Pre-and post-tsunami coastal planning and land-use policies and issues in India

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The philosophy, information and history of coastal resource use and planning in India largely determine the nature and direction of the present focus on post-tsunami policies and interventions. This paper examines pre-tsunami coastal planning and land-use trends and available data and projections in the post-tsunami scenario. Adequate, standardized and reliable landscape-level data are still not easily accessible, and in many instances unavailable, in the post-tsunami context for a range of basic variables such as estimates of post-tsunami damage, non-government and governmental rehabilitation and relief efforts, as well as social and environmental impacts. However, certain regions (particularly Tamil Nadu) and themes have been more rigorously documented in select NGO reports and by the press. This study uses many of these findings to piece together the post-tsunami coastal planning and land-use context.

1. Introduction

The 2004 Indian Ocean tsunami-affected the states of Tamil Nadu, Andhra Pradesh and Kerala and the Union Territory of Pondicherry on the mainland Indian coast; it also had a major impact on the Andaman and Nicobar Islands. The tsunami caused a water level rise all over the Indian coast, with inundation of coastal lands ranging from between 300 metres to three kilometres inland. Destruction was serious and incurred loss of life as well as damage to property in the Andaman and Nicobar Islands, the southern Bay of Bengal coast from southern Andhra Pradesh to halfway down Tamil Nadu (particularly from Chennai to Kodikkarai), Kanyakumari District on the southern extremity of the Arabian Sea and a small stretch of coastline bordering the Quilon–Alleppey districts in Kerala on the Arabian sea coast (Appendix 1). Of the aforesaid four areas, the areas that were impacted hardest are clearly the first three (TRINet\(^2\), 2005). Other than the Nicobar group of islands and several parts of the Andaman Islands, the badly affected districts were on the mainland — Nagapattinam, Cuddalore and Kanyakumari, in the order mentioned.

Several significant changes followed the tsunami, influencing many facets of coastal planning and governance. In retrospect, the most striking is the scale and intensity of attention the subject of coastal management and development has since received in India. Coastal habitats and coastal communities continue to be recipients of post-tsunami local, national and international consideration. The philosophy, information and history of coastal resource use and planning in India largely determine the nature and direction of the present focus on post-tsunami policies and interventions. The tsunami has been described as a “wake-up call” (Anon, 2005a), but for India, and perhaps for other areas in the Indian Ocean region, the destruction it caused was almost inevitable given the history of resource exploitation in the affected states. This paper examines pre-tsunami coastal planning and land-use trends and examines available data and analyses on this subject and projections for the post-tsunami scenario in the long term.

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1 ATREE, Bangalore, India.
2 TRINet is a network set up to address the information requirements of the ongoing tsunami rehabilitation and reconstruction activities in different parts of South India. Some of its members include the Nagapattinam NGO Coordination and Resource Centre (NCRC), Kanyakumari Rehab Resource Centre (KRRC) and the Auroville Information Centre.
2. Background

The Tamil Nadu coastline, inclusive of the Union Territory of Pondicherry, measures 1,076 kilometres; Kerala has a 590-kilometre coastline; and the Andhra Pradesh coast measures 970 kilometres. The Andaman and Nicobar Islands constitute the largest archipelago in the Bay of Bengal, comprising approximately 306 islands and 206 rocky outcrops, and covering a total area of about 8,200 square kilometres. Approximately 11 islands in the Andaman group and 13 islands in the Nicobar group are inhabited. The entire archipelago is located at a distance of approximately 1,000 kilometres from mainland India. Ninety percent of the total land area of 6,408 square kilometres of the Andaman group comprises reserve forests and protected areas, of which about 36 percent is designated as tribal reserves. The Nicobar group is spread over an area of 1,841 square kilometres, of which 1,542 square kilometres are forested (Sekhsaria, 2003).

There are various definitions of the coastal area. An ecological description of the coast refers to a region impacted by the interaction between land and the sea in general. The US Commission on Marine Science, Engineering & Resources offers the following definition: *The coastal zone represents that part of the land affected by its proximity to the sea, and that part of the ocean affected by its proximity to the land.* The Coastal Regulation Zone Notification, 1991, which specially governs coastal land use, refers to the region measuring 500 metres from the high tide line. This paper uses the ecological description for coastal land use and resource-use patterns.

3. Overview of land-use trends in states

3.1 Tamil Nadu and Pondicherry

Several anthropogenic influences have led to the destruction of some of Tamil Nadu’s critical coastal resources. Tamil Nadu now has a highly industrialized coast and this process of industrialization has come at the cost of the destruction of mangroves, coral reefs and other sensitive habitats along the coast. Principally, port development, sand mining and mangrove destruction constitute the main anthropogenic influences.

The Tamil Nadu coast comprises the Coramandel coast from Point Calimere to Pulicat Lake in the north, and the Gulf of Mannar up to the tip of Kanyakumari (the southernmost point on the Indian Peninsula). These regions are socially, ecologically and technologically distinct from each other (Bavinck, 2001) and the entire region is well-known for the range of its ecosystems that comprise sandy shores, estuaries, mangrove forests (such as Pitchavaram and Muthupet), seagrass beds and coral reefs (in the Gulf of Mannar). The *Mangrove atlas of India* prepared by the M.S. Swaminathan Research Foundation (MSSRF) states that Tamil Nadu has a total area of about 13,693 hectares of mangroves. The Gulf of Mannar was the first biosphere reserve declared by the Government of India and houses the sensitive Gulf of Mannar National Park.

3.1.1 Port development and industrialization

The state has three major ports — Tuticorin Port, Ennore Port and Chennai Port. It also has nearly 13 notified minor ports along the coast. The Government of Tamil Nadu proposes to develop the Sethu Samudram Canal Project, the impacts of which several environmentalists and scientists have cautioned against, paramount being the impacts on fishing grounds and the major ecological changes to the sensitive Gulf of Mannar Biosphere Reserve which it
traverses (Anon, 2004; Ramesh, 2004; Anon, 2005b; Anon, 2005c). There are also a number of industries located along coastal rivers such as the Uppanar in Cuddalore District. Industrial estates such as SIPCOT have been charged with polluting these rivers to a considerable degree (IPT, 2003; SACEM, 2006). Several reports on this subject are found on the SIPCOT Area Community Environmental Monitors Web site (www.sipcotcuddalore.com). In the district of Nagercoil, sand mining is carried out in Manavalakurichi by the Indian Rare Earths company and much of this activity is reported to be illegal.

### 3.1.2 Coral reefs

Venkataramajujam et al. (1981) reported that in Tuticorin, coral fragments of *Acropora formosa* (*challi*) are extensively collected from this region alone by around 30 boats, which remove an annual 80,000 cubic metres of reef-derived materials. In addition, about 30,000 cubic metres per year (or 15,000 tonnes) of massive corals are collected and used as building materials. The degradation of coral reefs in the Gulf of Mannar has been well-documented and many authors have reported severe degradation due to anthropogenic factors and by natural agents (Mahadevan and Nayar, 1972; Pillai, 1973 and 1975; Venkataramanujam et al., 1981; Silas et al., 1985; Venkataramanujam and Santhanam, 1985; Wafar, 1986; UNEP, 1985; UNEP/IUCN, 1988). Arjan Rajasuriya et al. (2002) states that coral and sand mining, pollution, sedimentation, fisheries, mangrove cutting, population pressure, commercial shell collection and industrial development have led to an increase in coral reef degradation in India. The Gulf of Mannar ecosystem is under tremendous pressure and direct threats such as the rapid removal of coral will ultimately impact the fishery potential of the area.

