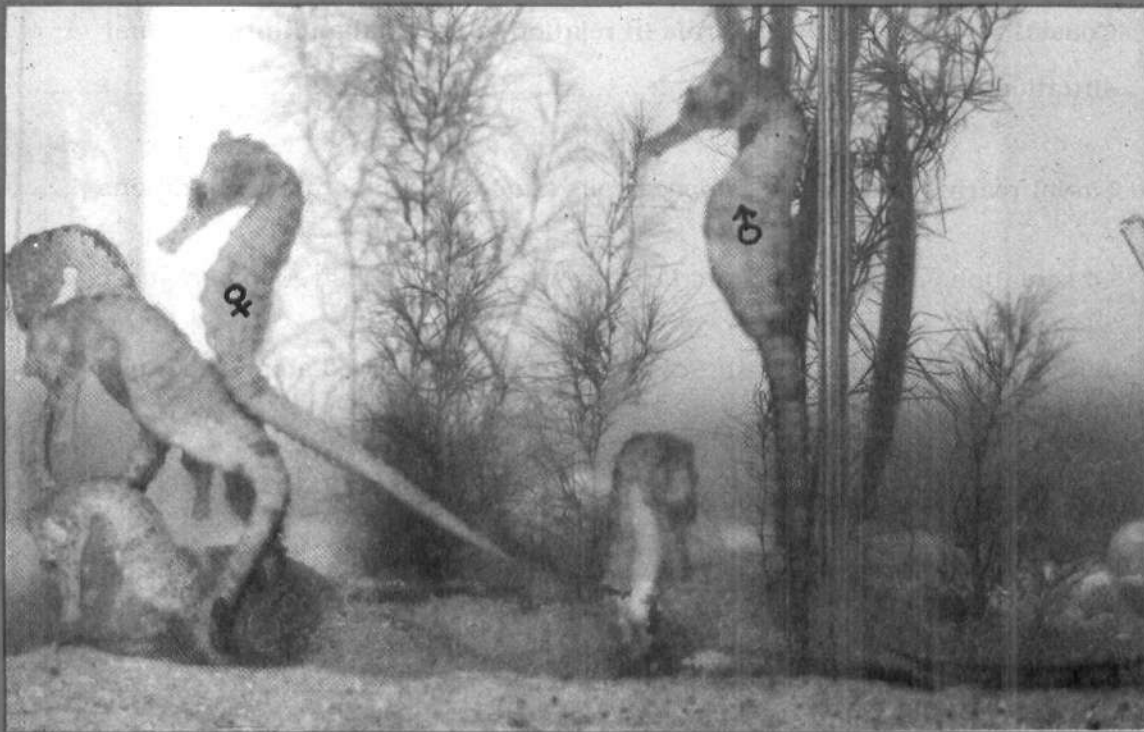




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INDIAN COUNCIL OF AGRICULTURAL RESEARCH

915 COASTAL ZONE GOVERNANCE: KERALA IN RELATION TO NATIONAL AND INTERNATIONAL SITUATIONS

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Introduction

Some of the leading coastal countries like Australia, China, France, Israel, Japan, New Zealand, Oman, Spain, Sri Lanka, Thailand, Turkey, U.K., U.S.A and others have taken urgent steps for coastal zone management following the 1992 United Nations Conference on Environment and Development (UNCED) to meet their commitments to the sustainable development of coastal areas and the marine environment under the national jurisdiction as per Chapter 17 of Agenda 21 of the above conference. As the coastal zone is generally busy with many economic activities like agriculture, forestry, fisheries, transport and manufacturing industries, it is necessary to accord priority to the conservation of the natural resources and the coastal ecosystem to ensure their sustainable development. Therefore, many coastal countries have evolved Integrated Coastal Zone Management (ICZM) plans. In many countries the coastal zone extends from the territorial limit (the wet side) to the tidally influenced habitat (the dry side). This entire zone comprising the wet side and dry side is treated as a single unit where the landward boundaries vary depending on the objectives and needs of the issues. Both the wet side and the dry side of this zone are generally managed and governed by a single agency. India too has initiated actions to exercise powers under Section 3(1) and 3(2) (v) of the Environment (Protection) Act, 1986 through a legal instrument called the Coastal Regulation Zone Notification issued in 1991 by the Ministry of Environment and Forests (MOEF). This zone extends from the low tide line (LTL) to a distance of 500 m and the landward side (including the estuaries and backwaters) influenced by the tidal action. In this zone as many as 13 activities and processes are proposed to be prohibited and 4 of them regulated through the provisions of the CRZ Notification.

The CRZ is classified into 4 categories for the prohibition or control of various activities (Table 1 and 2). Subsequently, the Department of Ocean Development (DOD) of the government of India, after evaluating the current and future activities in the ocean part of the coastal zone, prepared a declaration for the extension of the CRZ to the outer limit of territorial sea (upto 12 nm from the lowest low water level), as defined under the Maritime Zones Act, 1976 to prohibit and regulate certain activities and processes in conjunction with the existing acts, rules and notifications. The draft ORZ (Ocean Regulation Zone) document recognizes three zones (ORZ, I, II and III) similar to the CRZ. The landward boundary of the ORZ including the enclosed seas, estuaries and backwaters is not mentioned in the ORZ draft report (Table 3 and 4).

TABLE 1. Classification of coastal regulation zone in India (as per the 1991 Notification)

Category of CRZ	Description
Category I	(i) Areas that are ecologically sensitive and important, such as national parks / marine parks, sanctuaries, reserved forests, wild life habitats, mangroves, corals / coral reefs, areas close to breeding and spawning grounds of fish and other marine life, areas of outstanding natural beauty - historical / heritage areas, areas rich in genetic diversity. (ii) Areas between the Low Tide Line and the High Tide Line.
Category II	The areas that have already been developed, within the municipal limits or in other legally designated urban areas

up to or close to the shore line.

Category III Areas that are relatively undisturbed and those which do not belong to either category I or II. These will include coastal zone in the rural areas (developed and undeveloped) and also areas within Municipal limits or in other legally designated urban areas, which are not substantially built up.

Category IV Coastal stretches in the Andaman and Nicobar, Lakshadweep and small islands except those designated as CRZ I, II.

TABLE 2. Prohibited activities in the Indian CRZ (as per the 1991 Notification)

1. Setting up of new industries and expansion of existing industries.
2. Manufacture or handling or storage or disposal of hazardous substances.
3. Setting up and expansion of fish processing units including warehousing (excluding hatchery and natural fish drying in permitted areas).
4. Setting up and expansion of units / mechanisms for disposal of waste and effluents, except facilities required for discharging treated effluents into the water course with approval under the Water (Prevention and Control of Pollution) Act, 1974.
5. Discharge of untreated wastes and effluents from industries, cities or towns and other human settlement.
6. Dumping of city or town waste for the purpose of land filling or otherwise; the existing practice, if any, shall be phased out within a reasonable time not exceeding three years from the date of this Notification.
7. Dumping of ash or any wastes from thermal power stations.
8. Land reclamation, building or disturbing the natural course of seawater with similar obstructions, except those required for control of coastal erosion and maintenance or clearing of waterways, channels ports, for prevention of sandbars.
9. Mining of sand, rocks and other substrata materials, except those rare minerals not available outside the CRZ areas.
10. Harvesting or drawal of groundwater and construction of mechanisms therefore within 200 m of HTL; in the 200-500 m zone it shall be permitted only when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries.
11. Construction activities in ecologically sensitive areas.
12. Any construction activity between the low tide line and high tide line except facilities for carrying treated effluents and waste water discharges into the sea, facilities for carrying seawater for cooling purposes, oil, gas and similar pipelines and facilities essential for activities permitted under this Notification; and
13. Dressing or altering of sand dunes, hills, natural features including landscape changes for beautification, recreational and other such purposes, except as permissible under this Notification.

The coastal zone has the highest biological diversity, but as a common property, it is easily accessible to the various users. Therefore, the ongoing and prospective threats to the coastal life support systems need to be regulated through appropriate acts including the proposed biodiversity act. India, as a party to the International Convention on Biological Diversity (enforced in 1993), has recently drafted a Biological Diversity Act for the pur-

pose of conserving the biological resources, both indigenously occurring and naturalised, to sustain their use and share their benefits equitably.

TABLE 3. *Classification of the proposed draft ocean regulation zone*

Category of Description ORZ	
Category I	Territorial sea areas adjacent to the main land and Andaman & Nicobar and Lakshadweep islands that are ecologically sensitive and important such as national parks /marine parks / marine dependent wild life sanctuaries, habitats of endangered estuarine and marine species, marine environment of mangroves, corals, corals reefs, areas close to breeding and spawning grounds of fish and other marine life, areas of outstanding natural beauty / historical / cultural / heritage areas, areas rich in genetic diversity and such other areas as may be declared by the Central / State governments under relevant Acts like Wildlife (Protection) Act, 1972.
Category II	Territorial sea areas adjacent to the coastal areas that have already been used for development such as (i) construction of berths, wharf, navigational channel etc. in major and minor ports, (ii) sea off coastal industries, power plants, refineries and other industries which use sea for waste disposal through creeks, canals and pipelines. (iii) reclaimed areas, oil and gas transfer facilities, (iv) Corporation, Municipal limits of cities and towns, (v) sea off coastal areas being used for ship building and ship breaking activities, (vi) sea off beach resorts, marinas etc.,

Category III Territorial sea areas adjacent to coastal areas which are yet to be used for developmental purposes (not used for activities mentioned under Category II (ORZ II) and which have been used for developmental purposes to a limited extent (construction of fishing harbours and navigational channel) and also the sea areas between two developed areas.

TABLE 4. *Prohibited activities in the proposed ORZ*

1. Reclamation of sea for human settlement, construction of artificial islands for other commercial purpose is prohibited all along the coastline of the country.
2. Dumping of solid wastes, including plastic wastes arising from municipal, industrial and all the other sources including from the ship breaking industries.
3. Dumping of toxic wastes (as listed under EPA 1986) is prohibited in ORZ I, II, and III areas.
4. Construction of civil and other manmade structures and breakwaters, OTEC plants, floating industries/structures/ Single Buoy Mooring Stations, lightening operations, laying of pipelines for transport of oil, establishment of artificial islands, reefs, exploration and exploitation of oil and natural gas, reclamation of sea and its bed and sea bed mining in the critical habitats which are Ecologically Sensitive. However, such constructions /establishments will be permitted at a no-impact distance from the outer limits of these habitats.
5. Ship breaking activities are prohibited in the critical habitats. However, such activities will be permitted beyond the no-impact distance from the outer limit of the critical habitats.

