They are mostly seen as slum dwellers, and are therefore vulnerable to being displaced and relocated far away from the coast.

### 4.3. KANCHEEPURAM

The death toll in Kancheepuram district was 129 and the number of people affected in the district was estimated at about a lakh (100,000). In this district, the Kovalam creek is linked with the Buckingham canal and most of the kuppams<sup>15</sup> are located very close to the sea. Most fishing villages between the Kottivakkam to Kokilamedu stretch and Chinnakuppam to Alambaraikuppam<sup>16</sup> are located on slightly elevated land. The deaths in this area were less when compared to other low-lying areas like Meyyurkuppam and Uyyalikuppam. Another factor for the high death toll is the population density along the coast. For instance, the Meyyurkuppam to Uyyalikuppam stretch has only 5 villages but the death toll here is 27 when compared to the death toll of 22 in 47 villages located in the Kottivakkam to Kokilamedu stretch and the Chinnakuppam to Alambaraikuppam stretch. The Buckingham canal and the elevated topography considerably reduced losses.

The tsunami has damaged the fishing crafts, but there is not much damage to the huts as they are located on an elevated level. The local fishermen say that the Uppanar estuary's presence has safeguarded their habitation. The local people also say that there is at present no fishing in the sea because the local fishermen are lobbying for a boat for every fishing family.

### 4.4. VILLUPURAM

Villupuram district recorded a death toll of 47 in 33 villages and the numbers of affected people were put at 78,240. Many villages here are situated very close to the sea and casuarina plantations were found in a few sites. The Pondicherry government in many villages laid groynes. Thanthirayan kuppam is

a village, which is also affected by sea erosion. Here in the post tsunami the sea erosion has claimed lives of 2 children. The density of the population and the villages located near the coast is comparatively less. The Kaluveli and Yedaiayan Thittu backwaters enter the sea near Kadapakkam, the Buckingham canal also merges with the backwaters here. The Chief Minister has stated that the canal be opened during monsoons when flooding happens. However, this will have an adverse affect, as there will be increased siltation of the wetlands. Another problem is that the waters will bring down waste material, including non-biodegradable plastics into these areas. This will pose a challenge for the efficient management of wetlands of this area. There is a need to restore the ecological services of the canal and it needs to be included in the CRZ areas as it runs parallel to the coast.

### 4.5. PONDICHERRY AND KARAİKAL

The death toll in Pondicherry and Karaikal was 599 and the number of people affected was estimated at 43,432 in 33 villages. The number of affected villages in Pondicherry and Karaikal areas were 16 and 17 respectively. However, the death toll in Karaikal was 4 times (472) higher than that of Pondicherry (107). One of the reasons can be attributed to the fact that in the Pondicherry stretch, there is dune vegetation but in Karaikal region, the coastal ecosystems like dunes and casuarina plantations were uprooted (Ammankoil pathu area), and there is no natural barrier to protect the coast. In addition, Karaikal is closer to Nagapattinam district and the stretch is similar to that of the Nagapattinam coast. The government has also been responsible for the removal of sand from dunes for landfills. Another problem that is currently being faced in Karaikal is the rapid urbanisation of low-lying areas. This urbanisation process is linked to the policy on fisheries, as the policy encourages increased fishing and associated activities including the creation of more fish landing centres, which ultimately give rise to such developments.

### 4.6. CUDDALORE

In Cuddalore district, 617 lives were lost and 99,704 people in 51 villages were affected. The maximum death toll was in Devanamapattinam, close to Cuddalore town where 101 lives were lost. This is a tourist destination (Silver Beach) and human activities in this area are considerably high. Pudukuppam is another village close to the sea where the tsunami claimed the lives of about 96 people. In areas like Sothikuppam, a village located behind the SIPCOT

<sup>15</sup> A kuppam is a settlement of fisherfolk

<sup>16</sup> SIFFS & ICSF survey, January 2005

Industrial area, the sea front is protected by beach vegetation and coconut trees, the tidal waves were carried inland through the estuary of River Uppanar. In other taluks like Chidambaram, villages located between the backwaters and sea, have large populations. As a result, the death toll here was relatively high.

In some of the areas, there were no deaths because of presence of large beaches, the siting of villages relatively far away from the sea and use of the seafront by fishermen as only as workspaces and not as living space. Such locations include Andarmullipallam, Reddiarpalayam, Kayalpattu, Thiruchopuram, Thiyagavalli, Nochikadu, Nallavadu, Gundu uppallavadi, Kandakadu, Uchimedu, Thaikal thonithurai, Periyakuppam, Iyyampettai, Nanjalingsampettai and Pettodai.

In TS Pettai, the local people say that the water has only turned a little brackish after the tsunami; therefore the agricultural activities have not stopped. In Chinnakuppam, shrimp farms are being revived after the tsunami. In fact some of them are also attending the training given by the government in shrimp aquaculture. All these farms fall within 500m of the HTL.

#### 4.7. NAGAPATTINAM

The Nagapattinam coast is mostly low-lying and the coastline extrudes into the Bay of Bengal, hence the district faced the brunt of the tsunami. In addition, Nagapattinam has a narrow coastal stretch disturbed by human interventions. It is the worst affected area in Tamil Nadu. More than 6000 lives were claimed in this district alone. It has been reported that 196,184 people in 73 villages were affected by the tsunami.

The district has 5 Taluks – Nagapattinam, Keelvelur, Vedaranyam, Tarangambadi (Tranquebar), Seerkazhi. The death toll in Nagapattinam was 3378. Keelvelur reported 1498 deaths, Tarangambadi reported 525 deaths, Sirkali reported 516 deaths; and Vedaranyam reported 148 deaths. The death toll in Nagapattinam taluk is more than 50% of the death toll of the district. This is because Nagapattinam is one of the most densely populated areas. The coastline of Nagapattinam is narrow and projecting to the sea. In addition, the villages/ hamlets are located very near to sea, at an average of about 100m from the sea.

In Keelvelur Taluk, most of the deaths were reported from Velankanni – 900, and Serudoor – 80. The

remaining 518 deaths were reported from the surrounding villages. The beach of Velankanni was small because Uppanar river flowed adjacent to it. The authorities of Velankanni Church have broadened the beach by altering the river course. This has affected the sand dunes and beaches of Serudoor Village in the south. The population density in Velankanni was high because of tourists who came to the Church for Christmas and Sunday mass. Hence the number of tourist deaths is higher than that of local people.

The death toll in Tarangambadi and Sirkali was 1041. In Sirkali, most of the people live between the backwaters and sea. The number of deaths in Vedaranyam area was comparatively less (148). The villages in Vedaranyam are not located close to each other and the population density is also low. In addition, Vedaranyam is sufficiently protected by mangroves in Muthupet. This is the only area where wetlands, mangroves and forests have been protected to some extent. In Point Calimere, it was reported by local people that the deaths that occurred in this area were mostly of fishermen from outside the district. These fishermen use the coastal stretches of Vedaranyam, Kodiakarai for various fishing related activities, including sale of the catch trading places. Their activities have caused considerably damage to sand dunes in Valmikimedu. (Plate #23)

#### 4.8. THIRUVARUR

In Thiruvarur district 28 were lives lost but damage to property was not reported. This district has mangrove ecosystems and a lagoon, which is located along the coast. The Thiruvarur coast faces the Palk Bay, where the tidal action is very low and the coastal stretch is also small and located more to the interior in comparison with Nagapattinam. The villages here are not very close to the sea, in villages such as Thillaivalagam and Sengankadu the coastal community is located at least a kilometre away from the sea. Most of them are involved in fishing near the lagoon.

#### 4.9. TANJAVUR

The coastline of this district is fairly protected as it directly overlooks the Palk Bay. The death toll here was 33 and the number of affected people was 29278. Among the dead only one individual was from Tanjavur district, the other 32 persons were from the Nagapattinam and Kanyakumari coast. Only 3 huts in Marakkavalasai Village, Peravurani Taluk were fully damaged<sup>17</sup>.

<sup>17</sup> <http://www.thanjavar.tn.nic.in/Default.htm>

#### **4.10. PUDUKOTTAI**

In Pudukottai district, 15 lives were lost and 66350 people in 25 villages have been affected. The coastal stretch of the district faces Palk Bay where the tidal action of the sea is very low. This has resulted in less destruction and impact on human lives. Most of the villages are either at an elevated level or not very close to the sea. The villages in these districts are not densely populated. The mangroves of Vadaku Amma pattinam and the coral reefs in the Palk Bay helped to reduce the impact of tsunami here. The damage could have also been less due to Sri Lanka shadowing this region and due to the presence of natural barriers such as reefs. Many fishing communities lost their nets that they use for crab, prawn fishing as they lay them at night and collect them in the morning.

#### **4.11. RAMANATHAPURAM**

The tsunami claimed only one human life in this district. The coastal stretch of the district was protected from the tsunami by the Palk Bay on the left and by the coral reefs and island chain of the Gulf of Mannar on the right. The beaches here are also very sandy and broad. There has not been much disturbance to the ecosystem here due to which it acted as a natural barrier against the tsunami.

#### **4.12. THOOTHUKUDI**

Tuticorin district stands second in terms of the affected population next to Nagapattinam and Kanyakumari, i.e. 110,610 people have been affected. Only three lives were lost. The Tuticorin district coast is protected to some extent due to presence of islands in the Gulf of Mannar. In this district, most of the villages are located close to the sea but because of the rich coastal ecosystem on the coast and in the Gulf of Mannar, the number of lives lost was low.

#### **4.13. TIRUNELVELI**

In this district, 4 lives lost and 27,948 people in 10 villages were affected by the tsunami. Most of these villages are located very close to the coast. Tirunelveli district, which is located towards the southern end of Tamil Nadu, does not have a very rich coastal ecosystem other than dune vegetation. The affected villages have witnessed extensive sand mining activities. Since the coast here faces the Indian Ocean and the impacts of sea erosion are felt to a greater extent, groynes have been laid. These were severely impacted by the tsunami. The ground water was affected due to inundation by seawater. In areas where the beach is broad and sand binders are present, the impacts have been low.

In some of these places like west of Kootapuli where the casuarina re-growth had taken place, the tidal velocity and soil erosion seemed to be less as compared to the areas where the ecosystem had still not been restored. An interesting phenomenon that has been observed here is the recession of the sea to almost 10m. Sand was carried away by the tsunami waves and the groundwater level has increased in some areas Kootapuli; all Panchayat drinking water taps have become saline.

#### **4.14. KANYAKUMARI**

Kanyakumari district recorded the second highest death toll. The number of lives lost was 828 and 187,650 people in 33 villages were affected. The Kanyakumari coast has the unique feature of being the meeting point of three oceans (Indian Ocean, Bay of Bengal, Arabian sea). A coastal stretch of about 76 km in the west coast was most affected; this is also the area where the sea is usually relatively rough. The coasts in this district have rare earths, which is of high value. Some of the minerals found are used for nuclear energy production. Melamanakudi, Kolachel, Kottilpadu are the major affected areas. The tsunami affected the bridge that connected Keelamanakudi and Melamanakudi and the casualties in Melamanakudi are high because of impact of rubble of the bridge thrown up by tsunami. In Kolachel and Kottilpadu, as a result of mining, the coast does not have any natural barriers left. The villages in the district are densely located, and the affected areas are also densely populated.

#### **4.15. POST TSUNAMI RECONSTRUCTION ACTIVITIES: ECOLOGICAL IMPACTS ON THE COAST**

The state of Tamil Nadu is in the process of taking up reconstruction activities on the basis of several plans worked out by government departments and aid agencies. While it is accepted and appreciated that humanitarian needs should be the primary concern while planning and implementing these plans and activities, it is also important to note that short sighted and environmentally unsound plans could further aggravate the vulnerability of coastal habitats and communities.

Several government orders (G.O.) have been issued to district officials involved in the mammoth exercise of rebuilding the infrastructure that was affected by

the tsunami. Many of the Government Orders (G.O.s) do have references to the CRZ regulations and the need to respect these in all reconstruction activity. However, the poor state of implementation of the CRZ notification until now makes it difficult to convince one of the possibilities that these G.O.s and the CRZ notification will be upheld now.

### **Dumping of rubble**

After the tsunami a considerable quantity of rubble from damaged structures such as walls, houses and other structures has been generated. Disposal and clearing of the rubble, especially in cases where it is close to the shore area, pose a challenge and is undesirable. It must be noted that landfills in the CRZ area is banned and illegal under the CRZ rules. It was observed that rubble was being dumped along many areas all along the coasts of Tamil Nadu & Pondicherry, especially where the damage to houses and other buildings had been high. (Plate #24)

### **Reconstruction**

During the relief and rehabilitation phase, “food for work” programmes and construction/repair of houses and infrastructure undertaken has not taken into consideration that local ecology and resources. Sand and sandstone mining in CRZ areas have taken place for reconstruction activity.

### **Housing**

During the process of reconstruction, it will be necessary to respect the values and functions of wetlands, mangroves, swamps, sand dunes and other constituents of the coastal ecosystem. As per a GO issued in 1979, wetlands were not to be acquired for public purposes except in unavoidable circumstances and the District Collector was to verify if such acquisition was unavoidable and prior approval of government was to have been obtained in such cases. Orders were also issued from time to time that acquisition of wetlands should be avoided as far as possible. These orders were seen to be impediments in the way of speedy reconstruction and therefore the need to obtain prior permission from the government before acquisition of wetlands was sought to be done away with. Though this was a demand only from the Collector of Nagapattinam, it was felt that such demands might come from others areas too once the housing policy is notified and the process of land acquisition starts. Keeping this in mind the Special Commissioner recommended, this year, that all districts be exempted from seeking prior approval in such cases. The government

accepted this and an order has been issued that no prior permission is required before the acquisition of wetlands for housing purposes of tsunami affected families. The collectors were also ordered to exhaust all other options of land before acquiring wetlands.

This order though appreciable for the humanitarian aspect that it considers, can become a justification for rampant conversion of wetlands into housing plots. Such a move is not beneficial in the long run as wetlands perform very critical functions in the ecosystem as well as for the livelihoods of local people.

The G.O. 172 lays down the guidelines for construction of new houses. Those who had houses within 200m of the HTL will only be allowed to repair the affected houses as per CRZ norms. These families will also be given an option of moving beyond this distance and the state will assist this process by providing free houses to them beyond the 200m distance.