### 3.1.3 Mangrove destruction

Mangrove destruction has been widespread in Tamil Nadu as in other parts of the country. The process of degradation, however, began several years ago and under the aegis of the Forest Department in many instances (MSSRF, 2002a). Organizations such as the MSSRF have initiated mangrove restoration work in Pitcharvaram and Muthupet regions. Threats to mangrove forests persist despite restoration initiatives, for example efforts by the MSSRF. The problem of dam construction upstream of rivers continues in the state, which has already resulted in salinity change and mangrove destruction. The Government of Tamil Nadu has been engaged in a few restoration efforts in these regions but the concept of “joint mangrove management” has not become a uniform part of Tamil Nadu government policy. This concept is absent in the Gulf of Mannar region for instance.

### 3.2 Andhra Pradesh

The Andhra Pradesh coast also has a number of sensitive ecological features, which have similarly borne the effects of unregulated anthropogenic activity, mainly from shrimp farming and port-driven industrial development. The larger part of Pulicat Lake forms the southern tip of the coastal plains of Andhra. The lagoons, estuaries and backwaters measure about 640 kilometres. Areas that have significant mangrove growth are Kumaragom, Dharmadom, Chettuva, Nadakavu, Pappinisseri, Kunjimangalam, Chageri and Veli. The *Mangrove atlas of India* states that mangrove forests in Andhra Pradesh measure 582 square kilometres representing about 0.9 percent of the state’s total forest area (MSSRF 2002b).
3.2.1 Shrimp farming

Strung along the coast are approximately 1 100 fishing villages. Conversion of mangrove areas into shrimp and prawn culture farms is one of the most significant threats to the coastal areas of Andhra Pradesh and makes up for significant losses to marine ecosystems in turn. In Andhra Pradesh alone, various kinds of wetlands have been converted for shrimp aquaculture, which grew exponentially from around 8 000 hectares in 1991 to 1992 to about 53 000 hectares in 1994 to 1995 (Vivekanandan and Kurien, 1998). In addition, the loss of major ecological functions such as sediment trapping and shoreline protection serves to underscore the problems associated with mangrove conversion to increase direct food production. Monoculture of penaeid and non-penaeid prawns has been taken up extensively in all the nine maritime districts of the state. Coastal lands are converted into aquaculture ponds of sizes varying from one to several hectares. Apart from the brackish water/estuarine lands, many paddy fields further inland have been converted to aquaculture ponds for intensive carp/crab/prawn culture. This has become one of the most severe threats to the Andhra Pradesh coast, particularly in the district of East Godavari (EPTRI, 2005).

3.2.2 Port development

Port development and associated industries such as oil refineries along with port-associated constructions such as breakwaters has created a number of concerns in Andhra Pradesh. Besides the major port of Vishakapatnam there are 11 minor ports. Sridhar and Parthasarathy (2003) provide a detailed overview of the minor port development plans along the Indian coast. They highlight loopholes and gaps in environmental laws and also the poor state of implementation of laws governing maritime trade and the marine environment.

3.3 Kerala

Kerala’s land use on the coast follows a similar pattern of development where sand mining and industrial activity are dominant now. The state of Kerala has a narrow width bounded by the Western Ghats to its east, giving rise to about 41 westward-flowing rivers. There are also shallow aquifers all along the Kerala coast, for which the only source of recharge is rainfall. These rivers and numerous streams have created an intricate and extensive backwater system that runs parallel to the coast. The Kerala coast is characterized by mangroves, mud banks, coastal plantations and agricultural systems against the backdrop of the tropical forests on the Western Ghats hill ranges. Kerala has sparse mangroves that are largely fringe mangroves.

Fishery and other related industries continue to attract many people to the coast, resulting in the dwindling of agricultural practices. Along some parts of Kerala, people grow indigenous salt-tolerant varieties of rice in small patches (pokkali lands). These fields are found in Ernakulam, Trichur, Aleppy and Kottayam districts. There is also a traditional system of alternative cropping of prawns and pokkali paddy. This practice is slowly being replaced by intensive aquaculture and more recently is being nudged out to accommodate the shelter needs of a growing population (Madyastha and Rekha, 2005).

3.3.1 Sand mining

River and beach sand mining activities along coastal Kerala have been one of the most persistent contributors to environmental problems. Despite several orders from the High Court of Kerala to prevent beach and river sand mining, it continues unabated and completely
unregulated (Anon, 2001). For a detailed listing of legal orders made in Kerala and associated case laws concerning sand mining, mangrove destruction, environmental impact assessment and violations of the Coastal Regulation Zone Notification, visit the website http://www.geocities.com/sahasram_2000/environment/. The Kerala Government has introduced a special legislation called the Kerala Protection of River Banks and Regulation of Removal of Sand Act, 2001. The act mandates the creation of a River Bank Management Plan and a River Management Fund, while prescribing the conditions under which river sand can be mined. Beach sand mining is regulated under the Coastal Regulation Zone (CRZ) Notification, but the implementation of both laws is heavily criticized with several matters pertaining to violations pending in the High Court of Kerala. Mining of silica sand in Kerala is plagued with several systemic problems and is driven by complex economic and institutional factors, including corruption (Paul, 1997).

3.3.2 Port development

Kerala has one major port at Cochin and 17 minor ports. As in other states, conflicts are recorded over port development plans between the state government and local fishing communities (Sridhar and Parthasarathy, 2003).

3.4 Andaman and Nicobar Islands

Resource use in the Andaman and Nicobar Islands (ANI) has followed a disturbing trend since their colonization and occupation by early Europeans. The land-use patterns in the interiors translate into impacts on the coastal ecosystems. When India inherited the islands from the British, it undertook its own colonization programme (Venkateshwar, 2004). Resource use and the changes in the socio-economic profile of the islands are closely linked with this colonization. The Andamans are inhabited by four tribes of Negrito origin: the Great Andamanese, the Onge, the Jarawas and the Sentinelese. The Nicobars are home to two tribes of Mongoloid origin: the Nicobarese and the Shompens.

The islands still have approximately 86 percent of the original forest cover left, and probably another 10 to 20 percent has been degraded by human activities (ANET, 2003). The area of mangroves in the Andamans is 929 square kilometres. The ANI have some of the last pristine reefs in the Indian Ocean region, and are emerging as one of the most important coral reef sites in the world. Coral reefs stretch over an area of 11,000 square kilometres in the Andamans. These reefs are impacted by siltation, sand mining, agricultural runoff and damage due to fishing and tourism activities, besides the threat from a global rise in sea surface temperatures. The collection of corals, shells and sea cucumbers and other marine organisms from this region for commercial purposes has led to their drastic decline. There is also the problem of illegal fishing by Thai trawling fleets in the Andaman Sea. Many of these boats poach endangered marine species.

The main categories of natural vegetation of the ANI are coastal and mangrove forests and the interior’s evergreen and deciduous forests. The remaining 13 percent of land is largely revenue land and used for human settlement, agriculture and other anthropogenic activities. Most of the revenue land is along coastal areas where the settlements are concentrated. Rural and revenue areas are under CRZ category IV, except a very small area under CRZ II (developed areas on the coast). No development is permissible within 200 metres of the high tide line in CRZ IV areas. Of the revenue land, only 21 percent is under intense cultivation and another 11 percent is classified as fallow land and cultivable wasteland; plantation crops
cover 45 percent of the revenue land (ANET, 2003). The total urban area is 16.64 square kilometres.