6. Discharge of untreated and treated domestic, industrial, aquaculture wastes, nuclear and thermal plants, dredged materials, and operational discharges are prohibited in the critical habitat areas.

Note : 9 other activities in ORZ I, II, and III.

Guidelines in this regard will be presented by DOD/CPCB/DAC

Proposed ocean regulation zone

The Department of Ocean Development of the government of India prepared a draft notification containing the details of regulatory and preventive measures relevant to the coastal zone (ocean part) in exercise of the powers conferred under sections 3 (1) and 3 (2) (v) of the Environment (Protection) Act, 1986 and clause (d) of subrule 3 of rule 5 of the Environment (Protection) Rules, 1986. This draft notification was circulated to all the state governments for seeking the views of all concerned with the sustained use of the Indian seas. Coastal areas which serve as breeding and nursery grounds of various species of finfish and shellfish, areas of high genetic diversity, mudbanks, mussel beds, estuaries and mangroves are likely to fall under the purview of the proposed Ocean Regulation Zone Notification (ORZ I) as far as Kerala is concerned. The government of Kerala has constituted a committee to seek the opinion of the marine biologists and fisheries experts before a decision on the draft notification is taken.

An interdepartmental committee (task force) was constituted by the government of Kerala to formulate the strategies for the coastal zone management (land and ocean part) and advise the government on all matters and issues arising out of the 1991 Coastal Zone Regulation Notification of the government of India. After a preliminary meeting on the 27th May 1997, the task force constituted a sub-committee of experts from various disciplines comprising environment, fisheries and oceanography, which prepared a draft report based on various ecological, geographical and socio-

economic factors, significant to Kerala state, through several discussions and literature reviews.

Kerala coastal zone

An attempt is made here to review the issues relating to coastal zone governance in Kerala in the context of the Environmental Protection Act, and the draft Biodiversity Act. Kerala which has only a mean width of 67 km, is bordered by the Arabian Sea on the west (590 km long coastline) and the Western Ghats on the east.

The land area of 38,828 km² is almost equal to the continental shelf of 40,000 km². Coastal Kerala supports a population of 0.64 x 10⁸ fisherfolk. There are 41 west flowing rivers, which discharge into 30 estuaries, opening into the sea through perennial or seasonal outlets across the barmouths (Fig. 1). The estuarine bed level is around 1.5 to 1.8 m below the mean sea level. The estuaries remain separated from the sea by a narrow strip of land which is only 0.4 to 12 km in width. The estuaries and the backwaters which once occupied an area of 2,426 km², have now shrunken to 652 km² due to serious alterations during the past 150 years through reclamation for agriculture and human settlement. All

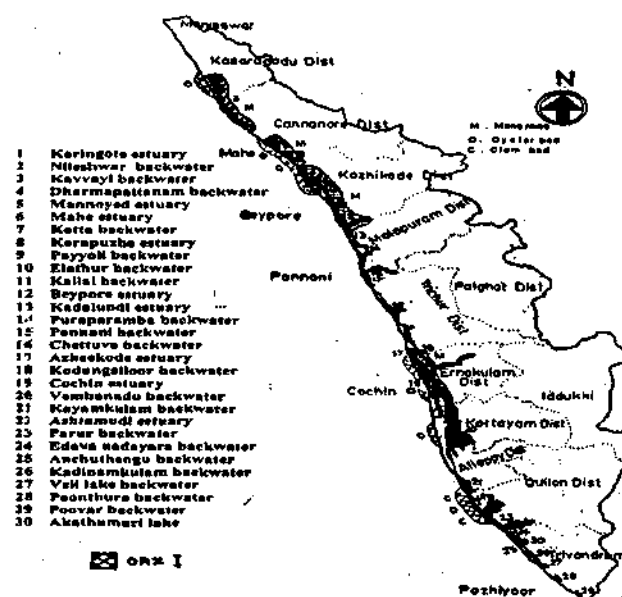


Fig. 1. Map of Kerala showing estuaries and backwaters.

the major estuaries are intertwined with urban agglomerations of high population density.

The intertidal belt is either sandy or rocky and the shorelines are in a constant state of flux. Shore erosion or accretion is imperceptible along many locations, while in places like Quilon, Cochin and Calicut erosion is causing severe damages, especially during the southwest monsoon season. Coastal area uses have tended to accelerate, accentuate and even adversely affect the shorelines and the associated ecosystems. Breakwaters and seawalls have been constructed over great stretches along the sandy shores, often masking the scenic beauty of the sandy beaches.

Territorial sea

i) General characteristics

The territorial sea (upto 12 nautical miles from the baseline) of Kerala with an area of 13,000 km² is characterised by sandy or muddy sea bottom, and rocky or coral patches in some locations. Except for the sedentary groups of organisms found in the rocky intertidal belt, most of the organisms in the coastal waters exhibit seasonal movements or migrations, depending on the behaviour of the species and the prevailing climatic and hydrographic conditions. Therefore, none of these species could be considered as specific to any small definable area or pocket along the coast. Many tropical finfishes and shellfishes have extended spawning periods linked with their genetic characteristics and influenced by the hydrographic conditions caused by the monsoons and the seasonal coastal drifts and currents. As most of the breeding takes place in the shallow waters, the entire coastal area acts as nursery ground for one species or the other, depending on their preference of the substratum, the sea depth and food. The penaeid prawn, *Parapenaopsis stylifera* (called karikadi in Malayalam) which affords has a rich fishery in the Kerala inshore waters, plays a vital role in the economy of the state, and breeds within the shallow 20 to 30 m deep grounds off Quilon, Alleppy and Ernakulam

districts over an area of about 1000 km² Therefore, this belt may be considered sensitive, which however, should not preclude any traditional activities, which are governed by various other environment protection rules and regulations of the state.

ii) Coastal fisheries

The coastal waters of Kerala are subjected to high fishing pressure by the mechanised (46 % of total catch) and motorised (50 % of total catch) sectors, mostly in the depths of 0 to 50 m, covering an area of 12,560 km² which is only 7 % of the all India area within the 0 to 50 m depth. The marine fisheries sector in Kerala generated a revenue of about Rs.1,000 crore from the internal market and about Rs. 800 crores through foreign exchange from the export market per year currently through a catch of about 5,50,000 tonnes, which is 24 per cent of the all India catch. The territorial sea (approximately 0 to 30-m depth) produced 62 % of the total catch of 5,70,000 tonnes in 1997. The entire catch of the outboard trawler fleet is caught from this depth belt, whereas 80 % of the outboard ringseiner fleet, 92 % of the non-mechanised fleet, 63 % of the outboard gillnetter fleet and 43 % of the trawler fleet catches are contributed by the territorial sea. The territorial waters yielded 72 % of the total prawn catches of Kerala, 88 % of oil sardine, 71 % of whitebait and 82 % of mackerel catch in 1997. About 73 % of the territorial sea catch belongs to the pelagics and 27 % to the demersals (of which 13 % is of prawns, lobsters and cephalopods). The annual catch per km² area in the coastal waters (0 to 50m depth) of Kerala is 41 t whereas it is only 12 t for all India. Bottom trawling is estimated to destroy about 13,000 t of benthic organisms per year in Kerala, causing thereby great loss to the benthic biodiversity and habitat degradation. The existing or proposed fisheries regulations should ensure sustained growth in fisheries as well as protection to the ecosystem, especially the benthic system.

iii) Mudbank (soft) ecosystem

The mudbanks which are 1 to 3 m thick

patches of calm, turbid waters with a high load of suspended sediment and a clayey bottom, appear close to the shore in a stretch of 2 to 5 km length parallel to the coast and 1.5 to 4 km across (width) the coast of Kerala (Fig. 2). They appear with the onset of the southwest monsoon (May & June) and disappear with the withdrawal of the southwest monsoon in September & October. The mudbanks are formed due to the periodic stress from the waves over a muddy bottom, resulting in bed erosion, generation of fluid mud and wave attenuation. The combined action of the waves and the currents transports the fluid mud en masse to the nearshore and the localisation of the mudbanks is attributed to wave energy convergence. The fine bottom sediment is generally transported from offshore. Along shore, extension of the mudbanks is due to the waves forcing from outside the mudbank area and the prevailing coastal currents of the southwest monsoon. The mudbanks usually form in the same place each year and after brief existence (generally 1.5 months) the fluid mud exhibits downslope movement, dissipating the mudbank. Year to year shifting of the mudbanks, if any, is attributed to the variations in the bathymetric conditions which decide the magnitude of energy convergence. The mudbanks exist be-

cause of the rheological behaviour of the bottom sediment, from which the suspended sedimentary material is derived. Shear thinning behaviour releases the dense suspension of mud from the bottom. The Newtonian and shear-thickening behaviour of the suspension under low shear stress might be responsible for maintaining it as a discrete unit.

Monsoon waves as high as 2 to 3 m outside the mudbank get reduced to 0.5 m near the mudbank within a distance of 1.1 km. Wave-induced oscillation of fluid mud causes wave energy dissipation, particularly in the seaward periphery of the mudbank. This wave dampening process in the mudbank facilitates safe anchorage and smooth fishing for the traditional fishermen during the monsoon season, which is generally unsafe outside the mudbank for fishing due to climatic limitations. The importance of the mudbanks to coastline stability and protection and to the sociocultural and economic wellbeing of the traditional fisherfolks is well known. A project mode investigation carried out by a multi-disciplinary team of subject matter specialists of CMFRI Institute has brought to light the physical, chemical and biological characteristics of mud banks south of Alleppy way back in seventies.