Those with houses between the 200m and 500 m distance will be given options to move into new houses beyond the 500m distance. These houses will be given free of cost to the willing families.

Affected houses located beyond 500m and affected houses that would like to remain in the original location between 200m and 500m will be given financial assistance for undertaking repairs.

It is likely that several affected families will exercise the option of moving into the free houses provided by the government beyond the 200m and 500m distance. If this does happen, some parts of the CRZ will become relatively free of habitation.

## IMPLEMENTATION OF LEGAL & POLICY FRAMEWORK FOR COASTAL CONSERVATION & REGULATION IN TAMIL NADU & PONDICHERRY

### 5.1 THE COASTAL REGULATION ZONE NOTIFICATION

#### – THE POTENTIAL TO PROTECT COASTAL HABITATS & COASTAL COMMUNITIES

The Coastal Regulation Zone Notification, issued in 1991 using the provisions of the Environment (Protection) Act, 1986 and the Environment (Protection) Rules, 1986 is the most significant and specialised legislation guiding anthropogenic activities along the coast. The crux of the Act and its Rules is that it empowers the Ministry of Environment and Forests (MoEF) with substantial power to take action “*for the purpose of protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution.*”

Apart from the Coastal Regulation Zone Notification, 1991 there are many legislations, official orders and notifications under these laws, related to coastal activities. The following are important: Indian Fisheries Act, 1897 (and the various state fisheries laws that followed); the Indian Ports Act, 1908; Merchant Shipping Act, 1958, Wildlife (Protection) Act 1972; Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981; Indian Coast Guard Act, 1974; and Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981 and Environment (Protection) Act, 1986; The Petroleum Act, 1934; National Environment Tribunal Act, 1995; Hazardous Wastes (Management and Handling) Rules, 1989, Coast Guard Act, 1978, the Territorial Waters, Continental Shelf, Exclusive Economic Zone and Other Maritime Zones Act, 1976, the Offshore Mineral (Development and Regulation) Act, 2002 .

In addition to this, India has signed and ratified several international conventions relating to oceans and related activities. Some of these are related to the marine environment and applicable to coastal areas also. The important ones are the following: MARPOL 1973/1978; 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 includes coastal biodiversity also (MoEF 2005). Others such ‘soft laws’ include United Nation Convention on Law of the Sea, and guidelines under the International Maritime Organization such as ballast water guidelines.

The CRZ notification seeks to operationalise three principles, which are very significant:

#### *Siting or location of activities or operations*

This is based on the understanding that coasts perform important functions for coastal communities and ecosystems. The coasts are important nesting and feeding grounds for several terrestrial and aquatic species. These coastal habitats also provide sustenance and livelihood opportunities to several coastal communities (both fishing and non-fishing communities). Rules for the siting of activities can ensure that the rights of traditional fishing and coastal communities over certain areas are not compromised to meet increasing development requirements such as the demands of the burgeoning tourism industry.

#### *Restricting and permitting appropriate activities*

The CRZ Notification defines the nature of activities that are to be regulated or restricted. It does not issue a blanket ban on all activities but lists activities that are restricted and those that are permitted.

#### *Balancing development and protection needs*

This principle is enshrined in the spirit of the CRZ, which recognizes that different areas have different ecological sensitivities and therefore need varying levels or modes of protection. Thus, the protection afforded to CRZ I is designed to be more stringent than that accorded to CRZ II areas, where more activities are permitted.

## 5.2. CRZ NOTIFICATION, 1991 – SALIENT FEATURES

The CRZ notification declared the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) up to 500 metres from the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and the HTL as the Coastal Regulation Zone. It imposed restrictions on the setting up and expansion of industries, operations or processes etc in the said **Coastal Regulation Zone (CRZ)**. For purposes of the Notification, the High Tide Line (HTL) is defined as the level up to which the highest point reached by the high tide during spring tides.

The Notification also stated that the coastal States and Union Territories should prepare within a period of one year from the date of the Notification, Coastal Zone Management Plans identifying and classifying the CRZ areas within their respective territories in accordance with the guidelines given in Annexure I and II of the Notification and that these plans are to be approved (with or without modifications) by the Central Government in the Ministry of Environment and Forests.

The CRZ notification follows a classification system for the CRZ based on their ecological and geomorphological characteristics and on the nature of anthropogenic presence in these areas.

- 1, CRZ-I (i) is to comprise areas that are ecologically sensitive such as national parks, sanctuaries, wildlife habitats, mangroves, coral reefs, areas close to breeding and spawning grounds of fish and other marine life, areas of outstanding natural beauty/heritage, areas likely to be inundated due to a rise in sea level resulting from global warming and such other areas as may be declared by the Central Government or the concerned authorities at the State/Union Territory level from time to time.
2. CRZ-I (ii) are those areas lying between the Low Tide Line and the High Tide Line.
3. CRZ-II areas are those already developed up to or close to the shoreline. This refers to areas within municipal limits or in other legally designated urban areas provided with drainage, approach roads, water supply, etc.
4. CRZ-III areas are those which are relatively undisturbed and do not belong to either CRZ I or II. These include the coastal zone in rural areas (developed and undeveloped) and those within

municipal limits or in legally designated urban areas that are not substantially built up.

5. CRZ-IV are the coastal stretches in Andaman and Nicobar, Lakshadweep and small islands, except those designated as CRZ-I, CRZ-II or CRZ-III.

## 5.3. IMPLEMENTING AGENCIES

The responsibility of implementing the CRZ Notification rests with the State Governments and the Ministry of Environment and Forests (MoEF). On 26 November 1998, the MoEF constituted 13 State Coastal Zone Management Authorities (SCZMAs), one for each of the coastal states and Union Territories and a National Coastal Zone Management Authority (NCZMA) to monitor and implement the provisions of the CRZ Notification. The National and State CZMAs also have the powers to enforce the clauses of the notification and address violations using the penal clauses in the Environment (Protection) Act, 1986.

The SCZMAs have a fairly extensive and important mandate, empowered to “take action and issue directions”. They can identify ecologically sensitive and economically important areas, implement all provisions of the CRZ Notification including recommending projects for clearance to the central and state governments.

The Tamil Nadu Coastal Zone Management Authority was first constituted vide amendment. **S.O. No. 992(E)** 26th November 1998. Its term has been extended periodically and on the 31st March 2005, its term was renewed once again.

In particular, the CZMAs are empowered to carry out the following:

1. Enquire into cases of alleged violations and issue directions under Section 5 of the Environment (Protection) Act, 1986.
2. Review cases of violations and refer such cases to the NCZMA.
3. Take action to verify the facts related to the cases of violations.
4. File complaints under the Environment (Protection) Act, 1986.
5. Deal with environmental issues referred to it.
6. It has a proactive responsibility of identifying ecologically sensitive areas along the coastal stretches and economically important areas and formulating specific management plans for these areas.
7. Such plans are to be authorised by the NCZMA.



8. Their most significant function however, is examining all proposals for projects in the CRZ areas before the relevant agencies such as the Central Government or the State Governments/ Administrations of UTs approve these projects.

However, it is not clear if the TNCZMP (Tamil Nadu Coastal Zone Management Plan) actually approves all activities that are located on the Tamil Nadu coast or whether this function has been further delegated. It is to be noted that further delegation will not be

possible, since this Authority was created for the specific purpose of examining development activities on the coast.

Although the CRZ notification is correct in focusing on concerns about unregulated development along the coast and in aiming at a balance between use and protection of the coast, some critical gaps in the notification make it very difficult to work on these concerns. They are common to the implementation of the notification in all coastal areas of the country.

**TABLE 5**  
**ROLES OF AGENCIES AND INSTITUTIONS WITH RESPECT TO COASTAL REGULATION**

AGENCY/ INSTITUTION	ROLE
MoEF	Clearance to certain activities as per Para 2 and 3 (also has to be as per CZMP)
State Government / UT	Clearance to all other permissible and regulated activities (as per CZMP)
SCZMA	Identify and Classify CRZ areas Examine proposals for changes of categorisation and CZMP Make recommendations to NCZMA about these changes Identify ecologically sensitive areas or areas needing special attention Assess projects proposed in CRZ areas and make suggestions to the Central Government on its approval/rejection. Approve and monitor residential constructions besides industrial projects File cases of non-compliance of conditions imposed under EPA or CRZ under Section 19 of EPA Inquire into CRZ violations (suo motto or on complaints) Issue directions to violators under Section 5 of EPA Deal with issues directed by Central Government or State Government or NCZMA Ensure compliance of SCZMP
NCZMA	Approve State CZMPs
District administration, District level CZMA <sup>18</sup>	Suggest changes in CRZ categorization

## 5.4. DILUTIONS

Since 1991, there have been 20 amendments and 3 corrigenda (up to January 2005) to the provisions of the Notification. Each of these amendments dilutes and introduces newer clauses that complicate and render many of the protective clauses meaningless.

<sup>18</sup> District

# A CHRONOLOGY OF AMENDMENTS & EVENTS<sup>19</sup> RELATED TO THE CRZ NOTIFICATION IN THE CONTEXT OF TAMIL NADU & PONDICHERRY

DATE OF AMENDMENT/ORDER/ EVENT & LEGAL CLAUSES	DETAILS / COMMENTS / FEATURES
31 <sup>st</sup> December 1992	<ul style="list-style-type: none"> <li>Intense pressure from hotel &amp; tourism lobby on Govt. of India that the restrictions under CRZ severely limited their scope of work.</li> <li>As a consequence, the BB Vohra Committee set up by the Central Government to study the CRZ Notification and its implications and submitted its report with recommendations to Gol on December 31, 1992.</li> <li>S.O 690(E) Corrigendum dated 19<sup>th</sup> September 1994 rectified that the BB Vohra Committee was set up to look into ‘tourism, and hotel facilities in the said zone’ (i.e. CRZ)</li> </ul>
11 <sup>th</sup> November 1993 S.O. 859 (E)	<ul style="list-style-type: none"> <li>Based on pressure from the tourism lobby, amendments were proposed to CRZ Notification</li> <li>A draft notification was issued inviting objections and suggestions from the public.</li> </ul>
18 <sup>th</sup> August 1994 later changed to 16 <sup>th</sup> August 1994 vide Corrigendum dated 19 <sup>th</sup> September 1994 S.O. 595 (E) EPA, 3(2)(v), 3(1) EP Rules 5(3)(a), 5(3)(d)	<ul style="list-style-type: none"> <li>Amendment stated that HTL was to be demarcated by demarcating authority constituted by Gol in consultation with Surveyor General.</li> <li>Importantly, the resultant amendment, in clarifying the meaning of HTL: <ul style="list-style-type: none"> <li>Significantly amended the mandatory CRZ of 100m for rivers, creeks, etc to 50m</li> <li>Gave expansive powers to Central Government, which could now grant permission for construction on the landward side within 200m from HTL (i.e. No Development Zone {NDZ}) according to its discretion.</li> </ul> </li> <li>Did not allow for flattening of sand dunes while landscaping, but allowed live and barbed fencing and conditional construction of basements.</li> <li>Goal posts, net posts, lamp posts were allowed.</li> <li>Basements were permitted subject to receipt of No Objection Certificate from State Ground Water Authority and provided it would not obstruct the free flow of ground water.</li> <li>Permitted plot falling in NDZ areas to be included for FSI calculation, although no construction would be permitted in NDZ.</li> </ul>
18 <sup>th</sup> April 1996 The Supreme Court’s judgment in the Indian Council for Enviro Legal Action case: Writ Petition (Civil) 664 of 1993 I.A 19 of 1995 by The Goa Foundation, India Heritage Society (Goa chapter), Nirmal Vishwa.	<p>The SC dealt with two main contentions of the petitioner; that of non-implementation of the notification and the validity of the 1994 amendment.</p> <ul style="list-style-type: none"> <li>The SC quashed 3 of the proposed amendments of August 1994: <ul style="list-style-type: none"> <li>The relaxation of CRZ limits to 50m from 100m limit for rivers, creeks, etc.</li> <li>Unbridled power granted to the Central Government</li> <li>The area of NDZ to be taken into account while calculating FSI-FAR be 100 per cent. (FSI-FAR indexes, it was decreed, could take into account only 50 per cent of NDZ in its calculations.)</li> </ul> </li> </ul> <p>Regarding the Notification implementation, the Supreme Court:</p> <ul style="list-style-type: none"> <li>Pulled up enforcement authorities for dereliction of duties, while directing authorities to implement the Notification. The court further commented that a single authority may not be able to monitor the CRZ, and suggested the constitution of State and National Coastal Zone Management Authorities, which could also draw upon the resources of NGOs to help implement laws.</li> <li>Ruled that CRZ for rivers be reinstated as a minimum of 100m in the absence of adequate justification to reduce it to 50m, and quashed the move to grant the Central Government arbitrary “unguided and uncanalised” powers to grant permissions for relaxation of NDZ limits. In addition, the court directed that</li> </ul>

<sup>19</sup> EQUATIONS gratefully acknowledges Ms. Aarthi Sridhar (ATREE) for her efforts and contributing the table for this report.