Land use in the Andaman Islands has changed drastically since the early periods of colonization. However, the post-Indian independence history of the islands is marked by large-scale deforestation of its rain forests to feed the growing sawmill industries first introduced by the British. The 1950s witnessed a great influx of settlers from the Indian mainland, who were encouraged by the Indian Government as part of its official colonization programme. There are several accounts which provide deep insights into the links between the colonization of the islands and their consequent environmental deterioration (Portman, 1899; Mukerjee, 1995; Sekhsaria, 2003; Venkateshwar, 2004). A significant development has been the Andaman Trunk Road which cuts through the heart of the Jarawa Tribal Reserve. The Jarawas are one of the six aboriginal tribes on the ANI, and had until recently strongly resisted contact with outsiders. This road is one of the major threats to the dwindling populations of the Jarawas who total barely 250 people. This road has also facilitated the destruction of forests in the Andamans; recent studies have shown that it has a significant bearing on the coastal ecosystems of this fragile archipelago. The interaction between deforestation and coral reef degradation has been clearly observed in the Andamans (Kulkarni and Saxena, 2002; Soundarajan et al., 1989; Turner et al., 2001). This emphasizes the importance of inland land-use planning for the conservation of marine and coastal resources.

3.4.1 Recent development trends in the islands

A number of developmental projects have been proposed in the Andaman Islands. Tourism has always been viewed as beneficial for the islands and many proposals exist to develop it further (Anon, 2006; Saldanha, 1989; Equations, 2005). Encroachment into forest regions has been enormous in the Andamans (ANET, 2003). Appendix 2 depicts the trend of encroachment as projected by the Andaman and Nicobar Forest Department. This is a result of uncontrolled migration into the islands driven by the subsidies offered. The net result is the illegal and rampant extraction of forest resources, intrusion into Jarawa territory, destruction of forest resources and eventually increased pressure on the fragile ecosystem.

Post-tsunami trends have resulted in massive changes in the Andamans in terms of resource use. On 7 May 2002, the Supreme Court of India passed an order stopping timber-felling activities in the region. Post-tsunami, the government has made requests to relax this ban and the Supreme Court issued orders dated 5 January 2005 to comply (including sand mining) to enable post-tsunami construction-related work (Anon, 2005d).

4. Fishery resource-use trends

To understand the changes that have occurred in the last ten years, it is necessary to examine over five decades of fishery history. Prior to independence, marine fishing was carried out at the subsistence level, almost exclusively by traditional fisherfolk. The current state of fisheries finds its genesis in the modernization programme introduced by the Government of India across the country. The Government of Kerala welcomed the Indo–Norwegian Project for Fisheries Community Development, whose objectives were to increase returns from “fishermen’s activities”, efficient distribution of fresh fish and a higher standard of living in

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project areas. The basic idea was to remove the “drudgery” of fishing and improve the economic condition of fishing communities. Several programmes for the motorization of fishing craft were also taken up across the country, such as that of the Bay of Bengal Programme on the east coast of India. The South Indian Federation of Fishermen’s Societies (SIFFS) in Kerala and the Government of Kerala’s cooperative initiative — the Matsyafed — actively promoted motorization programmes. Through these programmes, loans were provided to acquire motors and fishing nets with better access to improved fishing technologies and equipment (Salagrama, 2002).

There has been a phenomenal growth in marine fisheries in India during the last five decades, both quantitatively and qualitatively. The estimated total marine fish production in the country during 1947 to 1948 was 373,000 tonnes. The total marine fish production during 2004 to 2005 was 2,778,000 tonnes. This is entirely attributable to technological improvements made to fishing craft, the introduction of new fishing technologies, an increase in fishing efforts and the extension of fishing into relatively deeper regions. This has also resulted in several imbalances in the fishery resource itself. Much has already been said about the growth of fisheries in India and its subsequent declining trend (Kurien, 1985; Anon, 1990; Kurien, 1991; D’Cruz, 1998; Salagrama, 2002; Gillet, 2002; D’Cruz, 2004; Kurien, 2005). From these studies it is clear that there has been a tremendous expansion of mechanized fishing craft and fishing gear all along the Indian coast. A number of these crafts are unlicensed. In addition, in regions like Kerala, the traditional sector has itself undergone a fair amount of transformation. There is a profusion of crafts such as the *thangu vallams*, which operate large ring seines (akin to the purse seine). These boats were introduced in the 1980s. It was at this time that the Fisheries Department in Kerala stopped the registration of vessels. This implies that most *thangu vallam* vessels operating on the Kerala coast today are unregistered. Conflicts are no longer the usual variety that existed between the mechanized and the traditional sector, as the latter has undergone a fair amount of technical metamorphosis. Fisherfolk unions have not been able to address effectively the problem of fishery management. On the other hand, their demands appear limited to acquiring better technologies for their own constituencies. In Kerala, the *thangu vallams* consider themselves to be a part of the traditional sector, despite the huge investments and advanced technologies this fishing now involves (Kurien, 2005).

Accurate and reliable data form the backbone of fishery management. Fishery data in India are collected by the Central Marine Fisheries Research Institute (CMFRI) as well as by each state government through its fishery department. The data collected by these two agencies for a region are often dissimilar and there are several critiques of the reliability of such data. In particular, the data collected by the state departments have always been in question. The CMFRI data, however, follow a stratified multistage random sampling design (Srinath et al., 2005) and the trends from these data are presented in this paper.

The CMFRI conducted frame surveys, including a census of fisherfolk, craft and gear during 1961–1962, 1973–1977 and 1980. During 1998, a rapid census of fishing craft and gear was conducted. The results are summarized in Table 1.5

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4 Statistics from the Department of Animal Husbandry of the Ministry of Agriculture (http://dahd.nic.in/).

5 Extracted from *Status of exploited marine fishery resources of India* (Modayil and Jayaprakash 2003).
### Table 1. Census of fishing craft and gear in 1998

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<tbody>
<tr>
<td>Active fisherfolk</td>
<td>230 000</td>
<td>320 000</td>
<td>470 000</td>
<td>8 00 000</td>
<td>1 000 000‡</td>
</tr>
<tr>
<td>Artisanal craft motorized</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>26 171</td>
<td>50 922</td>
</tr>
<tr>
<td>Non-motorized</td>
<td>90 424</td>
<td>106 480</td>
<td>140 833</td>
<td>155 925</td>
<td>76 596</td>
</tr>
<tr>
<td>Mechanized</td>
<td>0</td>
<td>8 086</td>
<td>19 013</td>
<td>34 571</td>
<td>49 070</td>
</tr>
<tr>
<td>Trawlers</td>
<td>0</td>
<td>NA</td>
<td>11 316</td>
<td>NA</td>
<td>30 979</td>
</tr>
<tr>
<td>Total (mot. &amp; non-mot.)</td>
<td>90 424</td>
<td>106 480</td>
<td>140 833</td>
<td>182 096</td>
<td>127 518</td>
</tr>
</tbody>
</table>

†Source: Ministry of Agriculture, Government of India.
‡Projected (NA: not available)

Fishery data from CMFRI records for 1963 to 2003 show that there has been an overall increase in the fish catch as seen in Figure 1.

![Figure 1. Overall increases in fish catches, 1963–2003](image)

Source: Central Marine Fisheries Research Institute.

### 4.1 Kerala, Andhra Pradesh and Tamil Nadu

Appendix 3 shows the CMFRI data on the total annual fish catch in Kerala from 1985 to 2004. The data shows an increase in the amount of fish caught in these years. There has been a marked change in the fishing gear used in Kerala over the years.