The mudbank sediment consists of highly cohesive and flocculated clay. The most dominant textural class is silty or clayey with a good amount of sand, silt and clay. The mud density ranges from 1,080 kg to 1,300 kg/m³ and the dispersed particle size between 0.5 and 3 μ m. The clay which is 66 % of the sediment, consists of montmorillonite and kaolinite. The heavy minerals include opaque, hornblende, sillimanite, muscovite, pyroxenes, epidote, zircon, monozite and rutile.

The mudbank region is rich in the standing crop of phytoplankton biomass (70 to 130 ml/l), chlorophyll a (11 to 33 mg / m³) and total phytoplankton cell count (345 to 575,000/ l). Blooms of phytoplankton (> 10,000 cells per ml), mainly of species of *Noctiluca*, *Skeletonema* and *Fragilaria* occur in the

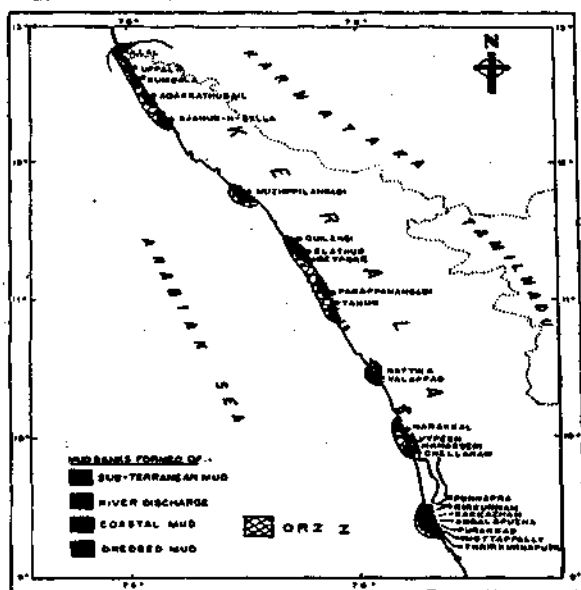


Fig. 2. Areas of mudbank formation and the various types of mudbanks along the Kerala and Karnataka coast (Source: CMFRI. Bull. 31).

mudbanks, which are inhabited by 58 species of planktonic algae. The zooplankton biomass is high (upto 4.06 ml/10 minute haul) in the mudbanks. There are 19 groups constituting the zooplankton which is dominated by the copepods (80 %).

The sediments of the mudbank carry rich loads of organic matter (5 %). About 90 to 95 % of the benthic fauna in the mudbank consist of polychaetes and molluscs. The former is more abundant in the shallow sea and the latter in the deeper areas. The meiobenthos consists mainly of the foraminifera, nematodes, ostracods, polychaetes, copepods and amphipods. The calm sea together with high productivity, favours fish and shellfish migration to the mudbanks and therefore, yields high catches. Fish production from the mudbank and nonmudbank areas during the 1966-'75 period for 3 months (June to Aug.) shows that the production in the mudbanks is 56 % higher than in the nonmudbank areas (Fig. 3). The catch consists of 50 species of fish and 6 species of prawns. *M. dobsoni*, oil sardine, silverbellies, flatfishes and anchovies form the bulk of the landings.

iv) Hard bank ecosystem

The highly productive Quilon bank of hard, rocky bottom located within Lat. 8°30' N and 9°30' N and Long. 75°25' E and 76°15' E, with a total area of 3,300 km², is a rich fishing ground for demersal fishes, shrimps and lobsters. Another small, hard bank (the Chettuva bank) located off Trichur within Lat. 10°31' N 10°33' N and Long. 75°09' E and 75°15' E, with an area of 28 km², is also a good fishing ground. The shoreward portions of both these banks deserve protection from any activity that might disturb these two hard banks unduly in the longrun.

v) Malabar upwelling area

Almost the entire territorial waters of Kerala which lie within the limits of the Malabar upwelling zone, yields about 30 to 40 %

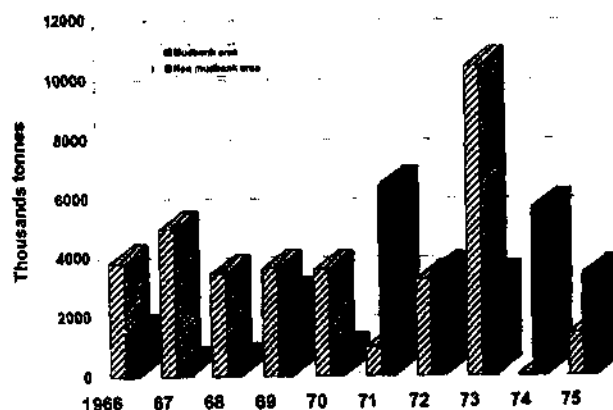


Fig.3. Annual fish catch from mudbanks.

(Source: CMFRI, Bull.31)

of the total fish catch of the state. This area supports the livelihood of 0.67 million fisherfolk and employs about 1,00,000 active fishermen. All the existing regulations under the Wildlife (Protection) Act 1972 and any other prohibition/ regulations deemed necessary in the course of future fisheries and allied activities should be strictly enforced and implemented for sustainable marine fisheries development and management.

vi) Mussel beds

The green mussel beds (*Perna viridis*.) occurring in the rocky intertidal areas up to

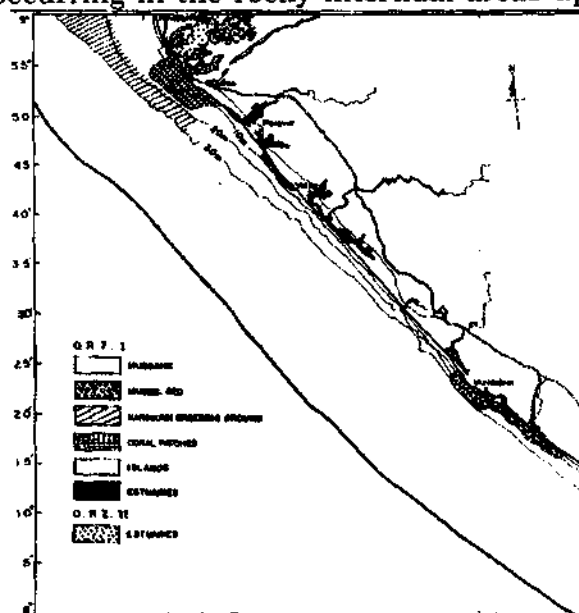


Fig.4. Coastal zone map of Kerala. 1. Kollamgode-Kovvilthottam.

the 15 m depth in parts of Quilon, Alleppy, Cochin and Calicut to Kasaragod, in a total area of 200 km², are sensitive habitats by virtue of their vulnerability to overexploitation, biodiversity degradation and pollution. The annual production of green mussel is around 2,000 to 5,000 t while the standing stock in an area of 555 ha has been estimated at 15,887 t. The mussel beds need to be included under the proposed ORZ I. Similarly the brown mussel (*Perna indica*) beds, found in the intertidal to the 10 m depth off Varkala to Kanyakumari, in a total area of 50 km², may be treated as sensitive habitats and included under the ORZ I. The annual production of brown mussel from the important fishing centres between Kovalam and Muttom (about 50 km) has been estimated at 500 to 2,000 t while the standing stock has been estimated

at 1,586 t. These rocky habitats also support rich rock lobster populations, which deserve conservation and protection.

vii) Rocky outcrops, islands and coral patches

The rocky outcrops (e.g., Sacrifice Rock) and small islands (e.g., Green Island) situated within the territorial waters off Calicut and Cannanore districts and their surroundings to the tune of 20 km² may be treated under the ORZ I in view of their ecological sensitivity and historic scenic importance. Similarly, the coral patches in and around Vizhinjam (about 15 km²) within the territorial water may be treated under the ORZ I. Owing to their rich biodiversity and importance as nursery grounds, some of the rich biodiversity pockets along the rocky habitats off Kovalam, Varkala and Tellicherry covering an area of about 20 km², and another 35 km² of patchy reef areas off Thangaserry may be treated as sensitive, and therefore, kept under the ORZ I.

viii) Prospective mariculture and sea-farming sites

Many areas along the intertidal, coastal and estuarine waters are suitable grounds for sea-farming of about 20 species of finfishes, 29

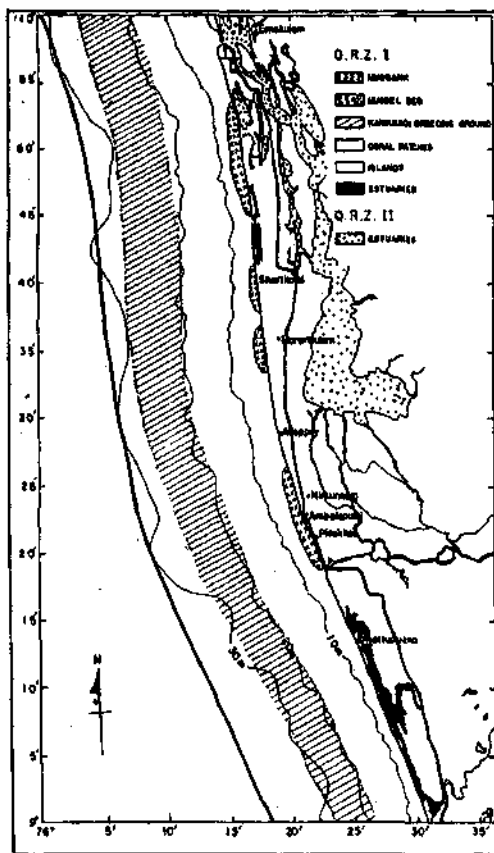


Fig.5. Coastal zone map of Kerala 2. Kovilthottam - Ernakulam.

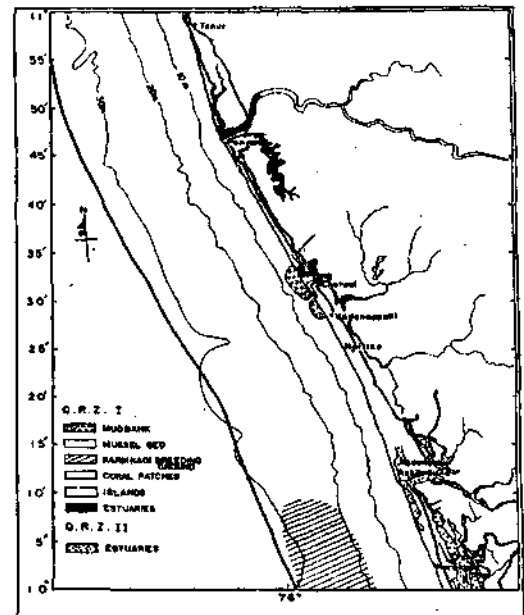


Fig.6. Coastal zone map of Kerala 3. Ernakulam-Tanur.