DATE OF AMENDMENT/ORDER/ EVENT & LEGAL CLAUSES	DETAILS / COMMENTS / FEATURES
	<p>CZMPs of all coastal states and union territories must be submitted by end June 1996, and set the date of hearing compliance of submission and finalisation regarding this for September 1996.</p> <ul style="list-style-type: none"> <li>- Directed that in matters dealing with local geographical areas, the High Court must see that the law is enforced and hear complaints made by local inhabitants. The Supreme Court would only scrutinise matters regarding approval of CZMPs, or any suggested modifications in existing classification of areas.</li> <li>- Issued show cause notices to the chief secretaries of states of Andhra Pradesh, Karnataka, Gujarat and Kerala for not having submitted their management plans as directed in interim orders issued earlier.</li> <li>- Finally, ruled that till the CZMPs are finalised, the interim orders mentioned above would continue to operate.</li> </ul>
<p>9<sup>th</sup> July 1997 S. O. No. 494(E) EPA 3(1), 3(2)(v), EP Rules 5(3)(a), 5(4)</p>	<ul style="list-style-type: none"> <li>· No objections were invited for this amendment.</li> <li>· The Court has issued no orders to date.</li> <li>· The rationale was that State Governments had expressed need for several essential facilities to be constructed in the coastal zones.</li> <li>· Several provisions of the amendment continue to be operative.</li> </ul>
<p>29<sup>th</sup> December 1998 S.O 1122(E) EPA 3(1), 3(2)(v), EP Rules 5(3)(a), 5(4)</p>	<ul style="list-style-type: none"> <li>· No objections were invited for this amendment.</li> <li>· The Central Government is said to have deliberated upon and decided to simplify procedure for demarcation of HTL, which it laid down in this notification</li> <li>· The HTL is defined as the line on land up to which the highest water line reaches during spring tide</li> <li>· The amendment lays down that HTL shall be demarcated uniformly in all parts of the country by demarcating authority or authorities so authorised by Central Government, in accordance with general guidelines issued in this regard.</li> <li>· However these have not been spelt out in the Notification.</li> </ul>
<p>Draft amendment dated 5<sup>th</sup> August 1999 S.O 692(E) EPA 3(1), 3(2)(v), 6</p>	<ul style="list-style-type: none"> <li>· Objections were invited to this amendment</li> <li>· The notification states that inhabitants of the CRZ area have faced difficulties and there is a need for infrastructure facilities along the coast</li> <li>· It sought once again to reduce CRZ for rivers, creeks and backwaters to 50m based on certain conditions.</li> <li>· It also stated that for permitted facilities for storage of petroleum products in Annexure - III, both MoEF and MoST were involved depending on location of project and port limits (port limits are those that have been notified as such before the 9th July 1997 amendment)</li> <li>· Facilities for receipt, storage and regasification of Liquefied Natural Gas were permitted according to guidelines issued by MoPNG and MoEF.</li> <li>· It permitted salt harvesting in CRZ-I areas between the LTL and HTL provided they were not classified as CRZ-I</li> <li>· It removed the authority for permitting construction along CRZ-III areas, which was introduced by the 9th July 1997 amendment.</li> <li>· Permission for construction required for 'local inhabitants' is to be granted by either the Centre or State or any designated authority (however it is not specified which of these is the final authority). The amendment lays down more conditions under which such construction maybe permitted.</li> <li>· Constructions in CRZ –III between 200-500m from HTL, were previously permitted for meeting traditional rights and customary uses. The words 'local inhabitants' have replaced the previous words 'traditional rights and customary uses'. The term local inhabitant used in this clause and elsewhere in the notification is defined as a person or his descendants who have been inhabiting in the area prior to the 19th February, 1991.</li> </ul>

DATE OF AMENDMENT/ORDER/ EVENT & LEGAL CLAUSES	DETAILS / COMMENTS / FEATURES
	<ul style="list-style-type: none"> <li>· Relaxations were made for reconstruction / alteration of existing buildings allowing for horizontal landward extension of dwelling unit not exceeding a total plinth area of 100m.</li> <li>· It made 'exploration for extraction of oil and natural gas in CRZ a permissible activity requiring permission from the MoEF'.</li> </ul>
<p>4<sup>th</sup> August 2000 S.O 730 (E) EPA 3(1), 3(2)(v), 6</p>	<ul style="list-style-type: none"> <li>· The amendment is the final notification for 5<sup>th</sup> August 1999 draft amendment.</li> <li>· The amendment states that all objections and suggestions relating to oil and natural gas exploration; procedure for according clearance to storages of specified petroleum products and receipt, storage and regasification of LNG and points raised by the petitioner in Delhi High Court in civil writ petition No. 4198/98 have been duly considered by the Central Government</li> <li>· This final amendment to earlier draft retained only two of proposed changes and withdrew the rest.</li> <li>· The changes were ones related to para 2(ii) about facilities for receipt, storage and regasification of LNG, which was permitted according to guidelines issued by the MoPNG and MoEF and 3(2)(ii) about exploration for oil and gas in the CRZ.</li> </ul>
<p>12<sup>th</sup> April 2001 S.O 329(E) EPA 3(1), 3(2)(v), EP Rules 5(3)(a), 5(4)</p>	<ul style="list-style-type: none"> <li>· No objections were invited for this amendment.</li> <li>· Projects of Department of Atomic Energy were exempted from prohibition.</li> <li>· Facilities for receipt and storage of petroleum products and LNG as specified in Annexure III appended to the Notification and facilities for regasification of LNG were permitted provided certain guidelines were followed.</li> <li>· The delegation of powers to accord clearances to MoST were withdrawn.</li> <li>· Land reclamation etc was permitted for certain activities provided that reclamation for was not done for commercial purposes such as shopping and housing complexes, hotels and entertainment activities.</li> <li>· Mining of sands, rocks and other substrata materials was permitted for exploration and extraction of oil and natural gas</li> <li>· Construction activities related to projects of Department of Atomic Energy were treated as permissible activities requiring permission from the MoEF.</li> <li>· Operational constructions for ports, harbours and light houses and constructions for activities such as jetties, wharves, quays and slipways, pipelines, conveying systems including transmission lines were also added to permissible activities needing MoEF clearances.</li> <li>· Projects relating to Department of Atomic Energy and (b) Pipelines, conveying systems including transmission lines were permitted in CRZ-I (i) areas</li> <li>· In the CRZ-I area, exploration and extraction of natural gas was permitted.</li> <li>· The West Bengal CZMA was made responsible for according permission for construction of dispensaries, schools, public rain shelters, community toilets, bridges, roads, jetties, water supply, drainage, sewerage which are required for traditional inhabitants of the Sunderbans Biosphere Reserve</li> <li>· The amendment permitted storage of petroleum products specified in the Annexure in any part of CRZ other than CRZ-I areas. Previously this was restricted only to port areas.</li> <li>· LNG was added to list of petroleum products on Annexure III</li> <li>· Environmental clearances accorded by MoST from 9th July 1997 till publication of this Notification are valid. All proposals for environmental clearance pending with MoST stand transferred to MoEF from date of publication of this Notification.</li> </ul>

DATE OF AMENDMENT/ORDER/ EVENT & LEGAL CLAUSES	DETAILS / COMMENTS / FEATURES
<p>11<sup>th</sup> January 2002 Draft amendment S.O 51(E) EPA 3(1), 3(2)(v), 6 EP Rules 5(3)(a),</p>	<ul style="list-style-type: none"> <li>• The rationale for this amendment is stated to be: <ul style="list-style-type: none"> <li>- The inhabitants of areas falling within CRZ are facing difficulties and there is a need for infrastructural facilities in these areas.</li> <li>- The Central Government is stated to have had consultations with state governments and taken a decision to permit construction of dwelling units and development of infrastructural facilities for local inhabitants; housing schemes of Urban Development Authorities which had been approved prior to 19th February 1991, facilities and activities including setting up of non polluting industries in the field of information technology and other service industries in the Special Economic Zones, and salt harvesting by solar evaporation of sea water in the said zone.</li> </ul> </li> <li>• It introduced a 90-day time limit for assessment of projects and 30 days for conveying a decision on the clearance status of projects proposed within the CRZ.</li> <li>• It introduced the same provisions (with slight modifications) for the Note of Para 1 (i) of the notification that the 5th August 1999 draft amendment introduced. This was despite these proposed provisions of 5th August 1999 draft amendment being excluded in the subsequent amendments dated 4th August 2000 and 12th April 2001, and 3rd October 2001.</li> <li>• The draft amendment exempted “non polluting industries in the field of information technology and other service industries in the CRZ of Special Economic Zones” from prohibitions as Para 2 (i) (c).</li> <li>• It sought to exclude mining of certain minerals under Atomic Energy Act, 1962 from the prohibited activities clause, subject to EIA studies and an approved mining plan.</li> <li>• Housing schemes in CRZ area, mining of rare minerals and specified activities/ facilities in SEZ were to be permissible activities requiring clearances from MoEF</li> <li>• Salt harvesting by solar evaporation of sea water was to be permitted in CRZ-I areas</li> <li>• In CRZ-II areas, exemption was made for housing schemes of State Urban Development Authorities</li> <li>• Further relaxations were sought for CRZ-III areas, based on similar changes proposed in 5th August 1999 draft amendment. All activities within SEZs were permitted.</li> <li>• This amendment substitutes the words ‘local inhabitants’ for traditional rights or customary uses.</li> <li>• The notification replicates all other provisions of the 5th August 1999 draft amendment as far as relaxations for constructions for ‘local inhabitants’ etc are concerned despite most of these being omitted in subsequent final amendments.</li> </ul>
<p>21<sup>st</sup> May 2002 S.O 550(E) EPA 3(1), 3(2)(v), EP Rules 5(3)</p>	<ul style="list-style-type: none"> <li>• The amendment is the final notification for the draft 11<sup>th</sup> Jan 2002 amendment.</li> <li>• It redefined distance up to which CRZ is measured along the rivers, creeks etc, as up to the point where a minimum salinity level of 5 ppt is recorded.</li> <li>• All the provisions that were common to the 5<sup>th</sup> August 1999 draft and the 11<sup>th</sup> January 2002 draft were struck down by this final amendment.</li> <li>• It permitted “non-polluting industries in the field of information technology and other service industries in CRZ of Special Economic Zones (SEZ)”</li> <li>• It retained the time limit on assessment of project documents that was proposed in the 11<sup>th</sup> January 2002 draft.</li> <li>• Certain changes were made to activities permitted in CRZ I, II &amp; III zones.</li> </ul>

DATE OF AMENDMENT/ORDER/ EVENT & LEGAL CLAUSES	DETAILS / COMMENTS / FEATURES
<p>19<sup>th</sup> October 2002 S.O 1100 (E) EPA 3(1), 3(2)(v), EP Rules 5(3)&amp; (4)</p>	<ul style="list-style-type: none"> <li>• No objections were invited for this amendment. It was issued in ‘public interest’ using Rule 5(4) of the EP Rules</li> <li>• Rationale was ‘to harmonise &amp; elaborate provisions of the Notification’ and to provide permission for setting up of certain projects that were presumably in public interest.</li> <li>• It stated that clearances given for activities in CRZ area were valid for 5 years before which construction or operations should commence. However further actions have not been elaborated on, for instance, on adherence to clearance conditions.</li> <li>• The following activities required MoEF clearances to be set up in CRZ areas: <ul style="list-style-type: none"> <li>- In CRZ-I areas installation of weather radar for monitoring of cyclone movement and prediction by Indian Meteorological Department was permitted.</li> <li>- In the CRZ-I between HTL and LTL, the following was permitted: desalination plants, storage of non-hazardous cargo such as edible oil, fertilizers and food grain within notified ports.</li> <li>- In CRZ II and III areas list of products in Annexure III was permitted subject to conditions mentioned in Para 2(ii).</li> </ul> </li> </ul>
<p>22<sup>nd</sup> April 2003 S.O 460(E) EPA 3(2)(1), 3(2)(v) EP Rules 5(3), 5(4)</p>	<ul style="list-style-type: none"> <li>• This amendment was issued using the public interest clause without inviting objections to the same.</li> <li>• Rationale given by Central Government was that it had been informed that large sized projects were being implemented without clearance from MoEF and that this resulted in destruction of mangroves, depletion of ground water and certain other activities involving ecological damage.</li> <li>• It sought to add a few more activities to list of permissible activities requiring environmental clearance from MoEF. There were: <ul style="list-style-type: none"> <li>- The demolition or reconstruction of buildings of archaeological or historical importance, heritage buildings and buildings under public use (defined in the amendment as including ‘use for purposes of worship, education, medical care and cultural activities.</li> </ul> </li> <li>• All other activities involving an investment of less than five crore rupees were to be regulated by the State level authorities in keeping with provisions of the Notification in Annexure I; any project costing more than five crores required clearance from MoEF</li> </ul>
<p>24<sup>th</sup> June 2003 S.O.725(E) EPA 3(1), 3(2)(v) EP Rules 5(3), 5(4)</p>	<ul style="list-style-type: none"> <li>• The notification introduced another clause under norms for development for CRZ IV for setting up of facilities for treatment of wastes and effluents arising from hotels, beach resorts &amp; domestic sewage and disposal of treated wastes and effluents in areas other than CRZ-I</li> <li>• This was to be based on a detailed scientific study to assess environmental impact of the same.</li> </ul>
<p>24<sup>th</sup> July 2003 S.O.838 (E) EPA 3(2)(1), 3(2)(v) EP Rules 5(3), 5(4)</p>	<ul style="list-style-type: none"> <li>• This amendment was issued using the public interest clause without inviting objections to the same.</li> <li>• The amendments were introduced by Central Government after it had considered specific requirements of projects relating to Department of Atomic Energy in terms of their location</li> </ul>

Analysis of amendments made to the CRZ Notification:

**1. Reduction in the No-Development Zone for promotion of tourism**

- The first amendment to the Notification was made because of pressure from the tourism lobby.
- The amendment was vide notification no. S.O. 595(E) dated 18th Aug 1994 on recommendations of the Vohra Committee, which was constituted on 1st Jan 1992 and report submitted on 31st Dec 1992. The issue dealt with was tourism. The reason for the constitution of the committee was that there was intense pressure from the hotel and tourism lobby on the GOI stating that the said notification was very stringent and their work was severely restricted by the CRZ.
- One of the recommendations of the Committee was reduction of distance of the NDZ in selected coastal stretches for promoting tourism. The Ministry amended the CRZ Notification, 1991 on 18th Aug 1994, reducing No Development Zone (NDZ) area all along the coast from 200m to 50m. The amendment also permitted construction in NDZ thus giving expansive powers to the central government to permit such constructions on the landward side within 200m from the HTL according to its discretion.
- Although the SC quashed the amendments later, the tendency of MoEF to dilute its own laws raises concerns about where its loyalties lie – a facilitator of impact inducing developments rather than that of a regulator.
- The NDZ reduction was eventually reduced to 50m in the case of A&N Islands and Lakshadweep for tourism development through amendment of amendment, S.O.838 (E), 24th July 2003 against the directives of SC in 2002, which were based on Shekhar Singh Committee report. The relaxation was based on identification of areas in NDZ by the Integrated Coastal Zone Management Plan study conducted by the MoEF. The MoEF may adopt a similar procedure in the future for areas on the mainland so that the tourism industry can be given open access to coastal areas – this is an area to watch out for in the near future.

**2. Demarcation of High Tide Line**

S.O 1122(E) dated 29th December 1998 only gave the definition of the HTL and stated that it will be marked by an authority. It is surprising that 7 years after the Notification was issued, the central government did not specify which authority and

did not provide guidelines for marking the HTL. The HTL has not been marked to date.