The change in fishing gear has determined the nature of the catch. In turn, the rise in demand for certain fish products has driven the demand for certain fishing gear. For example, when a market for oil sardines emerged, there was a marked increase in the use of gillnets in Andhra Pradesh and Tamil Nadu. This was mainly targeted at pelagic resources (Modayil and Jayprakash, 2003). However, analyses of the fish catch data and the consequent status of fishing craft and gear are not computed very carefully in the country. The CMFRI only collects catch data, while the state fisheries departments are supposed to monitor the craft and gear data. The latter is highly unreliable and only in a few instances have there been any careful censuses of craft and gear. In Kerala, SIFFS produced the Census of Artisanal Marine...
Fishing Fleet of Kerala in 1991, and another one later in 1998 (SIFFS, 1999). They propose
to undertake another such exercise in 2006. The Government of Tamil Nadu undertook a
census in the early 1950s and one more in 2000. Recently, on behalf of the Government of
India, the CMFRI undertook the huge exercise of conducting a fisheries census to include the
number of fishing families and the number of craft and gear and rough income estimates.
Aside from these data, there are no reliable estimates of fishing craft and gear. It is against
this backdrop that one must view the post-tsunami scenario, and particularly the impacts of
fisheries rehabilitation. In Tamil Nadu, the government conducted a census of fisherfolk and
these data were last published in 2000. No census exists for Kerala or Andhra Pradesh, and
poor socio-economic data is available on fishing communities.

There are also many studies that highlight the impacts of growth in fisheries on women.
Venkatesh Salagrama calls this the “masculanization” of fisheries, where women who once
were at the fore of all fishery marketing were finally relegated to a marginal role. With the
growth of several harbors and the mechanized sector, the catch landed was large and already
pledged to merchants from export and processing companies. Large landings immediately
crashed the prices of fish, even in neighbouring villages with small landing sites. This in
effect squeezed women traders out of the profession altogether in many places. At many
harbors, women are now engaged in marginal tasks such as cleaning, sorting, drying and a
few post-harvest tasks. Fish company agents and exporters now control the entire marketing
of fish at landing sites. In the wake of the tsunami, rehabilitation efforts on Chennai’s
coastline were impacted by the traditional marginalization and vulnerability of the
fisherwomen. Women in fishing villages here played a significant economic role, yet were
politically powerless and excluded from economic decision-making. Before the tidal wave
hit, men only engaged in fishing, while women handled all other responsibilities: Processing
fish; mending nets; caring for households, children, and the elderly, and even arranging
finances and loans from intermediaries and moneylenders for domestic needs and business.
While most men were still fearful to return to sea immediately after the tsunami, women were
providing almost 100 percent of the household income for Chennai’s 40 000 fishing families,
working as domestic servants, boat painters, net menders, shop keepers, and tailors.6

There are new trends in the fishery sector. Fisheries institutes and state governments are
actively promoting mariculture as a supplement to capture fisheries. There is talk about sea
ranching as a means to increase fish stocks in the ecosystem and other technological fixes
such as Fish Aggregating Devices — the latest fad being promoted, even by local
conservation organizations.

4.2 Andaman and Nicobar Islands

The National Biodiversity and Action Plan for the ANI provides information on the fishery
trends in the islands. The ANI coastline is 1 962 kilometres and around 35 000 square
kilometres of continental shelf provide potential fishing grounds. The 200 miles of Exclusive
Economic Zone (EEZ) around the ANI is vast and covers a sea area of 0.6 million square
kilometres, which is about 30 percent of the EEZ of India. The Census of India (1991)
estimated the fisheries potential to be 160 000 tonnes, of which 100 000 tonnes comprised
tuna and tuna-like fish. Reports by the Central Agricultural Research Institute (CARI) show

6 http://www.prb.org/Template.cfm?Section=PRB&template=/ContentManagement/ContentDisplay.cfm
&ContentID=12514
that out of the total 130,000 tonnes of pelagic stock, only 13,200 tonnes are currently exploited.

Other than the indigenous tribes, the ANI did not have any purely fishing communities and the fisheries sector began by bringing fishing families from the mainland and settling them on the islands. The Department of Fisheries was set up by the A&N Administration in the islands in 1955. Since then, fisherfolk from Kerala and Andhra have been settled in the islands. The A&N Administration provided these people with land, housing, loans and fishing equipment. CARI and the Fisheries Department are also developing the inland aquaculture sector. Efforts have been made by the ANI Administration to promote the growth of commercial fishing, storage, marketing and exports. They have set up the ANI Integrated Development Corporation (ANIIDCO). ANIIDCO has floated a company — Andaman Fisheries Limited (AFL) — which has set up cold storage and processing plants. The Marine Products Export Development Authority, funded by the Department of Ocean Development, is also in the process of implementing a demonstration project for prawn farming. However, community development is poor, as indicated by the dearth of cooperatives of self-help groups among fishing communities and settlers (ANET, 2003).

5. Issues

5.1 Post-tsunami land tenure and use issues

5.1.1 Tsunami damage estimates

Early in January 2005, the Government of India estimated reconstruction costs in the four Indian states devastated by the tsunami to be around 70 billion rupees (US$1.6 billion). The report was based on an assessment by federal government teams in the southeastern coastal regions of the states of Tamil Nadu, Andhra Pradesh, Kerala and Pondicherry and did not include costs of reconstruction in the ANI. The nationwide death toll at this stage stood at 9,995, with 5,689 people registered as missing. Of these people, 5,592 were from the Andamans archipelago alone, according to a Home Ministry statement (ReliefWeb, 2005a).

A Joint Assessment Mission undertaken by the World Bank, the United Nations and the Asian Development Bank, at the behest of the Government of India, made a preliminary estimation of damage and losses from its survey between the 1 and 15 February 2005 (Table 2).

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8 ReliefWeb is the world’s leading online gateway to information (documents and maps) on humanitarian emergencies and disasters. ReliefWeb was launched in October 1996 and is administered by the UN Office for the Coordination of Humanitarian Affairs (OCHA).
Table 2. Preliminary estimation of damage/losses between 1 and 15 February 2005

<table>
<thead>
<tr>
<th></th>
<th>Damage</th>
<th>Losses</th>
<th>Total</th>
<th>Effect on livelihoods†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>29.7</td>
<td>15.0</td>
<td>44.7</td>
<td>21.2</td>
</tr>
<tr>
<td>Kerala</td>
<td>61.7</td>
<td>39.1</td>
<td>100.8</td>
<td>36.3</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>437.8</td>
<td>377.2</td>
<td>815.0</td>
<td>358.3</td>
</tr>
<tr>
<td>Pondicherry</td>
<td>45.3</td>
<td>6.5</td>
<td>51.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Total (by sectors)</td>
<td>574.5</td>
<td>448.3</td>
<td>1 022.8</td>
<td>421.7</td>
</tr>
<tr>
<td>Relief‡</td>
<td></td>
<td>200.7</td>
<td></td>
<td>200.7</td>
</tr>
</tbody>
</table>

†Effect on livelihoods refers to the impacts on agriculture and livestock, fisheries and micro-enterprises and other livelihood sectors, measured in income terms.
‡Relief provided by local, state and national governments (not included in the total [by sectors]).

According to the Government of India's Report to the Nation in June 2005, as many as 12 405 lives were lost: 8 009 in Tamil Nadu, 3 513 in ANI, 599 in Pondicherry, 177 in Kerala and 107 in Andhra Pradesh. Non-governmental organizations say the death toll was much higher, and there is no clear proof of the exact number of deaths. Official estimates say the tragedy affected 27 92 000 people in 1 089 villages, including 43 000 people in Pondicherry; 196 000 in Andhra Pradesh; 130 000 in Kerala; 356 000 in ANI and 897 000 in Tamil Nadu. The tsunami destroyed over 235 000 homes, damaged 83 788 boats and rendered 39 035 hectares of cropped area unusable. The social infrastructure — schools, primary health centres, drinking water supply, anganwadis (child care centres) and other community assets in these areas were totally destroyed. The Prime Minister's National Relief Fund — the agency that requests citizens’ donations in the wake of any national tragedy, collected Rs.8.29 billion. According to the Prime Minister's Office, over 91 000 contributions from organizations and individuals were made for tsunami relief (Iype, 2005).