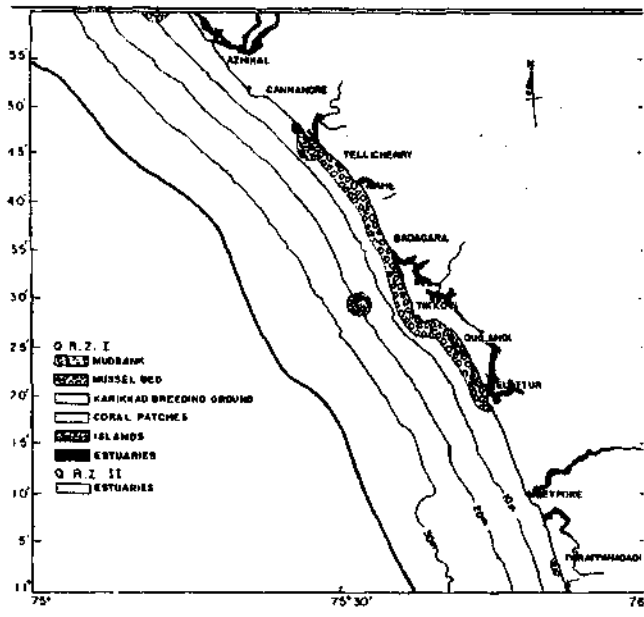


Fig.7. Coastal zone map of Kerala 4. Tanur - Azhikode.

crustaceans, 17 molluscs and 7 seaweeds. Aquaculture of mussels, pearl oysters and a few cultivable species of finfishes has good potential in certain sites spread along the coastal water as well as in the lower gradients of the adjoining estuaries of Trivandrum, Quilon, Ernakulam, Calicut and Cannanore districts. These coastal, estuarine and sea sites should be permitted for installing permanent, semipermanent or temporary structures for aquaculture (rafts, racks, longlines, cages etc.) either through free access or licensing, even if such areas may come under the sensitive categories within the existing CRZ or proposed ORZ. Other groups of potential seafarming candidates include the crabs, lobsters and groupers in the coastal zone.

The productivity of all these areas could be enhanced through searching of overexploited stocks by seeds produced in the hatcheries. The government may initiate steps to provide farm sites, training and subsidies or soft loans for investment in seafarming and searching through individual as well as cooperative efforts.

While formulating various development programmes in the coastal or ocean zone of high biological diversity, it is important to

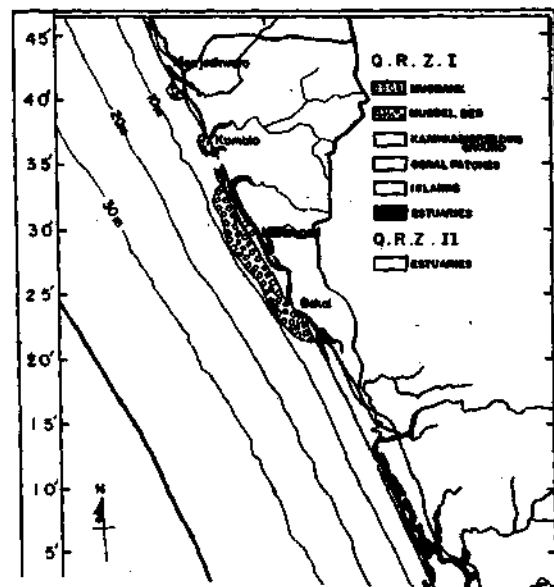


Fig.8. Coastal zone map of Kerala 5. Azhikode-Uppala.

consider the entire coastal and ocean zones as a single economic unit. Priorities may be fixed based on the imperatives of long-term protection to the critical habitats identified in this document. These habitats are considered to be highly vulnerable to overexploitation, pollution and various other manmade physical, chemical and biological threats. The critical habitats falling within the proposed ORZ along the Kerala coast are demarcated with their boundaries in Figs. 4 to 8.

Estuarine ecosystem

1) General characteristics

As the estuaries are "partially enclosed water connected with the ocean and characterised by the mixing of freshwater and seawater because of runoff and tidal ingress", these waterbodies may qualify to be treated under the proposed ORZ. Of the 41 rivers flowing into the sea bordering Kerala, 30 have either permanently or seasonally open estuaries or backwaters with a total waterspread area of 500 km² (within the total brackishwater area of 4,226 km²), which forms about 20 % of the total backwater areas in India. Reclamation for various purposes has reduced the Kerala brackishwaters area from 4,226 km² to 652 km²

at present. Most of the brackishwater, from the borders of the urban areas of Quilon, Alleppy, Ernakulam, Calicut and Cannanore districts. Fishing activities in the backwaters support the livelihood of about 0.2 million fishermen and provide employment for about 50,000 active fishermen. All the estuaries are highly productive and form nursery grounds for a variety of commercially important penaeid prawns, clams, edible oyster, crabs, mullets, pearlspot, catfishes, perches and others. The annual average (1992-'93) catch from the Kerala estuarine ecosystem is 24,024 t with the maximum contribution from Ernakulam district followed by Alleppy and Quilon districts (Fig. 9).

The backwaters are used for transport of oil, chemicals, toxic materials by barges, pipes etc., public transport, mining, waste disposal, mariculture, recreation, reclamation for agriculture and residential development. Domestic and industrial effluents discharged from the urban habitations and industries have led to instances of fish kills, degradation of benthic biota and a general decline in the natural carrying capacity of the system.

There is a total area of 1,671 ha of mangroves, either discontinuous or patchy, distributed in the lower reaches of the estuaries in Cannanore (755 ha), Calicut (263 ha) and Ernakulam (260 ha) districts. This habitat which is nursery for many shellfishes (mainly shrimps and prawns) and finfishes is vulnerable to overfishing.

Although edible oysters occur in all the estuaries, they grow abundantly in Ashtamudi, Vembanad, Mahi, Valapatnam and Neeleswaram backwaters and estuaries. Edible oyster culture has been found to be ecofriendly and quite viable. The clam beds of Ashtamudi and Vembanad lakes provide good clam fisheries. The high saline zones of these lakes close to the sea in the Malabar region are ideal for green mussel and pearl culture. However, many locations in the middle and upper stretches of the estuaries serve as retting grounds, where extremely poor environmental

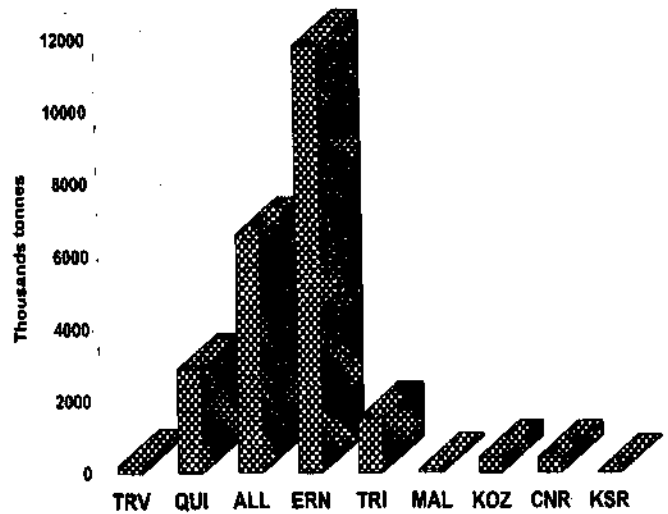


Fig. 9. Estuarine fish catch in the coastal districts of Kerala during 1992-'93.

conditions prevail resulting in low diversity index for zooplankton and benthos. There are over 200 medium and large scale industries and about 2,000 small scale industries discharging their effluents into the estuaries, besides a discharge of about 650 t of organic matter per day from 14 municipal bodies. Hot-spots of industrial pollution have been identified and demarcated in the estuaries of Calicut, Cochin, and Trivandrum. The heavy traffic of mechanised and motorised fishing vessels and cargo ships also contributes significantly to marine pollution which is very intense in the Azhikode to Alleppy and Quilon to Kollengode belts.

The State Pollution Control Board (SPCB) monitor various forms of coastal pollution which is co-ordinated by the Central Pollution Control Board (CPCB). A recent report of the Department of Science, Technology and Environment (DSTE), government of Kerala, states that "the waterbodies in the coastal zone are susceptible to pollution mainly due to the effluent discharged from industries; domestic and community sewage drainage from agricultural lands (containing fertilisers, pesticides, fungicides etc.), coconut husk retting areas and spillage of oil and kerosene in the vicinity of major commercial and fishing harbours also contribute to pollution of waterbodies. Some

of the major industries that discharge waste materials into the coastal zone are Western India Plywood, Mavoor Rayons, FACT, Cochin Refineries, Lakshmi Starch Factory, Hindustan Insecticides, Indian Rare Earths and TTP. Long term monitoring of the pollution of the coastal waters is being carried out under COMAP project in which, CESS and NIO study Kerala Coastal Zone. This study indicates that the threshold volumes exceeded nowhere in Kerala. However, if precautions are not taken, pollution can reach dangerous levels at several locations."

The inclusion of the estuarine habitats under the proposed ORZ may help safeguard this "buffer strip" against the hazards of pollution and reclamation. The estuaries in Kerala maintain exceptionally high levels of biological productivity. They play such important ecological roles as (a) nutrient and organic material transport through tidal circulation, (b) fishing grounds, (c) nursery grounds for many species of marine shrimps, crabs and fishes and (d) breeding grounds for the freshwater caridian prawns. The berried population of the fresh water prawn (*Macrobrachium rosenbergii*) migrates downstream the Cochin backwaters during September - December for hatching and the completion of larval metamorphosis. Out of 23.4 of downstream migrating berried population, only 30.2 % reaches the spawning grounds while the remaining 69.8 % is lost due to fishing.