**3. Construction for petroleum storage to be allowed in CRZ II & III**

S.O 730 (E) dated 4th August 2000 permitted storage of petroleum and its products thereby posing a threat to coastal environment. This also meant allowing construction in these areas including the NDZ.

**4. Exploration of oil and natural gas allowed**

The amendment no. S.O 730 (E) dated 4th August 2000 gave a blanket allowance of oil and natural gas exploration could take place on an extensive basis in CRZ. It could trigger off land acquisition process by government, following which there can be changes in land use. Mining in CRZ areas, including CRZ-I has also been permitted by amendment no. S.O 329(E) dated 12th April 2001. While the need is important, it is equally important to ensure certain safeguards for environmental protection, which the CRZ Notification has not specified clearly.

**5. Land reclamation allowed**

Amendment no. S.O 329(E) dated 12th April 2001 allowed reclamation of land for ‘certain activities’, which have not been defined. However, reclamation for commercial purposes has been prohibited. There is ambiguity in the term ‘certain activities’ that could still lead to unwanted impacts on coastal ecosystems.

**6. Setting up of non-polluting industries in field of IT and other service industries in Special Economic Zones**

Amendment no. S.O 550(E) dated 21st May 2002, by allowing such ‘service industries’, only opened up the CRZ areas for resource intensive and negatively impacting activities like tourism. SEZs have been controversial because of the status they enjoy, especially exemption from environmental norms. The process of demarcating SEZs has also been undemocratic in nature. Hence the CRZ only legitimises such negatively impacting activities if they come in protection of SEZ.

There are positive sides to the CRZ Notification too, e.g. classifying CRZ to include rivers, creeks etc, upto the point where a minimum salinity level of 5 ppt is recorded, and for the first time in history of CRZ, the clause of Environment Protection Rules

5(4) have been used to actually prevent further ecological damage, unlike earlier instances where the same clause has been used to relax provisions of the Notification and allowing more and more activities on coasts. But where the Notification fails miserably is in its poor implementation by state governments & union territories. It has also been interpreted inconsistently due to many of its provisions that are ambiguous and incomplete, like lack of guidelines for demarcating HTL. One glaring aspect is that the Ministry of Environment & Forests has succumbed to the development lobby, first from tourism and later others. It has frequently sought, and actually managed, to dilute it. It has rendered the CRZ Notification an instrument to plan and execute developmental activities rather than protect the highly pressurised coastal systems.



## KEY FINDINGS & RECOMMENDATIONS

The health of the coast is not only dependent on the activities taking place within it and their impacts but on the various activities taking place in non coastal areas and their extended consequences on the coast. While the regulations governing activities on the coast are critical to ensure its well being, there are a whole host of legislations and processes, which govern development activities.

1. **Jurisdiction** - One of the limitations of the CRZ notification is that it does not regulate anything beyond the coastal regulation zones. While the CZMP could address some of the activities beyond the 500m or 200m area on the basis that although they may be outside the CRZ, they potentially impact the CRZ, the effective regulation of the gamut of activities that have the potential to impact the coast can only be achieved if other laws governing development projects, urbanisation and economic growth incorporate these concerns. Many port related activities and other off shore activities are therefore not adequately regulated. There is a critical need to examine these laws and determine the changes that are needed in them so that these concerns may be addressed.

Actions needed:

- 1.1 Extend the Jurisdiction of CRZ to include the inter-tidal area in all zones
- 1.2 Urgent need to extend the CRZ seaward after detailed study to ascertain the area for impact from land based activities

Action by: MoEF

2. **Ambiguity** – None of the amendments have sought to clarify some of the other ambiguities and uncertainties such as the definition of ‘local inhabitants’, ‘traditional rights and customary uses’

The MoEF has still not issued a consolidated gazetted notification incorporating all the changes to the original notification making the interpretation of the various clauses a real challenge.

Action needed:

- 2.1. Definition of local inhabitants and ‘traditional rights and customary uses’ to be defined and identified in the context of the CRZ notification.

Action by: Civil Society and Government in consultation with local coastal communities

3. **Demarcation of the CRZ** - The HTL and LTL are to be demarcated only by authorities designated by the Central Government but the Government of India is still in the process of arriving at a common methodology for HTL/LTL demarcation. In none of the states has the HTL demarcation exercise been completed at the ground level.

Action needed:

- 3.1. Demarcation of the HTL and the LTL needs to be done at the earliest

Action by: NCZMA and SCZMA in consultation with local Panchayats.

4. At present no specific EIA procedures and guidelines for project clearance are mandated in the schemes of the CRZ.

The present procedures for environmental clearance are not laid down in the notification. It is not known if a standard procedure has evolved through practice. Therefore it is impossible to know if existing procedures are coherent or adequate in assessing potential impacts of proposed projects.

Action needed:

- 4.1. Detailed project clearance guidelines need to be given in the CRZ notification complimented by EIA procedures for all project clearances

Action by: the NCZMA and SCZMA

5. The central and state level processes of granting clearance to projects proposed in CRZ areas, needs to be clearly understood through several case studies of cleared projects covering various sectors and activities. Following this, a detailed critique of the process should be developed for the MoEF, which will highlight its strengths, weaknesses and recommendations to enhance effectiveness of the process as per ICZM objectives. Good practices that are part of clearance processes under the EIA notification and other laws could be incorporated into the CRZ clearance process. As in the case of the EIA notification, the CRZ notification should have one or more schedules that clearly list the kinds of projects mandating clearance from state or central government agencies. This study will help to evolve recommendations for the strengthening of the clearance process and incorporation of good practices like public hearings before granting clearance to projects.

Action needed:

- 5.1. In order to understand the true status of implementation of the CRZ notification until now, detailed studies exploring the following questions

will need to be undertaken:

- a. How many of the development activities on the coast have been established legitimately following all due legal regulatory procedures?
- b. How many of the legally established units comply with the conditions imposed on them?
- c. How many units have been established without following all the environmental regulatory procedures?

Action by: Peoples Movements and Networks, Civil Society Organizations in consultation with the SCZMA.

- 5.2. SCZMA suo moto needs to remove the ambiguity in its functioning by bringing into the public realm and disclosing practices they use to give clearances for projects

6. The only means of prosecuting the violator of the CRZ notification is under Section 19 of the Environment (Protection) Act, 1996. No court can take cognisance of an offence unless put forth by the Central Government (CG) or any authority or Central government authorised officer. Further, any person who has given a notice of sixty days showing his intention to file a complaint to the government can also make a complaint before the court after expiry of 60 days and the court can take cognisance on such a complaint (Upadhyay & Mishra 2005). This process gives the violator ample time to 'clean up' every time he may be found violating the law. This is especially true in the case of violation of pollution norms.

7. There are several specialised regulations that govern the activities mentioned in the CRZ. One such example is the regulation of aquaculture. The apex court in the matter of S. Jagannath Rao (S. Jagannath Rao vs. Union of India 1997 (1) AD SC 81) stated that permission for setting up any shrimp farm or shrimp pond in any ecologically fragile coastal area must be given only after a strict environmental test has been done. The union government was directed to constitute an authority for scrutinising every aquaculture application from the environmental point of view. The authority is called the National Aquaculture Authority (Upadhyay & Misra, 2005). It is important to study these specialised regulations and develop linkages between the implementation of the CRZ notification and these regulations. Another example of where the study of regulations and developing linkages is critical is between town and country planning laws, building regulations

and CRZ.

Action needed:

- 7.1. The linkages between other laws like Town and Country Planning; Building regulations and CRZ need to be synergized by MOEF

8. The Panchayati Raj Institutions Act, (PRIA) gives adequate powers to the panchayats to define and regulate developmental activities in areas under their jurisdiction. However the CRZ, by giving the powers to the SCZMA, overrides the rights and powers of coastal panchayats. This is clear from the fact that panchayats have no representation in the SCZMA.

Action needed:

- 8.1. The CRZ should be synergized with the PRIA for implementation of CZMP. Representation of panchayats in the SCZMA needs to be ensured. A clause in this regard needs to be included in the CRZ Notification to reflect the synergies with PRIA.

Action by: MoEF

9. The Tamil Nadu State Coastal Zone Management Authority is vested with certain powers and duties for protecting and improving the quality of the coastal environment and preventing, abating and controlling environmental pollution in the coastal areas of the state of Tamil Nadu. The Tamil Nadu Coastal Zone Management Authority's function is to regulate and monitor the activities in the coastal stretches. It is entrusted with the task of protection of coastal environment including examination of the project proposals. Ironically the term of the Coastal Zone Management Authority got over by the 5th January 2005, and the new authority, which comprises of similar members, was formed in March 2005. It is important to note that the state did not reconstitute CZMA when the rehabilitation phase was at its peak.

The following are suggestions to make the CZMA effective in performing its functions.

Actions needed:

- 9.1. The Governments of Tamil Nadu, Pondicherry and the MoEF should provide for the independent, responsive and transparent functioning of the State CZMA.
- 9.2. The Governments of Tamil Nadu, Pondicherry need to reconstitute district level committees constituted by the CZMA through maximum public participation and involvement of local governing bodies, especially the panchayats of fishing villages.
- 9.3. A mechanism should be devised to make officials

personally liable in case they fail to take action against violations.

9.4. Public access must be provided to all proceedings of the authorities, including minutes, copies of complaints, applications for approvals, approvals and action taken reports.

10. The execution of the functions of the State CZMAs across the coast could be greatly facilitated by the creation of District CZMAs whose basic functions would include: a) verification of details<sup>20</sup> of proposed activities in the CRZ areas, b) periodic monitoring of the coastal stretch to identify violations of the notification, c) booking of violators for violations of the EP Act and d) providing details of violations to the State CZMAs for necessary action (Sridhar, 2005)

11. An appropriate and creative mechanism needs to be devised to make local coastal communities participate in the implementation of the CRZ notification and its regular monitoring. [Afsah et al. 1997] state that the role of the regulator is substantially reduced when reliable information is in the public domain (Afsah et al. 1997). There is increasing evidence that public information can increase the role of informal regulation and that informal regulation does play an important role in enforcement.

12. Presently, the state Coastal Zone Management Plan has identified 31 maps and only 10 have been conditionally approved (Sridhar, 2005). The remaining 21 maps are to be approved by the Ministry of Environment and Forest (MoEF). In the current context of a conditionally approved CZMP, the state governments are evicting coastal communities by quoting the CRZ Notification.

13. This situation is not specific to Tamil Nadu but all the coastal states of the country. None of the states have fully approved plans and the MoEF has only granted conditional approval for these plans. The states are expected to resubmit revised plans and maps. Since no state possesses a fully approved CZMP till date, implementation of the CRZ notification has been abysmal. Without a fully approved and operational CZMP, it is not possible to arrive at a clear or even quick estimation of areas where certain activities are permitted. The present status is that all over the Indian coastline, violations of the CRZ notification abound. Relative to the number of violations, in response,

there has been insufficient punitive action from implementing agencies (Sridhar et al. 2005).

14. The current Coastal Zone Management Plan of Tamil Nadu has not been formulated with participation of civil society groups, peoples' movements and networks and coastal community. It only serves the purpose of a status report and is not a management plan in its true sense, as it has no information on permissible and prohibited activities. It also does not lay down the limits or extent to which activities can be permitted, and parameters which will help to decide when a moratorium should be imposed on impacting activities. Further, it contains a perfunctory listing of CRZ areas; in many cases it falls short of performing even this task, and is devoid of a management vision that recognizes the challenges of a dynamic socio-ecological system.

15. The CZMPs should also include area specific cumulative impact assessment studies, which give information about the prevalent levels of pollution and environmental damage due to ongoing activities in the area. Any proposal for clearance of a new project must be taken up only if it is proved that these levels of damage will not be enhanced by the proposed project. Thus along with location and potential impact of a proposed project, existing levels of damage in the area must be a critical parameter while deciding about new projects.

Actions needed:

15.1. The CZMP needs to be rewritten keeping in mind the context of current developments, including changes that may have been brought about by the tsunami, with full participation of all aforementioned stakeholders.

15.2. The maps must be translated and disseminated widely. Access to the same should be mandatorily provided upto Panchayat level in Tamil for comments and approval, prior to it becoming an approved working document.

15.3. The state government should also take immediate steps to identify erosion prone, tsunami affected areas and areas, which are likely to be inundated due to climate, change as CRZ I areas in the CZMP. Action by: The state government needs to direct the SCZMA to prepare the new CZMP's for Tamil Nadu and Pondicherry.

16. Reporting of violations increases when the public is more aware of regulations and their importance. Therefore CRZ related information must be made

<sup>20</sup> Details could include distance of proposed construction from HTL, presence of authorised structures in the vicinity, physical characteristics of the area, violations of the notification etc

publicly accessible and in user-friendly formats to encourage informal regulation of the law (Pargal et al. 1997).

17. Amendments to the CRZ notification should not be made without extensive consultations with civil society groups and especially the coastal dwelling communities (fishing and non fishing communities). Most of the amendments so far have been to dilute the original stipulations to restrict destructive activities on the coast. Indeed, of the 19 amendments (as of 24th July 2003) to the notification, only three called for objections and suggestions from the public<sup>21</sup>. The content of these committee reports are therefore bereft of critical inputs on issues of ground level implementation and the current problems facing coastal areas (Sridhar et al. 2005).
18. There are also various orders of the High Courts in the country and their interpretation of the CRZ notification. It has been pointed out by environmental lawyers T. Mohan and Sahasranaman “in particular that the lack of clarity and definitions in the CRZ notification has led to varying interpretations by the courts” (Advocates T. Mohan and P.B Sahasranaman pers. comm. 2005). At the same time, the MoEF has issued circulars (e.g. the doctrine of ‘infilling’ or building between empty plots) from time to time. The legal status of these circulars is not clear. It is recommended that a follow-up review process be initiated to address these deficiencies with the CRZ notification
19. It has been recommended that a Field Team be created with the responsibility to provide field information and verification of CRZ areas and details of anthropogenic activity to the Tamil Nadu State CZMA and the MoEF and assist the Tamil Nadu State CZMA in the identification of such zones and areas where rehabilitation and reconstruction can take place in accordance with the provisions of the CRZ Notification, bearing in mind livelihoods, environment and disaster mitigation concerns. The MoEF needs to be informed of this exercise should the Tamil Nadu Government consider the creation of the Field Team. In addition, the MoEF could consider issuing a notification/G.O/Circular expanding the functions of the TNSCZMA to also provide assistance to the Field Team (Sridhar 2005).