The Kerala Government assessed the damage to be about Rs.1 358 crores (one crore = ten million). In its request for aid to the Government of India, the Kerala Government stated that 172 persons were declared dead. The report also stated that the communities of Alappad and Arattupuzha were completely devastated — 219 villages and a population of 2 578 000 were affected. The government offered monetary compensation of Rs.100 000§ for dependents of dead adults, Rs.50 000 to families with dead children and Rs.25 000 to the injured. The document states that a total of 13 044 houses were affected by the tsunami, of which 2 919 houses were badly damaged, while 10 125 houses were partially damaged. There were 3 059 houses requiring minor repairs, while 7 066 needed major repairs (Anon, 2005e).

In the ANI, in the 38 affected islands, 3 513 persons were reported dead or missing. 50 000 persons were reported as being affected by the tsunami, 10 000 households were badly damaged, about 10 000 hectares of agricultural land were affected and 354 kilometres of roads were destroyed (Anon, 2006).

Apropos fisheries only, in 2005, the ANI administration released information on the immediate impact of the tsunami on fisherfolk (Equations, 2006). Besides several being rendered homeless, many fisherfolk lost their fishing inputs such as their craft, gear, engines and iceboxes. The ice plants and cold storages of the Department of Fisheries were also

§ Rs.100 000 = US$2 251.69 (December 2006).
severely affected. The department assessed losses to government property, departmental staff and losses to fisherfolk as detailed hereunder:

1. Loss to government property was estimated at Rs.82 000 000.
2. Two technical officials from Katchal Islands were reported missing.
3. 69 fisherfolk were reported missing/dead.
4. A total of 2 323 fisherfolk were directly affected.
5. 622 locally made dongies (boats without engines) were badly damaged.
6. 471 locally made dongies were partially damaged.
7. 316 engine-fitted boats were badly damaged/lost.
8. 294 engine-fitted boats were partially damaged.
9. Several fisherfolk lost their nets, fishing implements, marketing assets, etc.

In addition, the department also received about 1 600 additional claims for losses concerning craft and gear, which were being processed and at the time of writing this report. These claims were to be approved by a committee consisting of the Assistant Director of Fisheries of the Zone (convener), a representative of the Revenue Department of the area and Panchayat Raj Institution representatives.

5.1.2 Displaced persons

In the report Tsunami: one year on – India, ReliefWeb reported that the death toll for the entire country was 10 881, about 5 792 people were reported missing and 6 913 were injured. More than three million livelihoods were described as having been affected by the tsunami (ReliefWeb, 2005b). There are no aggregated and reliable statistics to date about the nationwide number of displaced persons. Various regional centres have been collecting data on deaths, houses damaged and so forth, and these are currently being compiled into databases by various efforts such as the United Nations Development Programme (UNDP)-supported Post-Tsunami Environment Initiative (www.ptei-india.org); the United Nations Tsunami Response System (UNTRS) supported a beneficiary tracking system developed by PricewaterhouseCoopers. These data were not yet available for this paper. The amount of money allocated or spent on tsunami rehabilitation so far is not really an indication of the number of displaced persons or the damage that occurred. The state governments have provided rehabilitation cost estimates to the Government of India to include the estimated cost of disaster mitigation work as well, so the costs do not reflect actual damage.

5.1.3 Temporary shelters

Despite the immediate surge of concern and aid for the victims of the tsunami, the relief phase saw a number of shortfalls in coordination and planning; consequently temporary shelters were inadequate and could not fully meet the needs of the affected persons. Shelters are categorized as temporary, intermediate or permanent, depending on the material utilized. Several hundred persons are still housed in temporary shelters nearly two years after the tsunami. In the ANI, many families still live in temporary shelters made from tin sheets or tar-coated sheets and corrugated metal with tarpaulins. There are reports of human rights violations in the temporary and intermediate shelters in the ANI (Chaudhry et al., 2006).

In many instances, NGOs began permanent shelter construction. Reliable estimates of the exact number of temporary shelters and intermediate shelters are not available, except where
NGO coordination centres were established, such as in Nagapattinam in Tamil Nadu. It is known that the following materials have been used:  
- bitumen-coated sheets for walls and roofs;  
- roofing of either asbestos or metal sheets;  
- cement-impregnated particle boards (for walls); and  
- corrugated FRP (fibre-reinforced plastic).

Available information on temporary shelters built with this material and their disposal has caused some concern. In many places, the bitumen sheets have completely disintegrated. Toilets were constructed (at a 1: 20 toilet/people ratio) in the temporary shelters and many of the septic tanks were not properly built, which has led to groundwater contamination. In terms of the environmental implications of these temporary shelter measures, the following information is needed:  
- the volume of different types of material being utilized for temporary shelters;  
- the total number of shelters, material used, septic tanks per shelter;  
- the total number of shelters currently in use;  
- information on re-use/recycling of the material;  
- evaluation of the health and environmental concerns generated by the material;  
- guidelines for dismantling of the shelters; and  
- guidelines for possible re-use/recycling and disposal of the material.

It is still not clear who is responsible for dismantling the temporary structures, which were abandoned after the occupants moved to intermediate or permanent housing. In Nagapattinam, it is reported that the government has undertaken the responsibility of clearing this additional debris (Sudarshan Rodriguez, personal communication).

In Tamil Nadu, the government has initiated a massive Tsunami Housing Reconstruction Programme, which envisages the construction of about 1 30 000 concrete houses. The State Relief Commissioner communicated a model memorandum of understanding to be entered into with NGOs and other rehabilitation agencies; designs and specifications of permanent houses developed by experts were to be approved by the District Collectors.

The Government of Tamil Nadu estimated that 54 000 houses were damaged in Tamil Nadu (Government of Tamil Nadu, 2006). However, the construction of new homes had already been begun by the NGOs. The World Bank has revised its assistance programme and is now extending another loan for the construction of approximately 65 000 houses for coastal areas not affected by the tsunami.

5.1.4 Shelter-related issues

The Government of Tamil Nadu introduced G.O. 172 on 30 March 2005 declaring that all new government-sponsored houses would only be constructed at least 200 metres from the high tide line. With the stated objective of providing built houses in safe locations to the tsunami-affected families, the government pledged assistance only to those who agreed to be relocated beyond 200 metres of the high tide line. Those who intended to construct buildings within 200 metres would not be eligible for government assistance. The government also extended assistance to those people whose homes were not damaged, but who wanted to relocate nonetheless. The ambiguity of the Coastal Regulation Zone Notification led to the

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10 Information on temporary shelters was gathered from Sudarshan Rodriguez of the PTEI project.
above interpretation, and it was deemed that no new constructions would be permitted within 200 metres for all categories of the CRZ. Sridhar (2005) stated that several ambiguities lay within the CRZ notification and in the post-tsunami context, and that they required urgent clarification by the Ministry of Environment and Forests. There was strong resentment towards G.O. 172 in various quarters. Several fishworker groups and NGOs termed it a discriminatory order. They put forth various arguments against the G.O., stating that fishing communities have a right to stay close to the shoreline and visibility of the coastal waters is important for their fishing activities. The lack of consultation with, and participation of fishing communities in these shelter guidelines has also been severely criticized. Others argue that the G.O. effectively tries to remove fishing communities from the coast, and this makes it easy for the tourism industry and other real estate interests to exploit the coast.