The landward extent of the ORZ in the various estuaries/backwaters of Kerala may be fixed at the point of high water tidal influx (5 ppt. salinity), which varies from place to place depending on the coastal physiography, slope / gradient, seasons and river discharge intensity and pattern. Therefore, this point should be decided on a case to case basis and also by the magnitude of stress caused by activities. As the landward part of the ORZ comprises more private properties with a variety of human activities, fixing a common boundary for all the activities together might lead to widespread objections and protests and hence retard development in the coastal sector. In view

of the unique resource use patterns, urbanisation, population concentration, low per capita land availability, development needs in the domestic power and industrial sectors, and excellent prospects of estuarine tourism, there is great potential for conflicts between conservation and development in the state. Therefore, only the major estuaries in the urban areas of Quilon (Ashtamudi) district and Ernakulam - Alleppy (Vembanad) districts, together forming about 237 km² should be brought under ORZ II. The landward extent in each estuary has to be decided by the local authorities taking into consideration the environmental, social, economic and development needs and on a case to case basis. All the other estuaries and backwaters may be categorised under ORZ I (263 km²).

ii) Cochin backwater: A case study

The Cochin backwater popularly known as the Vembanad Lake extends across the Alleppy and Ernakulam districts with two seasonal openings and one permanent opening into the Arabian Sea. Six rivers discharge into this backwater lake. Fishing takes place in this lake round the year. Due to reclamation, the lake area of 36,500 ha as estimated in 1834 has reduced to 12,700 ha in 1983. The lake is inhabited by 150 species of finfishes, 7 species of penaeid prawns, 6 species of palaemonidae and 2 species of clams, and is characterised by very high primary, secondary and benthic production. The estimated annual fisheries production is around 7,200 t (penaeid prawns 48.6%, finfishes 45.8 %, crabs 13.8 % and palaemonid prawns 1.8 %) while the black clam production is more than 7,000 t per year.

Species diversity index (H) for polychaetes and crustaceans in the Cochin backwaters determined in 1978 revealed a gradual reduction from the bar mouth towards the higher gradients, where the stress due to pollution was very high. The species diversity of bryozoans ranged from 0.42 during the monsoon season of oligohaline conditions to 1.82 during the premonsoon season for a station within a radius of 1 km from the

barmouth. The upper reaches of the estuary indicated low diversity. This reduced diversity index could be due to the changes that have taken place in the water quality of the Cochin backwaters. The bryozoans are excellent indicators of aquatic pollution.

The industrial effluent (ammonia, ammoniac nitrogen, fluorides, mercury, DDT, acidic chemicals and suspended solids) discharged from the Eloor- Edayar industrial belt into the Periyar river (which joins the Cochin backwaters) is estimated to be over 200 million litres/day. A recent report on the status of pollution in the Periyar river has quantified the annual load of mercury (2,000 kg), zinc (10,095 kg), copper (327 kg) fluorides (250 t) and iron (30 t) dumped into this river (*The Hindu*, dt. 29-6-'98).

Mass mortality of fish due to industrial pollution has been reported from the upper reaches of Cochin backwaters at Chitrapuzha and Champakara. Ammonia load of 432 to 560 ppm, along with acids and suspended solids, has been found to be deleterious to fish in this backwater lake. Mercury concentration ranged from 0.15 to 1.10 ppm, in the monsoon season in the sediments while at the effluent discharge point, it recorded 5.5 to 11.5 ppm. Indiscriminate application of about 10 types of pesticides to the tune of 480 t/year in the Periyar catchment area has led to the occurrence of DDT in clams and organochlorine in the black clams and fishes in the Cochin backwaters. High concentration of coliform bacteria has been detected in fish and bivalves from Cochin backwaters. About 40 ha of saline mudflat within the Cochin backwaters is being used for coconut husk retting. This has resulted in anoxic conditions and hydrogen sulphide accumulation, rendering the area unsuitable for almost any type of life. An EIA study conducted in the Cochin backwaters during 1994-'95 has revealed low benthic population in the Udyogamandal canal and a general decline in fish production.

Kerala's coastal zone management plan

In response to the government of India

CRZ Notification (dt. 19/2/91), the Kerala government has prepared the draft Coastal Zone Management Plan (CZMP) in December 1995 and recommended it for approval by the government of India. The task force constituted to examine the draft CZMP of Kerala after detailed discussions, took the following decisions.

1. Though the criteria used by the Kerala government for identifying the high tide line (HTL) were acceptable to the government, it was advised to get the HTL certified by the Chief Hydrographer (CH), Dehradun for the sake of maintaining uniformity at the all-India level.
2. Because of the special features and circumstances of Kerala like the limited land availability and high population density it was decided that the distance from the HTL along the creeks, rivers and backwaters shall be kept as 100 m or the width of the creek, river or backwater, whichever is less for the purpose of regulation.
3. Areas of outstanding natural beauty, heritages and historical sites identified in the plan were agreed to and the Kerala government has been asked to demarcate the spatial extent of these areas in the coastal maps under the CRZ -I category. Wherever necessary, CRZ -I areas have to be categorised or demarcated to the extent possible as CRZ -I within CRZ -II or III.
4. All the mudflats, the marshy surroundings and the mangrove ecosystem have been classified as CRZ -I. A buffer zone of 50-m distance belt around them will be maintained even if the width of the creek, backwater and river is less than 50 m.
5. The HTL position as on February 1991 has to be taken into consideration for demarcating the CRZ areas. Reclamation is not permitted, nor shall there be any construction on lands reclaimed after February 1991.
6. Dredging is allowed, but the land formed

as a result of dumping of the dredged materials should not be used for development activities.

7. Dredging material not be allowed to be dumped in the CRZ areas.
8. Only rare minerals not available outside the CRZ areas will be permitted for mining while the others shall not be permitted for mining in the CRZ areas.
9. The Ministry of Forests and Environment (MoEF) of the government of India will take up the issue of mining of rare earth with the Department of Atomic Energy (DoAE) to ascertain their mining plans so that erosion is minimised.
10. All uninhabited islands will be classified under the CRZ category.
11. Quilandy has been classified as CRZ-III.
12. No reclamation of *kayals* (backwaters) will be permitted within the CRZ areas.
13. No coastal roads or railways are permissible within CRZ -I areas, except for activities permissible under the 1991 Notification.

The CZMP was recommended for approval by the government of India subject to the above conditions and suggestions. The programme emphasises potential government actions, both preventive and remedial management measures. However, the agenda and the plan change from place to place to meet the local needs and circumstances. The government of Kerala insisted that the EIA (Environment Impact Assessment) for projects costing Rs. 10 lakhs and above should be referred to the State Committee on Environmental Planning and Co-ordination for review and assessment of environmental implications and the clearance of this committee will be required before the projects are sanctioned. For projects costing Rs 25 lakhs and above, comprehensive EIA statement by experts will be furnished while referring to the committee. For projects cost-

ing less than Rs.10 lakh, the environmental implication will be assessed by the concerned departments following the guidelines issued by the committee and the departments will be responsible for safeguarding the purity and stability of the environment. With the above conditions, the departments could proceed with the projects without referring to the committee (Kerala Gazette No. 6. DT 2/2/78-part I).

The national scenario

India is the major subcontinent in the Indian Ocean brim countries with a coast of 8,129 km length which is traversed by a network of inland waterbodies in the form of rivers, estuaries, lagoons, backwaters and brackishwater impoundments and mangroves. This coastal zone is vibrant with fishing activities operating from 2,251 fish landing centres, yielding a current annual catch of 2.7 million tonnes (1997-'98) by a fleet of 160,000 traditional, 32,000 motorised and 47,000 mechanised fishing craft. This zone comprises diverse habitats which are subjected to multiple uses in a variety of complex, mutually competing or contradicting issues resulting from habitation, population density, land use pattern, agriculture, aquaculture, availability of per capita land, power and various industrial activities. In order to resolve these, there is a countrywide polarisation between natural resource protection interests and economic development interests. This situation has considerably increased the responsibilities of the government in meeting the challenges of both these tasks to make the economic activities globally competitive and economically sustainable. The Environment (Protection) Act 1986 together with its CRZ Notification and the draft ORZ regulations and the draft National Biodiversity Legislation are being relied upon innocuously nowadays.

Coastal zone management in India poses several problems owing to the extent and diversity of the habitats, development needs, population pressure, urbanisation, conflicting user interests, seasonal natural disasters, di-

verse sociocultural habits, socioeconomic status of coastal communities especially of the fisherfolks and the economic and political agenda of each maritime state. The surveys conducted by the International Ocean Institute (India) have identified 17 problems that threaten the management and sustainable development of the Indian coastal zone. The GIS (Geographical Information System), which has been widely accepted as a tool for the sensitivity mapping of coastal areas for natural processes, fishing impacts, other manmade hazards like pollution, tourism etc., could be used for identifying and mapping these threats. The GIS allows the user to integrate and synthesise data from different disciplines into a single system. Its application helps to conduct modelling exercises for any given input/stress management plan. Remote sensing technology also provides valuable information on the quality and changing pattern of coastal zones. The GIS and remotesensing together could provide most of the data required for the ICZM. Based on these inputs, the ICZM plan could attempt to resolve the following issues: 1) regulation and management of all hazardous coastal activities, 2) input/output regulation and management for coastal resources conservation, 3) rehabilitation of degraded ecosystems, 4) establishment of protected areas, 5) enhancement of coastal production through searanching, 6) promoting indigenous and community practices and 7) encouraging seafarming and domestication of coastal habitats.

Coastal zone uses

The coastal zone is being intensively used for a number of activities, ranging from fishing to high-tech industrial activities which have resulted in manifold problems both of short-term and long-term implications. For example, the Kerala coast is thickly populated with 21.9 million people in the nine coastal districts. It is immediately clear, therefore, that the predominant use of this zone is human settlement. This is naturally followed by agriculture, fisheries, trade, industry, land

transport, shore protection work, port development and mining. The coastal waters together with an extensive interconnected network of estuaries and backwaters are used primarily for fishing, sea transport, dumping, shell mining and to a limited extent for aquaculture and tourism. All these activities in the coastal zone have resulted in a wide array of problems for the various resource users and the local government. The uses of and the threats to the various coastal habitats are presented in the Tables 5 and 6.