Several programmes have been undertaken by the state government to provide training to local communities and prospective entrepreneurs in shrimp farming and other economic activities. Information on these programmes undertaken by relevant department needs to be collected and the training content needs to include aspects of coastal management, ecology and protective regulations for the coast. Without these critical inputs at the training stage, it is not possible to expect CRZ compliance by new entrepreneurs.

A similar exercise also needs to be done for all the trainings and capacity building programmes undertaken as part of post tsunami reconstruction. This will ensure that all activities undertaken will respect CRZ norms. The CRZ and other relevant regulations also need to be prominently mentioned in all GOs pertaining to reconstruction.

Action needed:

- 19.1. There is a need for capacity building at the community and panchayat level on the CRZ rules and guidelines

Action by: state government with TNCZMA

20. It is critical that the State Pollution Control Board declares areas such as Manali and Cuddalore as critically polluted areas. This exercise of identifying areas needs to be done by an independent set of expert agencies and NGOs working in the field of environmental pollution, toxics and health along with local community members. Once this is done, it must be ensured that clearances are not given to industries that add to the pollution load in these areas.

Large coastal private plantations such as the one in the Vembalur area should be brought under some form of protection so that they are not converted into residential or commercial plots. Appropriate mechanisms need to be devised to provide motivation and economic incentives to the owners of such plantations so that they are not converted to other uses.

Vedaranyam is an ecologically sensitive area, which was declared a wildlife sanctuary in March 1968. However its protection has not been adequate. This may make it possible to improve the management of the wetlands and prevent its abuse through activities such as the establishment of aquaculture farms in nearby areas, which impact

<sup>21</sup> Rule 5(3)(d) of the Environment (Protection) Rules, 1986 requires that the Central Government issue a notification calling for objections and suggestions whenever it intends to introduce an amendment pertaining to the restrictions of activities. However, most of the amendments of the CRZ have been introduced using clause 5(4) of the Environment (Protection) Rules.

these wetlands.

Strict monitoring of use and protection of mangroves is also of utmost importance to keep our coasts stable and coastal communities protected. This again can be achieved only by creating a scheme on the lines of Joint Forest Management where local communities are involved in the protection and management of natural resource use.

Action needed:

- 20.1. It is important that Vedaranyam and several other wetlands be declared as wetlands of international importance under the RAMSAR convention.

Action by: MoEF

21. Encourage community based models of management

22. Community based models of management and conservation especially in mangrove areas, such as community-based tools are to be encouraged for the purpose of increased ownership and responsibility. Similarly, traditional methods of beach conservation and protection must be encouraged and studied.

Large areas of mangrove habitat has been destroyed and in many cases invaded by species such as *Prosopis juliflora*. Steps to study the reasons of mangrove habitat loss as well as their restoration should be undertaken. Invasive species like *Prosopis* should be removed as well as wherever ecosystem restorations are being undertaken, no exotics should be promoted. This is more so in the case of tourism areas where landscaping is permitted and the usual tendency is to have exotic varieties of plants. Shelterbelts like casuarinas are an option but it is better to allow for regeneration of natural vegetation as has been done in the case of Naalvedapathi.

The Institute for Ocean Management, which is also part of the Tamil Nadu Coastal Zone Management Authority (CZMA), has identified the following sites under the category of Ecologically Important Areas<sup>22</sup>. It is not clear if these areas have any legal protection under the Environment Protection Act, 1986, as is the case with Ecologically Sensitive Areas (ESAs). The CZMA is vested with the authority to identify areas as ESAs. Following the declaration of areas as ESAs, the nature of

activities that are to be permitted, regulated and prohibited will need to be clearly mentioned in each case through notifications, so that there is a clear framework for the effective protection of these areas on the basis of clear objectives.

Action needed:

- 22.1. The ecologically important coastal areas need to be declared as ecologically sensitive areas under the Environment Protection Act, 1986.

Action by: MoEF

- 22.2. A review of the policy of bio-shields, especially coastal plantations should be undertaken and all plantation and afforestation activities should be on hold till this review is undertaken.

Action by: Department of Environment & Department of Forests, governments of Tamil Nadu; Pondicherry

23. It is clear from observations that in certain coastal stretches, certain activities or units are being implemented far beyond a reasonable carrying capacity of the area. Their cumulative impacts are being felt on the ecosystem and on natural resources such as ground water. The ecosystem has been altered to such an extent by anthropogenic activities that they are unlikely to be able to revert to their original state or perform ecological functions as before. It therefore is necessary to undertake studies to identify the impacts being created by the present level of activity. Until such studies are undertaken, it may be necessary to place a moratorium on certain activities in identified coastal stretches, such as sand mining in the southern districts of Tirunelveli and Kanyakumari and entertainment parks and tourist villas and bungalows between Chennai and Mahabalipuram.

The Swaminathan Committee report on the review of the CRZ notification recommended that well-known detrimental activities such as the construction of seawalls and sand mining should be banned from most areas. It also recommended that vacant plots in the coastal zone should be left open, permitting only vital activities on the coast. The committee recommended that tourism be promoted in identified zones under certain conditions in a conditional manner.

Action needed:

- 23.1. Cumulative impact assessment studies need to be undertaken before grant of clearance to any more projects on the coast. This is to address the additional environmental damage that may result from any new proposed project in a certain area.

<sup>22</sup> <http://www.annauniv.edu/iom/EIA%27s.htm>

Action by: SCZMA to give directives to project proponents.

23.2. Sector-wise studies also need to be undertaken to assess the extent to which economic benefits and employment are created for local communities by activities such as tourism and these need to be weighed against the costs incurred by the communities by these activities in the form of loss of resources and socio-cultural impacts.

Action by: Government departments such as tourism

23.3. These studies should seek to determine the activities that are to be permitted along the coast and at what scale. These studies need to maintain the health and basic needs of local communities and ecosystems as central goals.

Suggestions specific to reconstruction activities  
It has been reported by UNDP that the CRZ Notification does not permit the construction of unauthorised structures and in fact stresses the legitimacy of all constructions along the coast. Since a large section of the marine fishing community is not in possession of land titles (a long standing demand of the fisherfolk), the Panchayats are unable to authorise their constructions. The numerous 'unauthorised constructions' by fisherfolk needs to be seen in this light. There were several structures along the coasts which may not have been authorised and which were destroyed by the tsunami. Strictly speaking, the reconstruction of those structures and dwelling units that were unauthorised prior to the tsunami would not be permitted by the notification in any of the zones. As explained earlier, most of the settlers near the coast have been fisherfolk who are dependent on the coast for their livelihoods and survival. As per the CRZ Notification, such constructions can only be permitted in the CRZ II and III areas. However, it is expedient that a Coastal Settlement Process takes place immediately to accord land titles for dwelling purposes only to the existing fisherfolk, with full participation of the fishing Panchayats. This will assist in checking future unplanned growth while providing the long-standing demand of the fishing community for security of land tenure (UNDP<sup>23</sup>).

As per the GO 172 "all the house owners of fully damaged and partly damaged kutcha and pucca houses within 200m of the High Tide Line, will be

given the choice to go beyond 200m, and get a newly constructed house worth Rs.1.50 lakh free of cost. Those who do not choose to do so will be permitted to undertake the repairs on their own in the existing locations, but they will not be eligible for any assistance from the Government."

Currently, GO 172 issued by the Tamil Nadu government encourages communities to relocate beyond the 200 m mark. It provides a disincentive for being located within 200 metres, by denying government aid for reconstruction within 200 metres. This is in violation of the very spirit of the CRZ recognising the right of the fishing communities and their livelihoods within the CRZ especially the 200 m zone. This can be construed to be a violation of human rights. However, NGOs are free to provide assistance to rehabilitation efforts within 200 metres. In all of this it must be seen that no construction is a violation of the provisions of the CRZ notification. For this to take place, the suggestions stated in the UNDP report must take place on the identification of CRZ areas and sites for rehabilitation (Sridhar 2005).

Actions needed:

23.4. The state government should make available to the civil society all land records/ relevant documents of pre and post 1991 land use patterns and constructions. These will contribute significantly to the ongoing reconstruction phase.

23.5. Reconstruction of houses, settlements and other facilities that existed prior to the tsunami are to be allowed and no new constructions should be allowed. Reconstruction activities should not alter the local beach ecology and geomorphology, especially in the case of use of raw materials such as sand stone, sand, etc. The type of reconstruction should be as per those permitted within the CRZ rules and guidelines. Technical guidelines reconstruction of shelters should be prepared as tool for organisations involved in reconstruction.

23.6. Since many NGOs new to the coast are developing fishing hamlets besides reconstruction of shelters, a guideline/key should be developed detailing all the activities and structures that are allowed in the different zones in the CRZ.

23.7. An addendum to GO 172 is much needed to protect the CRZ that becomes free of habitation. The GO must indicate that the lands that get freed up on the coast will be protected and used only in a manner, which maintains the ecological balance of the coast, and no developmental activities will

<sup>23</sup> See [http://www.undp.org.in/dmweb/Tsunami/CRZ\\_TN\\_w\\_annex\\_March2005.pdf](http://www.undp.org.in/dmweb/Tsunami/CRZ_TN_w_annex_March2005.pdf)

be undertaken unless proved as being beneficial to the ecology of the coast. These areas should be marked in the CZMP and special committees at the district level, which comprise of representatives of the fishing communities, should determine the future use of these lands.

23.8. The GO which allows district officials to acquire wetlands for the purpose of reconstruction and housing needs of tsunami affected families needs to specify a date after which such acquisition should not be allowed and the earlier GO which requires district officials to seek the state governments prior approval before such acquisitions should be restored.

## FACTUAL INFORMATION SUPPLEMENT TAMIL NADU

**Tamil Nadu<sup>24</sup>**

(8° 5' N to 13° 35' N and 76° 15' E to 80° 20' E), the southern most state of the Indian peninsula is spread over 1,30,058 km<sup>2</sup> and accounts for about 4 percent of the total area of the country. The topography of Tamil Nadu broadly consists of the coastal plains in the east and uplands and hills as one proceeds westwards. The plains account for more than half the area of the state<sup>25</sup>.

Barring the hills, the climate of Tamil Nadu can be classified as semi-arid tropical monsoonal. Temperatures range from a maximum of about 45°C in the plains in summer to about 10°C during the winter. Annual rainfall in the state is about 950mm with an average of 50 rainy days a year.

It is found that 43% of Tamil Nadu's geographical area is under agriculture with a per capita figure of 0.0982 ha. of agricultural land. While agriculture and allied sectors account for nearly 62% of the total employment of the state, their contribution to the economy is only 22%. In order to increase the productivity, the state has relied too much on improved crop varieties, fertiliser and pesticides. The residues of these have affected soil structure and polluted the water through leaching. Tamil Nadu has 17.5% of its area under forest cover, of which a sizeable area is degraded. The state has rich biodiversity resources but adequate attention has not been paid in the past to assess it effectively, with the result many species have become endangered.

Tamil Nadu has number of seasonal rivers. The surface water resources are almost fully harnessed by impounding the available water in 61 major reservoirs and also in 39,202 big and small tanks. As per the estimates, 60% of the ground water resources have also been utilised. During 1996-1997, the total fish production from inland fishing was 1.01 lakh tonnes, marine fish products were in the order of 3.56 lakh tonnes. The potential for inland fishing has not been utilised completely and coastal waters have also been polluted resulting in decreased catch per unit effort. The long coastline of over 1000 km is a major natural resource with immense value for commercial, recreational and aesthetic purposes. Agricultural

run off with pesticide residues and indiscriminate destruction of mangroves for fuel wood poses threats to this ecosystem.

*Socio-economic profile*

Tamil Nadu is the third industrialised and the most urbanised state in the country. The impact of industrialisation and urbanisation on the environment is substantial as evidenced from the rise in hazardous and biomedical waste generation, increasing vehicular population and consequent increase in energy demand and air pollution.

The total population of Tamil Nadu is 6,21,10,839 as per the results of the Census of India 2001 with the population of males being 31,268,654 and population of females being 30,842,185. The sex ratio (i.e., the number of females per thousand males) of population in the State has improved from 974 in the previous census to 986 in the present census. The literacy rate in the State has shown remarkable improvement. This has increased to 73.47% (40,624,398 persons) when compared to 62.66% during the previous census in 1991. The density of population in Tamil Nadu is 478 persons per km<sup>2</sup> whereas the national average is 324 persons per km<sup>2</sup>, and is the sixth highest among the major states of India.

*Topography of coastal districts*

The Tamil Nadu and Pondicherry coast is straight and narrow without much indentation except at Vedaranyam. Fringing and patch reefs are present near Rameswaram and the Gulf of Mannar. Pichavaram, Vedaranyam and Point Calimere have well-developed mangrove systems. 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 the 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, Mahabalipuram and North Madras near Ennore.

<sup>24</sup> <http://www.environment.tn.nic.in/StateofEnv.htm>

<sup>25</sup> <http://www.environment.tn.nic.in/StateofEnv.htm>



### *Thiruvallur district*

This coast has a very vast coastal plain, which extends from North of Toppala Palayam to South of Sattangadu. There are three strand lines, with intervening broad tidal flats occurring in the coastal plains. Lagoons, mangrove swamps, salt marshes, estuaries, creeks, sand dunes, spits and beach terraces represent the marine landforms. The coastline is mainly accreting with noticeable erosional effects particularly near Ennore. Development of offshore bars and shoals are observed near Ennore and Pulicat.

### *Chennai district*

The area is a vast coastal plain characterised by several strandlines, lagoons, mangroves, salt marshes, estuaries, creeks, barred dunes, spits, beach terraces, etc. The sandy beaches with beach sands rise slightly higher in the stretch<sup>26</sup>.

### *Kancheepuram district*

This coastal area comprises sandy beach with beach sand<sup>27</sup>. The coastal area of Kancheepuram district is characterised by several strand lines, lagoons, mangroves, salt marshes, estuaries, creeks, barrier dunes, spits, beach terraces, etc.

### *Villupuram district*

The major geomorphic features of this coastal tract are comprised of upland plains, flood plains, deltaic plains and coastal plains. This part of the coastal plain has a width of 6 km and exhibits different geomorphic features, which include strandlines, raised beaches, sand dunes, mangrove swamps and tidal flats.