In the early stages of relief and temporary construction, NGOs were fairly ignorant of CRZ laws and were mining sand dunes on the coast for building activities, which is strictly prohibited by law. Fishing communities do not have pattas or land rights and title deeds in most cases. However, the CRZ only allows authorized construction on the coast. The dichotomy has not been addressed yet.

Tamil Nadu has developed guidelines for construction on the coast. In the Andaman Islands, the Ministry of Urban Development and the Disaster Authority of the Home Ministry have set guidelines for housing. There are several matters that still remain unaddressed in the ANI. As noted earlier, there were several encroachments in the islands by settlers who constructed illegal houses. Many of these settlers have incurred losses from the tsunami. A debate rages as to whether these families are entitled to compensation and housing on humanitarian grounds or not. Whether permanent housing would mean security of tenure is not clear particularly for those who may have been classified as “encroachers”. It has also been noted that only one house is being issued per patta holder, although houses and people have multiplied since the last housing estimates were collated by the government. There have also been several debates on the matter of building design for the ANI. The Ministry of Urban Development and Housing has finalized a prefabricated house design for the Nicobars. However, the appropriateness of these designs is under debate since Nicobaris traditionally live in locally designed machans (made principally of bamboo and dhani leaves).

5.1.5 Agriculture

The tsunami damaged large tracts of agricultural areas, creating the following problems: salinized soils, topsoil was washed away, damaged standing crops, silt and sand casting and siltation of ponds, irrigation and drainage channels. In Tamil Nadu the Nagapattinam Tsunami Resource Centre estimated damage to 8 460 hectares of agricultural land in Tamil Nadu and about 5 000 hectares in Nagapattinam District itself. Many initiatives are underway in Tamil Nadu to restore agriculture-related livelihoods. These include removal of mud, clearing of drainage and irrigation channels, deep ploughing of fields and excavating trenches around fields. Twenty-three NGOs are involved in Nagapattinam District alone. Short-term measures include green manuring of fields and growing salt-resistant crops, while long-term measures are aimed at overall improvements in agriculture.

Limitations to the rehabilitation efforts for agriculture appear to be process related. Coordination, unrealistic community demands and expectations were listed at a recent

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11 Compiled from NGO presentations at the Workshop on Disaster Preparedness in Agriculture, NCRC.
workshop in Tamil Nadu on the tsunami and agricultural impact. Timely interventions appear
to have been lacking in this sector.

5.2 Post-tsunami coastline stabilization

5.2.1 Bioshields

The immediate reactions of the state governments to the tsunami were to fortify the coast by
constructing sea walls. A Tamil Nadu Government press release, dated 4 January 2005,
quoted the Chief Minister as having stated: “To ensure the Tamil Nadu coast is not ravaged
by the tsunami in future, protection works such as construction of sea walls, groynes, beach
protection measures will have to be taken up. It is also proposed to take up shelter belts,
mangrove plantations along the coastline to protect the coastal areas from the tsunami attack
in future” (Anon, 2005f). The first month after the tsunami witnessed many news reports
quoting the Tamil Nadu Government’s demands for a 1 000-kilometre sea wall for tsunami
protection (Das, 2005)! Recently, it has been reported that a 3.2-kilometre sea wall will be
built at Kalpakkam Township near the Kalpakkam nuclear power plant. While the penchant
for constructing sea walls has not completely waned, it has gradually given way to another
slogan — that of “bioshields” or coastal plantation defences. There are various arguments
about the appropriateness of these plantations, their impacts on coastal ecosystems and also
conflicts arising out of land use in coastal commons (Kerr et al., 2006).

The MSSRF has been spearheading the promotion of mangrove plantations and non-
mangrove bioshields, which it describes as “shelter-beds”. These shelterbelts are strips of
vegetation composed of trees and shrubs grown along the coasts to protect coastal areas from
high velocity winds, and also presumably from devastation like that caused by the recent
tsunami. They are stated to act as sand binders and to inhibit sand erosion. Shelterbelts are
promoted as a means to reduce windspeed and ameliorate the local microclimate. The Toolkit
for establishing coastal bioshields states that well-placed and well-managed shelterbelts or
bioshields can be used to increase agricultural productivity (Selvam et al., 2005). The
document states that in order to make bioshields effective at proposed sites, the choice and
mix of species should be decided based on the height and depth of the bioshield required. The
perception is that these plantations will augment incomes in the medium to long term.

Prior to the tsunami, the Tamil Nadu Forest Department was involved with the plantation of
Casuarina along the coast, although largely on revenue lands. Post-tsunami, the World Bank-
funded Emergency Tsunami Response Project (ETRP) is supporting the plantation of
mangroves and shelterbelts along the Tamil Nadu coast. The data from various coastal forest
divisions along Tamil Nadu show that only Casuarina is being planted all along the coast and
the entire exercise appears to be devoid of any science. The plantation exercise on the ground
does not currently follow any guidelines on how these bioshields should be raised.

The Swaminathan Committee report on revised coastal management legislation strongly
recommended the use of bioshields. The authors of the Review of the Swaminthan report
have been critical of this recommendation (Sridhar et al., 2006). They assert: “The use of
exotics in the putative ‘Bio-shield’ is strongly advised against. There should be some concern
about the unmitigated zeal with which the ‘bioshield’ concept is being promulgated as a win-
win solution in the wake of the tsunami. While it certainly has some benefits for local
communities in the short term, one is uncertain about how much protection it affords the
coast in actual terms. The last thing required is the further transformation of the coasts into
groves of fast-growing exotic species. It is also potentially quixotic to invest large amounts of energy and funds in the regeneration of mangroves in habitats where the primary conditions that led to their decline still exist. It may be instead important to more completely understand what those conditions are before large-scale eco-engineering operations like this are undertaken. Where possible, the regeneration of mangrove, beach and dune vegetation and coastal forests should definitely be considered, but the conditions under which they will be warranted and successful would be limited when compared with the much more important task of understanding and protecting coastal processes against the primary influences affecting it.”

The reviewers also state that access and visibility of the seashore and sea is crucial for fisherfolk as part of their daily decision-making and the bioshields could be a hindrance in this respect. Furthermore, there have been cases of conflicts between the forest department (who promoted and implemented afforestation projects) and local communities. They advise against carbon sequestration as a goal or major benefit from the creation of bioshields. They state: “Viewing bio-shields from a climate change/carbon sequestration angle may encourage a forestry paradigm on coastal systems, which is not desirable.”

6. Policies and institutions

6.1 Governance and institutional structures for coastal land management

India has inherited a unique categorization of lands, where the state is the custodian of all lands — a concept that technically allows for state regulation over the use of even private lands. In coastal areas, most government land is vested with the Revenue Department, followed by other departments such as the Forest Department, the Public Works Department and so forth. These revenue lands have various categories which vary in each state. Tenure arrangements also vary across landscapes and are governed by various state and central laws. Different government ministries and state departments in charge of implementing these laws exercise their jurisdiction over resource use in coastal areas. The Fisheries Department controls fisheries resource use. The Forest Department is in charge of the use of coastal forests that are on forest lands. The Wildlife Wing of the Forest Department is in charge of protected areas that are located on the coast and for the protection of marine species that are listed in the Schedules of the Indian Wildlife Protection Act, 1972.