TABLE 5. Coastal zone uses

Land
Habitations (urban and rural households, beach resorts)
Agricultural practices
Agriculture/fishery related traditional and small scale industries
Agriculture and fishery related trade
Fish processing, storage, ice plants, boat building and repairing yards
Infrastructure amenities for port development
Transport activities
Waterfront expansion for recreation and tourism
Mining
Industries (heavy and medium)
Coastal mangrove deforestation
Water
Fishing
Aquaculture
Artificial reefs (fish habitats)
Shipping / transport
Mining of minerals, corals and fossil shells from the sea
Clay and sand mining from estuaries/backwaters
Dumping
Port development
Recreation and tourism
Water use for industries
Nearshore drilling for oil

TABLE 6. Coastal zone threats

Natural

- Coastal erosion
- Seawater ingress
- Global warming and sea level rise
- Natural disaster from floods, storms, hurricanes and cyclones
- Outbreak of diseases
- Sedimentation

Manmade

- Population pressure and urbanisation
- Land use changes including reclamation and construction
- Shore protection works such as seawalls, groins and bulkheads
- Overfishing and inshore aquaculture
- Destruction of habitats and biodiversity including mangroves, coral reefs and benthos
- Mining
- Impact of ports Marine transport
- Uncontrolled tourism
- Manufacturing and processing industries
- Domestic, industrial and agricultural discharges

Sensitive coastal habitats

The Indian coastal zone is characterised by various natural resource systems. The habitats and species are sensitive if they are (i) fragile and susceptible to pollution, (ii) long lived and recruit poorly and (iii) slow to reach maturity, or poor recruitment larval dispersal or no larval stage or unable to move away. Although no attempt has been made so far to map the sensitivity of coastal areas, the gross sensitivity could be determined by the magnitude of different impacts and activities in the land-sea interface and in the coastal waters. Accordingly the following habitats have been identified as sensitive in the coastal zone.

These parts however, require detailed sensitivity mapping of the coastal zone before categorising it into various regulated or protected areas.

(i) Coral reefs: The coral reefs found in the Indian mainland seas and in the Lakshadweep and Andaman groups of islands include the sensitive fringing reef ecosystems in the Gulf of Mannar, Palk Bay, Gulf of Kutch and the atolls of the Lakshadweep group of islands and the continental island reefs of Andaman and Nicobar, all covering an estimated area of about 1,217 km². The Indian coral reef ecosystems are estimated to be capable of a fish production potential of 1.8 to 2.7 lakh tonnes per year. The taxonomic and ecological studies on the coral reef fauna, initiated in the sixties, have revealed the occurrence of 199 species of scleractinian corals under 37 genera from the reefs of India. Their diversity is high in the Andaman and Nicobar group of islands (135 species) and the Lakshadweep islands (105 species). The biocomposition of these reefs includes 180 species of benthic algae, 14 species of seaweeds, 12 species of seagrass, 4 species of lobsters, 108 species of sponges, 103 species of echinoderms, 600 species of finfishes in the Lakshadweep and Andaman & Nicobar group of islands and many species of crabs, bivalves, gastropods and cephalopods. The productivity of the reefs is estimated at 9.1 g C/m²/day in the Minicoy Island, 7.3 g C/m²/day in the Gulf of Manner and 3.9 g C/m²/day in the Andamans.

Besides natural processes like global warming, cyclones, erosion, siltation, diseases, pests (boring sponges & bivalves), algal blooms (*Noctiluca*, *Trichodesmium*, *Alexandrium* etc), indiscriminate exploitation of corals and the associated flora and fauna, dredging, reclamation and pollution have further threatened the reef ecosystem. Recent rise in sea surface temperature by 2 to 3°C has caused bleaching of

corals (30 to 80 %) in different parts of the world.

The Gulf of Kutch Marine Park, the Wandoor National Marine Park and the Gulf of Mannar Marine Park are basically of coral reefs. Many reef organisms have been brought under the CITES. The biological, chemical and pharmacological characteristics of all the reef biota and their products need to be evaluated for evolving various development and management options. Knowledge of the toxicological qualities of the reef biota, their taxonomy, distribution and abundance in space and time and their areawise cataloguing are vital for any disaster management in the ecosystem relating to human poisoning either direct or through food chain. An integrated reef ecosystem conservation and management concept is imperative for evolving a national reef conservation policy.

(ii) Seagrass habitat: Tropical seagrass meadows extend from the intertide to a depth of about 10 m. There are altogether 14 species (7 genera) of seagrasses in the Gulf of Mannar, Palk Bay, Mandovi estuary, Lakshadweep Island lagoons and the Andaman and Nicobar Islands. High-energy storms, grazing, predation, pests, diseases and human activities cause destruction of seagrass meadows. Studies conducted on the Indian seagrass habitats reveal considerable habitat loss and degradation at many places. Five to ten kg of seagrass and seaweeds per boat per day are removed from the Palk Bay while fishing for *Penaeus semisulcatus*.

(iii) Mangrove habitat: About 45 species of mangroves are available in India. In the peninsular India mangroves occupy only a limited 380 km long coast covering an area of about 3,55,500 ha, of which 82 % is along the east coast and the Andaman & Nicobar Islands and 18 % along the west. Large stretches of mangrove vegetation have been removed and the land reclaimed for housing, agriculture,

aquaculture and industrial activities. Remote sensing and GIS for assessing and monitoring the health of the mangrove ecosystem are very essential for formulating appropriate management strategies for their conservation.

(iv) Coastal beaches: The beaches constitute the interface between the land and the sea, where the natural physical processes are dynamic and intense; the shorelines are in a state of flux and seasonally subjected to erosion and accretion. Long sandy beaches with dunes are found along the east coast, whereas the west coast presents sandy pockets, rocky clefts and sprits, creek, bays and headland. The seasonal and annual longshore and on-shore-offshore sediment transport modifies the beach profile. Natural processes and human activities increasingly stress the beaches. Integrated management plan is necessary to safeguard the beaches from undue human activities.

(v) Estuarine habitats: The estuaries occupy an area of 1.25×10^6 ha along the Indian coast spread over nine maritime states and the Andaman & Nicobar Islands. About 52 % of the total backwaters are in Orissa and West Bengal and 19.7 % in Kerala. Problems posed by industrial growth along the banks of estuaries and upstream impoundment (e.g. Thanneermukkom bund in Vembanad Lake in Kerala) can be addressed through an integrated approach to coastal zone management.

Coastal biodiversity

The coastal biodiversity occupies different habitats ranging from sandy, rocky, coral or mudflat intertidal to the shelf edge, each with characteristic flora and fauna. The uses and applications of biodiversity knowledge are ethical, aesthetic, direct economic and indirect economic. Several coastal plants and animals contribute to our food, many constitute the food of other marine organisms and birds, some of them yield valuable drugs, a few others form

the raw material for industrial extraction, about 50 species are cultivable at present, a wide spectrum of coastal biota are used as marine curios, many of them are candidates for marine aquaria, while the general marine ecosystem itself together with its fascinating biodiversity, is a magnificent object of recreation. Although the fisheries resources are exploited for human consumption, a large number of species get destroyed in the process of exploitation. The biodiversity of sensitive coastal ecosystems (beaches, mangroves, estuaries, coral reefs, seagrass beds, and spawning and nursery grounds) face many anthropogenic threats. The most common manmade threats include the land use changes, conversion of natural areas, overexploitation of food species, destruction of nontarget biota, habitat degradation and destruction, domestic and industrial discharges, oil spills, waste dumping, coastal mining etc. The impacts of such human interventions need to be monitored, carefully and assessed periodically for the maintenance and use of the coastal zone. The existing Wildlife (Protection) Act, Environment (Protection) Act, the 1991 CRZ Notification, the proposed ORZ Notification and the proposed Biodiversity Act provide the necessary legal framework to safeguard the marine habitats and their biodiversity from manmade threats.

International status

Many European and some Asian countries have already recognised the coastal zone as a priority area for holistic management, taking into consideration the multiple user interests and conflicts, the seaward and landward boundaries, the legal framework and the sociocultural and economic scenarios and the coastal population. It is widely felt that an Integrated Coastal Zone Management (ICZM) approach is imperative: (1) to facilitate sustainable economic growth based on coastal living and nonliving resources, tourism etc.; (2) to control pollution, habitat alteration and

degradation; (3) to conserve habitats and species and (4) to assess and monitor the natural carrying capacity continually. The coastal zone extends inland and seaward to a variable extent, depending on political, administrative, legal and ecological considerations of wide-ranging issues. In many countries the coastal zone extends from the territorial limits (wet side) to the tidally influenced habitats (dry side) as the zone can be affected by remote activities (Annexures 1 to 6). Many nations have adopted a coastal regulation zone management through appropriate administrative and legal measures, wherein the "wet" and "dry" areas within the zone are treated as a single unit. Invariably, the boundaries, especially on the "dry" side, vary depending on the objectives and needs of the issues.

For a country like India, with diverse social, cultural and economic background of the coastal zone user population, physiography, development needs, foreshore traversing national highways and urban concentrations around a narrow estuary, a common regulation for the different maritime states might not be realistic or desirable. Uniform adoption of a coastal buffer zone of 500 m throughout the country under the CRZ has already caused serious social problems, sometimes even leading to litigation from many parts of the coastal states. Each maritime state has certain characteristic physiography, coastal sea and land use patterns. Therefore the limits to the boundaries of the regulated zone, especially of the landward boundaries, should be demarcated after a thorough study on all the possible impacts, both natural and anthropogenic, development needs etc. on the coastal zone of the concerned state. The regulations should be suitably restructured on a case to case basis as regards the boundaries that should be decided after a thorough examination of the merits of the concerned activities.

Postscript

In response to Decision 1/20 of the UNCED Preparatory Committee, many nations have initiated actions on the: 1) development of coastal and national maritime areas and 2) protection and rehabilitation of the marine living resources and their habitats, and evolved suitable Coastal Zone Regulations for multisector management, involving all stakeholders and affected agencies, with public support. All the countries relied on an Integrated Coastal Zone Management (ICZM) approach and regulated the activities in the seaward and landward extent under the same management program, which is governed by a single agency (Ministry).