### *Cuddalore district*

The northern part of the coast has sandy beach with beach sand. In the southern part, sandy beach is absent. Swamps and mangrove forest cover the extreme south part of this coast<sup>28</sup>.

### *Nagapattinam district*

This stretch consists of a narrow region of sandy beach along the coast in the delta region of the Cauvery. There are salt pans near Thirumullaivasal and Tharangampadi. To the south is Vedaranyam, a permanent swamp habitat with mangrove forest. The southern boundary of this stretch is marked by the change in the coastline from the south to the east—from Point Calimere to Rajamatam<sup>29</sup>.

The geomorphologic features observed in this stretch are sub-aerial deltas, strand plains, crevasses,

chennies, cusped bars, estuaries and swamps. The large part of the delta is occupied by their distributory flood basins comprising brown and reddish grey silty clay and fine sands. The coastline of Nagapattinam is straightened by south bound long shore currents from the Kollidam river mouth to point Calimere. From Point Calimere to further south the coastline forms a bay.

### *Thiruvarur district*

The geomorphic features observed in this stretch are sub aerial deltas, sand plains, crevasses and cusped bars, estuaries and swamps. A large part of the delta is occupied by inter distributory flood basins comprising brown and reddish grey clay and fine sands. The coastal stretch consists of a narrow region of sandy beach along the coast in the delta region of Cauvery river. In the east there is a permanent swampy region with mangrove forest<sup>30</sup>.

### *Tanjavur district*

This stretch starts from east of Mullipallam lagoon and ends with Jambumahadevipattinam.

### *Pudukottai district*

This coastal stretch consists of a narrow region of sandy beach along the coast in the delta regions of the Vellar River<sup>31</sup>. The Pudukottai coastal zone lies between Kattumavadi and north Varshali riverbank. The geomorphic features observed in this coast are sandy plains with elevations varying from 6 to 10 m above mean sea level.

### *Ramanathapuram district*

The northern part of this coastline stretches from Sundarapandipuram to Tondi. Salt pans are common in this part of the coast. The coastal area of Mudukulathur, Ramanathapuram and Rameswaram is sandy, and in this area the coast is fringed by sand dunes with swamps at the back. The coastline in this stretch is generally trending towards the south from where it takes an eastward trend towards Devipattinam enclosing the Palk Strait. In the southern part of this stretch between Devipattinam and Keelakkurai, there are raised beaches with sand bars parallel to the present coastline. The southern coast of this district is fringed by a chain of islands numbering about 16 and shoals extending to a distance of 5 to 9 km offshore<sup>32</sup>.

Coastal plains, older deltaic plains, cusped forelands, teri sand mounds, and teri tidal complexes are some of the geomorphic features observed in the stretch.

<sup>26</sup> <http://www.annauniv.edu/iom/Chennai.htm>

<sup>27</sup> <http://www.annauniv.edu/iom/Kanchipuram.htm>

<sup>28</sup> <http://www.annauniv.edu/iom/Cuddalore%20and%20Villupuram.htm>

<sup>29</sup> <http://www.annauniv.edu/iom/Nagapattinam.htm>

<sup>30</sup> <http://www.annauniv.edu/iom/Thanjavur.htm>

<sup>31</sup> <http://www.annauniv.edu/iom/Pudukottai.htm>

<sup>32</sup> <http://www.annauniv.edu/iom/Ramanathapuram.htm>

The coastline on this stretch is fringed by a strand plain over a width of about 1.5 km to 3 km, beyond which runs a wide track of fluvio-marine sediments manifested in tidal flats, salt marshes and paleo tidal flats. The coastline between Rameswaram and Mandapam is a huge cusped foreland bar built up with sand deposits representing repeated lowering of the sea level.

#### *Thoothukudi district*

The coastline from Vembar to Tiruchendur is a result of sediment accretion except for the Thiruchendur and Manappad areas that have cliffs along the coast resulting from erosions of mounds of Quaternary sediment. South of Tuticorin, near the mouth of Korampallam odai, a huge sand bar has developed into a northward trending beach cap 4 km from the main shore. A narrow beach marks the south of the Tiruchendur coastline, beyond which extends the coastal ridge from Manapadu to Kudangulam over which sand dunes and beach terraces have developed. The Quaternary sandstones are exposed as wave cut platforms along the entire coast from Periyatalai to Uvari. The following coastal geomorphologic features commonly occur in the coast: beaches, beach ridges, cliffed coast, sand dunes, beach terraces, spits, cuspates, salt marshes, teri sand. There are two physiographic features in the coast of Tuticorin district. In the coastal belt between Vembar to Thiruchendur, there are raised beaches with sand bars parallel to the present coastline. The sand bars are trend towards north to south direction. In the coastal area between Thiruchendur to Manappad, there are sand dunes and teri dune complexes<sup>33</sup>.

#### *Tirunelveli district*

The coast of Tirunelveli district extends from Kayamozhi in the North and to the south east of section of the Karungulam coast. The southern portion of the Thiruchendur coast consists of sandy beaches with beach sand containing heavy minerals. Sand dunes rise up to about 67m along the coast. The general relief goes over to 15 m and above.<sup>34</sup> The following coastal geomorphologic features commonly occur along this coast: beaches, beach ridges, cliffed coast, sand dunes, beach terraces, spits, cuspates, salt marsh, teri sands.

A narrow beach marks the southern portion of the Tiruchendur coastline, beyond which extends the coastal ridge from Manapadu to Kudangulam over which sand dunes and beach terraces have developed. The Quaternary sandstones are exposed as wave

cut platforms all along the coast from Periyatalai to Uvari.

#### *Kanyakumari district*

The Kanyakumari coast starts from north of Vattakkottai and ends with the Kerala State boundary. The coastal landscape of Kanyakumari District is mainly composed of beach ridges of rocky, sandy and swampy nature in the estuarine regions. Sand dunes and teri soil occur along the coast and away from the coast of Kanyakumari. The southern part of the coast is made up of sandy beaches with beach sands containing heavy minerals on the eastern and western sides of Kanyakumari. The sand dunes rise up to 67m. The general relief goes over to 15m above MSL<sup>35</sup>. The following coastal geomorphic features are observed along the coast of Kanyakumari district: beaches, beach ridges, cliffed coast, sand dunes and beach terraces. The marine landforms along the Kanyakumari district are restricted to a width of less than 1km, as the Western Ghats run very close to the coastline gaining elevation.

#### **Pondicherry**

The Union Territory of Pondicherry<sup>36</sup> is spread in an area of 492 km<sup>2</sup> and consists of four regions situated at different geographical locations isolated from one another. The Pondicherry region, which is the largest among the four, lies on the east coast of India, and consists of 12 scattered areas lying in between 11° 42' N and 12° 30' N, and 76° 36' E and 79° 53' E. The Karaikal region is about 150 km south of Pondicherry and is surrounded by the Nagaipattinam District of Tamil Nadu. It is located between 10° 49' N and 11° 01' N, and 79° 43' E and 79° 52' E. Yanam is located between 16° 42' N and 16° 46' N and 82° 11' E and 82° 19' E at about 840 km north-east of Pondicherry near Kakinada in Andhra Pradesh. Mahe lies almost parallel to Pondicherry between 11° 42' N and 11° 43' N and 75° 31' E and 75° 33' E, 653 km away on the west coast of India near Tellicherry in Kerala (Antony et al 1982)<sup>37</sup>.

Topographically, the Pondicherry region is flat country having an average elevation of about 15 meters above sea level, intersected by the deltaic channels of the rivers Gingee and Ponnaiyar and other streams forming the two main drainage basins, interspersed with lakes and tanks. To the northwest of Pondicherry town, a girdle of low hills (or an elevated ground of about 30m high) is noticed. This high ground suddenly emerges from the low alluvial plain country known as Gorimedu. This forms the most prominent feature of

<sup>33</sup> <http://www.annauniv.edu/iom/Tuticorin.htm>

<sup>34</sup> <http://www.annauniv.edu/iom/Tirunelveli.htm>

<sup>35</sup> <http://www.annauniv.edu/iom/Kanyakumari.htm>

<sup>36</sup> <http://www.pon.nic.in/stategovt/scitech/SECOND.htm>

<sup>37</sup> Antony et al. 1982 as cited on <http://www.pon.nic.in/stategovt/scitech/SECOND.htm>

the landscape. The Gingee river crosses the region diagonally from the north-west to the south-east. Ponnaiyar forms the southern border. The alluvial delta of Ponnaiyar is almost on dead level ground, only a few meters above the sea. The coastal border has a length of 22 km and a breadth ranging from four to six hundred meters. Superficially, the coast is flat and sandy. The coastal zone of Pondicherry comprises newer and older dunes including saline areas of clayey texture. The other zone is made up of the two plateaux – Pondicherry plateau and the Thiruvakkarai plateau.

Karaikal, which forms a part of the fertile Cauveri delta the region, is completely covered by the distributaries of the Cauveri. Covered completely by a thick mantle of alluvium of variable thickness, the lie of the land is flat having a gentle slope towards the Bay of Bengal in the east. It is limited on the north by the Nandalar and on the southeast by the Vettar. The group of rocks known as the Cuddalore formations is met with in the area contiguous to the Karaikal region in Nagappattinam District<sup>38</sup>.

#### *Socio-economic profile*

As per the census of India, 2001, the total population of the Union Territory of Pondicherry is 9,73,829—consisting of 4,86,705 males and 4,87,124 females registering a sex ratio of 1001 females for every 1000 males. The region-wise break up is given in Table 1. The literacy rate in the Union Territory of Pondicherry is estimated as 81.49%. Out of this the literacy level among male is 88.89% and that of female is 74.13%.

Agriculture is the most important occupation in the Union Territory of Pondicherry. It is a source of livelihood for about 35.20% of the rural population and this sector accounts for 5.66% of the Union Territory's income. The major crops under cultivation are paddy, sugarcane, coconut, groundnut, pulses and cotton. Next to agriculture, fisheries related activities are the next important activity. Pondicherry has a coastline of 45 km with 675 km<sup>2</sup> of inshore waters, 1347 ha of inland waters and 800 ha of brackish water fisheries. The fish production in 1954 was only 900 million tonnes. During 1999–2000, the fish production was 42,830 million tonnes – marine fish production of 38,620 million tonnes and inland fish production of 4108 million tonnes.

<sup>38</sup> <http://karaikal.nic.in/Administration/General/General.htm>

## THE DYNAMIC NATURE OF COASTAL ECOSYSTEMS AND THEIR FUNCTIONS

Coastal ecosystems comprise wetlands, sand dunes and beaches, mangroves, coral reefs and sea grass beds, swamps and estuaries. Each of these constituents has a significant role to play in sustaining ecological functions and thus in protecting coastal habitats, human and wildlife communities.

Coastal dunes are an unstable, shifting habitats formed as a result of dynamic interactions between ocean currents, winds, and storms. Currents and waves along the shore deposit sand on the beach, and the winds shape the sand into series of small hills that gradually migrate inland to be constantly replaced at the beachfront by new dunes. Since sand is unstable, dunes can achieve a maximum stature of only several hundred feet. Dune plants have to be able to tolerate life in shifting sands where water rapidly percolates through the soil and out of the reach of plant roots. The roots of some dune plants play a role in stabilising sand dunes, helping to shape the nature of this ecosystem. Beach grass is particularly notable in this regard and is often planted deliberately by people to keep the dunes in place<sup>39</sup>. Stable sand dunes play an important part in protecting the coastline. They act as a buffer against wave damage during storms, protecting the land from salt water intrusion. This sand barrier allows the development of more complex plant communities in areas protected from salt water inundation, sea spray and strong winds<sup>40</sup>.

Wetlands are habitats characterised by saturated (waterlogged) soils for at least part of the year and plants that are adapted to grow under wet conditions. They may be completely covered by water or the water may be just below the ground. There are many different types of wetlands, such as swamps (wetlands dominated by trees), marshes (wetlands dominated by non-woody plants such as grasses and sedges), wet meadows, bogs, fens, flood-plain forests, lakes, and ponds. Wetlands are to a large extent the product of land topography. They develop in depressions and low-lying areas that brings water table (groundwater) close to or even above the ground. Wetlands are very important features in the coastal landscape and provide humans with a number of natural resources.

They act as sponges that help to reduce the impacts of floods by absorbing water and serving as reservoirs for groundwater. As water flows through a wetland, pollutants such as excess silt and harmful nutrients are trapped; thus, the wetland acts as a filter of pollutants and helps to maintain clean water. Wetlands serve as vital habitats to many different species of flora and fauna.<sup>41</sup> Wetlands are also areas that absorb sea surges.

Mangrove forests are characterised by trees, shrubs and vines that thrive in brackish water (water of varying levels of salinity) and are often found in estuaries, the point where freshwater rivers flow into the oceans. Other than mangrove species, these ecosystems have plants, animals and micro-organisms that have adapted to life in the dynamic environment of the tropical inter-tidal zone. Mangrove ecosystems are important environmentally and economically; mangrove trees can reach a height of up to 45m, producing dense, closed canopy forests that can support up to 80 different plant species, mangrove soils and waters support an abundance of species, including economically important species of fish, molluscs and crustaceans. Mangrove swamps and creeks serve as nursery areas to many pelagic fishes and it is estimated that over 80% of global fish catch is directly or indirectly dependent on mangroves.<sup>42</sup>

Coral reefs are amongst the most biologically rich ecosystems on earth. About 4,000 species of fish and 800 species of reef-building corals have been described to date. Coral reefs have often been described as rainforests of the sea as they exhibit very high levels of species diversity. They buffer adjacent shorelines from wave action and the impact of storms. The benefits from this protection are many and range from maintenance of highly productive mangrove fisheries and wetlands to supporting local economies built around ports and harbours, where, as is often the case in the tropics, these are sheltered by nearby reefs. Much of the world's poor are located within the coastal zones of developing regions and depend directly on reef species for their protein needs. Coral reefs are a major draw for snorkelers, scuba divers, recreational fishers, and those seeking vacations on beaches.