6.2 Traditional community resource management

There are a few well-researched accounts on traditional and community-based fisheries and marine management practices in the country (Mathew, 1991; Baavink, 2003; Salagrama, 2003; Lobe and Berkes, 2004). These studies illustrate the different community arrangements for fisheries management, the designs of which are based on varying community institutions and structures, fisheries practices, governance mechanisms and habitats. Each study informs us of the possibilities and the limits of community involvement in managing the ecosystems they derive livelihoods from. A vast majority of the community arrangements for resource management are not well-researched or compiled. In particular, the community arrangements for management of fisheries in open waters are poorly understood, as are community responses to its current deterioration.

After the tsunami, much interest has been generated in the traditional governance systems along the coast. A few analyses exist that examine the role of traditional governance
institutions in the disaster relief stage (Gomathy, 2006; Salagrama, 2006), but further studies are required on the role of these governance institutions in resource use and resource management after the tsunami disaster.

6.3 Policies and regulations governing coastal land/resource management and use

The numerous laws governing coastal areas can be defined as either development laws or conservation laws. This paper discusses the most significant conservation laws in the post-tsunami context, i.e. the Marine Fisheries Regulation Acts and the Coastal Regulation Zone Notification.

6.3.1 Coastal Regulation Zone Notification

Among the laws guiding anthropogenic activities along the coast, the most significant and specialized legislation is the Coastal Regulation Zone (CRZ) Notification, 1991. The CRZ Notification was issued under Section 3(1) and Section 3(2)(v) of the Environment (Protection) Act, 1986. These clauses outline the powers of the central government to protect and improve the quality of the environment and take preventive measures to control and mitigate environmental pollution. This includes the power to delineate areas where anthropogenic activities can be regulated and restricted. The CRZ Notification is therefore a specialized legislation, which was introduced to protect the coastal environment of India. Most post-tsunami rehabilitation activities undertaken by governmental and non-governmental agencies in India take place in areas falling under the jurisdiction of the CRZ Notification.

The CRZ, or the zone under the purview of the CRZ Notification, was declared to comprise the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (on 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. In the case of rivers, creeks and backwaters, the notification states that the CRZ applies to both banks of the waterbody, but the distance of the CRZ from the HTL may be reduced from 500 metres on a case-by-case basis, with the reasons for the reduction being recorded in the Coastal Zone Management Plan (CZMP) of that state. However, this distance is not to be less than 100 metres or the width of the river, whichever is less. Therefore, lands in the backwater areas are also subject to the regulations of the notification.

Mechanism for the implementation of the CRZ Notification

The notification states that the respective state governments should have identified, classified and recorded all the CRZ areas in the state CZMPs — to be approved by the Ministry of Environment and Forests (MoEF). In these CRZ areas, from the date of the CRZ Notification, i.e 19 February 1991, certain restrictions will be imposed on various anthropogenic activities, including the setting up and expansion of industries, operations or processes. The responsibility of implementing the CRZ Notification rests with the state governments and the MoEF. The notification outlines the activities that are to be permitted by the MoEF and under which conditions. All other activities are to be regulated by the state governments and union territory administrations within the framework of the approved CZMPs.

12 This section draws from a detailed analysis of the CRZ notification in the post-tsunami context by this author (Sridhar 2005).
An organogram showing the institutions and structure developed for the implementation of the CRZ is provided in Appendix 4. 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 CRZ Notification’s provisions. The constitutions of the SCZMAs vary across the states, but their duties and responsibilities are identical. Compared to other authorities constituted by the MoEF under Section 3(3) of the Environment (Protection) Act [EP Act], the SCZMAs have a fairly extensive and important mandate. They are also empowered to “take action and issue directions” — substantial powers in legalese. Among various activities, the SCZMAs are mandated to identify ecologically sensitive and economically important areas, create integrated management plans and to act as the immediate authority empowered to implement all provisions of the CRZ Notification, including recommending projects for clearance to the government. The National Coastal Zone Management Authority (NCZMA) is also vested with important responsibilities for coastal protection requiring official tenure to function.

**Concerns with the implementation of the CRZ Notification**

While the CRZ Notification is one of the earliest specialized environmental legislations, in the 15 years since its introduction several anomalies have crept in, resulting in serious problems for implementation. Some of these concerns are described below and need to be addressed before imposing the law on rehabilitation efforts.

- Since 1991, there have been 19 amendments and about three corrigenda (up to 24 July 2003) to the provisions of the notification. Each of these amendments have sought to dilute the protective measures of the notification and in the process have introduced newer clauses that further complicate and render meaningless several of the protective clauses of the original notification.

- Despite the numerous amendments, the MoEF has not yet issued a consolidated notification in the official gazette, incorporating all the changes to the original notification. This makes the interpretation of the various clauses of the notification a real challenge. At the time of writing, the MoEF’s official Web site presently has only a few select amendments. All amendments and a consolidated notification need to be made publicly available.

- The series of amendments to the notification have made way for several industrial and large-scale commercial activities. However, none of the amendments has sought to clarify some of the other ambiguities and uncertainties such as the definition of key terms such as “local inhabitants”, “traditional rights and customary uses.”

- Although the states were supposed to prepare their CZMPs before February 1992, they only submitted the CZMPs after being directed to do so by the Supreme Court in 1996. The MoEF has only conditionally approved these state CZMPs. However, none of the states has incorporated the conditions laid out by the MoEF and have yet to prepare a revised CZMP that has been fully approved by the MoEF incorporating all its conditions. In the case of the tsunami-affected states, the CZMP is not yet fully approved.

- In none of the states has the HTL demarcation exercise been done at the ground level, for identification of zones and field implementation of the notification.
6.3.2 State Marine Fisheries Regulations Acts

In India, the official focus on fisheries has traditionally been on its development and only recently on its management. Management efforts in the various state marine fisheries regulation laws are mostly regulatory in nature, where the powers and responsibility for the same have been vested with the state. The tsunami-affected states each have state Marine Fisheries Regulation Acts (MFRAs). The MFRAs were drafted along the lines of the existing pre-independence legislation — the Indian Fisheries Act, 1927. The MFRAs act as conservation laws because they regulate fisheries through a system of spatiotemporal closures (e.g. monsoon bans), restrictions on mechanized fishing in nearshore waters, and gear and craft regulations. For Kerala, the ban on mechanized fishing in nearshore waters is now based on depth (up to 30 metres, north of Kollam and up to 20 metres in the southern region); for Tamil Nadu it is three nautical miles and for Andhra Pradesh it is eight kilometres. The various MFRAs also empower the state governments to restrict the number of boats that can be licensed or registered in the state, which allows for regulation of the fishing effort.

The regulatory paradigm of the marine fisheries laws has been hailed because there is an attempt to balance development needs with conservation, where human actions are regulated and where human presence is not prohibited as the wildlife laws mandate (Shanker and Sridhar, 2006). However, the insights into implementation of the laws are not as encouraging. In response to the rapid mechanization of fisheries from the 1950s onwards, the attendant implementation has been languid at best. Ironically, one of the main objectives of the MFRAs was to reduce the conflicts that arose between the traditional and mechanized sectors by officially demarcating fishing zones. In the absence of any implementation however, conflicts find newer grounds. Diminishing fish stocks and conflicts over resource extraction between the mechanized and traditional fisheries have been aggravated. These conflicts are either between different categories of fisherfolk over resource-use patterns and control, or conflicts between fisherfolk and the state over regulations on fishing practices. The attitude towards fisheries laws ultimately describes in what manner responsibility for the fishery resource is viewed by the community which currently appears to have only intensified unsustainable resource use and heightened social tensions. An organogram showing the functioning of the MFRAs is presented in Appendix 5.