For India, it would be more appropriate to formulate a common CRZ, rather than separate regulations for the coastal zone and ocean zone, wherein both the territorial waters and the landward extent of the ocean (estuaries / backwaters) should be covered and governed by a single agency (Ministry) through the promulgation of necessary policies, regulations and acts. For this purpose, the existing CRZ could be suitably amended to include the ocean part in the regulation/acts etc., so that the coastal areas could be managed as a single unit and by integrating all management processes with appropriate economic sectors (fishing, shipping, mining, transport, power, industry, housing, tourism etc.).

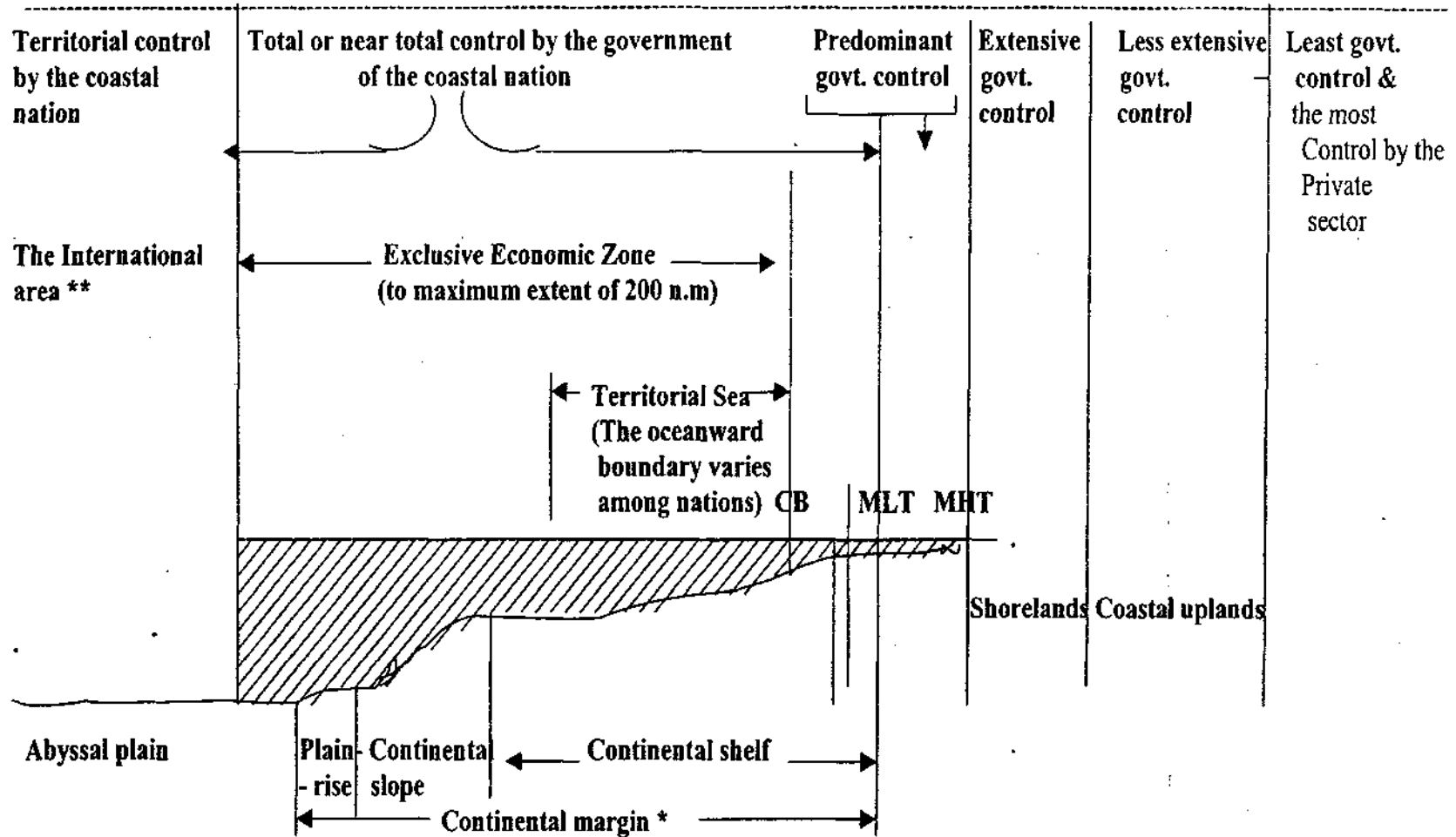
COUNTRY	ACT	Boundary Wet side	Boundary Dry side	Remarks
1	2	3	4	5
1. USA	Coastal Zone Management Act 1972	To the outer limit of the territorial sea	To the extent necessary to control shore land, the zone should have a direct significant impact on coastal waters. Legislation deliberately avoids fixed boundaries leaving it to individual states, likely to vary according to coastal physiography and demographic considerations, they actually be several miles in land from the coastline.	
2. Spain	Shores Act 1988	Sea shore and coastal water inlets, territorial and inland water	Hundred to two hundred meters	
3. Sweden		Territorial sea, to a distance of 12 n.m. rules out to sea	Hundred m from H.W. mark sometimes up to 500m	No construction
4. Australia	Coastal Protection Act 1972	Three n.m. from mean L.W.S. tide level	Hundred m above M.H.W.S. tide level	
5. UK	Territorial Sea Act 1987	Territorial Sea to 12 n.m.	No classification for the intertidal zone, it is more extensive in Scotland and Wales	
6. France			Hundred m from H.W. mark Two hundred m from H.W. mark	No construction No new rules
7. Norway			Hundred m from H.W. mark	No construction
8. Italy			Three hundred m from H.W. mark	No construction
9. Greece			Five hundred m from H.W. mark	Strict controls
10. Denmark			Three thousand m from H.W. mark	No summer house
11. USSR			Three km	
12. Philippines		Continental shelf	For areas where sea water intrudes (estuaries, backwater)	

Annexure 1. Coastal Zone Management Act in different countries

Source: Ocean & coastal management, Vol. 22 No.1/1994-MAIN LAND AND SEA.

Note: There is no universally accepted legal definition of the coastal/ocean zone. The coastal zone embraces the region of inter face between the land and the sea, the boundary in either direction varies according to the purpose of legislation and the geographical limits of jurisdiction of the relevant authorities. But invariably the outer limit on the wet side is the territorial sea of the country - which extends from 3 to 12n.m-by the Territorial Sea Act 1987.

Annexure-2: Extent of government control in the management of marine and coastal resources and environments. Source : Sourensen and McCreary (1990).



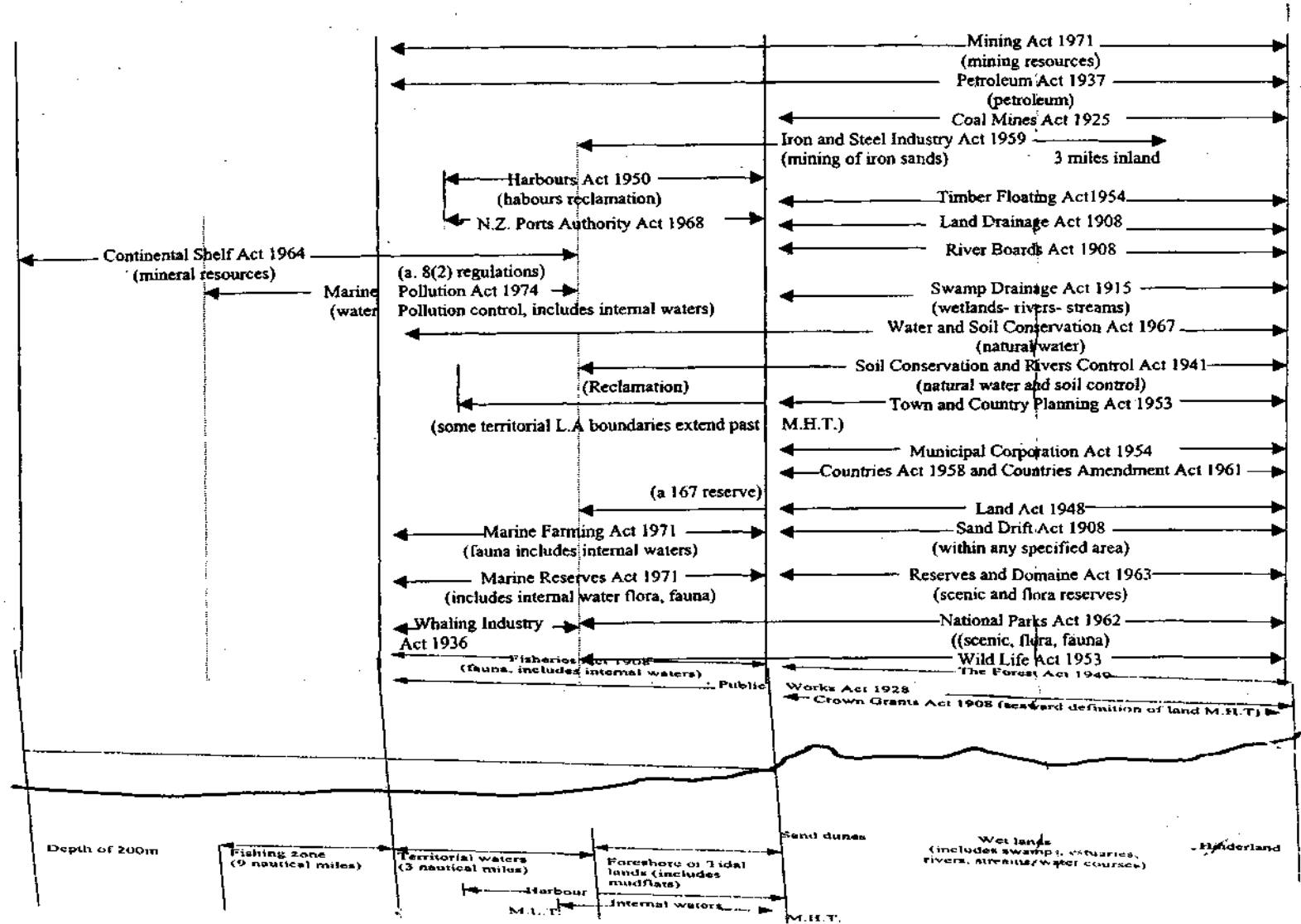
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* In a number of places, the continental margin extends oceanward beyond 200 nautical miles. In these situations, the oceanward boundary of the national jurisdictional claim can be the outer edge of the continental margin.