<sup>39</sup> <http://www.bookrags.com/sciences/biology/coastal-ecosystems-plsc-02.html>

<sup>40</sup> [http://www.epa.qld.gov.au/environmental\\_management/coast\\_and\\_oceans/beaches\\_and\\_dunes/coastal\\_dunes/](http://www.epa.qld.gov.au/environmental_management/coast_and_oceans/beaches_and_dunes/coastal_dunes/)

<sup>41</sup> <http://www.bookrags.com/sciences/biology/coastal-ecosystems-plsc-02.html>

<sup>42</sup> [http://www.oceansatlas.org/cds\\_static/en/mangroves\\_en\\_12730\\_all\\_1.html](http://www.oceansatlas.org/cds_static/en/mangroves_en_12730_all_1.html)

<sup>43</sup> [http://www.oceansatlas.com/cds\\_static/en/value\\_coral\\_reefs\\_en\\_31818\\_all\\_1.html](http://www.oceansatlas.com/cds_static/en/value_coral_reefs_en_31818_all_1.html)

An estuary is a semi-enclosed body of water where freshwater meets the sea. Typically located at the mouth of rivers, estuaries have characteristics of both fresh and marine habitats and serve as a vital ecological link between the two realms. Changes in salt concentration within the estuary present a real challenge to plants and animals. They not only have to be salt tolerant, but they also have to be able to tolerate frequent changes in salinity. Estuaries therefore have their own unique species that differ from those of wholly freshwater or marine habitats. Estuaries are also amongst the most productive ecosystems on earth in terms of the amount of organic matter produced by plants and algae. They are home to abundant fish, bird, and invertebrate populations, which take advantage of this tremendous plant and algal productivity.<sup>44</sup>

All of the above constituents of coastal ecosystems are prone to changes from several natural phenomena, some of which are gradual processes and others, sudden resulting in immediate, visible consequences. Some of the regular and recurring phenomena that take place in coastal areas are storms, cyclones and erosion.

In general, the coastal area of Tamil Nadu is prone to cyclones and depressions. Cyclones form in low-pressure zones in the Bay of Bengal. They typically occur on the east coast during the monsoon months of May to November when the southwest and northeast monsoons are active. A severe cyclone causes furious wind and torrential rain in the coastal region. The frequency of tropical cyclones in the Bay of Bengal, about 4–5 per year, is steadily increasing (Singh et al. 2001). Recent studies predict an increased occurrence of cyclones in the Bay of Bengal, particularly in the post-monsoon period, along with increased maximum wind speeds associated with cyclones (DEFRA 2004). The State of Environment Report of Tamil Nadu states that there are few specific zones along the coast that are identified as cyclone affected areas. The most affected areas along the Tamil Nadu coast are the: 1) Mamallapuram and Puduppattinam zone, 2) Marakkanam and Cuddalore zone, 3) Tharangambadi, Nagapatinam and Vedaranyam zone<sup>45</sup>. It is important to note that these cyclone prone areas are also ecologically sensitive.

Natural processes are not the only factors impacting coastal ecosystems. There are a wide range of anthropogenic activities that take place in coastal regions. These activities in many cases have a much greater influence in determining the health and survival of the coastal ecosystem and its constituents. Coastal erosion is caused by forces of nature but very often accentuated by anthropogenic activities like the making of structures on shores, removal of the materials from the shores, etc. <sup>46</sup>

There is ample literature to support the fact that the constituents of the coastal ecosystem play a critical role in reducing and deflecting the impacts of some of the sudden natural phenomena such as storms and cyclones by reducing their potential damage to human lives and property. For instance, there are studies to indicate that large sandy beaches help to absorb tidal surges and mangroves or other appropriate green belts cut off wind speeds. Coastal ecosystems like mangroves and coral reefs provide natural protection to coasts by dissipating considerable wave energy and hence only smaller waves of moderate intensity reach the shore. Equally important is their function in maintaining the biodiversity of the coastal ecosystems, which is necessary for the nutritional, and livelihood needs of the coastal communities. However, when development plans for the coast are worked out, the first casualties are these very constituents.

<sup>44</sup> <http://www.bookrags.com/sciences/biology/coastal-ecosystems-plsc-02.html>

<sup>45</sup> <http://www.environment.tn.nic.in/soe.pdf>

<sup>46</sup> <http://www.survas.mdx.ac.uk/pdfs/3dikshas.pdf>

## 2.1. ECOLOGICALLY IMPORTANT COASTAL AREAS OF TAMIL NADU<sup>47</sup>

A number of ecologically important sites are located in Tamil Nadu encompassing ecosystems such as coral reefs, mangroves and lagoons. These include Pulicat Lake, Vedaranyam, Gulf of Mannar and Pichavaram (see Table 6) and are described in more detail in the following pages.

TABLE 6  
ECOLOGICALLY IMPORTANT AREAS IN TAMIL NADU

DISTRICT	SITE	ECOLOGICAL IMPORTANCE	AREA (KM <sup>2</sup> )
Ramnadu	Gulf of Mannar (Islands between Rameswaram and Tuticorin)	Coral Reef	63.226
Nagapattinam	Vedaranniyam Muthupettai	Mangroves	24.53
Cuddalore	Pichavaram	Mangroves	10.61
Thiruvallur	Pulicat Lake	Lagoon	252.04

### Pulicat Lake

Pulicat lake is the second largest backwater lake in India and it covers an area of 461 km<sup>2</sup>. It is located between 13°26' N and 13°43' N latitude and 80° 03' E and 80°18' E longitude and situated almost parallel to the Bay of Bengal. It extends over the Ponneri and Gummidipundi taluk of Thiruvallur district in Tamil Nadu and the Sulurpet and Tada taluks of Nellore district in Andhra Pradesh and covers an area of about 461 km. Table 7 shows the extent of various wetland classes in Pulicat area.

TABLE 7  
AREA EXTENT OF VARIOUS WETLAND CLASSES IN PULICAT AREA

SALT MARSH(KM)	MUD FLAT (KM)	SALTPAN (KM)	LAKE (KM)
26.80	0.356	0.257	252.040

The lake extends to about 59km in the north-south direction with a maximum width of 17km in east to west direction in the northern sector of the lake. At its southern end, near the northern extremity of Pulicat town, it opens into the Bay of Bengal by narrow pass into the sea. The lagoon has a high water spread area of 460 km and low floodwater spread area of 250 km. From March till September, the mouth gets silted and reduced in width and depth, as it shifts position, simultaneously from the north and the south. The mouth gets completely closed once in above five

years or even little more frequently if there is no monsoon flood in any particular year.

### *Pulicat: a bird sanctuary*

Pulicat is the third most important wetland for the migratory shore birds on the eastern coast of India. The lake is an extremely important area for a variety of resident and migratory birds especially waterfowl. These include pelicans, herons, egrets, storks, flamingos, ducks and geese, gulls and terns. Greater flamingos occur in large numbers in the Andhra

<sup>47</sup> Source: <http://www.annauniv.edu/iom/EIA%27s.htm>

Pradesh part of the sanctuary, around the islands of Venadu and Irukkam.

#### Biodiversity of Pulicat

Pulicat Lake supports rich fauna and flora. Seagrass is commonly distributed in this lake supporting many faunal communities. The Institute for Ocean Management, Anna University made a quantitative assessment of the present status of biodiversity of Pulicat Lake. Their checklists report that 49 species of phytoplankton, 12 species of macro algae, seagrasses, 88 species of zooplankton, 81 species of benthos, and 39 species of fish are found in this area.

#### Pichavaram Mangroves

Pichavaram (11° 24' N to 11°27' N and 79° 46' E to 79° 48' E) is situated on the southeast coast of India, located about 240 km south of Chennai City and about 45 km south of Cuddalore. It is located between the Vellar in the north, the Coleroon in the south and the Uppanar in the west. It communicates with the sea via a shallow opening, which is the mouth in the sand littoral strand. It consists of number of small and large islets surrounded by numerous creeks, canals and channels. Table 8 shows the aerial extent of mangrove and other wetland classes in Pichavaram.

TABLE 8  
AERIAL EXTENT OF MANGROVE AND OTHER WETLAND CLASSES IN PICHAVARAM

MANGROVE(KM)	MANGROVE WITH SCRUB(KM)	TIDAL FLAT(KM)
8.79	1.82	1.44

#### Mangrove Ecosystem

The Pichavaram area has very significant mangrove ecosystems. Mangroves cover a total area of 12.05 sq km. The mangroves of Pichavaram are classified into six zones that are mentioned in detail below.

##### Zone I

*Avicennia marina* is dominant and shrubby in this region, where the soil is principally sandy mud. The sandy area is dominated by the *halophytes*, *Salicornia brachiata*, *Suaeda maritima*, *Sesuvium portulacastrum*, *Arthrocnemum indicum* and *Excoecaria agallocha* are some other plants, which are sporadically distributed here. Sand heaped areas are of frequent occurrence in this region and these heaps do not get flooded. The soil in the heaps is loose and supports plants such as *Boerhavia diffusa*, *Clerodendron inermae*, *Croton sp.*, *Eragrostis sp.*, *Geniosporum tenuiflorum*, *Ipomoea pes-caprae*, *Mollugo pentaphylla*, *Oldenlandia umbellata*, *Opuntia sp.*, *Phyla nodiflora*, *Spinifex littoreus*, *Thespesia populanea* and *Vernonia cinerea*. All the plants represented in this zone do not exceed 0.5 m in height.

##### Zone II

This zone includes the banks of three creeks lying parallel to the sea shore. The banks of these creeks show gradation of floristic components from the shoreline inwards. The eastern bank of the first creek shows three belts. The fringe of the shoreward belt

is almost barren, the middle belt is dominated by *Salicornia brachiata* and the inward belt is occupied by *A. marina*. The eastern bank of the second creek also has three belts. The shoreward belt is colonised by *Salicornia brachiata* and scrubby *A. marina*. The middle one is occupied by pure *Salicornia brachiata* vegetation and the inward belt is colonised by *Salicornia brachiata* and *A. marina*. The middle one is occupied by pure *Salicornia brachiata* vegetation and the inward belt possesses *Rhizophora apiculata* and *Rhizophora stylosa*, and the middle belt shows *A. marina* whereas the inner belt is found to have a mixed community of *Excoecaria agallocha* and *Salicornia brachiata*. The western bank of the third creek has barren sand and some terrestrial vegetation. *Arthrocnemum indicum* occurs in patches in this zone, which might probably colonise the 'blanks'.

##### Zone III

Luxuriant mangrove vegetation exists in this zone with the maximum number mangrove species. The fringes of the channels are bordered by *Rhizophora apiculata* and *R. stylosa*. *R. apiculata* is dominant along the main channels with more fresh water. *R. apiculata* and *R. mucronata* are co-dominants along the fringes of the other waterways. Immediately behind the *Rhizophora* communities, *Bruguiera cylindrica* and *Ceriops decandra* are common in shrubby habit. *Excoecaria agallocha* also occurs here. Just behind the fringe communities of *Rhizophora* and other plants, three types of communities can be observed as

- 1) a community composed exclusively of *Suaeda maritima*,
- 2) mixed communities of *S. maritima* and *A. marina*, and
- 3) community consisting exclusively of *A. marina*.

#### Zone IV

This fresh water zone is generally dominated by *Acanthus ilicifolius*. The vegetation on the two banks of the Thiruvasaladai freshwater channel varies considerably. The northern bank is dominated by *A. ilicifolius* along with a few representatives of *Dalbergia spinosa*, *Deris heterophila*, climbing on *A. ilicifolius*, *E. agallocha* and *Sonneratia apetala*. On the southern bank, there is sporadic occurrence of high *Avicennia officinalis* trees with mixed communities of *Arthrocnemum indicum*, *E. agallocha*, *Lumnitzera racemosa*, *Salicornia brachiata* and *S. maritima*.

#### Zone V

The western bank of the channel is rich with *Suaeda maritima* for about 3 km along with *Salicornia brachiata*. This area has a vast intertidal zone and some gullies. The *Suaeda maritima* community is also present here. The soil here is silty mud. On the eastern side of the channel towards the seashore, there is an extensive cultivation of *Casuarina equisetifolia*.

#### Zone VI

This zone exists nearly to the *Coleroon estuary*. The channel on the landward side has *Salicornia brachiata*, whereas the channel on the seaward side is occupied by small shrubby *A. marina*. Sand heaps have *Pandanus* species. The intermediate region before the junction of the two channels nearer the

*Coleroon* is occupied by *A. marina*, *Suaeda marina* and *Salicornia brachiata*.

The mangroves support an abundant growth of oysters and important fishes. Only one species of marine turtle, the Olive ridley (*Lepidochelys olivacea*) has been reported.

Pichavaram is an important habitat for a variety of resident and migratory waterfowl and other birds. About 200 species of birds have been recorded, among those egret, herons and storks. The mammals known to occur in this region include the common otter and jackal.

#### Fishery Resource

Pichavaram mangrove is a very good potential fishery source. Prawns constitute the bulk of total fisheries, along with crabs and mullets.

#### Vedaranyam

Vedaranyam (10° 15' N to 10° 35' N and 79° 20' N to 79° 55' E) is one of the coastal blocks of Thanjavur district. It is situated on the coast of the Bay of Bengal, and is of historical importance, since the days of the Chola kingdom. It has a tropical transitional bioclimate, which is characterised, by monthly average temperatures above 27°C. Total annual rainfall varies from 1000 to 1500 mm with a dry period of 5 to 6 months. Vedaranyam is one of the six major wildlife sanctuaries and also an important coastal wetland in Tamil Nadu. Table 9 shows the different wetland categories and their extent. This wetland serves as a nursery ground for several species of fish and shellfish and act as a seasonal home for a variety of migratory birds.

TABLE 9  
DIFFERENT WETLAND CATEGORIES AND THEIR EXTENT IN VEDARANYAM

MANGROVE (KM)	RESERVED FOREST (KM)	SALT MARSH (KM <sup>2</sup> )	TIDAL FLAT(KM)	SALTPAN (KM)
24.53	19.58	24.53	97.95	34.70

#### Vedaranyam Bird Sanctuary

Vedaranyam is one of the major wintering grounds in south India for migrant birds from north India, Europe, Asia and Africa. Its uniqueness lies in its having a coastal marine system and tropical forests. The number of reservoirs formed here for making salt serves as feeding grounds for migratory birds especially small waders and waterfowl and also for the resident population. These swamps host around

240 species of birds both migratory and resident. Among this, 48% is aquatic and the rest are land birds. November to January is the peak migratory period.