Some concerns with the implementation of the Marine Fisheries Regulation Act are as follows:

- The provisions of the MFRAs are not well-understood by fisherfolk in many parts of the coast (T. Peter, KSMTF\textsuperscript{13}, personal communication).
- The provisions of the law are also not fully utilized to maximize its potential to contribute to meaningful conservation.
- Implementation of the MFRAs has been poor on several counts. Most significantly, the MFRAs appear to have made no dent in the problem of overcapacity, a fact evident from the numerous unlicensed and unregistered vessels plying in all the tsunami-affected states.
- Fisheries statistics on craft and gear are suspect and such data collection has been under criticism from different quarters. In the context of the uninhibited fishery by unregistered vessels, the future of fishery regulation through the MFRAs appears to be somewhat grounded.
- As part of the relief and rehabilitation efforts, post-tsunami, there has been an unaccounted for number of boats and fishing equipment that was distributed along the

\textsuperscript{13} Kerala Swathantra Matsya Tozhilali Federation — Kerala Independent Fisherfolk Union.
affected villages, particularly the Tamil Nadu coast. There is also a vast amount of conflicting information on what this has meant in terms of increased fishing effort and the actual impact on the resource (ICSF, 2006).

6.3.3 Changes in legislation post-tsunami

Post-tsunami, there really have been no changes in legislation, either the CRZ notification or to the Marine Fisheries Regulations acts, although the tsunami did pose several challenges and did bright to light the inherent contradictions in the law and failure of its implementation. Questions began to be raised on the implementation of the CRZ Notification, the absence of which intensified the destruction by the tsunami. Several settlements and establishments had sprouted in nearshore areas where the law should have been employed. These buildings suffered grave damage during the tsunami.

Prior to the tsunami, the MoEF constituted the Swaminathan Committee to review the Coastal Regulation Zone Notification. This committee highlighted the importance of Integrated Coastal Zone Management, but failed in several areas to deliver a convincing plan of how this would actually take shape (for a detailed review of the Swaminathan Committee Report, see Sridhar et al., 2006). Following the publication of the Swaminathan Report, a document has been circulating that contains the text of what is purported to be the MoEF’s proposed new coastal legislation — the Coastal Management Zone Notification. The plan for coastal management outlined in it has generated much resentment from many quarters. The media carries regular reports highlighting condemnation of the CMZ plan by fishworker unions, NGOs and academicians. This CZM plan was recommended by the Swaminathan Committee. Some of the serious concerns with the proposed CMZ Notification include the following:

- Earlier violations of the CRZ Notification are sought to be nullified.
- The new law ushers in developmental activities that were hitherto not permitted in the coastal zone.
- It brings under its jurisdiction a much larger marine area (12 nautical miles as opposed to the earlier intertidal area), without really specifying the implications on fishing rights.
- It also does not deal with areas of overlap with other legislations that govern development in the marine and coastal areas.
- It does away with the earlier conservation design of the CRZ notification, which comprised No-Development Zones. Instead, these areas are all open to development subject to decisions made by a planning authority. In the absence of any checks and balances, this only signifies a simple way to permit anthropogenic activities endlessly and indefinitely on the coast.

6.4 Planning and decision-making processes

Both in the CRZ Notification as well as in the MFRAs, the text of the law is not clear about participation of local communities in decision-making. The responsibility for planning and decision-making is squarely affixed on the shoulders of Coastal Zone Management authorities – who may or may not consult with local communities. The MFRA makes no mention of consultation with fishing communities on regulations or management. However, it is well-known that the implementation of these laws and actual decisions that are made towards this end are influenced by lobby groups.
Under the MFRA, orders are issued on fishing regulations such as the dates of monsoon bans and to which fishing category they apply, among others. These orders are actively influenced by fisherfolk lobby groups, particularly the powerful mechanized sector. To this extent, “participation” can be concluded, but not by fair and transparent or officially recognized means.

7. Lessons learned and solutions identified

As with many recent natural disasters in the country, the destruction caused by the Indian Ocean tsunami was closely linked to the manner in which governments and people treated the coasts. Data is still pouring in from several governmental and non-government agencies through a range of programmes and projects. Projects such as the Post-Tsunami Environment Initiative (www.ptei-india.org) aim to understand the impact of the tsunami on environmental, social and policy aspects of coastal management and resource use. However, even in the absence of complete data from research projects, papers on earlier resource use patterns, media reports and discussions with community members and NGOs working on post-tsunami-related issues have revealed much. Despite the initial enthusiasm following the tsunami to implement the CRZ Notification, the current booming land prices in coastal areas are indicative of what lessons the tsunami has taught the country.

Many NGOs are engaged in dialogue with governments, either through coordination centres such as the one in Nagapattinam, Tamil Nadu or through workshops and meetings on specific issues such as shelters, ecological concerns and so forth. A plethora of recommendations has emerged from these exercises and heed should be paid to them.

Without sounding too prescriptive, or conversely trivializing the challenges ahead, a few measures are suggested here that can form a basis for future coastal resource management:

- Coastal management legislation, particularly the Coastal Regulation Zone Notification and the MFRA, needs to be critically reviewed to identify problem areas for implementation and management of the resources.
- Currently, coastal resource laws are not really grounded in science (both natural and social science). The aforementioned reviews of legislation should specify areas where management measures can benefit from scientific rigour and instruction.
- Coastal management measures and ecological restoration need to be grounded in good science. A range of restoration activities currently being undertaken such as creating bioshields and coral reef restoration should be injected with a hearty amount of scientific rigour. Literature is emerging about the importance of coastal forests and the conditions under which they can best benefit coastal communities. Wolanski sums it up well by stating “The science of bioshields is well established; the technology of bioshields is however still developing. It is a mixture of many socio-economic and ecological considerations” (Wolanski, 2006). While some may argue that in the Indian context the science is nascent, the pre-conditions Wolanski refers to seem to be forgotten by both donors and practitioners in their enthusiasm to produce results that are impressive.
- Attention should be paid to various reviews and critiques in the country that detail the problems with proposed changes to legislation. With many NGOs working on various aspects of coastal management, both pre- and post-tsunami, there is easily one consolidated report per issue, with fairly well-developed suggestions for research and intervention. With respect to coastal planning and management, the Statement of CRZ and rehabilitation in Tamil Nadu is recommended. This report was developed as an exercise to specifically
address concerns with coastal planning and development in the rehabilitation context (Sridhar, 2005; available at http://www.atree.org/Statement_CRZ.pdf).

• With regard to future legislation such as the proposed CMZ, a detailed critique of the Swaminathan Review was prepared by a group that has closely followed the implementation of the legislation and matters related to coastal conservation over the years. This is available at http://www.atree.org/Swaminathan_Review.doc. The report contains detailed steps that should be followed for improved understanding of coastal management needs and policy development.

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Appendix 1. Indian Ocean tsunami-affected areas in India

Appendix 2. Trends in encroachments in the Andaman Islands (ANI Forest Department)

Appendix 3. Total annual catch for the states of Andhra Pradesh, Kerala, Tamil Nadu and Pondicherry between 1985 and 2004

<table>
<thead>
<tr>
<th>Total catch</th>
<th>Andhra Pradesh</th>
<th>Tamil Nadu</th>
<th>Pondicherry</th>
<th>Kerala</th>
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<td>Kerala</td>
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<td>589 519</td>
<td>2004</td>
<td>2004</td>
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</table>

Appendix 4. Organogram showing implementation structure of the CRZ notification

Ministry of Environment and Forests

National Coastal Zone Management Authority

State Coastal Zone Management Authority

State Department of Environment

State Pollution Control Board

Committees (for specific tasks)

District Environmental Officers (sometimes from the SPCB)

Gram Panchayats/Local self-government agencies (in Kerala)
Appendix 5. Organogram showing the implementation structure of the State Marine Fisheries Regulation Act