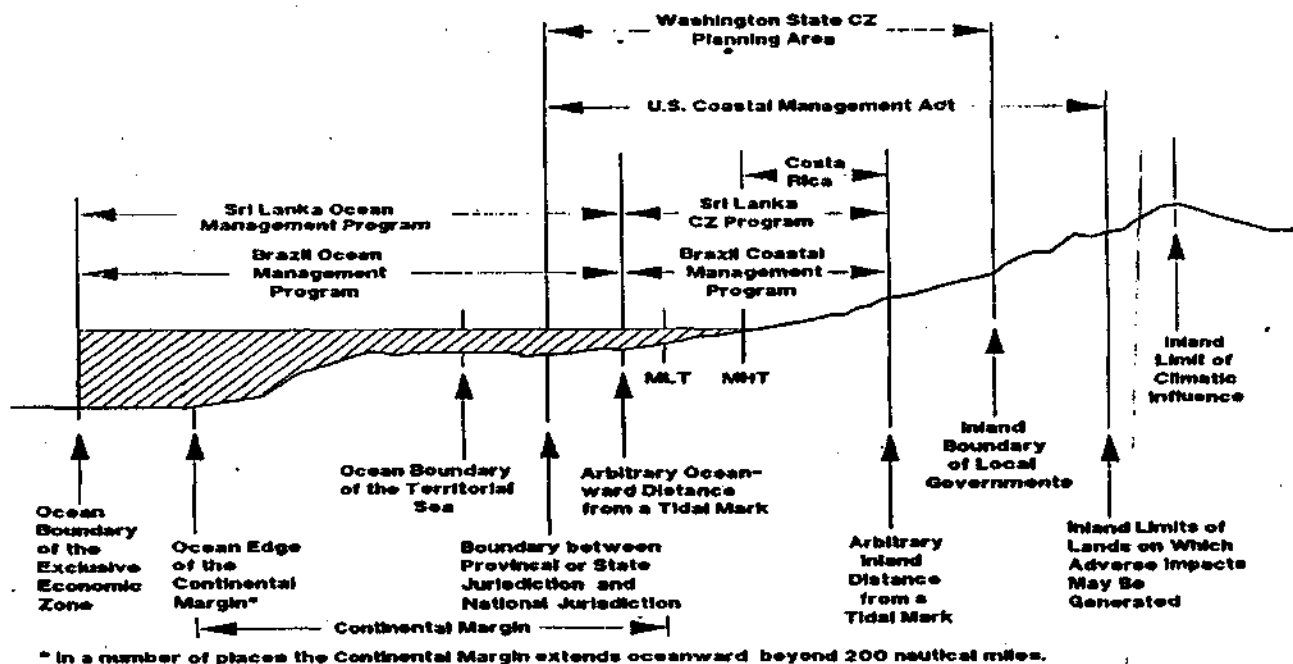
** The international area is a seabed and ocean waters beyond either continental margin or the exclusive economic zone (whichever is greater). Under the 1982 Law of the Sea Convention, the international seabed authority has some management authority, particularly with respect to marine mining.

CB- The coastal baseline is a series of straight lines that interconnect coastal headlands and promontories. The CB is the reference point used to map the oceanward boundary of both the territorial sea and the exclusive economic zone. MHT- MEAN HIGH TIDE; MLT- MEAN LOW TIDE

Annexure-3: Legislative administration of the coastal environment of New Zealand. *Source : Sourensen and McCreary (1990).*



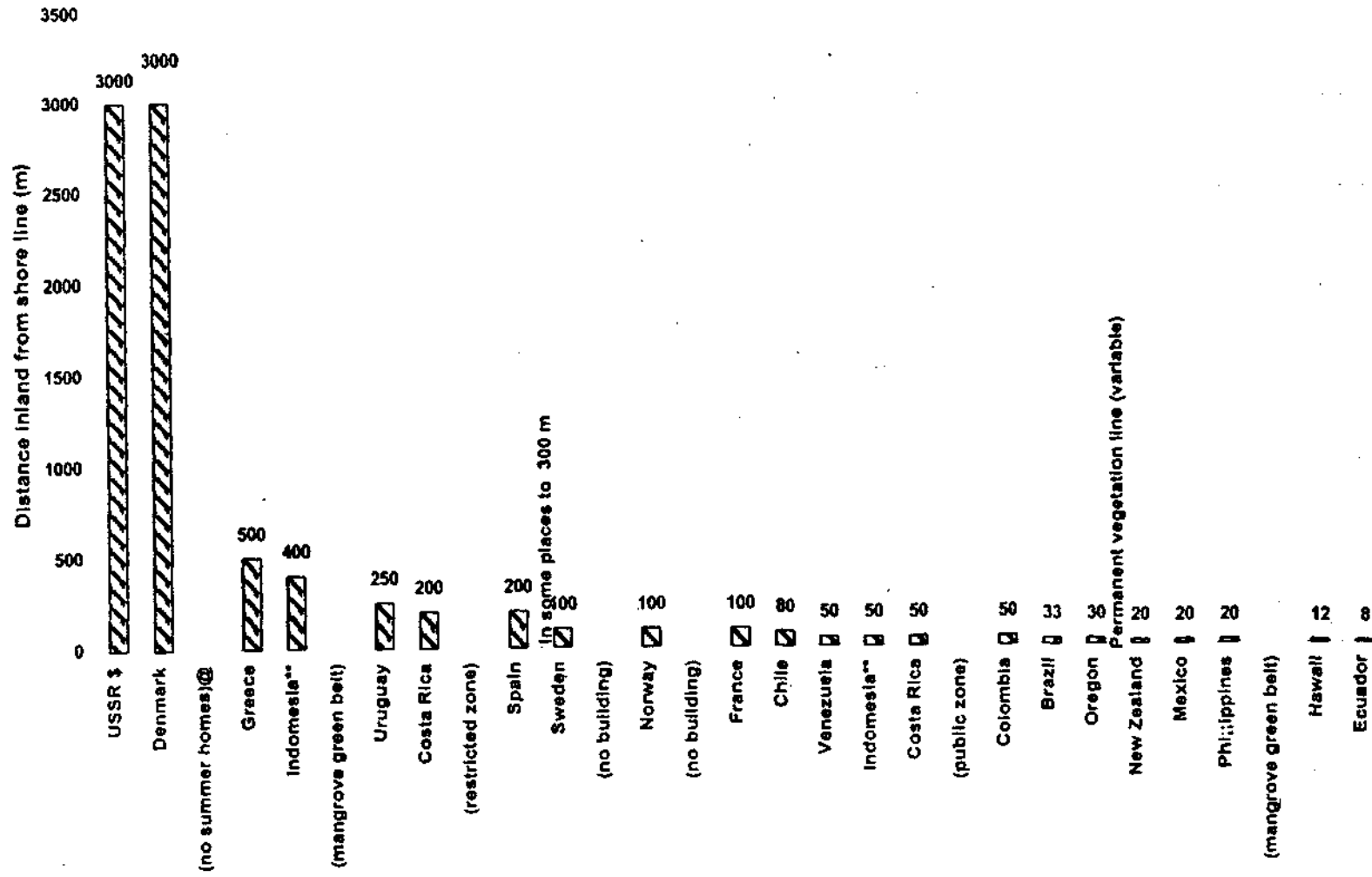
Annexure-4: Existing and potential boundaries of coastal zone programmes and ocean management programmes. (Source : Sorensen and McCreary (1990))



Annexure-5: Options for delineating the ocean and inland boundaries of a coastal zone or an ocean management area (Source: Sorensen and McCreary (1990))

		Increasing jurisdictional areas →					
Inland Boundary Options	Oceanward Boundary Options	Mean low tide (MLT) or mean high tide (MHT)	Arbitrary oceanward distance (s) from a tidal mark	Boundary between provincial or state jurisdiction and national jurisdiction*	Ocean boundary of the territorial sea* (usually between 3 and 12 n.m. from CB)†	Ocean edge of the continental margin or shelf**	Ocean boundary of the exclusive economic zone (EEZ) ††
		Increasing jurisdictional areas	Arbitrary distance (s) from a tidal mark (such as 200 meters from low tide)	Costa Rica (MLT)	Sri Lanka Brazil Israel	California (from 1972 to 1976)	Spain
	Inland boundary of local government's jurisdiction***	Western Australia (MHT)		State of Washington (for planning)			
	Inland limits of lands on which adverse impacts may be generated			U.S. Coastal Zone Management Act California (since 1976)			
	Inland limit of climatic influence						

- * In many cases the boundary between a coastal state (or province) and the national jurisdiction is the same as the territorial sea boundary line.
- ** In a number of places the continental margin extends oceanward beyond 200 nautical miles. *** The inland boundary of local government's jurisdiction often extends further inland than the lands on which adverse impacts may be generated.
- * The coastal baseline (CB) is a series of straight lines that inter connect coastal islands, headlands and promontories. It is used to map the oceanward boundary of territorial sea and the exclusive economic zone.
- ** The EEZ extends 200 n.m. or to the ocean ward limit of the continental margin, whichever is greater.



\$ Coast of the Black Sea (exclusion of new factories); @ 1-2 km

* Definition of shoreline varies, but it is usually the mean high tide. Most nations and states exempt coastal dependent installations such as harbour developments and marinas.

** Indonesia has both a 50m setback for forest cutting and a 400m "greenbelt" for fishery support purposes (see text for explanation).

Establish a setback line: There is a need to delineate a coastal construction setback line landward of the "high hazard zone" and prohibit construction seaward of it.

Annexure-6: Shoreland exclusion or restriction setbacks