During winter every year thousands of migratory waterfowls visit this area. The migrants include garganey, teals, shovellers, whistling teals, Caspian terns, godwits, golden plovers, great stone plovers,



sandpipers, little stints, red shanks, green shanks, ringed plovers, reef herons, whimbrels and red necked phalaropes. During spring the trees and shrubs with wild berries attract frugivorous birds like the koels, mynas and barbets. As winter sets in, a huge wave of insectivorous birds come down at Vedaranyam attracted by the abundance of insects and vegetable food. During the peak season of migration, the important long legged and small wanders found in reservoirs are greater and lesser flamingoes, gray heron, purple heron, reef heron, large, medium and little egrets, spoonbills, painted storks, etc. Long distant migrants constitute the majority of short-legged wading birds.

In addition to regular migrants, occasional migrants like cormorants, darter, black kite, booted hawk-eagle, short-toed eagle and ringed plovers are also seen in this sanctuary. Among the seasonal migrants are the little grebe, purple heron, white necked stork, black necked stork, white Ibis, flamingoes, Indian cuckoos and larks. Various types of gulls, such as the herring gull, great and lesser, black backed gull, brown headed gull are common in this sanctuary. Many kinds of terns like white winged black tern, whiskered tern, gull billed tern, Caspian tern, rosy tern, and Indian lesser crested tern are also seen in Point Calimere.

The sanctuary also includes reptiles like the monitor lizard, chameleon, and the star tortoise, cobra, saw scaled viper, and the Olive Ridley turtle. The mammals found in the Vedaranyam area are the black buck, spotted deer, wild boar, semi wild ponies, Jackal, black napped hare, bonnet macaque, civet cat, jungle cat, mongoose, etc.

### **Muthupet**

The Muthupet mangrove swamp is located in close proximity with the coastal wetlands of Vedaranyam. The swamp is spread out in an area of approximately 6800 ha, of which 77.20ha is occupied by well-grown mangrove and the remaining area is covered by poorly grown mangrove vegetation.

The aquatic fauna comprises juvenile and adults of finfishes, shrimps, molluscs, crabs and benthic invertebrates. Seaweeds such as *Chaetomorpha*, *Enteromorpha*, *Gracilaria*, *Hypnea*, etc. are found here. The mangrove zone of the forest is restricted to the edges of the brackish water lagoon where the true mangrove species are distributed in varying degrees of abundance. *A. marina* is the most common

and abundant species, followed by *E. agallocha*, *Aegiceras corniculatum*, *A. ilicifolius*, *S. maritima*, *S. monica*, etc.

The Institute for Ocean Management, Anna University had observed that there is a marked degradation in mangrove forests after comparing the wetland maps of 1989 and 1996. Mangroves have degraded in density at some of the places and have disappeared in several other places. The degradation has occurred mostly in sparse mangrove forests due to the expansion of the saltpan and human activities. The mangrove forest at Vedaranyam is also found to be degraded in density. However, dense mangrove forests have increased from 706 m<sup>2</sup> to 958 m<sup>2</sup>. In total, nearly 87 m<sup>2</sup> of total mangrove forest have degraded in Muthupet. As the Muthupet area is dry for most of the year, human activities like cutting of wood for fuel, grazing by cattle, etc. has caused the degradation of mangroves.

Finfishes constitute the bulk of the total fishery in Muthupet mangroves, followed by prawn fishery, crabs, oysters and clams. Birds recorded from this area are herons, egrets, kingfishers, mynas, plovers, and sandpipers.

### **Gulf of Mannar Area**

About 3,600 species of fauna and flora have been recorded from the Gulf of Mannar area by the Central Marine Fisheries Research Institute and other organisations (Neelakantan 1998<sup>48</sup>). The fauna of the Gulf is said to be one of the richest in the whole of Indo-west Pacific region.

The vegetation in Gulf of Mannar coastal area is not uniformly spread and is generally composed of thorny scrub that corresponds to littoral and swamp forests according to the classification of Champion and Seth (1968). It is characterised by species like *Thespesia populnea*, *Acacia planifrons*, *Tamarix sp.*, *Vitex negundo*, etc. Mangroves and their associated species are seen in Shingle, Kursadi, Kovi, Pumurichan, Manalli and Manalliputti Islands. *Avicennia*, *Rhizophora*, *Brugeira*, *Pumphis* and *Pandanus* occurs along the periphery of the islands in the study area. *Palmyra*, *casuarina*, *coconut*, *mango* and *tamarind trees*, etc. can be seen in the Kursadi, Musal and Nalla Tanni Islands (Neelakantan 1998<sup>49</sup>).

Algal growth is very rich in Gulf of Mannar. The algal productive area along the coastline from Mandapam to Kanyakumari is put at 17.125 ha. (MoEF 1987<sup>50</sup>).

<sup>48</sup> Cross-referenced from <http://www.annauniv.edu/iom/gulf%20of%20mannar.htm>

<sup>49</sup> Cross-referenced from <http://www.annauniv.edu/iom/gulf%20of%20mannar.htm>

<sup>50</sup> Cross-referenced from <http://www.annauniv.edu/iom/gulf%20of%20mannar.htm>

Kursadi and Shingle Islands have very rich algal beds. There are different types of algal species formed on coral reef in lagoons. The lagoon is rich in sea grass beds.

The sacred *chank Xancus pyrum* also occurs in Gulf of Mannar area. The sacred chank is found on fine or soft sandy substances under the water. The Gulf of Mannar is famous for its chank fisheries and pearl fisheries. There are about ten pearl banks in the region. The maximum concentration of pearl bank is found in the regions off Tuticorin and to some extent in between Nallatannitivu and Valinokkam point. The region between Tuticorin and Kanyakumari has extensive pearl banks (MoEF 1987<sup>51</sup>; Neelakantan 1998<sup>52</sup>).

The Gulf of Mannar has some significant amounts of monazite, illmenite, rutile and garnet, and a small amount of zircon and sillimanite are also mined. These minerals are found as placer deposits. It is expected that this activity will increase during the years to come (Mallik and Ray 1975; Loveson and Rajamanickam 1989). India was granted the right to mine metal rich nodules over 53,000 km of the seabed south of Gulf of Mannar (Govind 1989).

#### *Biodiversity of the Gulf of Mannar*

The Gulf of Mannar with its islands comprises three different ecosystems. They are:

##### *The Seagrass ecosystem*

The Gulf of Mannar area is rich in seagrass species. Important species of the seagrass community include *Enhalus acoroides*, *H. ovalis*, *H. ovata*, *H. beccari*, *H. stipulacea*, *Thalassia lemprichii*, *Cymadocea serrulata*, *C. rotundata*, *Halodule uninervis*, *Syringodium isoetifolium*, etc. In the Gulf of Mannar, the seagrass beds are the ideal feeding ground for the endangered marine mammal, the seacow (Dugong dugon). Numerous seaweeds are found in Gulf Mannar. The total productive area has been estimated to be around 10,000 ha, with a standing of more than 18,000 tons. The common seaweeds found here are *Ulva*, *Sargassum*, *Gelidiella*, *Gracilaria*, *Caulerpa*, *Halimeda*, *Padina*, *Hypnea*, *Turbinaria*, *Chondrococcus*, etc.

##### *Mangrove ecosystem*

The Gulf of Mannar constitutes unique mangrove vegetation.

##### *Coral reef ecosystem*

The Gulf of Mannar is one of the most important coral reef reserves of India that have very high productivity. The coral reefs are developed around a discontinuous chain of twenty-one islands that exist along a 140 km stretch between Rameswaram and Tuticorin (see Table 10 for more details). Different types of reef formations have been observed in the Gulf of Mannar. These include fringing reefs, patchy reef and coral pinnacles. Pillai (1971) has described the coral reefs of Gulf of Mannar in detail. There are 96 species of corals belonging to 36 genera in this area. Important genera include *Acropora*, *Montipora*, *Pocillopora*, *Turbinaria*, *Echinopora*, *Favia*, *Favites*, *Goniastrea*, *Leptastrea*, *Leptoria*, *Platygyra*, *Goniopora*, *Porites*, *Merulina*, *Symphyllia*, *Galaxea*, *Pavona*, *Coscinaria*, *Psammacora*, etc.

TABLE 10  
AREA UNDER CORAL REEFS IN THE GULF OF MANNAR

NAME OF THE ISLAND	CORAL REEF AREA (KM)	LIVE CORAL COVER (%)
Shingle	2.0	46
Krusadai	1.5	33
Pullivasal & Poomarichan	4.0	14
Manoli & Manoliputti	15	25
Musal	18	52
Mulli	7	25
Valai & Talayari	14	16
Appa	5	2
Poovarasampatti Palliarmanai	6	50
Anaipar	5	37
Nallathanni	2	38
Pulvinichalli	7	38
Upputhanni	3	6
Karaichalli	0.31	4
Vilanguchalli	1	8
Kasuwar	6	5
Van	2.5	7

<sup>51</sup> Cross-referenced from <http://www.annauniv.edu/iom/gulf%20of%20mannar.htm>

<sup>52</sup> Cross-referenced from <http://www.annauniv.edu/iom/gulf%20of%20mannar.htm>

## 2.2. ECOLOGICAL PROFILE OF PONDICHERRY

Wild animal population in Pondicherry comprises small mammals, birds, reptiles and amphibians as well as insects, but systematic data is not available. Significant bird populations may be spotted in Pondicherry near wetlands, tanks and well wooded areas. Specifically, two of the tanks, viz. Oussudu and Bahour tanks support large numbers of waterfowl. Bird population at Oussudu has been surveyed in the past during the winter season but no other study is available on the details of native and migratory bird diversity. However, instances of poaching of animals by people from neighbouring Tamil Nadu state are reported.

Though Pondicherry does not have Reserved forests or scrub jungle to support wild animals, it has wetlands such as Ousteri and Bahour Tank (fresh water), the marshy area near the light house (brackish water) and the backwaters found in Karaikal, which attract large numbers of water birds, both migrants and residents. These include ducks, teals, pochards and waders, which are migrants from north and central Siberia and Central Asia. Among the birds, the rare birds like pelican, white-necked stork and glossy ibis are recorded in good numbers in Ousteri tank. The crested pochard, which is considered to be rare species in South India, is found in thousands in Kaliveli Tank of nearby Tamil Nadu state and in hundreds in Ousteri Tank in Pondicherry. These waterfowl arrive in late August and early September and depart in mid April after spending their winter in India.

Small mammals that have been reported from the region include jackal, black napped hare, bonnet macaque, jungle cat, civet cat, and mongoose. Endangered marine reptiles like the Olive Ridley turtle and the leatherback have been breeding along the shores of Pondicherry and Karaikal.

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## INTERNET RESOURCES

<http://www.annauniv.edu/iom/EIA%27s.htm>

<http://www.bookrags.com/sciences/biology/coastal-ecosystems-plsc-02.html>

<http://www.bookrags.com/sciences/biology/coastal-ecosystems-plsc-02.html>

<http://www.environment.tn.nic.in/soe.pdf>

[http://www.epa.qld.gov.au/environmental\\_management/coast\\_and\\_oceans/beaches\\_and\\_dunes/coastal\\_dunes/](http://www.epa.qld.gov.au/environmental_management/coast_and_oceans/beaches_and_dunes/coastal_dunes/)

[http://www.oceansatlas.com/cds\\_static/en/value\\_coral\\_reefs\\_\\_en\\_31818\\_all\\_1.html](http://www.oceansatlas.com/cds_static/en/value_coral_reefs__en_31818_all_1.html)

[http://www.oceansatlas.org/cds\\_static/en/mangroves\\_\\_en\\_12730\\_all\\_1.html](http://www.oceansatlas.org/cds_static/en/mangroves__en_12730_all_1.html)

<http://www.pondicherry.nic.in/tsunami/dmg1002.htm>

<http://www.survas.mdx.ac.uk/pdfs/3dikshas.pdf>

<http://www.thanjavur.tn.nic.in/Default.htm>

<http://www.tn.gov.in/tsunami/damages.htm>

[http://www.undp.org.in/dmweb/Tsunami/CRZ\\_TN\\_w\\_annex\\_March2005.pdf](http://www.undp.org.in/dmweb/Tsunami/CRZ_TN_w_annex_March2005.pdf)



**PLATE 1**

Boulder wall opposite to the Coromandel Cement Factory at Ennore. The boulder wall on an average is 3.3m in height and 2.3m in width



**PLATE 2**

Sea wall along the road, north of Chennai



**PLATE 3**

Mangrove forests have been steadily cleared to establish salt pans. A view of a degraded mangrove forest that will eventually give way to salt pans

**PLATE 4**  
A high rise building with hatchery in Sulerikadu along the ECR located close to coastline



**PLATE 5**  
Devaneri housing complex beyond Elanthopu; along the ECR on the seaward side of the road; less than 50 m from the sea



**PLATE 6**  
Landscaping on the beach by use of granite slabs and Mexican grass-Mamallapuram





**PLATE 7**

A view of DeeJay Hatcheries at Kovalam within 100 m of the High Tide Line (HTL)



**PLATE 8**

Shrimp hatchery along the coast in Anumanthai



**PLATE 9**

Auroville Beach, Pondicherry - numerous tourism structures can be seen here



**PLATE 10**  
Industry located adjacent to Upannar estuary in SIPCOT area of Cuddalore. The CRZ Notification includes estuaries where salinity is 5 ppt as CRZ areas; the sea is seen in background



**PLATE 11**  
Sand dunes and vegetations conserved by coastal community – South Poiganallur, Nagapattinam



**PLATE 12**  
Sand mining right on the coast in Kallar river –Nagapattinam district  
Photo by Mr. Mathivanan –TNEC





**PLATE 1 3**  
'Bungalow on the Beach' hotel in  
Tarangambadi



**PLATE 1 4**  
Extension of dormitory of the bungalow,  
Tarangambadi



**PLATE 1 5**  
Agriculture lands in Thiruvarur district  
affected due to aquaculture

**PLATE 16**  
Salt pans in Tanjavur district



**PLATE 17**  
Aquafarms in Pudukottai district



**PLATE 18**  
Industrial expansion along the  
Thootukudi coast





**PLATE 19**

Mining for rare earth in Tirunelveli coast



**PLATE 20**

Sand dunes leveled for tourism;  
Sothavilai, Kanyakumari



**PLATE 21**

Wayside amenities constructed  
by Tourism Department on ECR  
- Kancheepuram



**PLATE 22**

Auroville beach in Pondicherry – many temporary structures can be seen here



**PLATE 23**

Sand dunes in Valmikimedu



**PLATE 24**

Rubble dumped on the coastal areas in Kanyakumari